

**Operating instructions**

**DControl Type PKDM**

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M 2138 GB



## Operating instructions

### Dcontrol / PKDM Controllers for voltage-regulated 3~ phase motors

#### Applications:

- Speed controller for fans in refrigeration, air-conditioning and clean-room engineering
- Pressure / temperature controller for refrigeration engineering



PKDM5..80: Software D1197A Part.No. 00162616 from version 07  
(with two sensor inputs)

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## 2 General

### 2.1 Copyright

The copyright for these operating instructions remains to

**Big Dutchman International GmbH, D-49360 Vechta, Germany, P.O. box 1163,  
Tel. 04447/801-0, Telex 25510 big d, Fax 04447/801-237**

This manual is subject to copyright. The information and drawings included in this manual shall not be copied nor shall they be used for anything other than the designated use. Neither shall they be given to third parties.

In the event of a breach of this obligation compensation must be paid.

All rights reserved, especially for the grant of patent or other registrations.

We reserve the right to modify technical data for reasons of further development. .



Please observe that this instruction manual is applicable to the device only. It is not applicable to the complete system.

### 2.2 Basis for the construction of the device

The device is constructed in accordance with the current state of technology and the recognised safety regulations.

Nevertheless, use of the device is associated with dangers which may cause death or injury to users or third parties as well as damages to the system and other objects.

- The device is intended exclusively for the tasks listed in the order confirmation. Any other or extraordinary uses of the device (unless previously agreed by contract) are considered contrary to regulations. The manufacturer is not liable for damages resulting from incorrect use.

The operating company alone bears the risk.



The designated use also includes the exact observance of procedures regarding assembly, operation and maintenance described in this manual.

### 2.3 Notes for use

- To allow for further developments construction methods and technical data given are subject to alteration.
- We do not accept any liability for possible errors or omissions in the information contained in data, illustrations or drawings provided.
- Inform yourselves about the measurements regarding assembly, adjustment, maintenance and operation **before the putting into operation**.
- Apart from the operating instructions and the obligatory regulations to be followed by users relating to accident prevention, the recognised technical regulations must also be observed (safety and branch related work as per UVV, VBG, VDE etc.).

- Apart from the operating instructions, the instructions of the manufacturers of components (e.g. sensors) have also to be followed.
- These devices are potentially dangerous if they are used incorrectly by untrained personnel or are not implemented according to their specified use.



Work on the system may only be carried out by persons who are competent because of special training or knowledge and practical experience with the unit. The operator has the sole power of decision.

#### 2.4 Transport, storage

- The Big Dutchman-controllers are packed ex factory to suit the transport method previously agreed.
- Always use the original packaging materials when transporting the controller.
- When transporting by hand, ensure that personnel possess the strength required to lift and carry the device.
- Avoid shocks and impacts to the device.
- Check the packaging and controller for damage.
- Store the controller in its original packaging in a dry and weather-proof room.
- The device must not be exposed to extreme heat and low temperatures.

#### 2.5 Duties of the user



The user is responsible for a safe and accurate operation of the device. Danger areas arising between BD devices and equipment provided by customer have to be secured by the user!

### 3 Safety measures

#### 3.1 Safety symbols and explanations

The below-mentioned symbols and instructions warn of possible dangers and point out to certain precautions.

Please observe these instructions and also inform other users!

#### 3.2 Symbols

When reading this manual you will find the following symbols:

	Attention! Hazardous area!
	Danger owing to electric current or voltage!!
	Important information!

#### 3.3 Special safety instructions

	<b>Warning</b>	This symbol indicates risks possibly leading to personal injury resulting in death or to severe injuries.
	<b>Caution</b>	This symbol indicates risks or insecure procedures possibly leading to injuries or material damage.
	<b>Note</b>	This symbol indicates notes leading to an effective, economic and environmentally-conscious handling of the installation.

#### 3.4 Electrical/electronic components

	Any faults detected in the electric system/modules/operating equipment must be corrected immediately. If these faults are not corrected, the device/system is potentially very dangerous. The device/system must therefore not be operated when it is faulty.
	Work on electric components/modules may only be carried out by trained electricians in accordance with electro-technical regulations (e.g. EN 60204, DIN VDE 0100/0113/0160). The owner is obliged to ensure that the devices are operated in perfect working order only.

- It is forbidden to carry out work on electrically live parts. The rating given in the enclosure for the device when open is IP00. It is possible to inadvertently touch components carrying hazardous voltages!
- During operation, the device must be closed or installed in a control cabinet.
- Fuses may only be replaced by new ones and must not be repaired or bypassed.
- Use only fuses specified in the schematic diagrams.
- The safe isolation from the supply must be checked using a two-pole voltage detector.

### 3.5 Employing external personnel

Von den Geräten können Gefahren ausgehen, wenn sie von unausgebildetem Personal unsachgemäß oder zu nicht bestimmungsgemäßem Gebrauch eingesetzt werden.

Mounting, maintenance and repair work is frequently carried out by non-operating personnel, which is not familiar with the special circumstances and the inherent dangers.

- Inform these people in detail on the dangers of their area of work.
- Check their method of working and intervene as soon as possible.



As supervisor, you are responsible for the safety of external personnel!

### 3.6 Accessories, spare parts

**Indicate the following for ordering spare parts:**

- Code-No. and description of the spare part or
- Pos.-Nr. with description and no. of manual in case parts without code-no.
- Invoice no. of original invoice
- Power supply, e. g. 220/380V-3Ph.-50Hz.

For queries please contact:

Big Dutchman International GmbH, D-49360 Vechta, Germany, Postfach 1163,  
Telefon 04447/801-0, Telex 25510 big d, Fax 04447/801-237.

	<b>Please note!</b> For your own safety we advise only to use parts, sensors and additional equipment approved and recommended by Big Dutchman. Regarding not-approved or recommended foreign products or other modifications not made by BD we cannot judge the safety risks in connection with the BD devices.
	Original BD parts and additional equipment or other products approved and recommended respectively by BD as well as the qualified advice can be received by the BD after-sales service (Tel. 04447-801-0). By mutual interest, we ask you to observe the above-mentioned instructions. <b>Operational safety is the prime necessity!</b>

### 3.7 Liability

Warranty and liability are excluded if unauthorized modifications on the machine, control systems or software result in damages to the device.

### 3.8 Disorders due to power failure

We recommend the installation of warning systems for a better control of your production units or the use of an emergency power-generating set for supplying the system with power in case of power failure. By this, you protect the birds and thus your economical health. Emergency power units with universal transmission for connection to a tractor are also suitable. For further information please contact your property insurance.

