PAC/PAP1600 Datasheet & Manual

Features:
Switched mode power supply/charger
Wide output range 0…72 V_{DC} & 0...120A
Analog control by an external 0…5V_{DC}
Power failure alarm output
Master-slave connection

Micropower PAP/PAC series is a high power, lightweight, advanced power supply series using modern switching technology. All units can be used as a power supply or constant voltage battery charger. The output voltage and output current can be adjusted from 0 to maximum value by a internal adjustment trimmers on the front panel, with an optional 0-5V analog control or serial bus. The PAC/PAP power supply series meets the safety and EMC requirements established by the EU.

Technical data

Variable		Unit	
INPUT DATA			
Input phase		-	1 Phase
Input voltage supply		V_{AC}	55…250 (55…200 reduced power)
Frequency		Hz	47…63
Input current		A	9
Recommended input fuse		A	10
Input cable area		mm^2	3x1
Input cable length		m	1,5
BATTERY CONNECTION			
Battery cable		mm^2	2x10
Battery cable length		m	2
ELECTRIC DATA			
Power factor		-	> 0,98
Efficiency (240Vac, 80%...100% load)		%	86…90
Inrush current (Limited by an NTC resistor)		A	< 30
Line regulation		%	±0,1
Load regulation		%	±0,5
Output setting accuracy		%	±0,1
Output ripple (f > 50Hz)		%rms	< 1 from maximum output voltage (< 1 MHz bandwidth). Resolution is defined by an 8-bit or 10-bit A/D converter of a microcontroller. Measured using nominal output voltage.
PROPERTIES			
Short circuit protection		-	Electrical current limiter
Wrong polarity protection		-	Electrical protection circuit
Isolation	input-chassis	V_{AC}	1500
	input-output	V_{AC}	3750
	output-chassis	V_{AC}	500
Standards	safety	-	IEC60335-2-29:2002 (Ed 4) + A1:2004 + A2:2009 IEC60335-1:2001 (Ed 4) + A1:2004 + A2:2006
	EMC	-	EN55032
Protection class	mechanical	IP	IP20 metal enclosure
	electrical	-	Class 1
Approvals			CE
Mounting		-	Wall, bench
Cooling		-	Temperature controlled fan
Operating temp range		°C	0…+40 (fixed assembly)
HMI		-	LED
CHARGER DIMENSIONS			
Charger weight excl. cables		kg	1,90
Outer dimensions	W x H x D	mm	267 x 135 x 85

Power Supply Models

Trimmer adjustable power supplies							
Model	**Input voltage range **)**	**Nominal output voltage**	**Voltage setting range**	**Nominal output current**	**Current setting range**	**Maximum output power**	**Installation/dimensions (width x height x depth)**
1600/12	55-250V_{ac}	12V_{dc}	0-18V_{dc}	120A	0-120A	1600W	Wall /bench 267x135x85 mm
1600/24	55-250V_{ac}	24V_{dc}	0-36V_{dc}	60A	0-60A	1600W	Wall /bench 267x135x85 mm
1600/36	55-250V_{ac}	36V_{dc}	0-54V_{dc}	40A	0-40A	1600W	Wall /bench 267x135x85 mm
1600/48	55-250V_{ac}	48V_{dc}	0-72V_{dc}	30A	0-30A	1600W	Wall /bench 267x135x85 mm

0-5 V external control signal adjustable power supplies							
Model *)	**Input voltage range **)**	**Nominal output voltage**	**Voltage setting range**	**Nominal output current**	**Current setting range**	**Maximum output power**	**Installation/dimensions (width x height x depth)**
1600/12AI	55-250V_{ac}	12V_{dc}	0-18V_{dc}	120A	0-120A	1600W	Wall /bench 267x135x85 mm
1600/24AI	55-250V_{ac}	24V_{dc}	0-36V_{dc}	60A	0-60A	1600W	Wall /bench 267x135x85 mm
1600/36AI	55-250V_{ac}	36V_{dc}	0-54V_{dc}	40A	0-40A	1600W	Wall /bench 267x135x85 mm
1600/48AI	55-250V_{ac}	48V_{dc}	0-72V_{dc}	30A	0-30A	1600W	Wall /bench 267x135x85 mm

