DP1xx1-2

Low Voltage Power Supplies
suitable for DIN rail mounting

User's Manual

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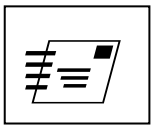
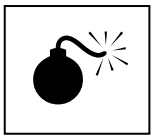
1 Notes, Terms and Warnings

In this manual some symbols, whose meaning is listed below, are used to underline particular arguments.

There is a dangerous condition that must be measured and avoided. The not-respect of indications marked with this symbol can cause serious damages to people, animals and things.

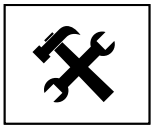


The argument is very wide and could require a deeper examination with the technical support.

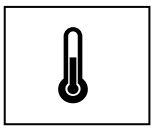


The not-observation of what described could damage the products.

Features and functionalities which cannot be easily found in other products. A shortcut to reach a target is shown.



A change or repairing intervention which can be made directly by the user.



An aspect which is connected to the temperature or longevity of the product.

The terms listed below are also used:

Product
: The power supply described herein.

User
: Who selects and/or installs and /or uses the product.

Application
: The machine, the equipment, the device, etc. on which the product is applied.

2 Risks and Precautions

A T T E N T I O N

Following are listed the most important warnings to be fully comprehended and applied by the user who, in case of non-complete comprehension or impossibility to apply them correctly, must not use the product at all.

	The DP1xx1-2 power supplies are components. It is user's responsibility as the installer to be sure the product complies with the rules and regulations in force. The user must also be trained in the installation of the electronic equipment to fully comprehend the features, the calibration parameters and indications contents of this guide. The user must provide for the application of all the local safety laws and regulations in force in the Country and/or application in which the product is used.

	The user must provide that the product is inaccessible while powered on. The user must also consider that, because of the capacitors inside the power supply, it is necessary to wait at least for 90 seconds after the power off before acceding to the power supply. According to the external capacitors eventually mounted on the power supply circuit, it is possible the user shall have to wait more time.

	While working the product produces heat which can raise the temperature of some parts (as heat sink, for example) up to values that can cause burns. Such a condition remains for a long time even after the product has been powered off. The user must provide for the appropriate protections and signals, must train the operator, the staff of the technical support and risk maintenance, and then must state it in the service manual of the finished product.

	In series to each alternate input phase a protective fuse must be placed. See ahead about fuse dimensioning.
	The power supply output is not insulated from the input. The insulation from the main supply must be made with the use of a transformer. It is absolutely forbidden to connect the power supply directly to the main supply.
	On some damage conditions the power supply could emit sparks and fire. The cabinet and the nearby components must be chosen to tolerate this eventuality and to avoid propagation of flames to the application.
	The products cannot be used in life support applications or where the failure of the products could cause death or injury to people, animals or things, or economic losses. The user not able to assure this condition must not use the products herein described.
	Do not dismantle the product, do not try and repair it and do not modify it without being expressly authorized by LAM Technologies.
	If the product is used in any manner that does not comply with the instructions given in this manual, then the product could be permanently damaged. For example, the product could be permanently damaged if power supplied with voltage superior to the allowed one, and so on.

3 Introduction

3.1 Product Description

The DP1xx1-2 products are low voltage power supplies, unregulated, and suitable for DIN rail mounting.
They represent the ideal solution to supply electric motor drivers and other devices which do not require a stable power supply.
The low and medium voltage input can be both single phase and three phase kind. Using the power supply with three phase input it is possible to get a greatest output current.
The particularly compact case includes, besides the rectifier bridges and the filter capacitors, also the electronic circuit for the capacitors discharge.
Moreover, the DP1xx**2** models incorporate the braking resistor control which, through the adjustment of a trimmer placed frontally and easy to be reached, can be easily adapted to the features of the supplied device.
The connection is through removable, colored and numbered terminal blocks, for a quick and simple wiring.
Finally, each model is provided with a power supply status LED indicator.

3.1.1 Available Models

The DP1xx1-2 power supplies family is available in various models diversified according to the functionality, to the power supply voltage and the delivered phase current.
The products whose code ends with number 1 belong to the basic power supply version, while the number 2 placed at the end of the code identifies the power supplies provided with the braking resistor control.

Model	Braking resistor control	Maximum supply voltage (Vac)	Maximum available current (Arms)	
			Single phase input	Three phase input
DP1651	No	42	12	16
DP1652	Yes	42	12	16
DP1741	No	68	8	16
DP1742	Yes	68	8	16
DP1831	No	135	6	12
DP1832	Yes	135	6	12

3.1.2 Main Features

- ✓ Compact size
- ✓ Single phase or three phase AC input
- ✓ Power ON LED indicator
- ✓ Circuit for the filter capacitors discharge
- ✓ Braking resistor control (DP1xx2 models only)
- ✓ Free setting of the braking resistor intervention voltage (DP1xx2 models only)
- ✓ Working braking resistor LED indicator (DP1xx2 models only)
- ✓ Interrupted braking resistor LED indicator (DP1xx2 models only)
- ✓ Easy DIN rail installation
- ✓ IP20-compliant construction
- ✓ Low cost

3.2 Accessories

Code	Description
LSP1004	DIN rail kit consisting of hook and spring
LSP4012	Terminal blocks kit consisting of: 1pc. numbered removable terminal block, red color, 2 poles 1pc. numbered removable terminal block, grey color, 2 poles 1pc. numbered removable terminal block, grey color, 4 poles
LSP4004	5pc. numbered removable terminal block, red color, 2 poles
LSP4005	5pc. numbered removable terminal block, grey color, 4 poles
LSP4014	5pc. numbered removable terminal block, grey color, 2 poles

