# Rowan Elettronica

*The Italian Answer to Automation Problems*

# BRUSHLESS ASYNCHRONOUS MOTORS G Series LIQUID COOLED

ENGLISH - REV.7 del 04/05/2020

# INDEX

## ROWAN ELETTRONICA



## G SERIES VECTOR MOTORS



**IMPORTANT!**

**ROWAN ELETTRONICA s.r.l.** declines any responsibility for inaccuracies contained in this manual, due to printing errors and/or transcription. It also reserves the right to make at its discretion and without notice the changes it deems necessary for the better functioning of the product.
**As for the details and characteristics** reported in this manual there is a maximum tolerance of ±10%, unless otherwise stated. The relative diagrams are approximate and are to be perfected by the user.
**The warranty** on the products is understood as ex-works under the conditions specified in the appropriate document to be requested from the Commercial Department or through the website www.rowan.it

# Rowan Elettronica s.r.l

## COMPANY

Rowan Elettronica S.r.l. was established in the Seventies to manufacture variable speed motors and actuators based on proprietory patents. It has progressively developed and consolidated its standing thanks to the quality and reliability of its products and the high professionality and experience of its consultancy and assistence services, growing from its first factory of 200m² in Cresole of Caldogno (VI) to its current 3,000m², which include the manufacturing base and after sales assistance centre. Rowan Elettronica has a highly specialised technical staff who offer their tried and tested experience in the following departments:

- the **Electronics Research Laboratory,** which studies and creates new technological solutions, equipped with anechoic chamber and all necessary instrumentation for measuring and testing electromagnetic compatibility;
- the **Technical Department**, which produces the printed circuit board masters and electrical wiring diagrams using cutting edge IT instruments and a high level of professionalism and know-how;
- the **Quality Management Department**, responsible for the co-ordination of all activities concerning the Rowan Elettronica Quality System and supervision of the quality controls on all products entering and leaving the company;
- the **Mechanical Prototyping Department** studies and creates new mechanical solutions and versions of nonstandard motors;
- the **Production Departments:** ***AC Actuators - Inverters - Instruments/Interfaces/DC actuators - Motors***, which assemble and test all standard products;
- the **Automation Department,** where appliances equipment and switchboards receive a high portion of standard Rowan products and thereby offering the possibility to verify every detail in the application of Rowan components, particularly in their installation and improvement;
- the **Technical Assistance/Consultancy Department,** widely appreciated for its willingness (on average, the staff dedicate approx 8 hours a day on telephone assistance).

In addition to the technical departments, Rowan Elettronica has an efficient support organisation such as **Administration-Accounts**, **Sales Department**, **Commercial Department and Buying Department.**

## PRODUCTION

- Single and three phase high speed AC motors and related one or two-way actuators for speed and/or torque control.
- Three-phase AC motors for inverters.
- Vector inverters and related motors with inner functions for positioning, synchronism, winding/unwinding and converters for voltage/frequency.
- Inverters for three-phase asynchronous motors.
- Single axis control instruments for electric axis, loading in motion, cutting in motion and positioner functions.
- Soft starters for three-phase asynchronous motors.
- Speed regulators for three and single phase commercial fan motors both indipendent or multiple.
- Three and single phase voltage regulators for resistive and inductive loads for DC power units.
- Drives for unidirectional/bidirectional DC motors
- Voltmeters/ammeters with displays for readings and set thresholds by on/off or PI outputs.
- Interface boards for signal converting, for setting proportional speeds between several motors, for converting signals from temperature probes, sensors, loading cells.
- Accessories for industrial automation such as safety devices, boards for ramp generating, thermoregulators, photoelectric bars, battery chargers and servo-diameter instruments.

## QUALITY

*Rowan Elettronica has received certification for its* ***Quality System*** *according to UNI-EN ISO9001:2000, keeping in line with the increasing demand to univocally guarantee quality levels in implementing company procedures .*

With regards to Rowan product quality, this is a list of the main company control procedures:

- **Quality control of goods on arrival** carried out by specialist staff who strictly fulfill the procedures and test methods established for each single type of component, a continous thread of information is maintained with suppliers on material conformity and the possibility of improving aspects of performance and reliability.
- **Quality control on products on dispatch:** every product is individually tested according to specific procedures. On completion of the test each article is given a serial number that guarantees its traceability and identification at any time.

For example in **electronic products** sector the test procedure prescribes:

*SPECIAL RESIN TREATMENT FOR BOARDS* to prevent any malfunctions caused by humidity in the switchboards within the statutory limits.

*GENERAL BOARD TEST CYCLE* in real operating conditions. As each board enters the production line, it is assigned a test manual containing the procedures that are then rigorously and integrally carried out by the assigned technical staff. The test manual, among other important indications, also specifies the auxiliary equipment required for the test (which also undergo periodical controls and calibrations), the step by step sequence of tests and the standard setup.

For **motors,** the test procedure includes:

*VERIFICATION OF RESISTENCE, IMPEDENCE, INSULATION (2000V).*

*VERIFICATION OF CHARACTERISTICS* in no load operating conditions: this step tests characteristics such as absorption and noise levels and functionality of any other related components such as tachymetric dynamo, brake, encoder, fan, etc.

# G SERIES VECTOR MOTOR

## GENERAL TECHNICAL FEATURES

## Introduction

Rowan El. three-phase asynchronous motor with cage rotor can be called "**INVERTER DUTY**"; they have been designed to work with inverters that use PWM technique and in particular with **Rowan inverter.**
The construction robustness, the thermal circuit breaker and the high insulation ensure the reliability of the motors and the best performances available on the market. Moreover, the vacuum impregnation of the winding pack ensure a partial attenuation of the background noise caused by the frequency modulation.
The sizes of Rowan El. vector motor are in conformity to MEC standards of the equivalent series, therefore are perfectly interchangeable with equivalent power commercial asynchronous motors. The motors are built in extrusion profile to guarantee the maximum robustness and the best cooling through the refrigeration liquid canalization; there are available from MEC132 up to MEC160XL

## General features

### Stator winding

*Power supply* ..... three-phase
*Available Voltages* ..... (125△ / 220人)...(230△ / 400人)...(270△ / 470人)...(300△ / 520人)...(400△ / 690人)
*Frequency* ..... 50Hz
*Poles* ..... 4 poles standard
*Maximum temperature* ..... +180°C
*Insulation*..... **tropicalized to H class with vacuum process** (to guarantee more environmental protection
..... and less noise, thanks to a better blockage to the spools)
.....on request is available a certificate UL, F Class insulation system (winding)
*Protections* ..... thermic probe with N.C.contact (opening at 160°C)
..... contact capacity 1A - 230VAC

### Rotor

*Type* ..... squirrel-cage without any touching parts (collectors, brushes, rings, etc...)
..... the dynamic balancing is in compliant to level R of the standard CEI EN 60034-14
.....the shaft finishes are rectified J6

### Cooling

*Type* ..... refrigeration liquid, IP55 protection
*Minimun Temperature* ..... 10°C
*Maximum Temperature* ..... 85°C
*Minimum Flow* ..... 250 lt/hr
*Maximum Flow* ..... 5000 lt/hr (on request with in/out double tube)

### Mechanical Features

*Material* ..... **aluminium,** (housing, shields, brake housing)
*Versions* ..... **brakeless**
..... **with 24Vdc front and rear safety spring actuated brake,** (the shaft is blocked with no power)
*Available shapes* .....**B3** (footed)...**B5** (flanged)...**B3/B5** (footed and flanged)
*Bearings* ..... **C3 2RS and ZZ**
*Maximum speed* .....7800rpm MEC132 series - 7000rpm MEC160 series
*Noise* .....less than 70dB
*Speed transducer* .....standard, without transducer on request

### Speed feedback transducer features

*Type* .....LINE DRIVER encoder, PUSH PULL output
*Supply* .....+12Vdc standard, +5Vdc or + 24Vdc on request
*Pulse/rotation* ..... 1000 standard, from 360 to 4096 on request
*12 Vdc and 5 Vdc channel max load* .....20mA
*Insulation* .....thermal and magnetic insulation from the motor shaft

### Environment characteristics

*Motor protection level* .....IP55 (IP65 on request)
*Environmental temperature* .....-20°C to +40°C
*Motor max. temperature on the external body* ..... max 80°C (depending on what kind of liquid used)
*Relative humidity* .....5% to 95% without condensation

### Compliance regulations

Conformity to **EMC 2014/30/UE** and **LVD 2014/35/UE(Low Voltage)** directives, in reference to **CEI EN 60034-1** and **CEI EN60204 -1** standard.

