

Compact power,  
condensed function.



The new VARIODRIVE Compact motor  
VDC-3-49.15

The engineer's choice

**ebmpapst**

# Short as a small fan, strong as a large fan and more intelligent than both of them together.

*In countless applications, countless small drive units provide faithful and reliable service. Here, compact internal rotor motors are commonly known as an "all-purpose tool". However, these derive their power either from their overall length or the speed, frequently require multi-stage reduction gears and thus take up considerable installation space. Our answer to the lack of space: more power density. The VDC-3-49.15 is an extremely compact external rotor motor with high dynamics and uniform torque over a wide speed range. Extensive additional options, outstanding performance data and versatility in use allow it to reach a class otherwise reserved for internal rotor motors.*

## **From 0 to 100 watts in 5.2 centimetres**

When high output is required but only limited installation space is available, power density is the most important keyword. Therefore, an optimum ratio of rated output and size was one of the most important factors in developing the new VARIODRIVE Compact motor VDC-3-49.15. The performance data of both motor designs (rated voltage 48 or 24 VDC) speak for themselves.

With a diameter of 63 mm and a length of just 52 mm, both versions are substantially shorter than comparable internal rotor motors. At a nominal speed of 4000 rpm each, they attain a rated torque of 250 mNm or 150 mNm. The high overload capacity allows start-up torques that are twice that high. At a current draw of 2.9 A (48 V) and 3.5 A (24 V), the drives have a continuous output of 105 W and 63 W, respectively.

The integrated electronics control all motor functions of the VDC-3-49.15 and transmit the relevant operating data to the outside where necessary. Depending on the application, this may allow any special motor configurations necessary to be created by simple parameter configuration or programming the electronic control system. This saves costs for development, production and stock-keeping.

## **Maximum performance with sensitivity**

As the developer of the world's best compact fans, we are known for our external rotor motors. Though the requirements of a universally usable drive motor differ greatly from those of a fan motor, our engineers used their enormous wealth of experience for further development of the external rotor motor principle. The result is something to behold: The VDC-3-49.15 is a multi-pole external rotor motor with a completely integrated state-of-the-art electronic control unit that combines a small construction volume with power, intelligence and precision.

In the new series, high overload capacity and a large breakaway torque provide the necessary punch. The considerable torque can be used over a wide speed range with consistently high efficiency. The motors attain dynamic values which, with additional external moments of inertia, approach those of internal rotor motors. Thus they are also suited for applications in which an internal rotor motor was used previously, without full deployment of its dynamics.

When high sensitivity is required, the powerful DSP (Digital Signal Processor) and the well-engineered software make full use of their strengths. The continuous sinus commutation of all 3 winding phases enables accurate control of the drives, even at the lowest speeds. For example, the drive can be controlled with holding torque when at a standstill and has considerable control quality without additional sensors, even at the lowest speeds.



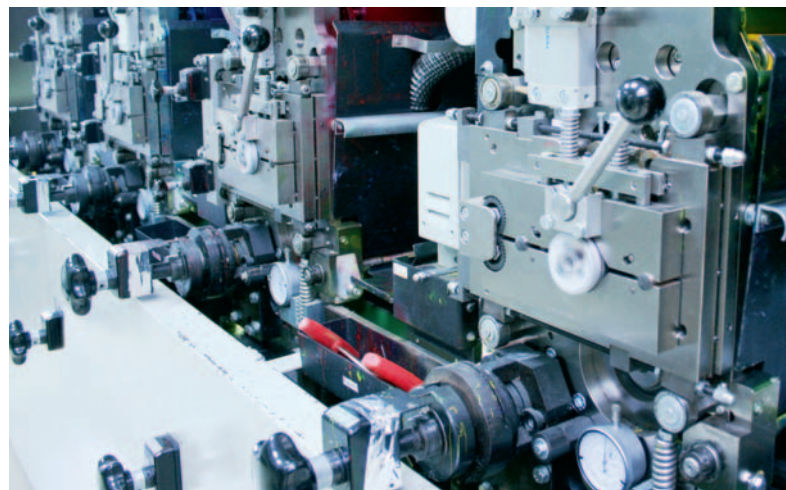


### As versatile as the range of applications

With its compact design, the VDC-3-49.15 series is suitable for many applications in which only limited space is available. In addition, much more potential lies in its inner features. Their characteristic strengths make the drives suitable helpers in a wide variety of advanced application areas.