4 Installation

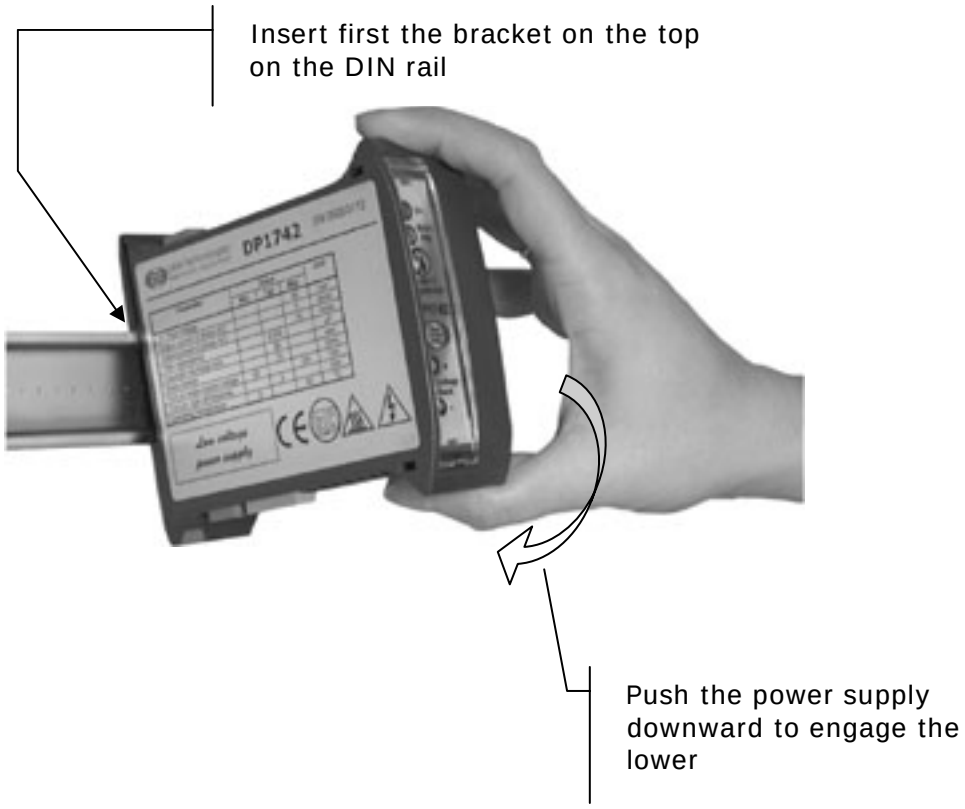
4.1 Inspection

Verify the power supply is not damaged, the package is intact and all accessories of the ordered product are included. Furthermore, control the power supply code corresponds to the ordered one, eventual special and customized version included. In case of problems please address to the product's vendor.

4.2 Mechanical Installation

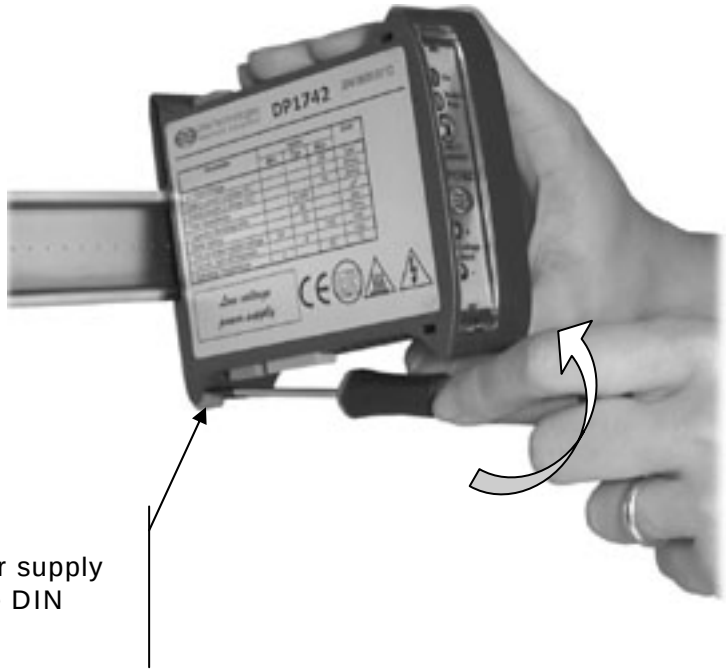
The power supply is designed to be mounted vertically on a 35mm DIN rail.

To block the power supply on the DIN rail, insert first the bracket on the top, on the back of the case, over the top of the DIN rail, keeping the power supply slightly inclined as shown in the figure, then push the power supply downward to engage the lower section of the rail. To verify the correct engagement of the power supply try and pull it slightly upward to control it is still in position.



To remove the power supply from the DIN rail insert a small flat bladed screwdriver into the red colored hook on the bottom, on the back of the power supply. Push the hook downward and pull the power supply upward slightly rotating it, releasing it from the DIN rail as shown in the figure.

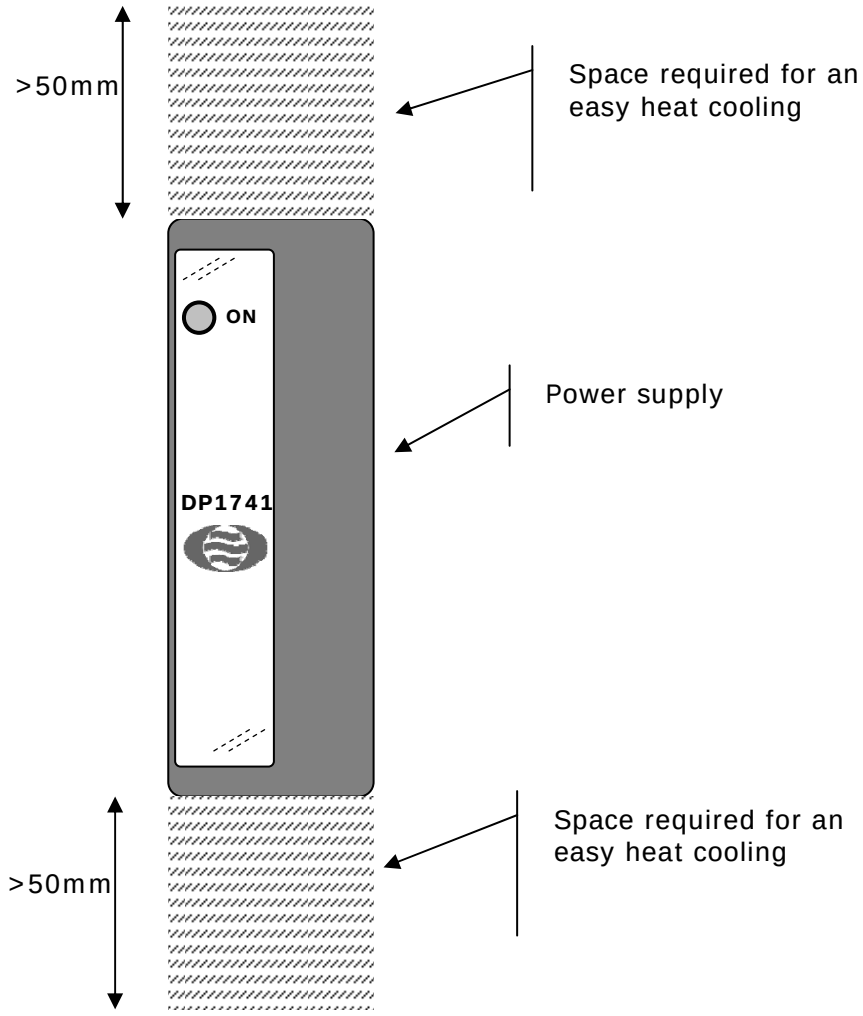
Insert a small flat bladed screwdriver into the red colored hook