### Certifications

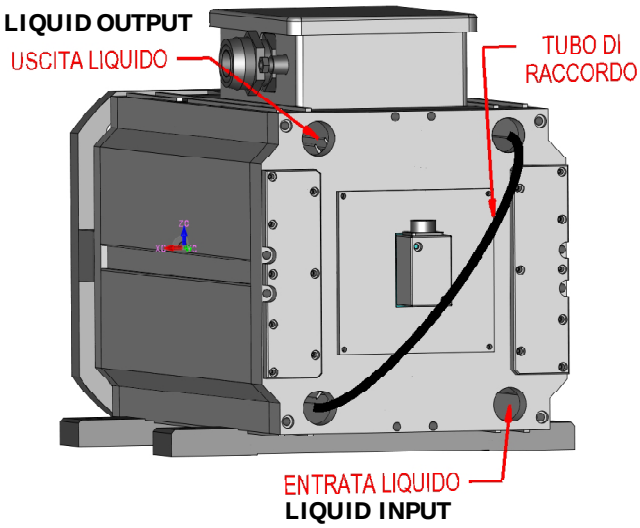
**ATEX certification** ..... with particular building solutions Rowan El. is in keeping with **ATEX 2014/34/EU** directive, with reference to **Ex II 3G Ex ec IIC T3 Gc - Ex II 3D Ex tc IIIB T135°C Dc** standards for working in zones 2 and 22 (environment with gas or dusty and low hazard of explosion).

# G SERIES VECTOR MOTOR — COOLING

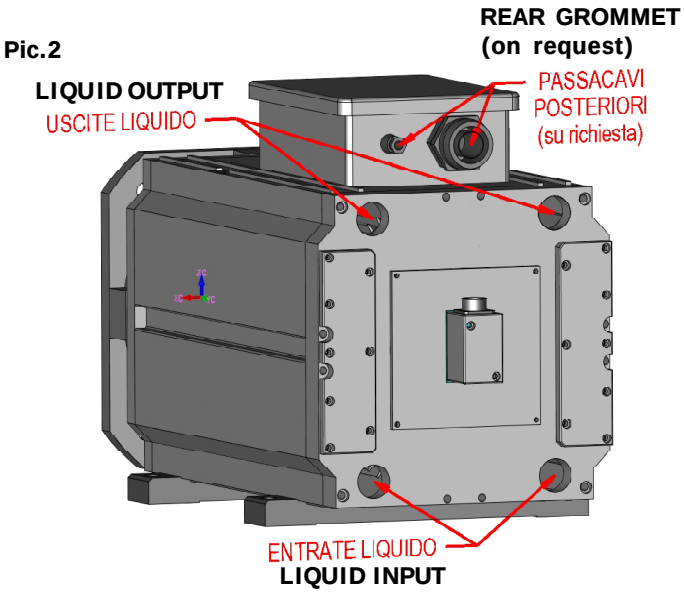
The picture below shows the rear of the liquid cooled.
Regarding the input and output of the refrigeration, the motor will be supplied with 4 threaded holes must connect as the two examples below, to avoid air bubble inside that can be let down the cooling efficiency:
- lower hole as input and the upper hole as output (Pic.1).
- both lower holes as input and both upper holes as output (Pic.2).

The motor MEC132 series will be supplied with the thread of liquid input and output holes 1/2 inch;
The motor MEC160 series will be supplied with the thread of liquid input and output holes 1 inch;

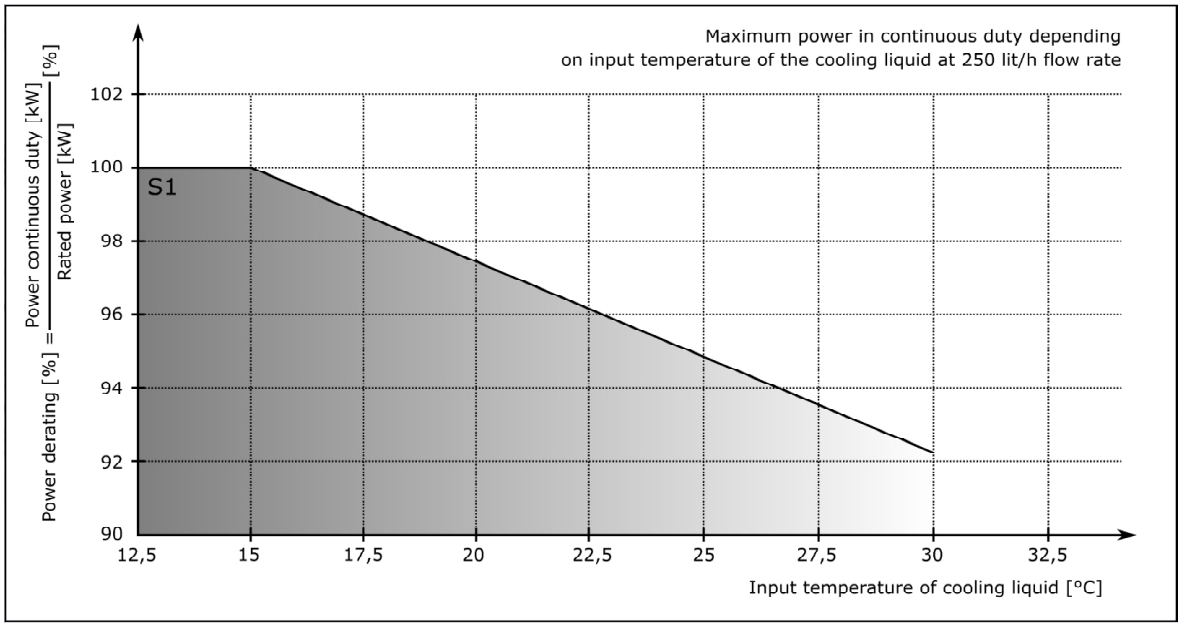
**Pic.1**




**Pic.2**




## Table of motor power according to the imput liquid temperature




How to use the efficiency value to calculate the cooling system suited.
The power dissipated is determined from the following formula:

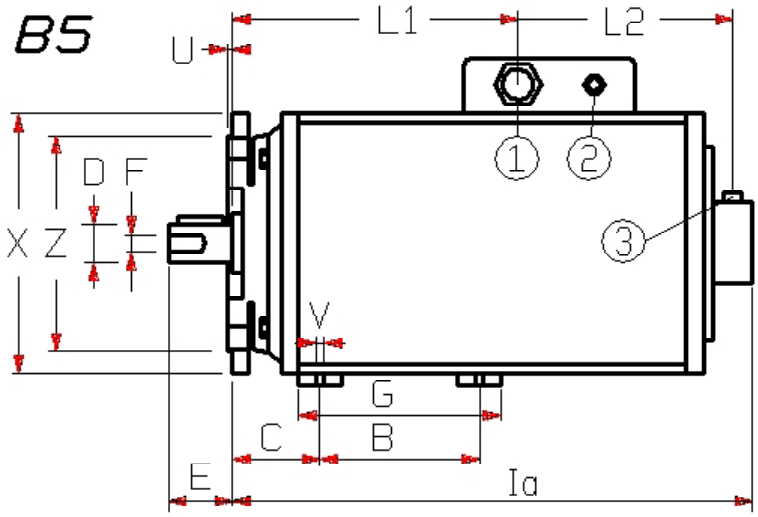
$$P_{diss}\ (W) = P_n\ (W)\ .\ \frac{100\ -\ \mathbf{h}(\%)}{\mathbf{h}\,(\%)}$$

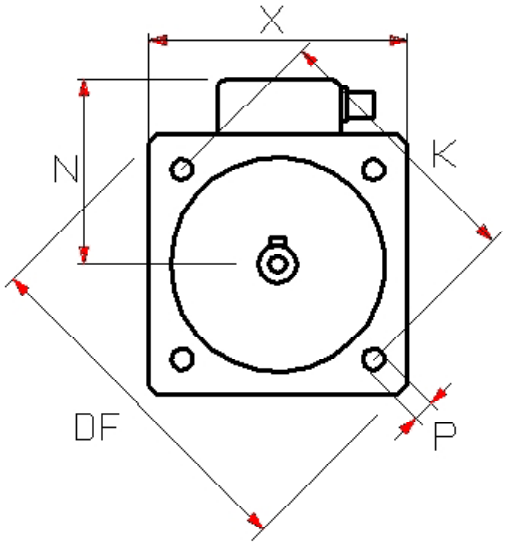
The increasing of liquid temperature (water) with 250lt/hr flow is calculated from the following formula:

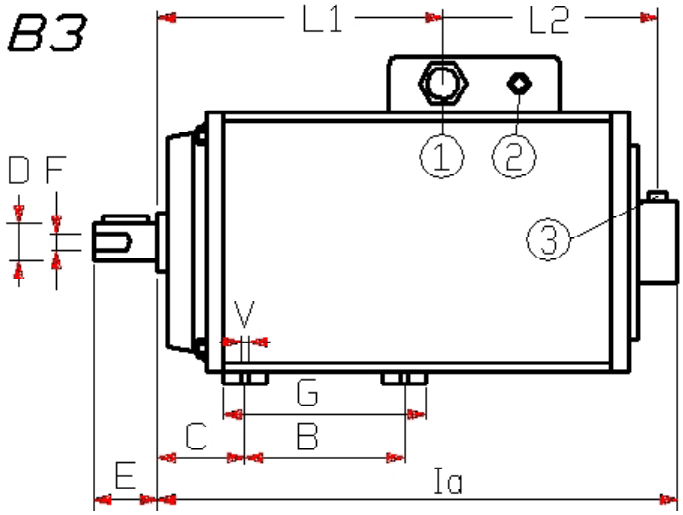
$$\mathbf{D}T\ (°C) = \frac{P_{diss}\ (W)}{4186 \cdot 250} \cdot 3600$$

