MOTOVARIO®
HEART OF MOTION
a TECO Group company

www.motovario.com

USER MANUAL

drivon®
NEW HEART OF ELECTRIC MOTION

QL0314/ REV.1

INDEX

1. SAFETY AND OPERATING INSTRUCTIONS FOR DRIVON (Low Voltage Directive 2006/95/EEC)

1.1 GENERAL

During operation, Drivon power converters may, depending on their protection class, have live, bare, moving or rotating parts or hot surfaces. Unauthorized removal of covers, improper use, incorrect installation or operation causes a risk of serious personal injury or material damage. Further information can be found in this documentation.
All transportation, installation and maintenance work must be carried out qualified personnel (comply with IEC 364, CENELEC HD 384, DIN VDE 0100, IEC 664 and DIN VDE 0110, and national accident prevention regulations).
For the purpose of these basic safety instructions, qualified personnel are persons who are familiar with the assembly, installation and commissioning and operation of this product and who have relevant qualifications for their work.

1.2 PROPER USE IN EUROPE

Drivon power converters are components intended for installation in electrical systems or machines.
When installed in machines, the Drivon converter cannot be commissioned (i.e. commencement of the proper use) until it has been ensured that machine meets the provisions of the EC directive 2006 /42 /EEC (machine directive); EN 60204 must also complied with. Commissioning (i.e. implementation of the proper use) is only permitted when the EMC directive (2004/108/EEC) is complied with.
Drivon converters with the CE mark meet the requirements of the low voltage Directive 2006 /95 / EEC, with PWM switching frequency 2kHz. Optional modules are available in order to meet regulation with higher PWM switching frequencies. The harmonized standards stated in the declaration of conformity are used for the Drivon converters.
Technical data and information for connection conditions can be found on the rating plate and in the documentation, and must be complied with. The Drivon converters may only be used for the safety functions which are described and for which they have been explicitly approved.

1.3 TRANSPORT AND STORAGE

Information regarding transport, storage and correct handling must be complied with.

1.4 INSTALLATION

The installation and cooling of the equipment must be implemented according to the regulations in the corresponding documentation.
The Drivon converter must be protected against impermissible loads. Especially during transport and handling, components must not be deformed and/or insulation distances must not be changed. Touching of electronic components and contact must be avoided.
Drivon converters have electrostatically sensitive components, which can be easily damaged by incorrect handling. Electrical components must not be mechanically damaged or destroyed (this may cause a health hazard!)

1.5 ELECTRICAL CONNECTIONS

When working on live Drivon converters, the applicable national accident prevention regulation must be complied with (e.g. VBG A3, formerly VBG 4). The electrical installation must be implemented according to the applicable regulations (e.g. cable cross section, fuses, ground lead connections).
Further instructions can be found in the documentation.
Information about EMC- compliant installation - such as shielding, earthing, location of filters and installation of cables can be found in the Drivon converter documentation. These instructions must be complied with even with CE marked Drivon converters. Compliance with limiting values specified in the EMC regulations in the responsibility of the manufacturer of the system or machine.

1.6 OPERATION

Where necessary, systems where Drivon converter are installed must be equipped with additional monitoring and protective equipment according to the applicable safety requirements, e.g. legislation concerning technical equipment, accident prevention regulations, etc.
The parameterization and configuration of the Drivon converter must be selected so that no hazards can occur.
All covers must be kept closed during operation.

1.7 MAINTENANCE AND REPAIRS

After the Drivon converter is disconnected from the power supply, live equipment components and power connections should not be touched immediately, because of possible charged capacitors. Observe the relevant information signs located on the Drivon converter.
Further information can be found in this documentation.

2. CORRECT USE OF THE ELECTRONIC DRIVE

Compliance with the operating instructions is the prerequisite for problem free operation and fulfilment of any warranty claims. These operating instructions must therefore be read before working with the device!
These operating instructions contain important information about servicing. They must therefore be kept close to the device.
The Drivon series is device for industrial and commercial systems equipped with Motovario electronic drives and induction motors. This is a compact system delivered by Motovario factory and its disjunction is forbidden.
The electronic drive is designed to work fixed on motor or in the vicinity of the motor. For wall mounting an optional bracket is supplied.
Commissioning (implementation of the intended use) is not permitted until it has been ensured that the machine complies with the EMC directive 2004/108/EEC and that the conformity of the end product meets the machine directive 2006/42/EEC (note EN 60204).