Push the screwdriver slightly downward and pull the power supply upward, releasing it from the DIN rail

The heat generated by the power supply while operating must be dissipated toward the surrounding air. To assist cooling, the power supply must be installed vertically in an area with a sufficient air gap of about 50mm above and below the power supply itself, with no obstructions (wiring cables are anyway allowed). No space needs to be left on the sides and more power supplies can be packaged side by side taking a very compact space.

According to the running cycle, the space can be also substantially reduced without compromising the correct working of the power supply.

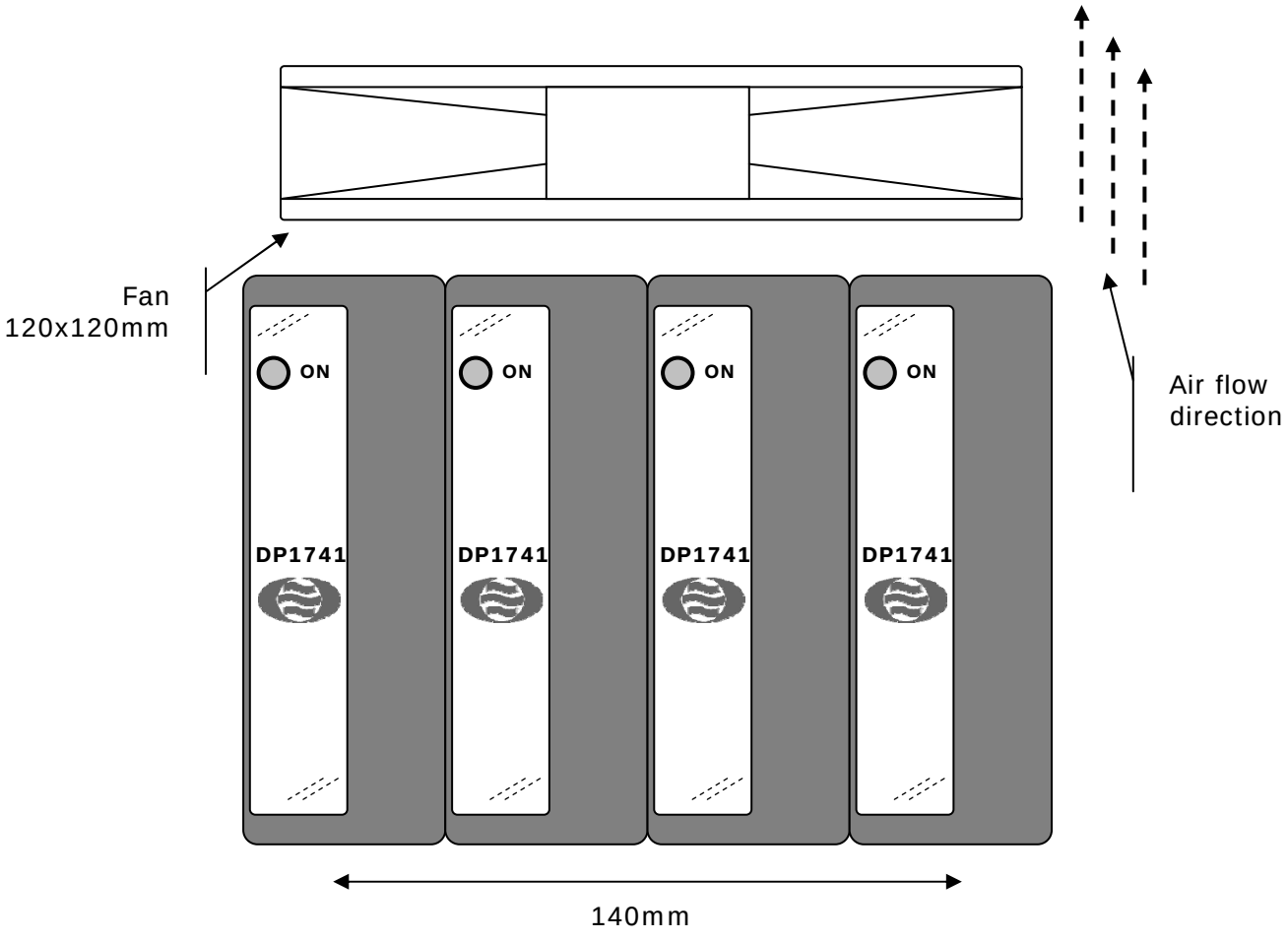


4.3 Air Cooling

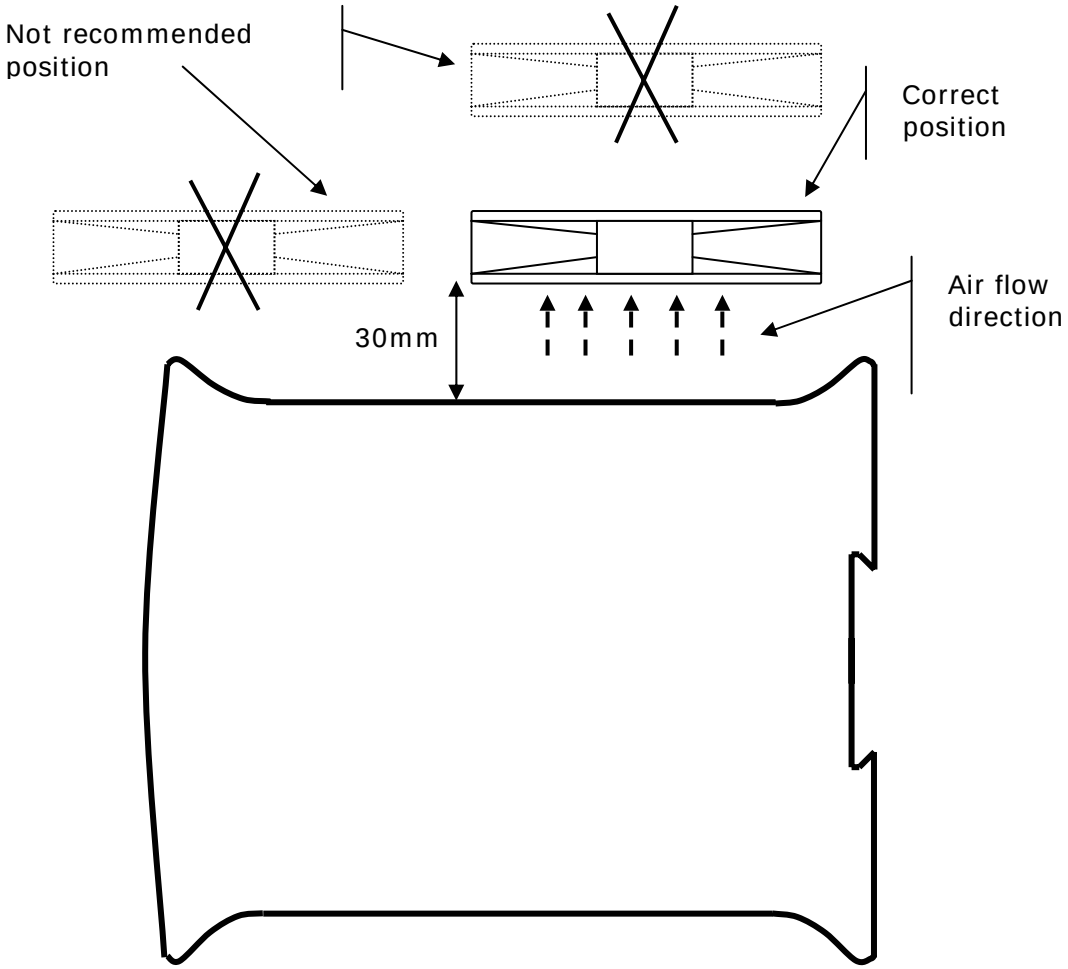