*) Cable sets with modular connectors are included: 1,5 m cable for analog control and 2,5 m for temperature compensated models

**) Reduced power 55…250Vac, see curves; max 1200W when used with DC input

Models with power failure output relay (24V models as type designation example)		
Model	Option description	Cable set
1600/24H	Trimmer adjustable model with power failure alarm relay	1,5 m, modular connector
1600/24AIH	Analog controllable model with power failure alarm relay	Analog + relay cables
1600/24TH	Temperature compensated model with power failure alarm relay	Temp. comp + relay cables

Master-slave connection (24V models as type designation example)	
Master units *)**	**Slave units**
PAP1600/24, PAP1600/24AI or PAP1600/24T	PAP1600/24S RS232 control bus in/out
Control to slave via RS232 bus	PAP1600/24SH slave unit with relay, RS-232 bus in only
Cable set for master slave connection included in slave unit type number, 0,6 m modular connectors at both ends	

***) Master unit or slave with RS232 bus output cannot include the alarm relay

Customized versions on request

- Cyclic battery chargers or customized charging curves for all kind of batteries
- Sense models

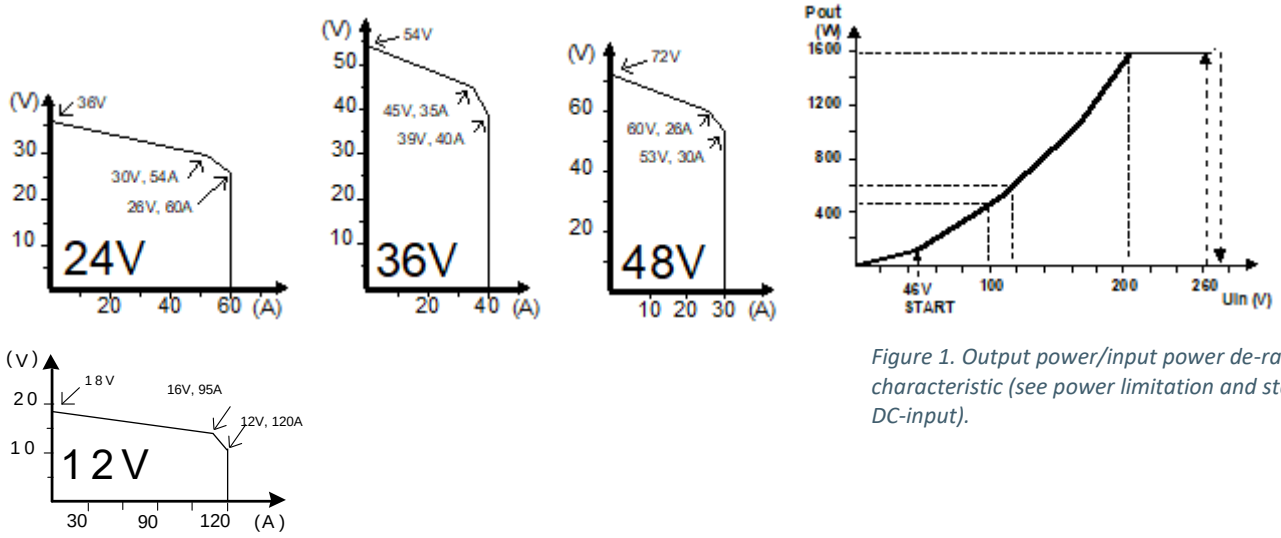


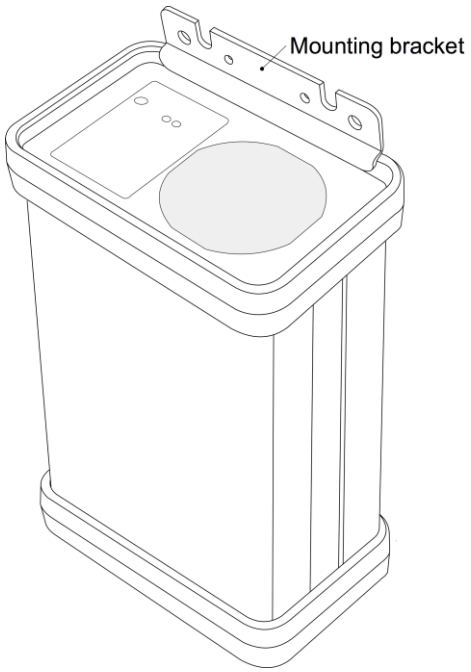
Figure 2. Typical output current/voltage characteristics.

Figure 1. Output power/input power de-rating characteristic (see power limitation and startup at DC-input).

Installation

The location must be dry, dust-free and indoor. The acceptable full power temperature range is 0°C…+40°C****). The thermal protection will cause the unit to power down at a too high operating temperature. The power supply is not waterproof. Keep it dry and away from areas with high humidity to avoid the risk for electrical shock and damages to the charger.

****) For PAP1600/12, maximum current at range of 0°C... +35°C.



Wall mounting

The power supply can be mounted to the wall with the aid of two mounting brackets. Mount on both ends of the power supply unit a bracket as shown in the figure.

The power supply can be installed horizontally or vertically. In case the power supply is mounted vertically with the cables downwards, the floor and everything right below the power supply must be fire-resistant. Vertical mounting is prohibited in case this condition cannot be met.