In medical technology, they power sensitive regulating pumps with a wide regulating range, e. g. peristaltic pumps in dialysis equipment. They can also be used as force- and distance-controlled operation for rehabilitation devices. In packaging technology and the textile industry, the adjustable torque limitation and accurate closed loop speed control allow optimum adaptation of coil drives and winding drives to the materials used.

Integrated into a bus system, the motors are used in automation, such as a drive for format adjustment or as a feed drive. For electronic gearboxes such as those in letter distribution systems, the drive is equipped optimally with the optional bus interface, its integrated 4-quadrant electronic control unit, the high overload capacity and the digital fault output.

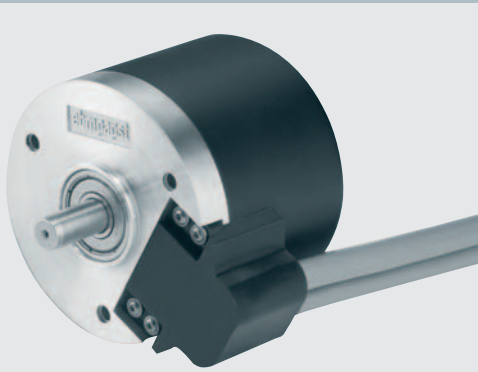


### Performance advantages at a glance

- Compact model
- Very high power density
- Steep speed-torque curve
- High overload capacity
- Extremely wide speed control range
- Holding torque near  $n = 0$
- High dynamics, comparable to BCI
- Robust housing and bearing system
- Long service life
- Type of protection: IP 54, standard

# VARIODRIVE Compact motor

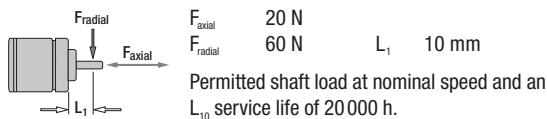
VDC-3-49.15



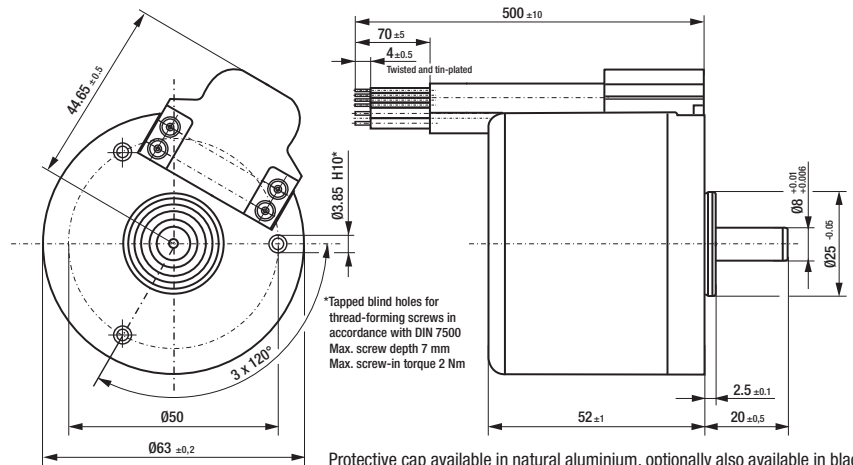
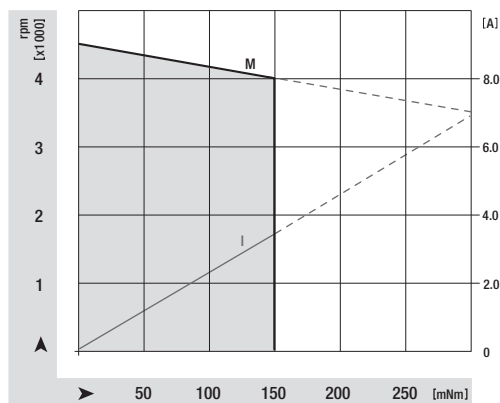
- 3-phase external rotor motor in EC technology.
- Rotor with multi-pole magnetised neodymium magnet.
- High power density with compact model.
- Integrated operating electronics with high-performance DSP.
- Excellent control behaviour with field-oriented control with sinus commutation.
- Extensive interface for variety of functions and operating mode selection.
- Overload protection with integrated temperature shutoff.
- Robust mechanical design with aluminium cover and sealed plug system.