2.1 GENERAL

The Drivon features a compact design with optimum control characteristics.
Its frequency inverter provides a sensorless current vector control, which always provides an optimized voltage to frequency ratio in combination with asynchronous three phase motor types. For the drive unit, this means very high starting and overload torques with constant speed.
This series of devices can be adapted to individual requirements by means of extension modules. Drivon designed to be used in different types of applications (pumps, fans, conveyors, …) consists of extremely reliable components and is controlled by software that provides excellent performance with special attention to the system energy efficiency. Drivon ensures a constant motor torque throughout a wide range of frequencies and provides fast and precise output according to the application dynamic conditions allowing high torque overload of the motor.
Conceived for extremely different and variable supply conditions, Drivon is available both in single-phase / three-phase version (200 ÷240 ± 10% V / 47 ÷ 63 Hz) with a motor power between 0.25 and 1.5 kW, and in three-phase version (360 ÷ 480 ± 10% V / 47 ÷ 63 Hz) with a motor power between 0.25 and 5.5 kW with integrated mains filter.
A wide range of standard and optional interfaces is available for a simple and flexible use. The electronic part is located in two different chassis sizes, one for power up to 1.5 kW and the other one for power up to 5.5 kW.
This manual is based on the software version 1.030. The installed firmware release can change according to Motovario project development. If the frequency inverter uses a different software version, this may cause differences. If necessary, the latest manual should be downloaded from the internet (www.motovario.com).
If a bus system is used for communication, a corresponding description (e.g. Drivon for CANopen and Modbus) is provided, or this can be downloaded from the internet (www.motovario.com).

The parameters are set in different ways namely BSi software tool for PC (via micro USB interface), Keypad, CANopen, Modbus.
Moreover, LEDs are provided for the visual diagnostics of the operating status.

2.2 OVERVIEW

This manual describes all Drivon product family. Wherever the Drivon is mentioned in the following, this refers to information that applies to all device in this family.

• Functionalities

All models of the Drivon series have the following functionalities:

• Basic features of the Drivon:

1. High starting torque and precise motor speed control setting by means of sensorless current vector control
2. Available both directly on the motor or close to it.
3. Permissible ambient temperature up to 40°C (please refer to specification data)
4. Integrated I/O signals
5. Integrated EMC mains filter
6. Integrated (not isolated) Modbus and Canopen
7. Programmable direct current braking
8. Emergency dynamic braking
9. On board Temperature sensor
10. Evaluation of an incremental encoder via digital inputs possible
11. Linking for additional modules
12. All parameter specified by PC software, keypad/display, Modbus and CANopen

2.3 DELIVERY

Check the equipment immediately after delivery/unpacking for transport damage such as deformation or loose parts.

If there is any damage, contact the carrier immediately and carry out a thorough assessment.

Important! This also applies even if the packaging in undamaged.

2.4 SCOPE OF SUPPLY

Drivon standard version:

1. IP55 (optionally IP66 depending on IP degree of the motor)
2. Integrated EMC mains filter
3. 4 multifunction digital inputs
4. 1 analog input -10÷10V / 0÷20mA selectable by jumper
5. 2 reserved Safe Torque Off digital inputs
6. 1 internal potentiometer
7. 1 multifunction relay output
8. 1 reserved bimetallic thermal switch digital input
9. 1 line driver incremental encoder interface
10. 1 CANopen interface
11. 1 ModbusRTU interface
12. 1 serial interface USB
13. DC-bus terminals

14. Operating instructions as PDF file from Motovario web site
15. BSi software tool for inverter management via PC

Expansion modules:

1.	I/O signals	(options: IOA, IOB)
2.	Mechanical brake	(option: EMB)
3.	Dissipative dynamic braking	(option: BC)
4.	Potentiometer and Start/Stop	(option: PS)
5.	EtherCAT interface	(option ETC)
6.	ProfiBUS DP interface	(option PDP)
7.	Profinet interface	(option PNT)