Leave at least 10 cm free space at both ends of the power supply to ensure sufficient ventilation.

When used as a charger, the charging process generates explosive hydrogen gas. Install power supply as far away as possible to prevent hydrogen gases going inside the charger. Keep the area well ventilated. Never use an open flame or equipment that produce sparks close to the power supply and battery.

Charging operation

1. Ensure that the power supply is switched off and that the environment meets the conditions as described in the previous section.
2. Connect the output cables to the load / battery terminals: + cable to the + terminal and – cable to the – terminal
3. Turn the power on by connecting the main cord.
4. During normal power supply operation / charging process, the STATUS LED will light continuous orange.
5. To avoid sparking, disconnect the power supply main cord before disconnecting the cables.

DC Input connection

The power supply input cable is connected as follows:

L	negative or positive DC supply input
N	positive or negative DC supply input
PE	protective earth

Output voltage

Trimmer or analog control adjustable modules, type example PAP1600/24 or PAP1600/24AI:

The output voltage and output current limit of the power supply can be adjusted as follows:

- Trimmer adjustable models: with the multi-turn potentiometers accessible from the front panel.
- Analog controllable models by an external 0-5Cdc voltage. See detailed description

Both voltage and current can be adjusted from zero to the maximum value. Maximum 1600W output power is available within the adjustment range.

Temperature compensated models, type example PAP1600/24T:

The power supply includes 16 pre-programmed output voltages that are set by the code switch. See the setting table for this unit. Any of these 16 different voltage settings can be taken in use and additionally be adjusted within ±5% using the trimmer on the front panel. See the instructions for choosing the programmed voltage and the fine-tune adjustment.

LED

STATUS LED indicates different phases during charging process. In normal power supply operation, an orange LED indicates a healthy output voltage.

Overcurrent protection

The output of the power supply is protected against overcurrent and short circuits by an automatic, self-resetting electronic current limiter.