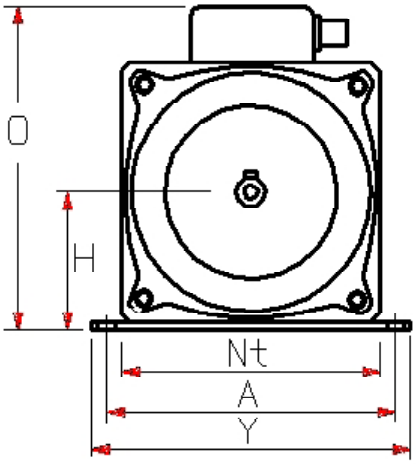
# G SERIES VECTOR MOTOR

## DIMENSIONAL DRAWINGS OF BRAKE LESS MOTORS




(1) Grommet for the Connection: **Three-phase supply + Ground**

(2) Grommet for the Connection: **Thermic Probe**

(3) Connector for the Connection: **Encoder**

**Note:** the standard versions have the grommet on the motor side, on request it can be positioning on the back.

| G SERIES VECTOR MOTOR | MECHANICAL DIMENSIONS of BRAKELESS MOTORS FROM MEC132 UP TO MEC160XL |
|---|---|

| MEC Sizes | | 132 | 132L | 132XL | 160 | 160L | 160XL |
|---|---|---|---|---|---|---|---|
| A | | 285 | | | 320 | | |
| B | | 240 | | | 255 | 300 | 300 |
| C | | 90 | | | 120 | | |
| D | | 38 | 42 | | 42 | | |
| E | | 80 | 110 | | 110 | | |
| F | | M10 | | | M10 | | |
| G | | 290 | | | 305 | 350 | 350 |
| H | | 132 | | | 160 | | |
| Ia | | 580 | 630 | 710 | 565 | 650 | 750 |
| L1 | | 315 | 362 | 445 | 353 | 438 | 538 |
| L2 | | 400 | 450 | 530 | 541 | 626 | 726 |
| N | | 190 | | | 230 | | |
| Nt | | 245 | | | 276 | | |
| O | | 322 | | | 390 | | |
| P | | 14 | 16 | | 16 | | |
| U | | 4 | | | 4 | | |
| V | | 13 | | | 14 | | |
| Z | | 230 | | | 250 | | |
| X | | 252x252 | | | 280x280 | | |
| DF (FLANGE DIAMETER) | | 300 | 350 | | 350 | | |
| K | | 265 | 300 | | 300 | | |
| Y | | 315 | | | 365 | | |
| SPLINE | | 10x8x70 | 12x8x90 | | 12x8x90 | | |
| REDUCED SHAFT | D | 28* | 38* | | 38* | | |
| | E | 60 | 80 | | 80 | | |
| | F | M8 | M10 | | M10 | | |
| | Spline | 8x7x45 | 10x8x70 | | 10x8x70 | | |
| REDUCED FLANGE | P | M12 | 14 | | M12 | | |
| | Z | 180 | 230 | | 230 | | |
| | X | 252x252 | 252x252 | | 280x280 | | |
| | DF (FL. DIAM.) | 250 | 300 | | 300 | | |
| | K | 215 | 265 | | 265 | | |
| MOTORS WEIGHT 4POLES (Kg) | | 70 | 84 | 104 | 105 | 140 | 169 |

*HEAT-TREATED SHAFT

Dimensions in mm

***Attention***

**The dimensions in the table concern motors without brake:** to know the dimensions of the motor with front brake, it is necessary to add “Ia” dimension to the brake-holder bell measures shown in the relative paragraph. The mounting of the line driver encoder to any motor does not mean any change in the motor bulk.

**In the liquid-cooled motor cannot possible to install the rear brake.**

## Description motors with brake

***MOTOR WITH FRONT BRAKE***

In **standard version** Rowan Elettronica motors can be equipped with a spring brake by a holder bell fixed on the motor front side. In this case the motor shaft is extended in order for the brake-holder bell to be placed, which reproduces common standard motors flanges; one of the positive aspects of this kind of mounting is the fact that load and brake are close, so braking is safe and efficient, without involving the whole shaft length.

***CAUTION!*** It is not possible to equip a normal G series Rowan motor with a brake later, since the shaft replacement would be necessary.

Electomagnetic brakes chose by Rowan El. for its motors are strong and reliable, just as the motor itself. The spring brake operates at 24V direct voltage and must be supplied independently.

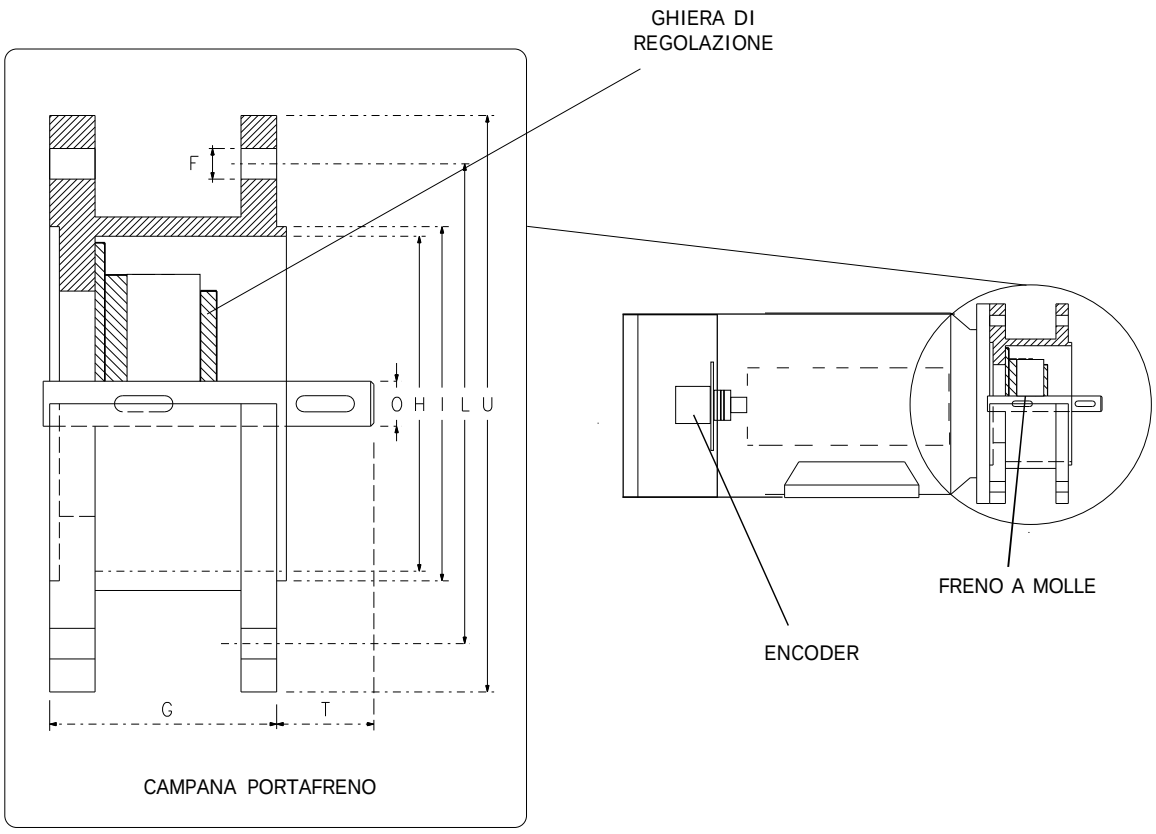
**The spring brake (called safety brake as well)** operates without power supply. When it is powered at 24V, the electromagnet presses the springs and frees the motor shaft: on the contrary, without power supply, springs are released, thus blocking the motor shaft. If necessary, it is possible to soften the braking by adjusting its regulation ring.

Motors from MEC80 to MEC160XL can be supplied on request equipped with spring brake and manual unlocking lever, while smaller size motors can be manufactured without manual unlocking lever.

The spring brake is used as safety brake in case of power lack for applications implying hanging or inertial loads, such as overhead loads as cranes, shovel loaders, trippers, pump bobs, trolleys. The spring brake standard protection level is IP54.

Operating features are kept by 0,3 mm ± 0,05 gap.

Please remind that **in some cases, with spring brake application to a motor, a reduction of the shaft dimensions may be necessary**, if compared to the standard, as explained in the relative table; because of this reason and the fact that motors with brake have an extended shaft it is advised to see the paragraph **"Possible motor installation position and speed limits"**, above all if side stresses need to be applied to the shaft.