## Nominal data

| Type  |                                    | VDC-3-49.15 24 V  | ... 48 V      |
|---|------------------------------------|---|---------------|
| Nominal voltage ( $U_{BN}$ )                  | V DC                               | 24 (18 to 30)   | 48 (18 to 55) |
| Nominal speed ( $n_n$ )                       | rpm                                | 4000  | 4000          |
| Rated torque ( $M_n$ )                        | mNm                                | 150   | 250           |
| Nominal current ( $I_{BN}$ )                  | A                                  | 3.5   | 2.9           |
| Nominal output power ( $P_n$ )                | W                                  | 63  | 105           |
| Speed at no-load operation ( $n_0$ )          | rpm                                | 4400  | 4500          |
| No-load current ( $I_0$ )                     | A                                  | 0.22  | 0.15          |
| Max. reverse voltage                          | V DC                               | 35  | 60            |
| Set value                                     | V DC                               | 0 to 10   | 0 to 10       |
| Set speed                                     | rpm                                | 0 to 5000   | 0 to 5000     |
| Speed control range                           | rpm                                | 0 to 4000   | 0 to 4000     |
| Locked-rotor protection                       |                                    | yes   | yes           |
| Torque limitation to $M_{rated}$              |                                    | $M_{rated}$   | $M_{rated}$   |
| Protection from overload                      |                                    | yes   | yes           |
| Temperature shut-off (via electronics)        |                                    | 110 °C off/on after acknowledgement of "C" hardware enable (< 100 °C) |               |
| Starting torque                               | mNm                                | 300   | 500           |
| Rotor moment of inertia ( $J_R$ )             | kgm <sup>2</sup> x10 <sup>-6</sup> | 108   | 108           |
| Thermal resistance ( $R_{th}$ )               | K/W                                | -   | -             |
| Type of protection                            |                                    | IP 54*  | IP 54*        |
| Permitted ambient temperature range ( $T_U$ ) | °C                                 | 0 to +40  | 0 to +40      |
| Motor weight (m)                              | kg                                 | 0.72  | 0.72          |
| Part No.                                      |                                    | 937 4915 600  | 937 4915 607  |



\*Type of protection specified pertains to installed state with seal on the flange side.



Protective cap available in natural aluminium, optionally also available in black.

## Basic functions:

- Closed loop speed control with analogue set value input.
- Control of speed  $n = 0$  with holding torque.
- Extended motor dynamics via short-term peak current with  $I^2t$  peak current limitation.
- Torque limitation via analogue set value input (for current limitation).
- Control input for hardware enable for safe switch-on after safety shut-off.
- Separate signal output with TTL level as rotation direction information.
- Signal output for status display of the drive via TTL level (drive ready yes/no).
- Separate power supply for motor logic (logic power supply can remain active even when motor is switched off).

## Pin configuration

| Colour                       | Function | Description                                | Circuit* |
|------------------------------|----------|--|----------|
| Blue (1,5 mm <sup>2</sup> )  | Gnd      | Shared earth                               | Yes      |
| Brown (1,5 mm <sup>2</sup> ) | +Ub      | Logic power supply                         | Yes      |
| Black (1,5 mm <sup>2</sup> ) | UZK      | Power supply                               | Yes      |
| Pink                         | S1       | 0 ... 10 V – speed controller              | Yes      |
| Green                        | TXD      | Communication / programming interface      | No       |
| White                        | RXD      | Communication / programming interface      | No       |
| Grey-pink                    | A        | Control input A, TTL level                 | Yes      |
| Violet                       | B        | Control input B, TTL level                 | Yes      |
| Grey                         | IST      | Actual value 1                             | Yes      |
| Red-blue                     | F+       | Frequency specification for speed setpoint | No       |
| Brown                        | S2       | –5 ... +5 V current limitation (torque)    | Yes      |
| Black                        | C        | Control input C – hardware enable          | Yes      |
| Red                          | E        | Actual value 2                             | Yes      |
| Yellow                       | D        | Drive status                               | Yes      |

\*Connections marked "No" must not be occupied when carrying out basic functions.

## Other options on request:

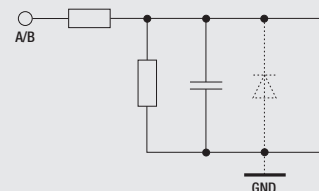
- Set value input for closed loop speed control operation via set value frequency or PWM signal.
- Input for set value for specifying driving profiles.
- Programming of the  $I^2t$  peak current limitation.
- 2-channel encoder signal with up to 100 pulses/revolution via programmable division ratio of the actual value output between both outputs.
- Torque monitor with actual value optionally either as analogue voltage, frequency or PWM signal.
- Electrically isolated inputs and outputs.
- Control inputs for direction of rotation and brakes with line break detection.
- Position control of the drive.
- RS-485 interface as open communication and programming interface.
- Version with CANopen bus interface (DSP 402).