Series/parallel connection

Parallel operation: No restrictions, passive load sharing
Series operation: Up to 500V total voltage

Warning

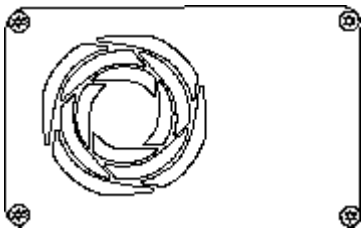
Dangerous voltages, capable of causing death are present in the power supply. Do not remove the cover. There are no operator serviceable parts inside the unit. Refer servicing to qualified service personnel only.

Charge lithium batteries only with appropriate BMS (Battery Management System).

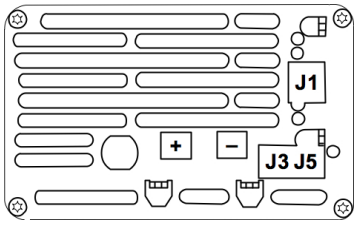
Feature selection table

	Trimmer	Analog	Relay	Bus out	Bus in	Temp	Sensor	Code switch	External LED
Trimmer adjustment	•		•	•			•		•
Analog control (isolated)		•	•	•			•		•
Alarm relay	•	•	•		•	•	•	•	•
BusOut (RS–232 control to slave)	•	•		•	•	•	•	•	
BusIn			•	•	•	•	•	•	
Temp. compensation			•	•	•	•	•	•	•
Sensor	•	•	•	•	•	•	•	•	•
External LED	•	•	•			•	•	•	•
Customized charging algorithm chargers with code switch			•	•	•	•	•	•	•

Modular connectors



Front panel



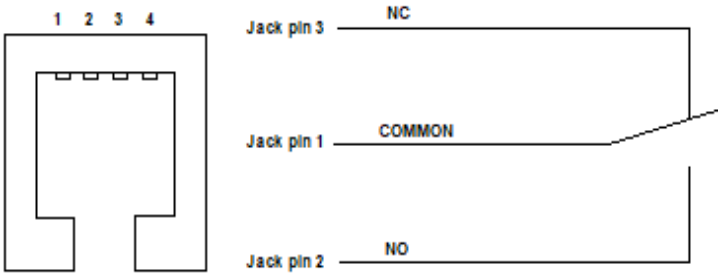
Rear Panel

J1 Option	Analog input 0-5 V
J3 Special version	Temperature compensation
	Voltage sense
	External LED
J5 Standard	RS-232 bus in and out, master-slave
Option	Alarm relay
Option	External LED

Alarm relay models

On models with an alarm relay, the alarm relay output indicates whether the output voltage is healthy or not. The alarm signal is activated in case of an AC failure or charger failure. Both normally closed signals and normally open contacts are available.

Pin configuration, modular jack J5 with alarm relay option.



Cable

Black = common
Red = NO
Green = NC

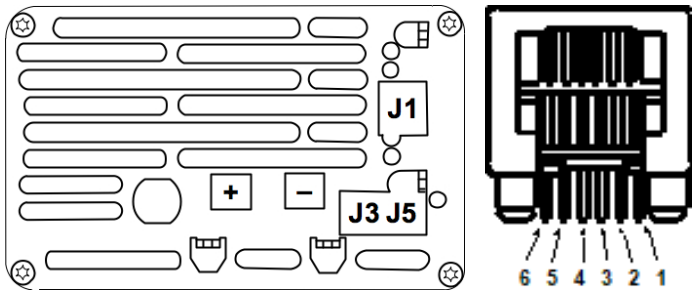
Relay

Isolation:	Technical data:
Output to case: 500 V	0,5 A@24 V_{DC}
Output to GND: 120 V	0,5 A@120 V_{AC}

Analog control and master-slave connection

The optional analog control input J1 allows full control of the output current and voltages and it provides the measured values for both. A +5V supply power is available for the supply of the control logic. The analog input has an isolation value of 500 V towards the input and output of the power supply.

The master–slave bus cables are connected from the master unit to the slave units as shown in the picture.