# G SERIES VECTOR MOTOR

## MOTORS WITH BRAKE

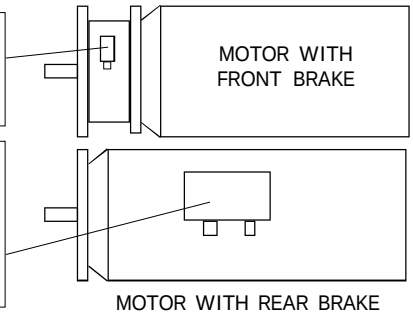
## ELECTROMECHANICAL CHARATERISTICS OF BRAKES

| BRAKE HOLDER BELL DIMENSIONS<br>Measures in mm<br>(measures on brakets are on demand) | | | | | | | | | BRAKE ELECTRICAL DATA | | WEIGHT |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | POWER ABSORBED | BRAKING TORQUE | |
| MEC | G | I | O | T | F | U | L | Chiavetta | W | Nm | kg |
| 132 | 127 | 230 | 38 | 80 | 14 | 300 | 265 | 10x8x70 | 55 | 90 | |
| 132L | 127 | 230(250) | 42 | 110 | 14(16) | 300(350) | 265(300) | 12x8x90 | 55 | 90 | |
| 132XL | 127 | 230(250) | 42 | 110 | 14(16) | 300(350) | 265(300) | 12x8x90 | 55 | 90 | |
| 160 | 127 | 230(250) | 42 | 110 | 14(16) | 300(350) | 265(300) | 12x8x90 | 55 | 90 | |
| 160L | 127 | 230(250) | 42 | 110 | 14(16) | 300(350) | 265(300) | 12x8x90 | 55 | 90 | |
| 160XL | 127 | 230(250) | 42 | 110 | 14(16) | 300(350) | 265(300) | 12x8x90 | 55 | 90 | |

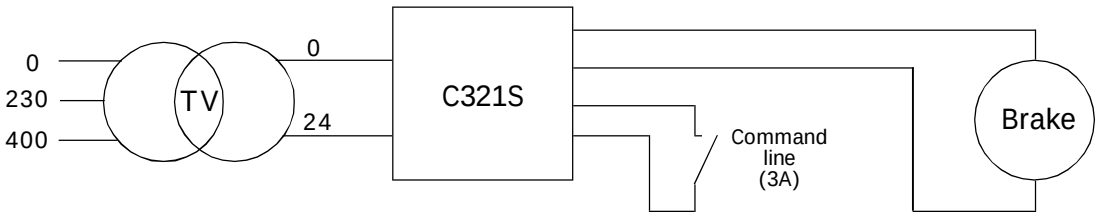
## *Brake connection*

On standard version with front brake, the brake has a numbered 4 pin connector on the brake dome.
Connect the brake to terminals 1 and 2 of the connector.

On special version with rear brake, the brake connection is available on the services terminal block mounted by the power terminal block (see also **Dimensional drawings of brakeless motors and connection terminal boards**).
Connect the brake at terminals 1 and 2 of the connector.




**The brake operates with 24VDC**. in S6 functioning with 5' excitation and 5' de-energizing maximum.
It is always good practice to connect a flywheel diode or a R/C in parallel with the brake, especially in proximity to appliances that are particularly sensitive to disturbances (the diode has a better filtering effect, but delays the brake release).
**N.B.** For optimum control of the brakes, Rowan El. offers the C321S board which wiring is reported below:

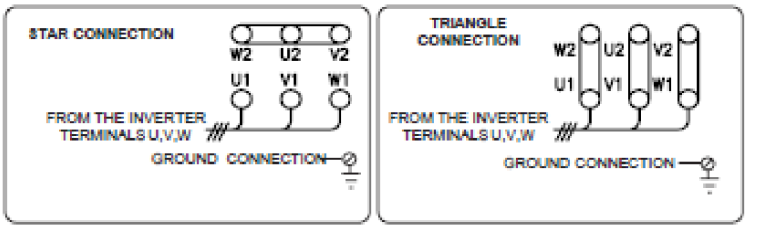



The C321S provides a start current of 34Vdc maximum and a working voltage of 24Vdc. This will speed up the separation of the brake and prevents overheating during continuous operation. For repeated excitations, wait for 1 second, at least, between brake de-energizing and re-excitation.

# G SERIES VECTOR MOTOR — CONNECTION

## Connecting the three-phase supply to motors from MEC 132 to MEC 160XL

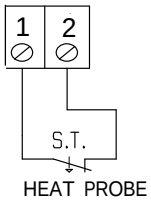
Motors can be STAR or DELTA connected.




**The choiche between star or delta connection depends on the combination with the inverter.**
For this purpose, see tables regarding **"Inverter 400 parameter setting"** on the following pages.
The encoder is connected by external connector (see on the opposite page).

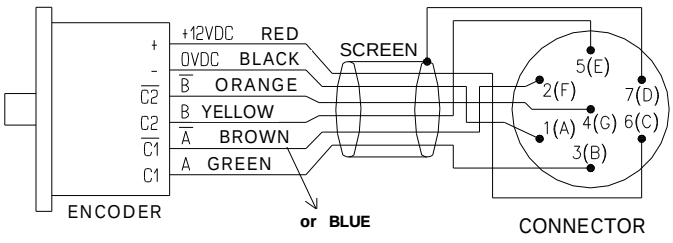
## Connecting the heat probe

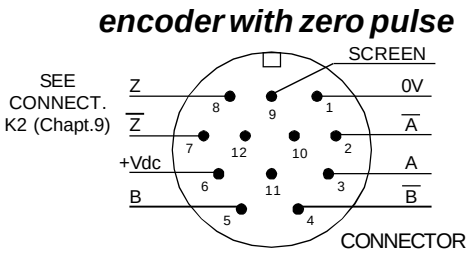
The heat probe is a N.C. contact that opens when the motor winding temperature rise above 160°C, this safety limit corresponds to H class (180°C). It is used as an emergency for the run relay, accounting for the fact that the maximum contact capacity is 1A - 230 Vac
Depending on the type of motor, the probe connection can be found in the following types of terminal blocks:




## Connecting the LINE DRIVER Encoder

Standard Rowan "G" series motors are fitted with a LINE DRIVER encoder with a +12 Vdc supply voltage and 1000 pulses/rev resolution.
On request encoders with different resolutions, +5 Vdc supply voltage and with inpulse of zero can be provided.
For a +5 Vdc supply the inverter will also have to be modified for this voltage.
The encoder power supply and phase signals are taken to the connector according to the wiring diagram below:



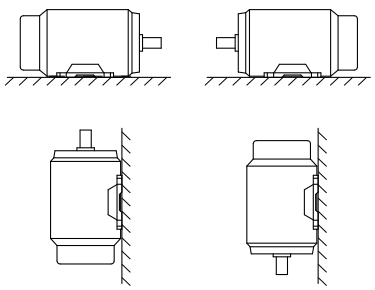
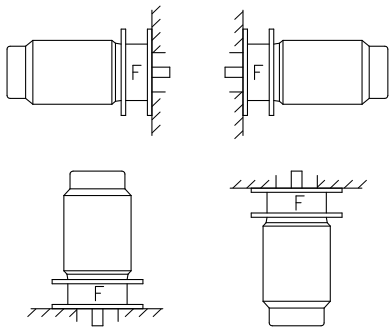
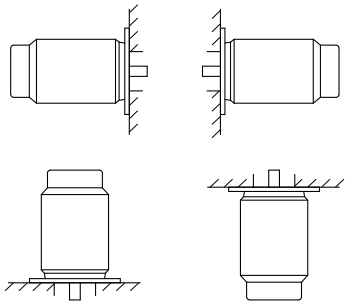
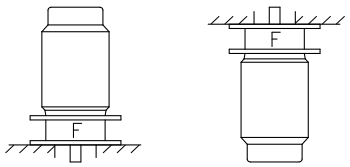
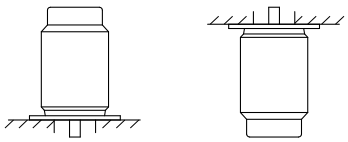
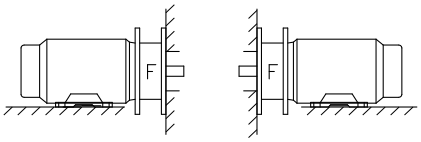
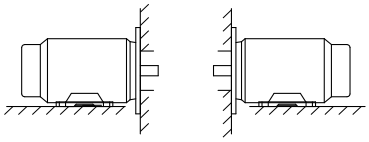

**HOW TO USE THE ENCODER FOR ADDITIONAL INVERTERS 400 OR OTHER DEVICES**
It is possible to connect the motor encoder signals at the following conditions:
- connect by **screened cable.**
- the maximum absorbion for each encoder channel **must not get over 20mA** in both cases of 12Vdc and 5Vdc.