Its exceptional efficiency allows the product to be used even if absence of forced ventilation.

Whereas high output currents are required to the power supply, or the working cycle is very heavy or the ambient temperature is high, it is possible to recur to forced ventilation to maintain the power supply temperature within the functioning range values.

The fan can be positioned over or under the power supply. A lateral position is not recommended. Thanks to the compact size of the power supply, an only and economic fan of 120mm x 120mm can supply air circulation sufficient for 4 power supply simultaneously.

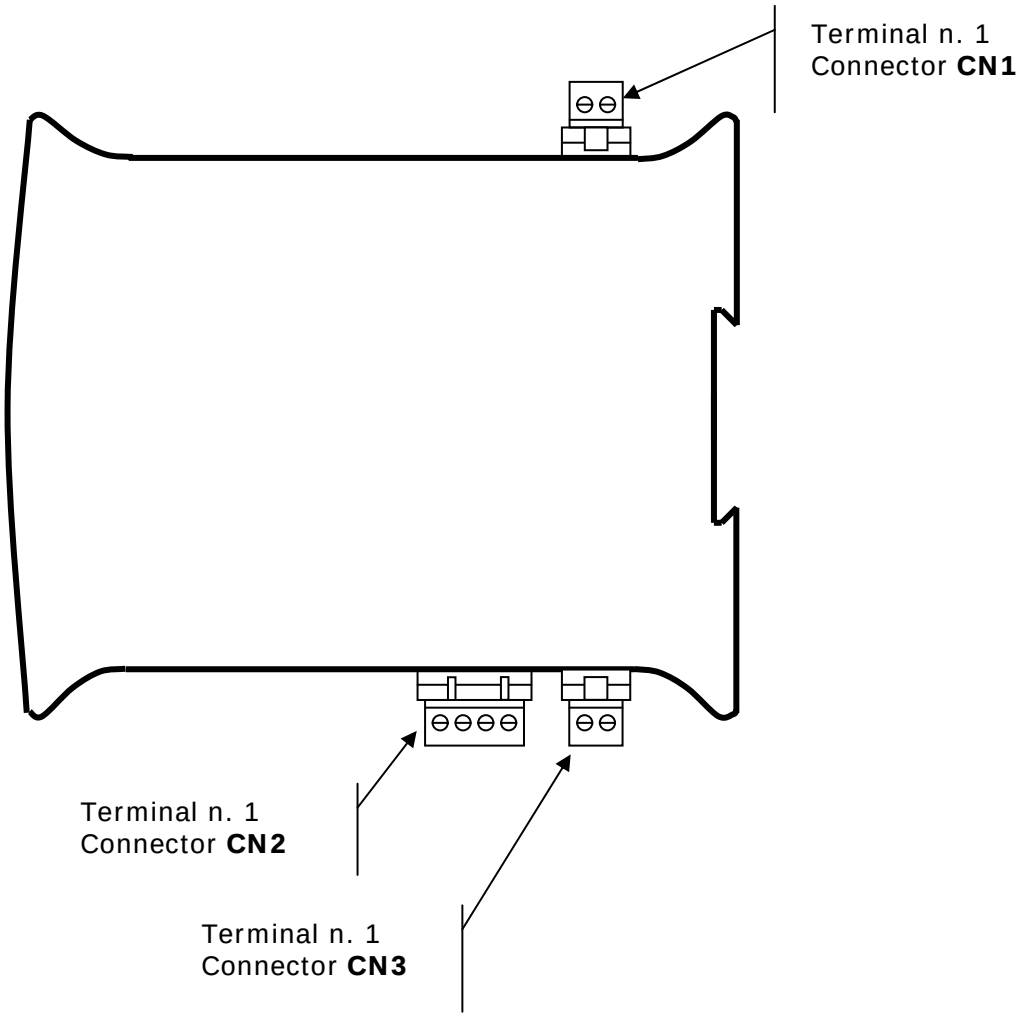


In case of a reduced size fan, it must be set in a rear position and at about 30mm high from the power supply. A nearer or more distant position could reduce its effectiveness.