**3.9 First aid**

For the case of an accident, unless specified otherwise, a first-aid kit must always be available at the place of work. Material taken out and used is to be replaced immediately.

**If you need help, describe the accident as follows:**

- where it happened
- what happened
- the number of persons injured
- what type of injury
- who is reporting the accident (your data)!

**3.10 Waste disposal**

After finishing the assembly or repair of this installation, dispose of the packing material and remains which do not need to be further used according to the legal provisions for recycling.

The same applies to the component parts after putting the installation out of service.

## 4 General description

### 4.1 Scope of application

The controlling device as described is intended for infinitely variable speed settings in voltage-regulated 3-phase motors for driving fans and pumps.

### 4.2 Technical data

The name plate refer to a maximum ambient temperature of 40°C (with internal semiconductor fuses) or 50°C (without internal semiconductor fuses).

Version: housing IP54, internal semiconductor fuses							
Type	Part-Nr.	Rated current for 40°C (1) [A]	max. line fuse (2) (A)	internal semiconductor fuse (3) (Part.-Nr.)	Heat dissipation approx. [W]	weight [kg]	line voltage
PKDM5	304558	5	10	FF20A 6x32mm pack of 10 fuses: 349026	25	2,4	3~208-415V (-10 % to +6%) 50/60 Hz
PKDM12	304570	12	16	FF30A 10x38mm pack of 10 fuses: 349027	55	3,4	
PKDM15	304560	15	20		70	4,7	
PKDM20	305594	20	25	FF30A 10x38mm gRL single fuse 00155984	80	5,7	
PKDM25	305532	25	35	FF50A D02 pack of 10 fuses: 349028	100	12,7	
PKDM35	305533	35	50	FF63A D02 pack of 10 fuses: 349029	150	13,0	

- Maximum cross section for line and motor connection

PKDM5..20 : 2,5 mm<sup>2</sup>

PKDM25/35 : 6 mm<sup>2</sup>

PKDM25/35 E : 10 mm<sup>2</sup>

PKDM50/80(E) : 35 mm<sup>2</sup>

- Stepless controlled output voltage approx. 20-100% (line voltage)
- Minimum motor current
  - for PKDM5: 0,2 A
  - for PKDM10...80: 0,5 A

- Input resistance for sensor or signal set for the rotational speed:
  - for 0-10 V input :  $R_i > 100 \text{ k}\Omega$
  - for 4-20 mA input:  $R_i = 100 \Omega$
- Voltage supply e.g. for sensors +24 V  $\pm 20 \%$ ,  $I_{\max}$  120 mA
- Output (0-) 10 V,  $I_{\max}$  10 mA (short-circuit-proof)
  - For function as speed controller: fixed voltage 10V for external potentiometer
  - For function as a P-controller: 0-10V proportional to the regulated output voltage
- Max. permissible ambient temperature depending on version
  - for controller with internal fuses type PKDM.. :40° C (up to 55° C with derating)
- Min. permissible ambient temperature 0°C (if mains voltage is not switched off up to - 20°C)
- Permissible installation height 0..4000m amsl. Above 1000 m amsl the rated current is to be reduced by 5% / 1000 m.
- Permissible rel. humidity 85 %, no condensation
- Interference emission in accordance with EN 61000-6-3
- Interference immunity in accordance with EN 61000-6-2
- Harmonics current EN 61000-3-2  
The units comply with EN 61000-3-2 for a „professional unit". Up to a maximum current of 4 ampere the limits were complied without any qualification.

### 4.3 Versions

IP 54 for wall mounting

- ◆ PKDM.. Motor protection using TK or PTC resistor connection.

#### 4.4 Power decrease for increased ambient temperatures

The unit's maximum permissible ambient temperature is depending on version 40°C, or version 50°C. Up to that temperature a load of the quoted rated current is possible.

The removal of heat in the unit due to power dissipation is dependent on the ambient temperature, so the maximum load has to be reduced if the ambient temperature is higher than 40° C or 50°C! For each degree higher the load has to be reduced approx. 2.2 %.

The median (measured 24 h) has to be 5°C below the max. ambient temperature.

Pay attention of the unit's power dissipation and their possible effects on the ambient temperature if the unit is mounted in a switch cabinet (☞ Technical data)!

#### Maximum load for ambient temperatures higher 40°C for versions with internal fuses

Type	Part.-Nr.	Rated current for 40°C	max. current load for 45°C	max. current load for 50°C	max. current load for 55°C
PKDM5	304558	5	4,5	3,9	3,4
PKDM10	304559	10	8,9	7,8	6,7
PKDM12	304570	12	9,4	9,4	8,0
PKDM15	304560	15	11,7	11,7	10,1
PKDM20	305594	20	15,6	15,6	13,4
PKDM20(500V)	305600	20	15,6	15,6	13,4
PKDM25	305532	25	19,5	19,5	16,8
PKDM35	305533	35	27,3	27,3	23,5
PKDM50	305563	50	39,0	39,0	33,5
PKDM80	305564	80	62,4	62,4	53,6

## 5 Installation

### 5.1 Mounting

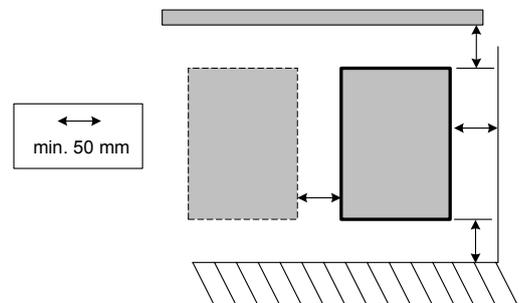
- Assemble the device on a clean and stable base. Do not distort during assembly! Use the appropriate mounting devices for proper installation of the unit!
- Do not mount equipment on vibrating base!!
- Use the appropriate fixing equipment. The plastic washers must be installed between the screw heads and the housing for models with mounting holes on the inside of the housing. !
- Install the device away from transport routes. However, ensure that the device is still easily accessible!
- Depending on the housing model cut off necessary cable inlets respectively to the cable diameter. Or alternative use cable inlet for cable glands. Metal sheet housings are supplied with stoppers. Any cable ducts openings not used must be sealed!
- Protect the device from direct exposure to sunlight!
- The device is designed for vertical installation (cable inlet down). A horizontal or reclined installation is only permissible after consultation with the manufacturer.