## TERMINALS CLOSURE

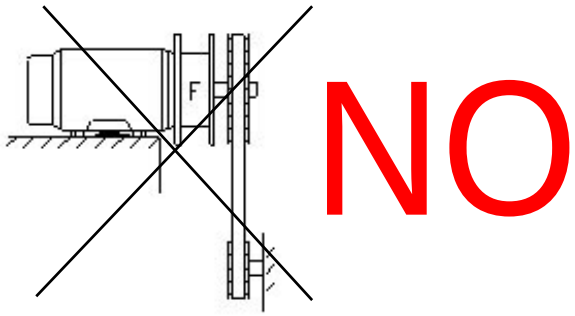
**IMPORTANT: At least once a year, is it suggested to check the terminals closure, especiallly the power ones, both on the inverter and on the motor, in order to avoid possible loosenings and consequent overheating of the contact point and the connected cable.**

# G SERIES VECTOR MOTOR

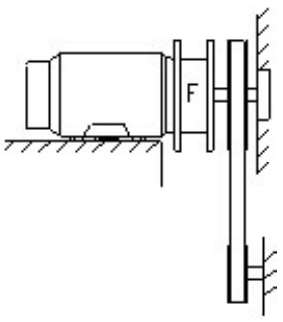
## POSSIBLE INSTALLATION POSITIONS

| STANDARD MOTORS (EVEN WITH REAR BRAKE) | | FRONT BRAKE MOTORS (NOTE: OUTPUT WITH JUNCTION or REDUCER ONLY) | |
|---|---|---|---|
| **B3 VERSION**<br>MOTORS:<br>132 - 132L - 132X<br>160- 160L 160XL |  | **B5 VERSION**<br>MOTORS:<br>NONE |  |
| **B5 VERSION**<br>MOTORS:<br>132 |  | **B5 VERSION**<br>MOTORS: 100L<br>132 - 132L - 132XL<br>160 - 160L - 160XL |  |
| **B5 VERSION**<br>MOTORS:<br>132 - 132L - 132XL<br>160 - 160L - 160XL |  | **B3 / B5 VERSION**<br>MOTORS: 100L<br>132 - 132L - 132XL<br>160 - 160L - 160XL |  |
| **B3 / B5 VERSION**<br>MOTORS:<br>160 - 160L - 160XL |  | | |

### MOTOR WITH BRAKE and LATERALLLY LOADED (PULLEY)




MOUNTING ADVISE AGAINST




CORRECT MOUNTING

# G SERIES VECTOR MOTOR — BEARINGS

## Bearing Types

The bearings we use are single-row, preloaded ones, of the most reliable brands.
They are radial ball type with metal screens on both sides 2RS or ZZ, at increased radial clearance C3 and prelubricated with special permanent grease 2AS (-30 °C to +160 °C).
On 4 pole motors we mount FRONT and BACK bearings 2RS C3 type, on 2 pole motors, instead, ZZ C3 type ones. The FRONT bearing is fixed to the motor shield with a SEEGER RING; the rear bearing is free.

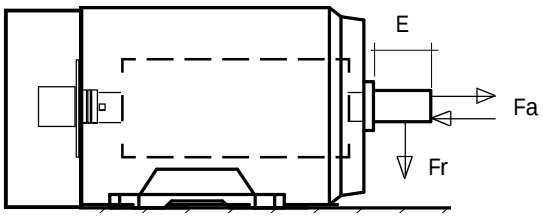
## Motor mechanical limits

***CAUTION!*** To avoid malfunctions and breakdowns in mechanical parts it is recommended that the parameter 1.3.1 MAX MOTOR SPEED does not exceed the mechanical limits given in the table below.

| MAXIMUM SPEED COMPATIBLE WITH MECHANICAL CHARACTERISTICS OF MOTORS | | | | | | | |
|---|---|---|---|---|---|---|---|
| **MEC SIZE** | 132 | 132L | 132XL | 160 | 160L | 160XL | 160R |
| **MAX rpm** | 7800 | 7800 | 7800 | 7000 | 7000 | 7000 | 7000 |

## Maximum radial and axial loads on the motor shaft

In this paragraph we will talk about the maximum radial forces (Fr) and axial forces (Fa) determined for Rowan motors; once considered the useful values as described, they are then compared with the ones written on the following tables.




**Fr** (Radial Force) is calculated basing on **E/2** of the sticking out shaft.
**Fa** (Axial Force)

When the mechanical transmission produces a radial load, you can calculate the value by the following formula and compare with the maximum value shown on the next page table:

$$F_r = K \cdot \frac{P_M \cdot 19{,}1 \cdot 10^6}{n \cdot D_{pr}} [N]$$

key:

$P_M$: power necessary to the motor [kW]
n: rotational speed of the motor shaft [rpm/min]
$D_{PR}$: pitch diameter [mm]
K: coefficient depending on the transmission type, see following table.

| TRANSMISSION TYPE | K |
|---|---|
| Chain | 1,2 ... 1,5 |
| Trapezoidal belt | 1,5 ... 2,0 |
| Cogged belt | 1,1 ... 1,3 |
| Flat belt and belt tightener | 2,5 ... 3,0 |
| Flat belt | 3,0 ... 4,0 |

| G SERIES VECTOR MOTOR | BEARINGS |
|---|---|

In the following tables, radial and axial loads are calculated for 20.000 working hours at the speed indicated (approximated and not guaranteed since conditioned by the load matching characteristics).

| 4 POLE ROWAN MOTORS<br>MAXIMUM RADIAL OR AXIAL LOAD ON THE SHAFT<br>for BEARINGS LASTING 20.000 Hours (indicative) | | | | | | | |
|---|---|---|---|---|---|---|---|
| MEC | MAX REV. [RPM] | Front Bearing (2RSC3) | Nr. Front Bearings | Rear Bearing (2RSC3) | Nr. Rear Bearings | Fr [N] | Fa [N] |
| 132 | 1500 | 6209 | 2 | 6206 | 2 | 2.035 | 763 |
| 132L | 1500 | 6209 | 2 | 6206 | 2 | 1.909 | 716 |
| 132XL | 1500 | 6209 | 2 | 6206 | 2 | 1.936 | 726 |
| 160 | 1500 | 6309 | 2 | 6206 | 2 | 3.140 | 1177 |
| 160L | 1500 | 6309 | 2 | 6206 | 2 | 3.310 | 1241 |
| 160XL | 1500 | 6309 | 2 | 6206 | 2 | 3.452 | 1295 |

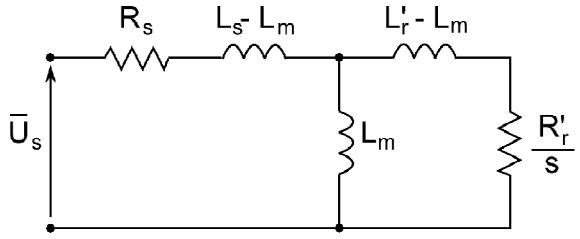
| G SERIES VECTOR MOTOR | MOTOR FAST MAINTENANCE |
|---|---|

"ROWAN" motors are purposely designed to be controlled by Vector inverters and their intrinsic characteristics are especially suited to support repeated start-up surges and dynamic braking.
Since they are brushless motors, their maintenance is reduced to a bare minimum and normally merely concerns the bearings and changing the encoder.

Considered the particular assembly of this version of the liquid-cooled motor, for the bearings or other parts maintenance contact Rowan Elettronica directly.

## G SERIES VECTOR MOTOR — EQUIVALENT CIRCUIT

The equivalent circuit allows the identification of the motors characteristics in certain operating conditions. The values corresponding to each size are shown in the data sheets for each individual motor.




$\bar{U}_s$ : Phase Voltage
$R_s$ : Stator Resistance
$R'_r$ : Rotor Resistance
$L_s$ : Stator Inductance
$L'_r$ : Rotor Inductance
$L_m$ : Mutual Inductance

## G SERIES VECTOR MOTOR — HOW TO CALCULATE THE RESISTANCE VALUE for ROTOR and STATOR

The resistance value for Stators and Rotors mentioned onto next pages, have been detected at 25°C environment temperature. In presence of different temperatures, it is possible to re-calculate the resistance value by using the following formula:

T0 = 25°C
T1 = XXX°C

$$R(T1) = R(T0) \times \frac{1 + A \times T1}{1 + A \times T0}$$

Acu = 1/235 (copper winding)
Aal = 1/225 (aluminium cage)