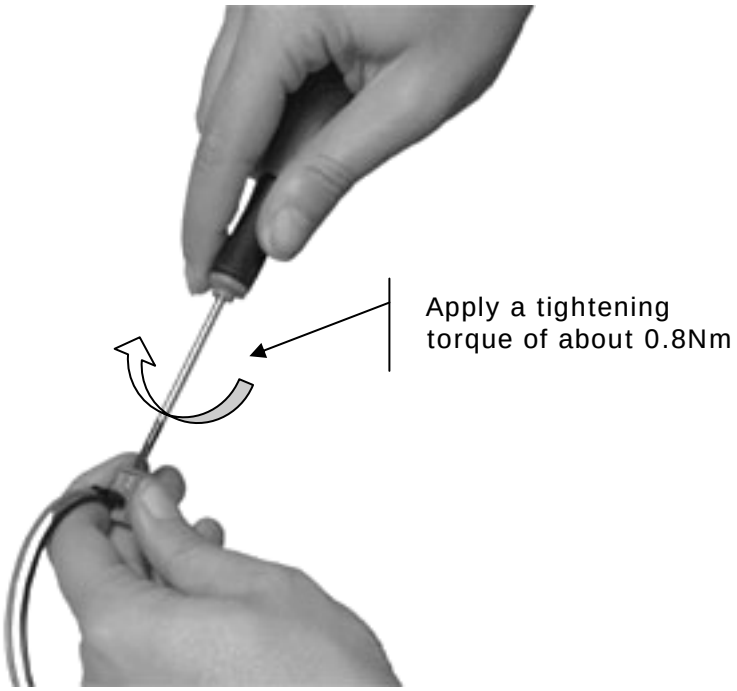
4.4 Wiring

The use of numbered and colored removable terminal blocks makes easier the wiring of the power supply.



Each terminal block does not contain iron and is supplied with mobile truck. The clamping screw is slotted head sized for screwdriver of 3 x 0.6mm.

We recommend to apply a tightening torque of about 0.8Nm.



All terminals can tighten correctly cables with section between 0.1mm^2 and 2.5mm^2 (24…14 AWG).

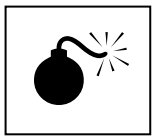
We recommend to skin off the cable for 7/8mm as shown in the figure below.

4.4.1 AC Supply Voltage

The power supply is designed to work both with single phase and three phase AC voltage. When the input is a three phase type it is possible to obtain an higher output current.

In series to each input it must be placed a fuse, a time delayed type, with working voltage higher than the one applied to the power supply. The suggested nominal current is detailed here below:

Model	Fuse to be placed in series to each AC input
DP1651	25A T
DP1652	25A T
DP1741	20A T
DP1742	20A T
DP1831	20A T
DP1832	20A T

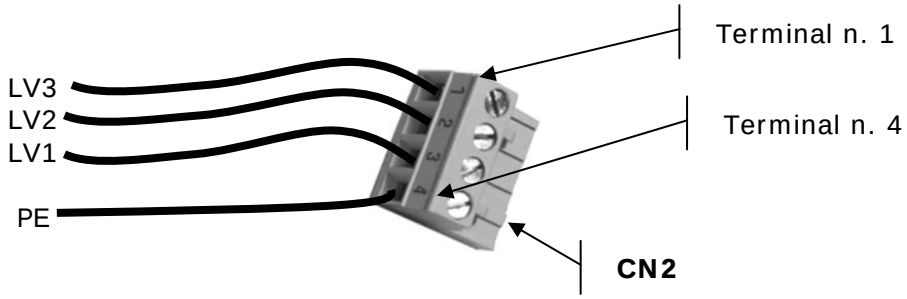


The AC voltage *VL* applied to the power supply input must never exceed the maximum value stated for each model.
This condition must be always guaranteed, considering the maximum positive variation of the main supply voltage applied to the transformer primary winding and a null load. In the following table are detailed the maximum allowed values for each model.

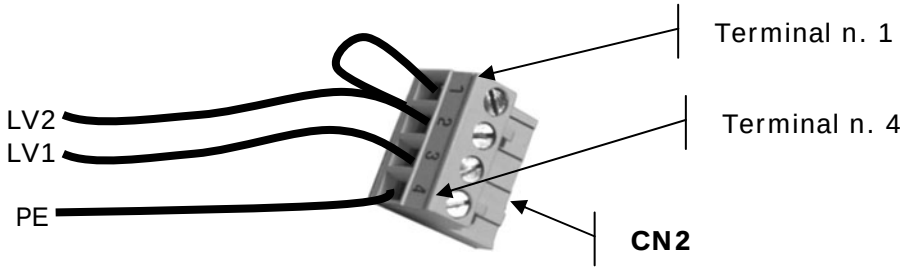
Model	Maximum voltage applicable to the input (VL)
DP1651	42Vac
DP1652	42Vac
DP1741	68Vac
DP1742	68Vac
DP1831	135Vac
DP1832	135Vac

The exceeding of the maximum voltage limit damages irreversibly the power supply.

The AC input voltage is applied to the terminals 1, 2 and 3 of the CN2 4 poles connector. The terminal 4 is used to execute the ground connection.



In the event that a single phase voltage is applied, use the terminal 3 and the terminals 1 and 2 short circuited together as better shown in the following picture.



Contact n.	Description
1	LV3, AC voltage input
2	LV2, AC voltage input
3	LV1, AC voltage input
4	PE, ground (internally connected to GND)

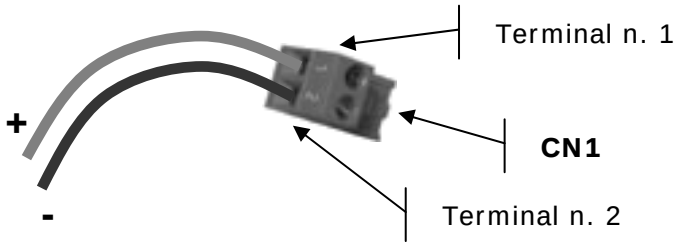
For the connection between the transformer and the power supply, it is necessary to apply a cable with section suitable for the maximum current thought to be used.
It is not necessary to use a shielded cable but we recommend not to install the cables coming from the transformer near the signal ones.