### 1. Control inputs

| A | B |  |
|---|---|--|
| 0 | 0 | Output stage enabled                     |
| 0 | 1 | Direction of rotation: counter-clockwise |
| 1 | 0 | Direction of rotation: clockwise         |
| 1 | 1 | Brakes*                                  |

low (0) 0 to 0.8 V  
high (1) 2.4 to 30 V

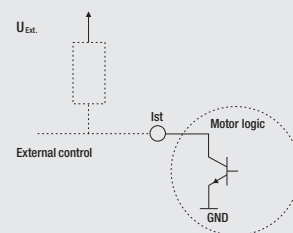
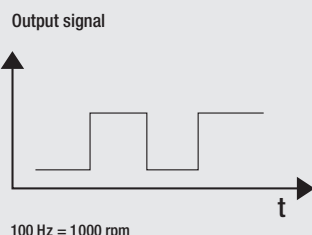
\*Brake operation:  
In holding status, the position can be held for long periods at rated torque or for short periods ( $I^2t$  function) at start-up torque.



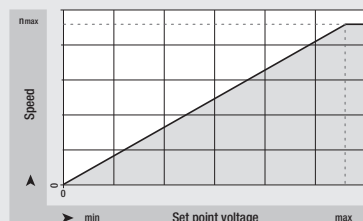
### 2. Actual value output

#### Design:

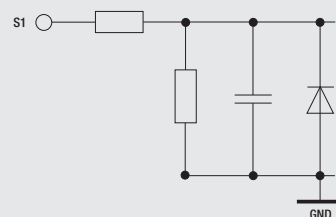
Open collector  
 $U_{ext,max} < 36 V$   
 $U_{CESAT} = 0.4 V$   
 $I_{CMAX} < 10 mA$



### 3. Set value input



Speed setting for closed loop speed control using set point voltage (0 to 10 V DC interface)



For additional detailed information, refer to the corresponding specification data sheets. Always observe the safety instructions and other instructions from the operating manual.



### Attachment configurations

Depending on the gear type, the following attachment configurations are available for the VDC-3-49.15 motor:

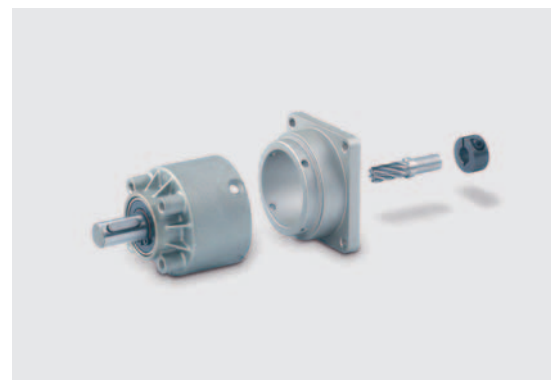
#### Gearbox attachment via a NEMA 23 interface

Gearbox attachment via NEMA 23 interface is uncomplicated and is particularly suitable for short runs or fast sampling requirements. The gearbox can even be attached by the end customer directly, thanks to the clamping pinion with accurate centring and a square intermediate flange.

#### Gearbox attachment as direct attachment

For short and medium-sized runs, various gear types can be attached using an adapter pinion and round intermediate flange. For medium-sized and large runs, the intermediate flange can also be replaced by an adapted gearbox base flange, resulting in extremely short and compact motor-gearbox combinations for maximum output with limited installation space.

The table below provides an overview of the possible attachment configurations and reduction ranges for each gear type.



### Gearbox versions at a glance

| Gear type           | Attachment via Nema 23 interface | Direct attachment | Possible reductions from ... to |
|---------------------|----------------------------------|-------------------|---------------------------------|
| Compactline 91      | X                                |                   | 7.8:1 to 67.3:1                 |
| Compactline 92      | X                                | X                 | 15.47:1 to 92.3:1               |
| Flatline 85         | X                                | X                 | 18:1 to 102:1                   |
| Performax 52        | X                                |                   | 5:1 to 54:1                     |
| Performax 63/63 HRL |                                  | X                 | 3.18:1 to 30:1                  |
| Noiseless Plus 63   |                                  | X                 | 4.3:1 to 26:1                   |
| EtaCrown 75         |                                  | X                 | 4.1:1 to 33.33:1                |

The VDC-3-49.15 unites compact dimensions with the highest power density and intelligence. Find out more about the many advantages and possible applications of the new VARIODRIVE Compact motor. Can we contribute to the success of your applications with other ebm-papst products and engineering achievements? Just ask us. We look forward to hearing from you.

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