**Be sure to observe proper heat dissipation**  
(☞ Technical data „heat dissipation“)

### 5.2 Minimum space requirement

In order to ensure sufficient ventilation of the device, clearance on all sides of at least 50 mm has to be maintained to the housing walls, switch cabinet doors, wiring ducts, etc. The same clearance applies to the installation of several devices next to each other. (☞ illustration). When installing several devices on top of each other, the danger of reciprocal heating exists. This layout is only then permissible when the air suctioned from the upper unit does not become warmer than the permissible ambient temperature (☞ Technical data). I.e., a correspondingly larger clearance or thermal shielding is required.



### 5.3 Outdoor installation

Outdoor installation is possible up to -20°C when the controller supply is not switched off.

**Installation must be protected from the effects of weather as much as possible, including protection from direct sunlight!**

#### 5.4 Installation location for agriculture

In order to avoid damage caused by ammoniac vapours (NH<sub>3</sub>), the controller shall not be installed in the stable but rather in an outhouse wherever possible.

#### 5.5 Temperature influences during commissioning

Avoid condensation in the controller and hence functional faults attributable to condensation by storing the controller at room temperature!

#### 5.6 Residual-current-operated protective device

Owing to possible leakage currents occurring when the device is switched on, it is advisable to use short-time-delayed current-operated circuit-breakers. This prevents any triggering by mistake. Plans without neutral conductor connection ↪ Elektrical connections: mains connection.

#### 5.7 Potential at control voltage connections

The control voltage connections (<50 V) relate to the joint GND potential (Exception: Relay contacts are potential free). There is a potential separation between the control voltage connections and the earthed conductor. It must be ensured that the maximum external voltage at the control voltage connections cannot exceed 50 V (between „GND“ terminals and „PE“ earthed conductor).

If necessary, a connection to the earthed conductor potential can be established, install bridge between „GND“ terminal and the „PE“ connection (terminal for screening).



#### 5.8 Employment in the IT NET

In the IT net the neutral point of voltage is not grounded; in the case of a short-circuit between a phase (e.g. „L1“) and protective grounding „PE“ becomes the protective grounding potential = "L1".

#### **In order to ensure a trouble-free enterprise in this case:**

1. the „GND“ potential of the control ports does not have to be connected with the protective grounding potential,
2. the „N“ lead must not be connected.

**As a consequence of the connection between „GND“ potential of the control ports with protective grounding potential, the following must be considered (exception relay contacts floating):**

1. Only with lines for mains voltage and environment are suitable attach.
2. Attach over suitable isolating amplifiers.

## 6 Electrical connection (see also appendix: connecting diagram)

### 6.1 Mains connection

Power from the mains is connected to terminals: PE, L1, L2, L3 and N. Here it must be strictly observed that the mains voltage lies within the allowable tolerance specifications (☞ General description: Technical data and nameplate affixed to the side).

The neutral conductor connection "N" is only for the leakage current's reduction. It is of no significance for the function of the device. The connection is not applicable for power supply networks without a neutral conductor. Since higher leakage currents may arise by this across the protective-cable connection "PE", unwanted triggering by mistake may occur in systems with FI protection circuits.

	<p><b>If the neutral conductor „N“ is not connected and the „PE“ connection is interrupted, touching can result in dangerously high leakage currents. In this case, EN 50178 Section 5.3.2.1 for devices with leakage current above 3,5 mA must be observed.</b></p> <p><b>The supply voltage has to correspond to DIN EN50160!</b></p>
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(Employment in the IT network ☞ chapter 5.8)

### 6.2 Adjustment to specific mains conditions

#### ◆ Fixed 60 Hz assignment

Upon connection, the mains frequency (50 or 60 Hz) is automatically detected and used to trigger ignition of the thyristors. . If, in exceptional cases, a 60 Hz mains frequency cannot be clearly identified, fixed assignment can be necessary (mains failure, as device operates at 50 Hz if 60 Hz is not detected). The device reacts with a power failure when a determined attribution at 50 Hz has been set (☞ see chapter „Faults and troubleshooting: Mains failure).

#### By Dipswitch S1 Nr. 6

ON (up) = 60 Hz fix

OFF (down) = automatic detection

#### ◆ Deactivating phase monitoring

The device has built in phase monitoring (☞ Faults and troubleshooting: Mains failure). For special applications (e.g. unbalanced mains supply, phase position other than 120° on a soft generator or for transformer operation) this can be disconnected after consultation with Big Dutchman.

The motor is thus no longer protected by TWO PHASE OPERATION (observe Motor protection chapter).

#### By Dipswitch S1 Nr. 8

ON (up) = phase monitoring activ

OFF (down) = phase monitoring deactivated

### 6.3 Motor connection

The motor leads are connected to the terminals: PE, U,V,W. Several fans can be connected to the controller. The maximum total current of all motors (maximum rated current for electronic control of the voltage) must not exceed the current rating for the controller. If the maximum control current for the electronic voltage control is not known, then allowance for an increase in the motor nominal current must be made.

Typical is this for 2- and 4-pole motors at approx. 25 %, for 6-pole motors at approx. 20 %, for 8- and 10-pole motors at approx. 15 % and higher pole motors at approx. 5 %. For the control of motors made by other manufacturers (not Big Dutchman) the control characteristics and the maximum current for electronic regulation of the voltage should be enquired from the manufacturer.

#### 6.3.1 Motor feeder cable



The applicable standard for radiating interference is EN 61000-6-3. An unshielded motor feeder cable is required for compliance with the standard.

### 6.4 Motor noise

Motor noise can occur when fans are controlled using electronic voltage controllers (phase cutting = series „P...“). Such noise can be system-dependently perceived as a disturbance. This noise is relatively low for fast-running fans where the noise from the air is high. The noise from motors in slower-running fans where the noise from the air is less, can be dominated by resonance in the lower speed ranges.

For systems where noise is critical, we recommend using our Fcontrol series frequency converters with integrated sinusoidal filter.

### 6.5 Motor protection

#### ◆ PKDM5..80

The motor can be protected by connecting the thermal contacts or PTC resistor (PKDM: M = motor protection using TK or PTC resistor connection).



**When several motors are connected ensure that the thermal contacts or PTC resistors are always connected in series. A maximum of six individual thermistors (DIN 44081 or DIN 44082) may be connected in series to a single device. Depending on the motor type, at least two or three individual sensors are built in.**

**Monitoring of motors in „Ex“ zones is not permissible. For systems of this type an additional posistor tripping unit is required, with disconnection via a separate motor protection circuit.**

The unit switches off when a connected thermal contact or PTC resistor has tripped the circuit (interruption between both TK terminals). The unit then remains switched off. The fault-indicating relay opens (terminals 11-12 bridged) the red LED for motor fault illuminates, the green LED for operating goes off.