During functioning the power supply dissipates part of the absorbed power in the form of heat. In the following table is detailed the power typically dissipated on the power supply at full load.

Power dissipated on the power supply				
Model	***Min***	***Typ***	***Max***	***Unit***
DP1651		22		**W**
DP1652		22		**W**
DP1741		22		**W**
DP1742		22		**W**
DP1831		16		**W**
DP1832		16		**W**

4.4.2 DC Voltage Output

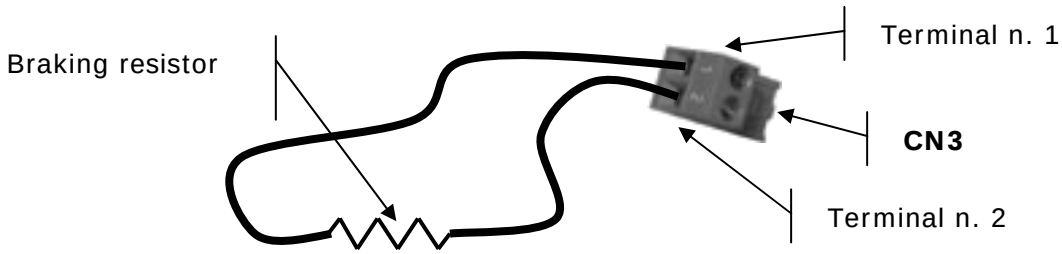
The output voltage, rectified and filtered, is available on the CN1 connector with the following polarity:



CN1 - Signals set-up	
Contact n.	**Description**
1	+Vp, positive DC voltage
2	-Vp (GND), negative DC voltage

4.4.3 Braking Resistor Connection

The DP1xx**2** models are provided with the braking resistor electronic control.
The braking resistor is connected to the power supply by the CN3 connector.



The section of the cables used for the connection must be dimensioned according to the current passing through the braking resistor. The current value can be obtained dividing the braking resistor intervention voltage by the value of the same resistor. For example, if the threshold is calibrated at 80Vdc and a 10ohm resistor is connected, the current passing through the resistor is equal to 80 / 10, i.e. 8A.

5 Functionality and Setting

5.1 General Description

The DP1xx**1** series power supplies do not need to be calibrated and it is sufficient to supply the AC input voltage to make them working soon. The DP1xx**2** models, which are provided with the braking resistor electronic control, need the voltage intervention calibration of the braking resistor itself.

Inside each power supply there is a double circuit for the filter capacitors discharge, which insures a voltage level next to 0 past *Cft* time, as detailed in the technical data (see chapter 6 Technical Data)

5.2 Transformer Dimensioning

5.2.1 Typology and Selection of the Transformer

It is always better to use a three phase transformer as the DC output voltage ripple is reduced and the impulsive input currents limited. The use of a three phase transformer is an obliged choice when the power exceeds 600W.
For lower powers it is possible to use also single phase transformers.
The use of autotransformers or solutions which does not grant the main supply insulation is forbidden.
The voltage on the transformer secondary winding is influenced, as well as by the main supply variations, also by the applied load. If such variations are excessive there is the risk, in absence of load, to exceed the maximum values allowed by the power supply or by the device connected. Therefore choose a transformer with a low output impedance, able to guarantee a voltage value almost constant to the changing of the load.
Usually is considered of good quality a transformer which insures a voltage difference between the null load and full load conditions lower than 5%.

5.2.2 Secondary Voltage

The secondary voltage must be chosen according to the DC voltage to be obtained from the power supply output.

When said value is known, the secondary voltage is obtained dividing by 1.41 the DC voltage needed at the power supply output and then adding the value 2 to the result.

The described formula will result as follows:

$$VL = (Vp / 1.41) + 2$$

For example, if we wish a DC output voltage equal to 70Vdc the transformer secondary shall have to be able to supply (70 / 1.41) + 2, i.e. 52Vac about.
During dimensioning do always consider the maximum possible variation of the main supply in the worst operative conditions. Furthermore, verify with the manufacturer of the transformer the variations which could occur on the secondary windings according to the absorbed power.

5.2.3 Power

The transformer power must be calculated as the sum of the power required by the load plus the power supply losses. These last are reported in chapter 4.4.1 AC Supply Voltage.
It is a good norm to over dimension the transformer at least of 10%.

5.3 Braking Resistor

Applicable only to DP1xx**2** models.

5.3.1 General Description

The braking resistor has the purpose to dissipate, in the form of heat, the energy fed back by the load applied to the power supply. This condition is frequent when the power supply is connected to drivers for DC or brushless motors and the motor suddenly decelerates. In this situation the mechanical energy fed back by the load tends to raise the DC voltage up to levels which could inhibit the functioning of the drivers. The braking resistor intervention can prevent this condition dissipating the mechanical energy in the form of heat.

5.3.2 Dimensioning

The resistive value of the braking resistor must be chosen in order that during its intervention the passing through current does not exceed the maximum allowed value. This last value depends moreover on the intervention voltage calibration of the resistor itself.

In the following table are reported the maximum current values which could be dealt by the braking resistor control circuit and the minimum resistive value of the resistor itself, considering to calibrate the intervention voltage at the maximum voltage available from the power supply. In case the intervention voltage is inferior, the resistive value of the braking resistor can be furtherly reduced, maintaining firm the maximum current limit.

This value is calculated dividing the intervention voltage by the resistor. Then, calibrating for example the intervention voltage at 30Vdc and using a 3.3ohm resistor, is obtained a current of 9A about, which is within the allowed limits.

Model	Irbrk, maximum braking resistor current	Rbrk, minimum resistor value
DP1652	15A	4ohm
DP1742	12A	8ohm
DP1832	12A	15ohm

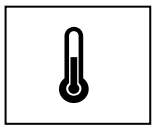
The braking resistor working voltage must be adequate to the voltage fed by the power supply, while the nominal power must be chosen considering the power given back by the load and the working cycle with which the resistor itself intervenes.
Take present that the resistor shall have to be however able to support the instantaneous peak power supplied by the load.