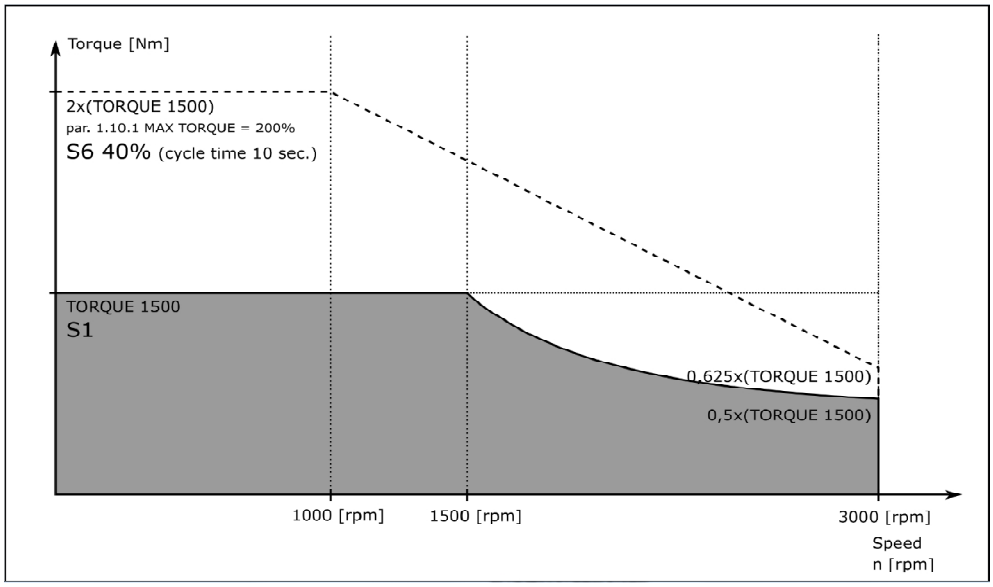
# G SERIES VECTOR MOTOR

## TORQUE DIAGRAMS of 4POLES MOTORS

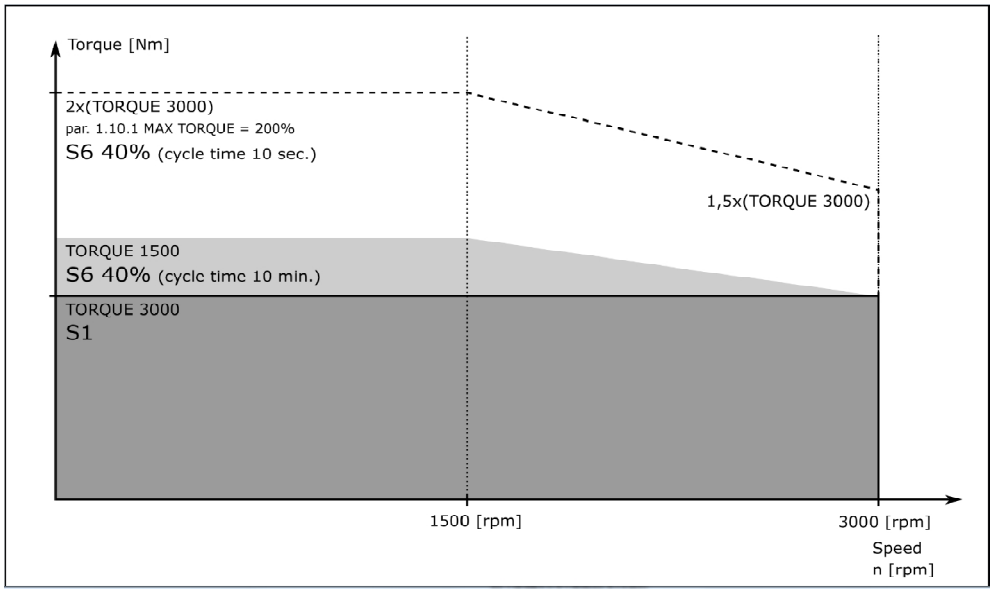
### *Torque diagrams and operating areas*

Le curve riportano l'andamento della coppia sviluppata dai motori vettoriali Rowan Elettronica in funzione della velocità in abbinamento con gli inverter vettoriali Rowan Elettronica.
Le tipologie di servizio sono definite secondo la norma CEI EN 60034-1.
See the useful data for each motor in the tables described on the following pages.

***STAR CONNECTION***




***DELTA CONNECTION***



# G SERIES VECTOR MOTOR — 4 POLES

## M E C 1 3 2 - C o d . T G L 4 R . . . .

| MOTOR VERSION | | 2 | |
|---|---|---|---|
| TECHNICAL CHARACTERISTICS | | CONNECTION | |
| | | STAR | DELTA |
| RATED POWER | kW | 15 | 26 |
| RATED VOLTAGE | V | 370 | 387 |
| RATED FREQUENCY | Hz | 53,9 | 103,6 |
| RATED CURRENT | A | 32 | 52 |
| RATED SPEED | RPM | 1500 | 3000 |
| MAXIMUM SPEED | RPM | 7800 | 7800 |
| TORQUE 1500 | Nm | 96 | 96 |
| TORQUE 3000 | Nm | / | 83 |
| $cos_f$ | - | 0,91 | 0,85 |
| h | % | 80,1 | 88,9 |
| ROTOR RESISTANCE (25°C) | $m_W$ | 263,1 | |
| STATOR RESISTANCE (25°C) | $m_W$ | 284,7 | |
| ROTOR IMPEDANCE | mH | 51,3 | |
| STATOR IMPEDANCE | mH | 51,3 | |
| MUTUAL IMPEDANCE | mH | 49,6 | |
| MOMENT OF INERTIA J | $Kgm^2$ | 0,028125 | |
| MAX ENVIROMENT TEMPERATURE | °C | 40 | |
| MIN ENVIROMENT TEMPERATURE | °C | - 20 | |
| INSULATION CLASS | - | H | |
| THERMIC PROBE INTERVENTION AT | °C | 160 | |

## MEC 132 PAR. SETTING for inverter 400

| CONNECTION | | STAR ( 1500 rpm ) | DELTA ( 3000 rpm ) |
|---|---|---|---|
| with INVERTER | | 400/3 | 400/5 |
| PARAMETERS | unit | | |
| par. 1.1.1 LINE VOLTAGE | V | 400 | 400 |
| par. 1.1.2 MOTOR NOM CURRENT | A | 32.0 | 52.0 |
| par. 1.1.3 MOTOR NOM FREQUE | Hz | 52.0 | 101.4 |
| par. 1.1.4 MOTOR NOM VOLTAG | V | 369 | 416 |
| par. 1.1.5 MOTOR POLES | - | 4 | 4 |
| par. 1.1.10 MOTOR LOAD FUNC | - | NO | YES |
| par. 1.3.1 MAX MOTOR SPEED | rpm | 1500 | 3000 |
| par. 1.6.2 KP GAIN | - | 41 | 50 |
| par. 1.6.3 KI GAIN | - | 41 | 50 |
| par. 1.6.4 VECT MAGNET CURR | % | 33.7 | 39.6 |
| par. 1.6.5 ROTOR COSTANT | Hz | 7.0 | 8.2 |
| par. 1.6.13.1 KP ID REGULATOR | - | 0.95 | 0.6 |
| par. 1.6.13.2 KI ID REGULATOR | - | 0.1 | 0.06 |
| par. 1.6.13.3 KP IQ REGULATOR | - | 0.95 | 0.6 |
| par. 1.6.13.4 KI IQ REGULATOR | - | 0.1 | 0.06 |
| par. 1.7.2 STATOR L | mH | 51.3 | 17.1 |
| par. 1.7.3 ROTOR L | mH | 51.3 | 17.1 |
| par. 1.7.4 MUTUAL INDUC | mH | 49.6 | 16.5 |
| par. 1.10.15 ADAPT PERC TORQ. | % | 106.2 | 108.8 |
| par. 1.10.16 ADAPT TORQ. [ Nm ] | % | 90.0 | 51.9 |
| par. 1.12.1 PWM FREQUENCY | kHz | 5 | 5 |

# G SERIES VECTOR MOTOR — 4 POLES

## M E C 1 3 2 L - C o d . T G M 4 R . . . .

| MOTOR VERSION | | 2 | |
|---|---|---|---|
| TECHNICAL CHARACTERISTICS | | CONNECTION | |
| | | STAR | DELTA |
| RATED POWER | kW | 19 | 30 |
| RATED VOLTAGE | V | 364 | 370 |
| RATED FREQUENCY | Hz | 54 | 103,6 |
| RATED CURRENT | A | 41 | 60 |
| RATED SPEED | RPM | 1500 | 3000 |
| MAXIMUM SPEED | RPM | 7800 | 7800 |
| TORQUE 1500 | Nm | 122 | 122 |
| TORQUE 3000 | Nm | / | 96 |
| $cos_f$ | - | 0,93 | 0,91 |
| h | % | 80,1 | 86,4 |
| ROTOR RESISTANCE (25°C) | $m_W$ | 205,6 | |
| STATOR RESISTANCE (25°C) | $m_W$ | 210,7 | |
| ROTOR IMPEDANCE | mH | 43,6 | |
| STATOR IMPEDANCE | mH | 43,6 | |
| MUTUAL IMPEDANCE | mH | 53,6 | |
| MOMENT OF INERTIA J | $Kgm^2$ | 0,036133 | |
| MAX ENVIROMENT TEMPERATURE | °C | 40 | |
| MIN ENVIROMENT TEMPERATURE | °C | - 20 | |
| INSULTATION CLASS | - | H | |
| THERMIC PROBE INTERVENTTION A T | °C | 160 | |

## MEC 132L PAR. SETTING for inverter 400

| CONNECTION | | STAR ( 1500 rpm ) | DELTA ( 3000 rpm ) |
|---|---|---|---|
| with INVERTER | | 400/3,5 | 400/6 |
| PARAMETERS | unit | | |
| par. 1.1.1 LINE VOLTAGE | V | 400 | 400 |
| par. 1.1.2 MOTOR NOM CURRENT | A | 41.0 | 60.0 |
| par. 1.1.3 MOTOR NOM FREQUE | Hz | 51.7 | 101.1 |
| par. 1.1.4 MOTOR NOM VOLTAG | V | 357 | 403 |
| par. 1.1.5 MOTOR POLES | - | 4 | 4 |
| par. 1.1.10 MOTOR LOAD FUNC | - | NO | YES |
| par. 1.3.1 MAX MOTOR SPEED | rpm | 1500 | 3000 |
| par. 1.6.2 KP GAIN | - | 51 | 50 |
| par. 1.6.3 KI GAIN | - | 51 | 50 |
| par. 1.6.4 VECT MAGNET CURR | % | 32.7 | 43.6 |
| par. 1.6.5 ROTOR COSTANT | Hz | 7.8 | 7.3 |
| par. 1.6.13.1 KP ID REGULATOR | - | 0.95 | 0.6 |
| par. 1.6.13.2 KI ID REGULATOR | - | 0.1 | 0.06 |
| par. 1.6.13.3 KP IQ REGULATOR | - | 0.95 | 0.6 |
| par. 1.6.13.4 KI IQ REGULATOR | - | 0.1 | 0.06 |
| par. 1.7.2 STATOR L | mH | 43.6 | 14.5 |
| par. 1.7.3 ROTOR L | mH | 43.6 | 14.5 |
| par. 1.7.4 MUTUAL INDUC | mH | 53.6 | 17.9 |
| par. 1.10.15 ADAPT PERC TORQ. | % | 105.8 | 111.1 |
| par. 1.10.16 ADAPT TORQ. [ Nm ] | % | 84.6 | 51.6 |
| par. 1.12.1 PWM FREQUENCY | kHz | 5 | 5 |