The unit starts up again once the drive has cooled down by switching the mains voltage OFF and the ON again or by enable ON/OFF (terminal "D1").



**An outside voltage may never be connected to the terminals „TK“!**

**The internal motor protection does not function if a bypass circuit has been realised. In this case and as well as other precautions, an additional thermal contact protective device is necessary.**

### 6.6 Special function only for PKDM.: Motorstart with maximum output voltage „Hard start function“ (**Big Dutchman does not use this function!**)

For types PKDM „Hard start function“ can be activated for the connected fans. „Hard start function“ means to force the controller to generate for approx. 10 seconds max. voltage (100 %) ignoring any control signal. Afterwards the output voltage adjusts itself to the given or over the control amplifier calculated value. For operation as P-controller the „Hard start function“ works also by switching over the control function („Heating“/„Cooling“).

#### By Dipswitch S1 Nr. 5

ON (up) = with hardstart function

OFF (down) = no Hardstart Function (**factory setting!**)  
After switching on of the mains voltage on the output voltage rises during the firmly programmed run-up time to the given value.

### 6.7 Signal cable (sensor cable)

Pay attention to sufficient distance from powerlines and motor wires to prevent interferences.



**The control cables may not be longer than 30 m. Screened control cables must be used when the cable length is longer than 20 m.**

**When using a screened cable, the screen must be connected to the protective conductor at one end; i.e. only at the control unit (as short and as low an inductance as possible!)**

**6.8 Enable ON / OFF to digital IN 1 (Big Dutchman does not use this function)**

Enable ON/OFF (electronic disconnection) and reset after motor fault via potential free contact, terminals „D1“-„D1“.

- ◆ Device ON with contact closed
- ◆ Device OFF with contact open („Fault relay K1 not released, terminals 11-14 bridged“)

Display for disconnection: green LED flashes



**No disconnection (isolation) when turned off, in accordance with VBG4 §6.**

**6.9 Signal connection or sensor connection ( Analog IN1, Analog IN2, ..)**

PKDM.. controllers have 2-analog inputs (Analog IN1 & Analog IN 2).

- Input 1 (Analog IN1) terminals E1 / GND
- Input 2 (Analog IN2) terminals E2 / GND (**Big Dutchman does not use this function!**)

Ensure correct polarity when connecting; a 24 V DC power supply is integrated for sensors. For sensors in two-wire-technology (4-20mA signal), the connection is made on the +24 V and “E1” and “E2” terminals (the GND terminal is omitted). The connection is independent of the programmed operating mode and from the sensor signal employed. Place the internal plug (jumper) for the external default signal in the correct position , factory setting 4..20mA.

**(Jumper for Input signal ↻ Pos 6)****6.10 External speed setting (operation as a speed controller)**

The signal for selecting the speed is connected to the terminals „E“ (E1) and „GND“; be sure to observe correct polarity. The maximum length of the connecting cable shall be 30 m (screened).

- ◆ Setting signal **4-20 mA** Jumper **E1.1 and E1.2 down inserted**
- ◆ Setting signal **0-20 mA** Jumper **E1.1 and E1.2 not inserted**  
0-20mA signal is possible by connecting in an external **resistor (499 Ω / 0,25 W)** in parallel between the terminal “E” and “GND”.

◆

	<p><b><u>Standard range of application for Big Dutchman</u></b> Setting signal <b>0-10 V</b> or external potentiometer jumper E1.1 and E1.2 not inserted.</p> <p>An external speed setting is possible by using a <b>10 kΩ</b> potentiometer connected to the terminals „A“ (+10 V) und „GND“ with pick-off at terminal “E” (E2)</p> <p>(see picture 1 and picture 2 on pages 27 and 28 / marked area 3)</p>
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### 6.10.1 Inverting setting signal

With switch 1 to Dipswitch S1 (not inverted by the factory).

Schalter 1 ON = setting signal inverted (10-0 V, 20-0 mA, 20-4 mA)

#### **Standard Big Dutchman:**

**Switch 1 OFF = setting signal not inverted (0-10 V, 0-20 mA, 4-20 mA)**

### 6.11 Operation with second setting signal at input „E2“ (special function only for PKDM..) (**Big Dutchman does not use this function!**)

An input for a second default signal is activated over the switch 7 on Dipswitch S1. Place the internal jumper „E2.1“ and „E2.2“ depending on signal in correct position.(see input „E1“).

- Setting signal **not inverted**

By operation with a second signal the controller works automatically at the higher level of the two analog inputs (E1 or E2).

- Setting signal **inverted**

By operation with a second signal the controller works automatically at the lower level of the two analog inputs (E1 or E2).

### 6.12 Sensor connection (operation as a P-controller) (**Big Dutchman does not use this function!**)

The signal from the sensor for detection of the actual value is connected to the terminals „E“ or „E1“ and „GND“, for sensor in two-wire-technology output 4-20mA) to terminals „E“ (E1) and „24V“. Be sure to observe correct polarity. The maximum length of the connecting cable shall be 30 m (screened).

There is an integrated power supply (+24 V,  $I_{max}$ . 120 mA) for e.g., a pressure sensor of type DSF-2-25 r MBG-30I.

Sensors with the following standard signals may be connected depending on the programming of the controller: 0-10 V, 4-20 mA, KTY10-6 (PTC temperature sensor).

#### 6.12.1 Operation with a second sensor signal at input „E2“ for dual circuit condensers (only for PKDM..) (**Big Dutchman does not use this function!**)

The entrance for a second sensor signal is activated over the switch 7 on Dipswitch S1. Place the internal jumper „E2.1“ and „E2.2“ depending on signal in correct position (see jumper for input „E1“) By operation with a second sensor signal automatic regulation at the higher level of the two analog inputs (selection amplifier integrated e.g. for dual circuit condensers).

### 6.13 Switch over control function at Digital IN2 (only for operation as P-controller) (**Big Dutchman does not use this function!**)

For operation as P-controller an external switch over of control function is possible. When terminals "D2"- "D2" are bridged, the device works with the opposite function than the set with Dipswitch 1 (☞ 7.2.7).

### 6.14 Fault indications

An external fault indicator is available over the potential-free contacts of the built-in relay (contact load-carrying capacity 5 A, 250 V AC). The relay is energized if the controller is on mains supply, i.e. terminals "11" and "14" are bridged. If there is a fault the relay is de-energized, i.e. terminals "11" and "12" are bridged.