For example, if the load feeds back a power of 500W per 1 second every minute, the average power dissipated in the form of heat can be calculated as 500W per 1 second divided by 60 seconds, therefore (500 * 1) / 60, i.e. 8.3W about. Consequently the formula is as follows:

Prbrk = (Pl * Ton) / (Toff)

Where:

Prbrk, braking resistor power
Pl, power fed back by the load
Ton, braking resistor intervention time (time in which the load feeds energy back to the power supply)
Toff, time in which the braking resistor remains off (time in which the load absorbs energy from the power supply)



It is evidenced that the calculation has to be considered reliable if the time Ton is sufficiently short to guarantee an use of the braking resistor within the features stated by the manufacturer.

5.3.3 Intervention Voltage

The braking resistor intervention voltage can be regulated within a wide range allowing to adapt at best the power supply to the application.

For the adjustment it has been placed a trimmer on the front panel of the power supply and two test points to which to connect a multimeter to verify the imposed voltage.

In the following table it is detailed the adjustment range for each power supply model.

Model	*Vrbon, intervention voltage*			*Unit*
	Min	*Typ*	*Max*	
DP1652	20		60	**Vdc**
DP1742	50		100	**Vdc**
DP1832	100		200	**Vdc**

Before proceeding with the adjustment, disconnect the braking resistor from the CN3 connector, then insert a multimeter switched to measure DC voltages, with at least 2Vdc on full scale, in the holes identified as *BR voltage check*, respecting the indicated polarity; subsequently rotate the trimmer marked as *Brake V. Adjustament* up to read on the multimeter the wished intervention voltage divided by 100.
For example, if we wish to set the intervention voltage to 85Vdc, the trimmer will be regulated till when the multimeter indicates 850mVdc (that is 0.85Vdc, i.e. 85/100).

Typically the braking resistor intervention voltage must be set to a lower level in respect to the maximum voltage allowed by the devices connected to the power supply, in order to prevent on them the over voltage protection intervention or, worse, their breakage.
Moreover, it is very important to be sure that the chosen intervention voltage value is never reached during the power supply standard functioning (for example because of the main supply voltage variations), otherwise the control circuit constantly activates the braking resistor, wasting a great quantity of energy and causing the overheating and the possible breakage of the resistor itself.

5.4 Signal LEDs

The DP1xxx series power supplies are provided with a green signal LED named *On*; a second LED, yellow colored, named *Brake Resistor* is present only on the DP1xx**2** power supplies.

On

The LED *On* lights up when the power supply output voltage is higher than 12Vdc. At lower voltages it is possible that the LED is still visible but with a lower luminous intensity.

Never use the information given by the LEDs for security purposes.
To be sure that the power supply output voltage is not dangerous it is necessary to remove the AC input voltage and wait for the *Cft* time.

Brake Resistor

This LED gives contemporaneously two different information on the power supply status.
During the standard functioning, the LED lights up each time the output voltage exceeds the set threshold, indicating the braking resistor intervention.

Instead, if the LED remains constantly lighted up, even with the output voltage lower than the set threshold, it is indicating that braking resistor is interrupted (or not correctly cabled).

6 Technical Data

The following are the electric, physical and mechanical details of each single driver.

DP1651					
Symbol	*Description*	*Value*			*Unit*
		Min	*Typ*	*Max*	
VL	AC supply voltage			42	**Vac**
Vp	DC output voltage			60	**Vdc**
Ip1ph	Output current available from single phase AC input			12	**Arms**
Ip3ph	Output current available from three phase AC input			16	**Arms**
Cfc	Filter capacitors capacitance		12,000		**µF**
Cft	Filter capacitors discharge time		90		**s**
Mechanical Specifications					
FDh	Height		100.4		**mm**
FDl	Depth		119.0		**mm**
FDw	Width		35.0		**mm**
FDnw	Weight		320		**Gr**
Rated range of use					
FCa	Altitude			2,000	**M**
FCt	Temperature	0		50	**ºC**
FCh	Humidity (no condensing)	10		90	**%**
Condition of storage and transport					
SCa	Altitude			4,000	**M**
SCt	Temperature	-20		60	**ºC**
SCh	Humidity (no condensing)	5		95	**%**

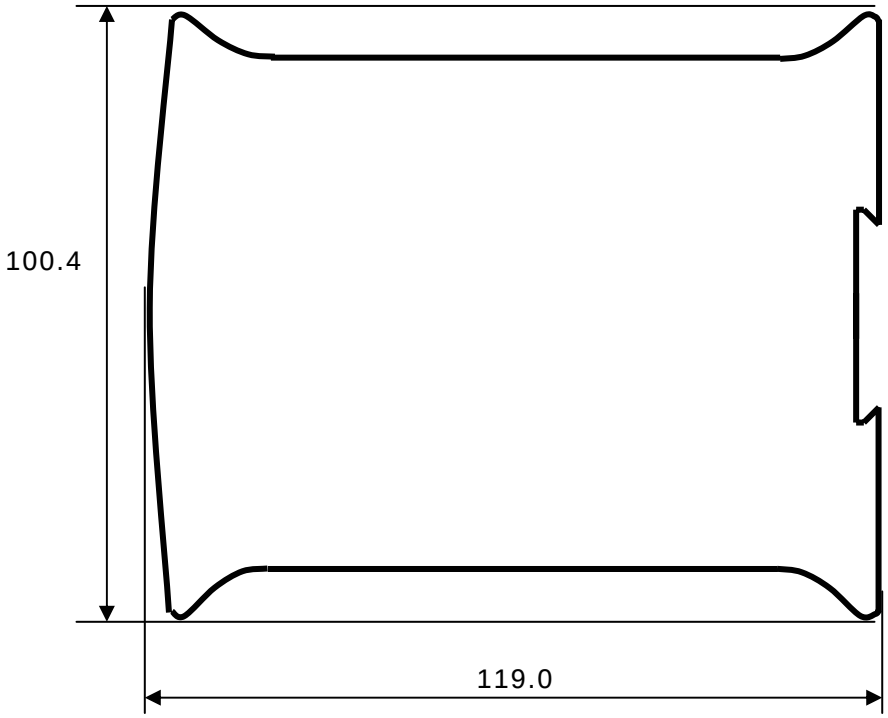
DP1652					
Symbol	***Description***	***Value***			***Unit***
		Min	***Typ***	***Max***	
VL	AC supply voltage			42	**Vac**
Vp	DC output voltage			60	**Vdc**
Ip1ph	Output current available from single phase AC input			12	**Arms**
Ip3ph	Output current available from three phase AC input			16	**Arms**
Cfc	Filter capacitors capacitance		12,000		**µF**
Cft	Filter capacitors discharge time		90		**s**
Rbrk	Braking resistor	4		1,000	**Ω**
Vrbon	Braking resistor intervention voltage	20		60	**Vdc**
Vrbh	Hysteresis voltage between braking resistor power on and power off		4		**Vdc**
Mechanical Specifications					
FDh	Height		100.4		**mm**
FDl	Depth		119.0		**mm**
FDw	Width		35.0		**mm**
FDnw	Weight		350		**Gr**
Rated range of use					
FCa	Altitude			2,000	**M**
FCt	Temperature	0		50	**ºC**
FCh	Humidity (no condensing)	10		90	**%**
Condition of storage and transport					
SCa	Altitude			4,000	**M**
SCt	Temperature	-20		60	**ºC**
SCh	Humidity (no condensing)	5		95	**%**