# G SERIES VECTOR MOTOR — 4 POLES

## M E C 1 3 2 X L - C o d . T G N 4 R . . . .

| MOTOR VERSION | | 2 | |
|---|---|---|---|
| TECHNICAL CHARACTERISTICS | | CONNECTION | |
| | | STAR | DELTA |
| RATED POWER | kW | 21 | 34 |
| RATED VOLTAGE | V | 370 | 389 |
| RATED FREQUENCY | Hz | 3,1 | 103 |
| RATED CURRENT | A | 44 | 68 |
| RATED SPEED | RPM | 1500 | 3000 |
| MAXIMUM SPEED | RPM | 7800 | 7800 |
| TORQUE 1500 | Nm | 134 | 134 |
| TORQUE 3000 | Nm | / | 108 |
| $cos_f$ | - | 0,92 | 0,85 |
| h | % | 80,6 | 87,6 |
| ROTOR RESISTANCE (25°C) | $m_W$ | 183,3 | |
| STATOR RESISTANCE (25°C) | $m_W$ | 154,5 | |
| ROTOR IMPEDANCE | mH | 37,7 | |
| STATOR IMPEDANCE | mH | 37,7 | |
| MUTUA INDUTTANZA | mH | 36,4 | |
| MOMENT OF INERTIA J | $Kgm^2$ | 0,046875 | |
| MAX ENVIRONMENT TEMPERATURE | °C | 40 | |
| MIN ENVIRONMENT TEMPERATURE | °C | - 20 | |
| INSULATION CLASS | - | H | |
| THERMIC PROBE INTERVENTION A T | °C | 160 | |

## MEC 132XL PAR. SETTING for inverter 400

| CONNECTION | | STAR ( 1500 rpm ) | DELTA ( 3000 rpm ) |
|---|---|---|---|
| with INVERTER | | 400/3,5 | 400/6,5 |
| PARAMETERS | unit | | |
| par. 1.1.1 LINE VOLTAGE | V | 400 | 400 |
| par. 1.1.2 MOTOR NOM CURRENT | A | 44.0 | 68.0 |
| par. 1.1.3 MOTOR NOM FREQUE | Hz | 51.5 | 101 |
| par. 1.1.4 MOTOR NOM VOLTAG | V | 366 | 409 |
| par. 1.1.5 MOTOR POLES | - | 4 | 4 |
| par. 1.1.10 MOTOR LOAD FUNC | - | NO | YES |
| par. 1.3.1 MAX MOTOR SPEED | rpm | 1500 | 3000 |
| par. 1.6.2 KP GAIN | - | 50 | 50 |
| par. 1.6.3 KI GAIN | - | 50 | 50 |
| par. 1.6.4 VECT MAGNET CURR | % | 42.2 | 49.4 |
| par. 1.6.5 ROTOR COSTANT | Hz | 6.6 | 7.6 |
| par. 1.6.13.1 KP ID REGULATOR | - | 0.95 | 0.45 |
| par. 1.6.13.2 KI ID REGULATOR | - | 0.1 | 0.045 |
| par. 1.6.13.3 KP IQ REGULATOR | - | 0.95 | 0.45 |
| par. 1.6.13.4 KI IQ REGULATOR | - | 0.1 | 0.045 |
| par. 1.7.2 STATOR L | mH | 37.7 | 12.6 |
| par. 1.7.3 ROTOR L | mH | 37.7 | 12.6 |
| par. 1.7.4 MUTUAL INDUC | mH | 36.4 | 12.1 |
| par. 1.10.15 ADAPT PERC TORQ. | % | 110.3 | 115.1 |
| par. 1.10.16 ADAPT TORQ. [ Nm ] | % | 92.6 | 52.8 |
| par. 1.12.1 PWM FREQUENCY | kHz | 5 | 5 |

# G SERIES VECTOR MOTOR — 4 POLES

## MEC 160 - Cod. TGP4R....

| MOTOR VERSION | | 2 | |
|---|---|---|---|
| TECHNICAL CHARACTERISTICS | | CONNECTION | |
| | | STAR | DELTA |
| RATED POWER | kW | 25,5 | 45 |
| RATED VOLTAGE | V | 362 | 379 |
| RATED FREQUENCY | Hz | 52,5 | 102,4 |
| RATED CURRENT | A | 54 | 88 |
| RATED SPEED | RPM | 1500 | 3000 |
| MAXIMUM SPEED | RPM | 7000 | 7000 |
| TORQUE 1500 | Nm | 162 | 162 |
| TORQUE 3000 | Nm | / | 143 |
| $cos_f$ | - | 0,87 | 0,84 |
| h | % | 86,4 | 92,7 |
| ROTOR RESISTANCE (25°C) | $m_W$ | 146,3 | |
| STATOR RESISTANCE (25°C) | $m_W$ | 137,3 | |
| ROTOR IMPEDANCE | mH | 31,0 | |
| STATOR IMPEDANCE | mH | 31,0 | |
| MUTUAL IMPEDANCE | mH | 29,4 | |
| MOMENT OF INERTIA J | $Kgm^2$ | 0,061875 | |
| MAX ENVIRONMENT TEMPERATURE | °C | 40 | |
| MIN ENVIRONMENT TEMPERATURE | °C | - 20 | |
| INSULTATION CLASS | - | H | |
| THERMIC PROBE INTERVENTION AT | °C | 160 | |

## MEC 160 parametrizzazione inverter 400

| CONNECTION | | STAR ( 1500 rpm ) | DELTA ( 3000 rpm ) |
|---|---|---|---|
| with INVERTER | | 400/5 | 400/7 |
| PARAMETER | unit | | |
| par. 1.1.1 LINE VOLTAGE | V | 400 | 400 |
| par. 1.1.2 MOTOR NOM CURRENT | A | 54.0 | 88.0 |
| par. 1.1.3 MOTOR NOM FREQUE | Hz | 51.3 | 101.3 |
| par. 1.1.4 MOTOR NOM VOLTAG | V | 359 | 410 |
| par. 1.1.5 MOTOR POLES | - | 4 | 4 |
| par. 1.1.10 MOTOR LOAD FUNC | - | NO | YES |
| par. 1.3.1 MAX MOTOR SPEED | rpm | 1500 | 3000 |
| par. 1.6.2 KP GAIN | - | 50 | 61 |
| par. 1.6.3 KI GAIN | - | 50 | 61 |
| par. 1.6.4 VECT MAGNET CURR | % | 48.3 | 49.4 |
| par. 1.6.5 ROTOR COSTANT | Hz | 6.0 | 5.4 |
| par. 1.6.13.1 KP ID REGULATOR | - | 0.95 | 0.45 |
| par. 1.6.13.2 KI ID REGULATOR | - | 0.1 | 0.045 |
| par. 1.6.13.3 KP IQ REGULATOR | - | 0.95 | 0.45 |
| par. 1.6.13.4 KI IQ REGULATOR | - | 0.1 | 0.045 |
| par. 1.7.2 STATOR L | mH | 31.0 | 10.3 |
| par. 1.7.3 ROTOR L | mH | 31.0 | 10.3 |
| par. 1.7.4 MUTUAL INDUC | mH | 29.4 | 9.8 |
| par. 1.10.15 ADAPT PERC TORQ. | % | 114.1 | 115.2 |
| par. 1.10.16 ADAPT TORQ. [ Nm ] | % | 102.3 | 53.8 |
| par. 1.12.1 PWM FREQUENCY | kHz | 5 | 5 |

# G SERIES VECTOR MOTOR — 4 POLES

## M E C 1 6 0 L - C o d . T G R 4 R . . . .

| MOTOR VERSION | | 4 | |
|---|---|---|---|
| TECHNICAL CHARACTERISTICS | | CONNECTION | |
| | | STAR | DELTA |
| RATED POWER | kW | 34 | 56 |
| RATED VOLTAGE | V | 370 | 384 |
| RATED FREQUENCY | Hz | 52,9 | 102,7 |
| RATED CURRENT | A | 68 | 108 |
| RATED SPEED | RPM | 1500 | 3000 |
| MAXIMUM SPEED | RPM | 7000 | 7000 |
| TORQUE 1500 | Nm | 215 | 215 |
| TORQUE 3000 | Nm | / | 178 |
| $cos_f$ | - | 0,88 | 0,84 |
| h | % | 88,5 | 92,7 |
| ROTOR RESISTANCE (25°C) | $m_W$ | 109,2 | |
| STATOR RESISTANCE (25°C) | $m_W$ | 106,5 | |
| ROTOR IMPEDANCE | mH | 31,1 | |
| STATOR IMPEDANCE | mH | 31,1 | |
| MUTUAL IMPEDANCE | mH | 29,9 | |
| MOMENT OF INERTIA J | $Kgm^2$ | 0,08719 | |
| MAX ENVIRONMENT TEMPERATURE | °C | 40 | |
| MIN ENVIRONMENT TEMPERATURE | °C | - 20 | |
| INSULATION CLASS | - | H | |
| THERMIC PROBE INTERVENTION AT | °C | 160 | |