- By switching off via enable (terminal „D1“) the relay is not de-energized.
- By sensor failure (only in P-control operation) message only via the LEDs (yellow + green), the relay is not de-energized.

#### A fault is indicated with:

- A phase failure\*,
- blown semiconductor fuse\*,
- excessively high temperature at the unit,
- a defective controller-internal voltage supply,
- overheating by the motor (thermal contacts or thermistor connected).

(\*for „mobile application“ version, there is not error message for phase failure or blown semiconductor fuse!)

### 6.15 Voltage supply for external equipment

There is an integrated power supply e.g. for pressure sensors of the type DSF2-25 / MBG-30I.

Terminals      + 24 V      Output voltage tolerance  $\pm 20$  %.  
Max. onload current 120 mA



**In the event of overload or short circuit (24 V ↔ GND), the control voltage cuts out and hence switches off the control unit.**

#### Reconnection after solving failure cause:

- ◆ PKDM...  
with Multifuse:      automatic switch on.

**6.16 Output voltage (0-10 V (needed only as required))****For operation as a P-controller (☞ basic settings):**

Output voltage 0-10 V,  $I_{\max}$  10 mA (terminals „A“ / „GND“) is approximately proportional to the regulated output voltage. This can be used for example for a “slave controller” or for a valve positioning motor.

**For operation as a speed controller (☞ basic settings):**

Fixed 10 V,  $I_{\max}$  10 mA voltage for maintaining the speed from an external potentiometer.

## 7 General settings and operating elements

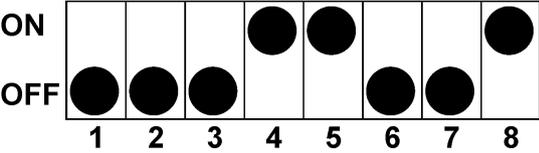
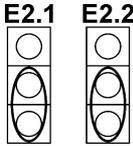
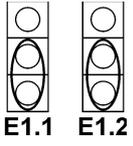
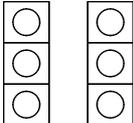
### 7.1 Programming the operating mode (speed controller / P-controller)

It is possible to use the device as speed controller or as P-controller.

Selection of the function must first be made by setting the internal **(Dipswitch)** and Jumper.

	<b>Caution: not under voltage! Observe the safety notices! Changed functions become active partly only after renewed switching on the mains voltage!</b>
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Please change factory setting: operation as P-controller for sensor with 4-20 mA signal at „E1“!

<p><b>Dipswitch settings Big Dutchman</b></p>  <p>ON</p> <p>OFF</p> <p>1 2 3 4 5 6 7 8</p> <p>See also picture 1 and picture 2 on pages 27 and 28 (marked area 1)</p>	<p><b>Jumper E2.1 and E2.2 for input E2</b> input for additional functions (only PKDM)</p> 
	<p><b>Jumper E1.1 and E1.2 for Input E1</b> Standard input</p> 
	<p><b>Attention!</b> <b>Big Dutchman Standard</b> (Jumpers are <u>not</u> inserted)</p> 

General setting for:						
Speed controller Big Dutchman			P-controller (not used by Big Dutchman)			
Input 0-10 V (0-20 mA / 4-20 mA and Inverting  electrical connection: „External speed setting“)			Not Big Dutchman	Temperature-sensor TF..(KTY10-6)	Pressure sensor <b>4-20mA</b> DSF./MBG	Pressure-sensor 0-10 V
Dip-switch S1	Function:	Setting:	Function:	Setting:		
1	Signal function	ON = 10-0 V OFF = 0-10 V	Control function	ON = increasing output voltage for decreasing actual value OFF = <u>increasing output voltage for increasing actual value</u>		
2	No function	-	Min. air shut down	ON = <u>nicht actv</u> OFF = activ		

3	Type of control	<u>ON</u> = <u>Internal pot</u>  OFF = external pot or 0-10 V	Type of signal (for <b>PKDT5</b> no function)	OFF	<u>ON</u> = <u>4-20mA</u>  OFF= 0-20mA	<u>ON</u> = <u>2-10V</u>  OFF = 0- 10V
4	For speed controller	ON	For P-controller	<u>OFF</u>		
<b>Additional functions:</b>						
5	Hardstart Function (for <b>PKDT5</b> no function)	<u>ON</u> = with Hardstart function  <u>OFF</u> = <u>no Hardstart function</u>	Hardstart function (for <b>PKDT5</b> no function)	<u>ON</u> = with Hardstart function  <u>OFF</u> = <u>no Hardstart function</u>		
6	60 Hz assignment	<u>ON</u> = 60 Hz fix  <u>OFF</u> = <u>automatic detection</u>	60 Hz assignment	<u>ON</u> = 60 Hz fix  <u>OFF</u> = <u>automatic detection</u>		
7	Input E2 (for <b>PKDT5</b> no function)	<u>OFF</u> = <u>input not activ</u>  <u>ON</u> = input activ	Input E2 (bei <b>PKDT5</b> no function)	<u>OFF</u> = <u>input not active</u>  <u>ON</u> = input activ		
8	Phase monitoring	<u>ON</u> = <u>phase monitoring active</u>  OFF = Phase monitoring deactivated	Phase monitoring	<u>ON</u> = <u>phase monitoring active</u>  OFF = Phase monitoring deactivated		
<b>Jumper</b>						
<b>E2.1+</b> <b>E2.2</b> + <b>E1.1+</b> <b>E1.2</b>	Type of signal	0-10 V both not inserted	Depending of type of sensor	Both up inserted	<u>Both down inserted</u>	Both not inserted

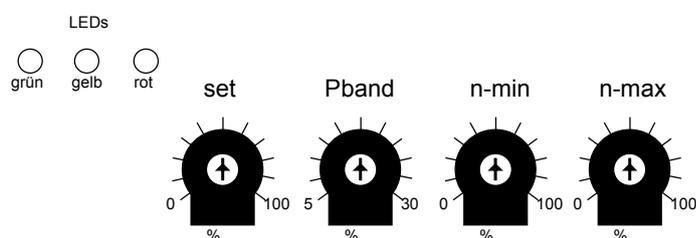
*Chapter 7.1 = connector position set at the factory*

## 7.2 Controls

## Operation as speed controller for Big Dutchman

For operation as a speed controller, the output voltage is set manually by adjusting the built-in potentiometer, by an external potentiometer or external signal (0-10 V).