Pin configuration J1

1. Ground
2. Current control input
3. Voltage control input
4. Measured current value
5. Measured voltage value
6. +5V (max 20mA) output

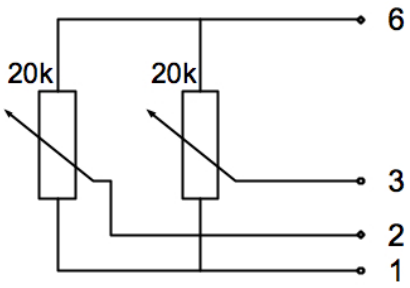
Figure 3. Pin configuration of the modular connector J1.
The analog control card is connected via an AMP Modular 6 connector.

Controlling the analog card

All control voltages must be between 0 and +5V, Higher voltages are not allowed. The control logic is positive, so that a +5V control voltage gives a maximum value from the power supply, while 0V means minimum output. As soon the control connector is unplugged from the modular connector, the power supply is reset to the minimum output values.

The measured values can be read from the measurement signals. The measured values are scaled equal to the target values. If the power supply is set to the voltage reference, the measured value must be equal to the target. The same counts for the current control and its measured value. Measured signals (both together) can be loaded with max 20mA; otherwise proper operation cannot be guaranteed.

The modular connector is isolated from the input, output, and enclosure of the power supply. This enables the possibility to parallel or series connect several power supplies maintaining equal voltages. The number of connected devices is not limited. The 500V insulation voltage may, however, not be exceeded. This manual cannot be applied in case the connector of the analog card differs from a modular connector (9-pin D-connector). In that case it is an incompatible analog controlled power supply.



Connection example using the internal +5Vdc supply and external potentiometers.

The +5V can be used as a supply for external circuits. The circuit shown to the left lets the power supply operate as a potentiometer-controlled device. It is important to keep in mind that the +5V output may not be loaded more than 20 mA, otherwise proper operation cannot be guaranteed.

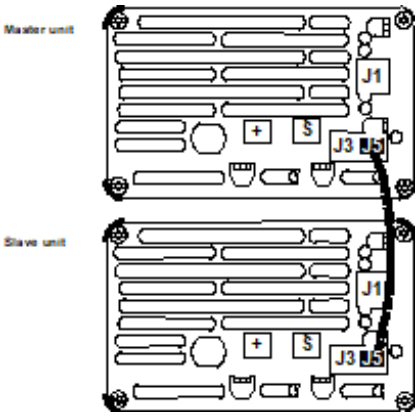
Optional master-slave connection

Using a master power supply together with a slave unit.

The master unit can be either a trimmer adjustable model (e.g. PAP1600/24) or an analog controllable model (e.g. PAP1600/24AI). The slave unit is a separate unit without any adjustment possibilities, e.g. type PAP1600/24S or PAP1600/24SH, which has an alarm relay output.

If more current or a higher voltage is needed, the adjustable master power supply can be connected in parallel or in series, via the digital bus, with the slave unit, which follows the master unit but has no adjustment possibilities by itself. Dependent on the connection, the maximum output current, or the voltage is doubled, while both power supplies are simultaneous adjusted using the multi turn potentiometers, or external analog control. A maximum of one slave unit can be used in this way. Contact your local distributor in case more slave units are to be connected. Special terminals and wires are needed. The power supply's output terminals and the communication bus terminals are isolated, so that the outputs can be connected in series for obtaining a higher voltage.

Serial bus connection



The bus cable is connected from the master unit (J5) to the slave unit (J5). The first unit, or master unit has potentiometers for voltage and current adjustment. An erroneous connection of the bus cable does not cause any damage but causes the slave unit to not follow the commands sent from the master unit. Due to the digital bus connection, only one slave unit can be connected to the master unit.

J5 has the following pin configuration:

Pin 1 and 3	serial output
Pin 2 and 4	serial input

Pin 1 of the master unit is connected to pin 4 of the slave unit. Pin 3 of the master unit is connected to pin 2 of the slave unit.