## MEC 160L PAR. SETTING for inverter 400

| CONNECTION | | STAR ( 1500 rpm ) | DELTA ( 3000 rpm ) |
|---|---|---|---|
| with INVERTER | | 400/6 | 400/8 |
| PARAMETERS | unit | | |
| par. 1.1.1 LINE VOLTAGE | V | 400 | 400 |
| par. 1.1.2 MOTOR NOM CURRENT | A | 68.0 | 108.0 |
| par. 1.1.3 MOTOR NOM FREQUE | Hz | 51.1 | 100.8 |
| par. 1.1.4 MOTOR NOM VOLTAG | V | 384 | 428 |
| par. 1.1.5 MOTOR POLES | - | 4 | 4 |
| par. 1.1.10 MOTOR LOAD FUNC | - | NO | YES |
| par. 1.3.1 MAX MOTOR SPEED | rpm | 1500 | 3000 |
| par. 1.6.2 KP GAIN | - | 50 | 37 |
| par. 1.6.3 KI GAIN | - | 50 | 37 |
| par. 1.6.4 VECT MAGNET CURR | % | 37.8 | 30.6 |
| par. 1.6.5 ROTOR COSTANT | Hz | 4.8 | 6.4 |
| par. 1.6.13.1 KP ID REGULATOR | - | 0.95 | 0.95 |
| par. 1.6.13.2 KI ID REGULATOR | - | 0.1 | 0.1 |
| par. 1.6.13.3 KP IQ REGULATOR | - | 0.95 | 0.95 |
| par. 1.6.13.4 KI IQ REGULATOR | - | 0.1 | 0.1 |
| par. 1.7.2 STATOR L | mH | 31.1 | 10.4 |
| par. 1.7.3 ROTOR L | mH | 31.1 | 10.4 |
| par. 1.7.4 MUTUAL INDUC | mH | 29.9 | 10.0 |
| par. 1.10.15 ADAPT PERC TORQ. | % | 107.9 | 105.0 |
| par. 1.10.16 ADAPT TORQ. [ Nm ] | % | 99.0 | 47.5 |
| par. 1.12.1 PWM FREQUENCY | kHz | 5 | 5 |

# G SERIES VECTOR MOTOR — 4 POLES

## MEC 160XL - Cod. TGX4R....

| MOTOR VERSION | | 1 | |
|---|---|---|---|
| TECHNICAL CHARACTERISTICS | | CONNECTION | |
| | | STAR | DELTA |
| RATED POWER | kW | 40 | 63 |
| RATED VOLTAGE | V | 387 | 386 |
| RATED FREQUENCY | Hz | 52,7 | 102,6 |
| RATED CURRENT | A | 78 | 121 |
| RATED SPEED | RPM | 1500 | 3000 |
| MAXIMUM SPEED | RPM | 7000 | 7000 |
| TORQUE 1500 | Nm | 255 | 255 |
| TORQUE 3000 | Nm | / | 200 |
| $cos_f$ | - | 0,86 | 0,86 |
| h | % | 88,6 | 90,3 |
| ROTOR RESISTANCE (25°C) | $m_W$ | 110,0 | |
| STATOR RESISTANCE (25°C) | $m_W$ | 81,4 | |
| ROTOR IMPEDANCE | mH | 27,6 | |
| STATOR IMPEDANCE | mH | 27,6 | |
| MUTUAL IMPEDANCE | mH | 26,5 | |
| MOMENT OF INERTIA J | $Kgm^2$ | 0,1167188 | |
| MAX ENVIRONMENT TEMPERATURE | °C | 40 | |
| MIN ENVIRONMENT TEMPERATURE | °C | - 20 | |
| INSULATION CLASS | - | H | |
| THERMIC PROBE INTERVENTION AT | °C | 160 | |

## MEC 160XL PAR. SETTING for inverter 400

| CONNECTION | | STAR ( 1500 rpm ) | DELTA ( 3000 rpm ) |
|---|---|---|---|
| with INVERTER | | 400/6,5 | 400/8 |
| PARAMETERS | unit | | |
| par. 1.1.1 LINE VOLTAGE | V | 400 | 400 |
| par. 1.1.2 MOTOR NOM CURRENT | A | 78.0 | 121.0 |
| par. 1.1.3 MOTOR NOM FREQUE | Hz | 51.2 | 100.9 |
| par. 1.1.4 MOTOR NOM VOLTAG | V | 410 | 467 |
| par. 1.1.5 MOTOR POLES | - | 4 | 4 |
| par. 1.1.10 MOTOR LOAD FUNC | - | NO | YES |
| par. 1.3.1 MAX MOTOR SPEED | rpm | 1500 | 3000 |
| par. 1.6.2 KP GAIN | - | 50 | 50 |
| par. 1.6.3 KI GAIN | - | 50 | 50 |
| par. 1.6.4 VECT MAGNET CURR | % | 32.0 | 38.2 |
| par. 1.6.5 ROTOR COSTANT | Hz | 5.5 | 5.5 |
| par. 1.6.13.1 KP ID REGULATOR | - | 0.95 | 0.95 |
| par. 1.6.13.2 KI ID REGULATOR | - | 0.1 | 0.1 |
| par. 1.6.13.3 KP IQ REGULATOR | - | 0.95 | 0.95 |
| par. 1.6.13.4 KI IQ REGULATOR | - | 0.1 | 0.1 |
| par. 1.7.2 STATOR L | mH | 27.6 | 9.2 |
| par. 1.7.3 ROTOR L | mH | 27.6 | 9.2 |
| par. 1.7.4 MUTUAL INDUC | mH | 26.5 | 8.8 |
| par. 1.10.15 ADAPT PERC TORQ. | % | 105.7 | 108.2 |
| par. 1.10.16 ADAPT TORQ. [ Nm ] | % | 99.7 | 49.1 |
| par. 1.12.1 PWM FREQUENCY | kHz | 5 | 5 |

# G SERIES VECTOR MOTOR — CODYING

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| T | G | D | 4 | R | 5 | M | A | X | F | X | 5 | X |

Example:
THREEPHASE G-SERIES ASYNCHRONOUS MOTOR - MEC 90 - 4 POLE - 230/400VAC 50Hz - ENCODER LD 1000rpm - AXIAL FAN - B5 STANDARD SHAPE - IP54, WITHOUT FILTER.

**13 Free position for further information**

**A = liquid cooled**
**C = circle form**
**P = various details**
**X = no further informations**
**S = star connection**

**Power supply** 1

**T** = three-phase

**Motor Series** 2

**G** = *G series*
""with squirrel-cage rotor"

**MEC** 3

**L** = 132
**M** = 132L
**N** = 132XL
**P** = 160
**T** = 160R
**R** = 160L
**X** = 160XL
**O** = 180
**S** = 200

**Pole number** 4

**2** = 2 pole **4** = 4 pole
**6** = 6 pole **8** = 8 pole

**Motor Voltage** 5

Three-phase supply
**R** = 230/400 **K** = 125/220
**V** = 400/690 **V** = 400/690
**T** = 265/460 **N** = 230 **P** = 400

**Hertz** 6

**5** = 50 Hz
**6** = 60 Hz

**Trasducer** 7

**G** = encoder LD 512i/g without zero
**L** = encoder LD 500i/g without zero
**M** = encoder LD 1000i/g without zero
**N** = encoder LD 1024i/g 8/24V without zero
**O** = encoder LD 1024i/g 5V with zero
**P** = encoder LD 2000i/g without zero
**R** = encoder LD 2000i/g with zero
**T** = encoder LD 1000i/g with zero
**S** = encoder LD 2000i/g 5V with zero
**U** = encoder LD 750i/g without zero
**V** = encoder LD 1000i/g 5V without zero
**X** = without trasducer

**8 Fan type and accessories**

**A** = axial
**B** = axial + cover
**C** = normal scroll
**D** = axial 3 phase
**G** = increased scroll
**H** = mechanically self-ventilated
**X** = fanless

**9 Brake type and accessories**

**M** = 24Vdc spring brake
**L** = 24Vdc spring brake + unlocking lever
**A** = increased spring brake
**B** = increased spring brake + unlocking lever
**P** = 24Vdc rear spring brake
**X** = brakeless

**10 Motor shape**

**F** = B5 standard
**Z** = B3 standard
**S** = B3/B5 standard
**R** = B5 reduced shaft and flange
**G** = B5 standard shaft and reduced flange
**H** = B5 reduced shaft and standard flange
**B** = B3 reduced shaft
**L** = B3/B5 reduced shaft and flange
**M** = B3/B5 standard shaft and reduced flange
**P** = B3/B5 reduced shaft and standard flange
**A** = B5 increased shaft and reduced flange

**11 Shape peculiarity**

**X** = none
**S** = left terminal board
**I** = external encoder connector
**L** = polished flange
**C** = short back

**12 Motor protection degree**

**5** = IP 54
**6** = IP 54 fanless
**7** = IP 55
**8** = IP 56
**9** = IP 65

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