Setting	Potentiometer
Output voltage 0-100 % (switch S1-3 ON) Control by internal potentiometer ( <b>no function for BD</b> )	„SET“
No function	„Pband“
Minimum output voltage 0-100 % (basic speed) ~ 100 Volt	„n-min“
Maximum output voltage „n-min“-100 % (speed limiter)	„n-max“



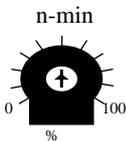
## LED indications

Meaning	LED
Normal operation without any faults	green
Motor fault (interruption at TK terminals)	red
Line fault (failure by a line phase)	yellow + red
Interruption / short circuit in sensor line, or sensor actual values outside the measuring range (only for operation as controller)	yellow + green
Device overheating (measured at internal heat sink)	Red blinking
Line interruption to heat-sink sensor	Green + red on and yellow blinking
„D1“-„D1“ terminals are not bridged (no enable)	Green blinking

## 8 Settings for operation

### 8.1 Settings for operation as a speed controller

#### 8.1.1 Min. speed „n-min“ (minimum output voltage or basic speed)

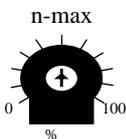


If required setting of a minimum output voltage, e.g. basic speed (minimum airflow rate) of connected fans..

Setting range:

from the counter-clockwise limit = „0“ (no „n-min“) to 15-100 % (△ approximately the mains voltage).

#### 8.1.2 Max. speed „n-max“ (derating) and Cos $\phi$ -adjustment



If required setting of a maximum output voltage, e.g. speed limiter.

Setting range:

From the clockwise limit (100 %) to 20 % (△ approx.. 100 % - 20 % of the applied mains voltage).

For a given minimum output voltage to the setting „n-min“.

For cos  $\phi$  adjustment, turn „n-max“ counterclockwise such that the maximum output voltage will just be measured (with TRUE-RMS

multimeter). This adjustment must be made for maximum output from the fans. All flaps must be opened when using centrifugal fans.

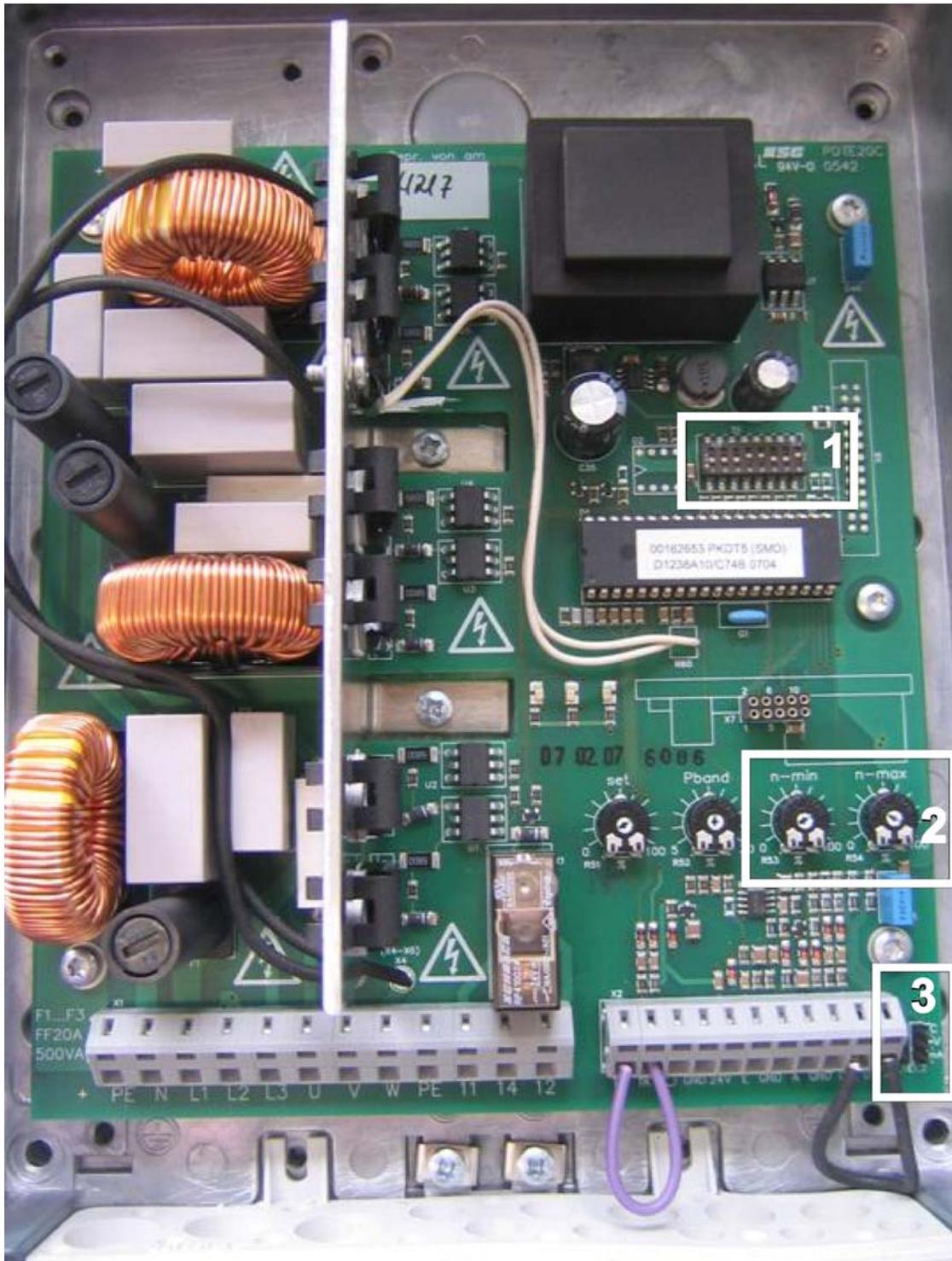
#### **Cos $\phi$ – adjustment:**



The output voltage from the unit depends on the inductance of the motor (cos  $\phi$ ).

By this, the maximum output voltage can already be reached below the maximum input signal (<10 V / 20 mA). A correction is possible by setting „n-max“ (cos  $\phi$ -adjustment).

Picture 1: PKDM 5



Picture 2: PKDM 12



## 9 Faults and troubleshooting

### 9.1 Mains fault

#### Function only for a connected inductive load

The device is provided with a built-in phase-monitoring function for the mains supply. In the event of a mains interruption (failure of a fuse or mains phase) the unit switches off after a delay. The unit then switches on again automatically after approximately 5 seconds when the voltage has been restored.