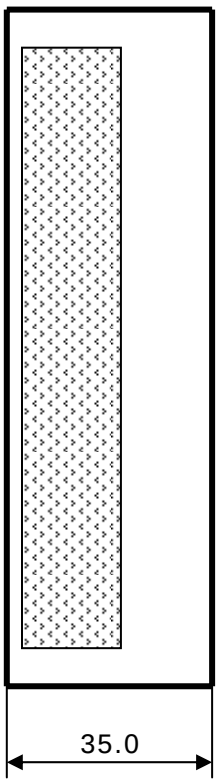
DP1741					
Symbol	***Description***	***Value***			***Unit***
		Min	***Typ***	***Max***	
VL	AC supply voltage			68	**Vac**
Vp	DC output voltage			100	**Vdc**
Ip1ph	Output current available from single phase AC input			8	**Arms**
Ip3ph	Output current available from three phase AC input			16	**Arms**
Cfc	Filter capacitors capacitance		6,000		**µF**
Cft	Filter capacitors discharge time		90		**S**
Mechanical Specifications					
FDh	Height		100.4		**mm**
FDl	Depth		119.0		**mm**
FDw	Width		35.0		**mm**
FDnw	Weight		320		**Gr**
Rated range of use					
FCa	Altitude			2,000	**M**
FCt	Temperature	0		50	**ºC**
FCh	Humidity (non condensing)	10		90	**%**
Condition of storage and transport					
SCa	Altitude			4,000	**M**
SCt	Temperature	-20		60	**ºC**
SCh	Humidity (no condensing)	5		95	**%**

DP1742					
Symbol	***Description***	***Value***			***Unit***
		Min	***Typ***	***Max***	
VL	AC supply voltage			68	**Vac**
Vp	DC output voltage			100	**Vdc**
Ip1ph	Output current available from single phase AC input			8	**Arms**
Ip3ph	Output current available from three phase AC input			16	**Arms**
Cfc	Filter capacitors capacitance		6,000		**µF**
Cft	Filter capacitors discharge time		90		**s**
Rbrk	Braking resistor	8		1,000	**Ω**
Vrbon	Braking resistor intervention voltage	50		100	**Vdc**
Vrbh	Hysteresis voltage between braking resistor power on and power off		4		**Vdc**
Mechanical Specifications					
FDh	Height		100.4		**mm**
FDl	Depth		119.0		**mm**
FDw	Width		35.0		**mm**
FDnw	Weight		350		**Gr**
Rated range of use					
FCa	Altitude			2,000	**M**
FCt	Temperature	0		50	**ºC**
FCh	Humidity (no condensing)	10		90	**%**
Condition of storage and transport					
SCa	Altitude			4,000	**M**
SCt	Temperature	-20		60	**ºC**
SCh	Humidity (non condensing)	5		95	**%**

DP1831					
Symbol	***Description***	***Value***			***Unit***
		Min	***Typ***	***Max***	
VL	AC supply voltage			135	**Vac**
Vp	DC output voltage			200	**Vdc**
Ip1ph	Output current available from single phase AC input			6	**Arms**
Ip3ph	Output current available from three phase AC input			12	**Arms**
Cfc	Filter capacitors capacitance		3,000		**µF**
Cft	Filter capacitors discharge time		90		**s**
Mechanical Specifications					
FDh	Height		100.4		**mm**
FDl	Depth		119.0		**mm**
FDw	Width		35.0		**mm**
FDnw	Weight		320		**Gr**
Rated range of use					
FCa	Altitude			2,000	**M**
FCt	Temperature	0		50	**ºC**
FCh	Humidity (no condensing)	10		90	**%**
Condition of storage and transport					
SCa	Altitude			4,000	**M**
SCt	Temperature	-20		60	**ºC**
SCh	Humidity (no condensing)	5		95	**%**

DP1832					
Symbol	***Description***	***Value***			***Unit***
		Min	***Typ***	***Max***	
VL	AC supply voltage			135	**Vac**
Vp	DC output voltage			200	**Vdc**
Ip1ph	Output current available from single phase AC input			6	**Arms**
Ip3ph	Output current available from three phase AC input			12	**Arms**
Cfc	Filters capacitors capacitance		3,000		**µF**
Cft	Filter capacitors discharge time		90		**s**
Rbrk	Braking resistor	15		1,000	**Ω**
Vrbon	Braking resistor intervention voltage	100		200	**Vdc**
Vrbh	Hysteresis voltage between braking resistor power on and power off		4		**Vdc**
Mechanical Specifications					
FDh	Height		100.4		**mm**
FDl	Depth		119.0		**mm**
FDw	Width		35.0		**mm**
FDnw	Weight		350		**Gr**
Rated range of use					
FCa	Altitude			2,000	**M**
FCt	Temperature	0		50	**ºC**
FCh	Humidity (no condensing)	10		90	**%**
Condition of storage and transport					
SCa	Altitude			4,000	**M**
SCt	Temperature	-20		60	**ºC**
SCh	Humidity (no condensing)	5		95	**%**





Dimensions expressed in millimeters. Not full-scale drawings.

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