Line fault (failure of a line phase)	yellow + red
--------------------------------------	--------------

#### **Remedy:**

Check the mains supply and the internal semiconductor fuses.

In special cases phase failure can be deactivated for other types.  
(☞ Electrical connections: Adjustment to specific mains conditions.)

### 9.2 Temperature fault

The unit is fitted with a built-in temperature monitoring device coupled to the internal heat sink. The unit cuts out at a temperature of approximately 90°C and cuts in automatically again when the unit has cooled down again to about 65°C. An excessively high unit temperature is signalled by the internal LED's.

Excessively high unit temperature (measured at the internal heat sink)	red blinking
--	--------------

Interruption in the leads to the heat-sink sensor	green + red on and yellow blinking
---	------------------------------------

#### **Remedy in the event of an excessively high unit temperature:**

- Check whether the heat dissipation is adequate.
- Check for any overloading of the unit, i.e. whether the maximum control current occurring is above the rated current for the unit.

### 9.3 Motor fault

The unit cuts out and does not switch on again when the connected thermal contacts or PTC resistors for type PKDM have tripped (interruption between both terminals „TK“) (☞ Electrical connection: Motor protection).

Motor fault (interruption TK-terminals)	red
---	-----

## 9.4 Sensor signal faults

### Function only for operation as a P-controller

The unit is fitted with a built-in monitoring device for the sensor signal. A fault is signalled over the internal LEDs in the event of an interruption or a short circuit in the sensor conductors, or measured values that are outside of the measuring range for the unit.

For controllers model range PKDM sensor monitoring is also for the second input „E2“ (if activated by dipswitch).

Interruption / short circuit in the sensor leads or sensor values measured that are outside of the measuring range	yellow + green
--	----------------

### Cause for the signal „Sensor fault“ and the response by the controller

#### 1. For a temperature-dependent control (input for temperature sensor, type TF...):

- In the event of an interruption in the sensor leads.  
The controller acts as in the case of an extremely high temperature, i.e. maximum output voltage  
(Control response for increasing speed for increasing actual value, see setting for operation reversed control function (actual>set = n+)).
- In the event of a short circuit in the sensor leads.  
The controller acts as in the case of a very low temperature, i.e. minimum output voltage.  
(Control response for increasing speed for increasing actual value, see setting for operation reversed control function (actual>setl = n+)).
- In the case of temperatures at the sensor that are outside the measuring range of the controller,  
- for PKDM5/10/12/15/25/35...: at approx. -25° C and as of approx. +75° C.

The controller functions automatically again with the value measured at the temperature sensor after the fault has been rectified or when the actual temperature returns to within the measuring range of the controller.

#### 2. For a pressure-dependent control (input 0-10 V / 4-20 mA):

- In the event of an interruption in the sensor leads or for a short circuit between the terminals „E“ and „GND“.  
The controller acts as in the case of a very small measured value, i.e. minimum output voltage.  
(Control response for increasing speed for increasing actual value, see setting for operation reversed control function (actual>set = n+)).

- When the upper or lower limit of the measuring range for the sensor has been reached
  - For a 4-20 mA input for a sensor signal of approximately 4mA or approx. 20mA.
  - For a 0-10V input for a sensor signal of approx. 0 V or approx. 10 V.

The controller functions automatically again with the value measured at the temperature sensor after the fault has been rectified.

### 9.5 If controller doesn't work correctly

#### **Setting of dipswitch not under voltage!**

**If the device is on mains supply modifications will not be identified and realized.**

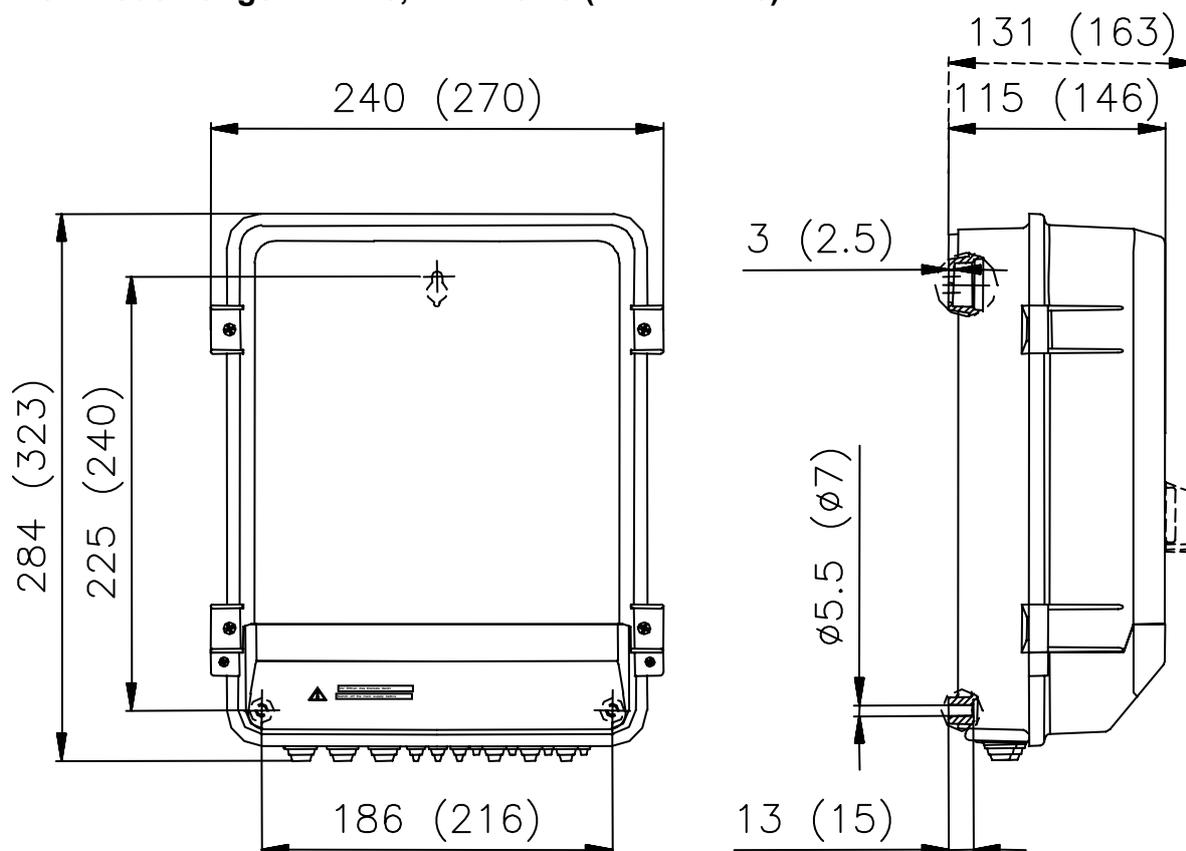


**It is forbidden to carry out work on electrical live parts. The enclosure rating of the device when open is IP00! It is possible to inadvertently touch components carrying hazardous voltages.**

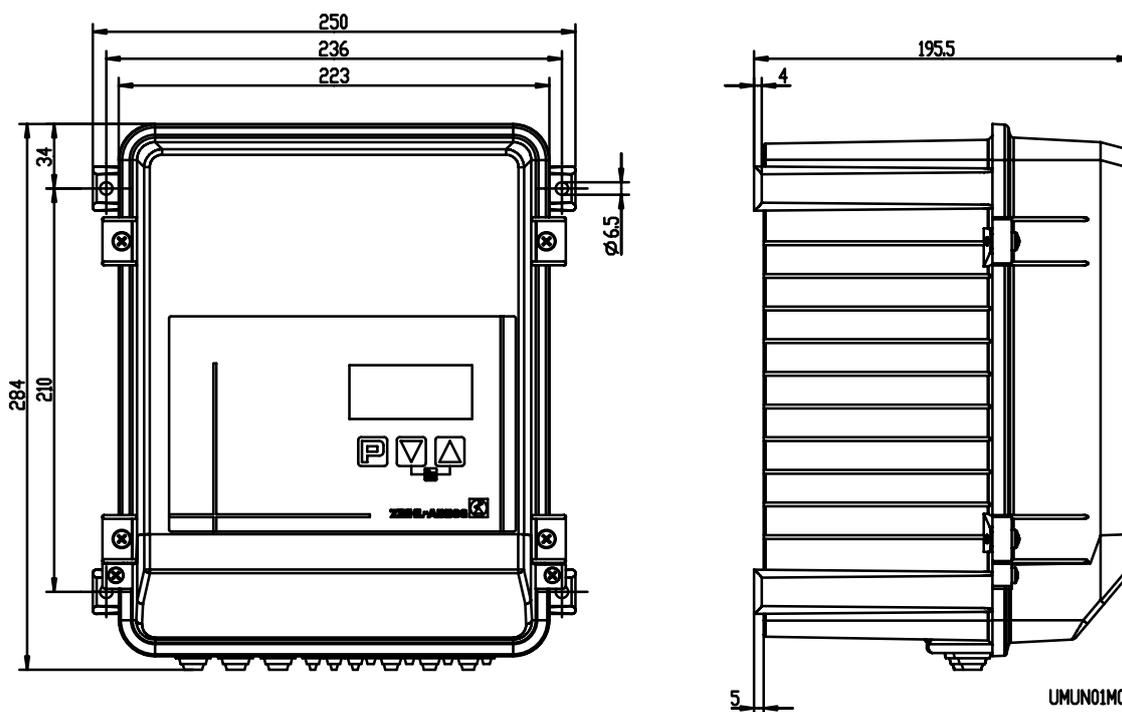


10.2 Dimension sheet

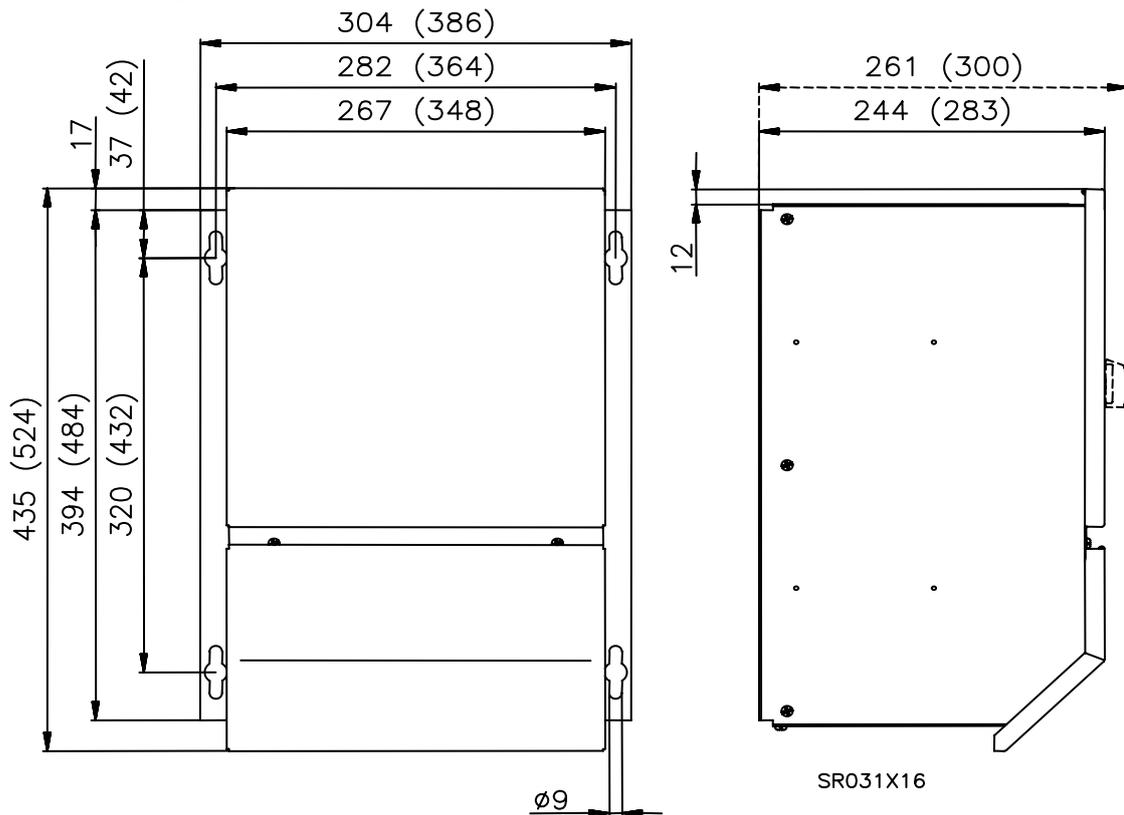
IP 54 model range: PKDT5, PKDM5/10 (PKDM12/15)



IP 54 model range: PKDM20



**IP 54 model range: PKDM25/35 (PKDM50/80)**



**IP 20 model range: PKDM25/35E (PKDM50/80E)**