2.5 SAFETY AND INSTALLATION

Drivon is equipped for use in industrial high voltage systems and are operated at voltages that could lead to severe injuries or death if they are touched.
The moto-inverter and its accessories must only be used for the purpose which is intended by the manufacturer. Unauthorized modifications and the use of spare parts and additional equipment which has not been purchased from or recommended by the manufacturer of the frequency inverter may cause fire, electric shock and injury.
All of the associated covers and protective devices must be used.
Installation and other work may only be carried out by qualified electricians with strict adherence to the operating instructions. Therefore keep these 3 operating instructions at hand, together with all supplementary instructions for any options which are used, and give them to each user.
Local regulations for the installation of electrical equipment and accident prevention must be complied with.

2.5.1 EXPLANATION OF LABELS USED IN THIS MANUAL

DANGER Indicates an immediate danger, which may result in death or serious injury.
WARNING Indicates a possibly dangerous situation, which may result in death or serious injury.
CAUTION Indicates a possibly dangerous situation, which may result in slight or minor injuries.
NOTICE Indicates a possibly harmful situation, which may cause damage to the product or the environment.
NOTE Indicates hints for use and useful information.

2.5.2 LIST OF SAFETY AND INSTALLATION NOTES

DANGER Danger of electric shock

The frequency inverter is supplied with a dangerous voltage. Touching certain conducting components (connection terminals, contact rails and supply cables as well as the PCBs) will cause electric shock with possibly fatal consequences.

Even when the motor is at a standstill (e.g. caused by an electronic block, blocked drive or output terminal short circuit), the line connection terminals, motor terminals and braking resistor terminals, contact rails, PCBs and supply cables may still conduct hazardous voltages. A motor standstill is not identical to electrical isolation from the mains.

Only carry out installations and work if the device **is disconnected from the voltage** and **wait at least 5 minutes** after the mains have been switched off! (The equipment may continue to carry hazardous voltage for up to 5 minutes after being switched off at the mains).
Follow the **5 safety Rules** (1.Switch off the power, 2.Secure against switching on, 3.Check for no voltage, 4.Earth and short circuit, 5.Cover or fence off neighboring live components).

DANGER Danger of electric shock

Even if the drive unit has been disconnected from the mains, a connected motor may rotate and possible generate a dangerous voltage. Touching electrically conducting components may then cause an electric shock with possible fatal consequences.
Therefore prevent connected motors from rotating.

WARNING Danger of electric shock

The voltage supply of the frequency inverter may directly or indirectly put it into operation, or touching electrically conducting components may then cause an electric shock with possible fatal consequences.
Therefore, all poles of the voltage supply must be disconnected.
For devices with a 3-phase supply, terminals L1/L2/L3 must be disconnected.
For devices with single phase supply, terminals L1/N must be disconnected.
For devices with a DC supply, terminal -DC must be disconnected.
Also, the motor cables U/V/W must be disconnected.

WARNING Danger of electric shock

In case of a fault, insufficient earthing may cause an electric shock with possibly fatal consequences if the device is touched.
Because of this, the frequency inverter is only intended for permanent connection and may not be operated without effective earthing connections which comply with local regulations for leakage currents (>3.5mA).
EN 50178/VDE 0160 stipulates the installation of a second earthing conductor or an earthing conductor with a cross-section of at least 10mm^2.

WARNING Danger of injury if motor starts

With certain setting conditions, the frequency inverter or the motor which is connected to it may start automatically when the mains are

switched on. The machinery which it drives (press / chain hoist / roller / fan etc.) may then make an unexpected movement. This may cause various injuries, including to third parties.
Before switch on the mains, secure the danger area by warning and removing all persons from the danger area.

CAUTION Danger of burns
The heat sink and all other metal components can heat up to temperature above 70°C. Touching such components may cause local burns to the affected parts of the body (hands, fingers, etc.).
To prevent such injuries, allow sufficient time for cooling down before starting work-the surface temperature should be checked with suitable measuring equipment. In addition, keep sufficient distance from adjacent components during installation, or install protection against contact.

NOTICE Damage to the frequency inverter
For single phase operation (115/230V) the mains impedance must be at least 100uH for each conductor. If this is not the case, a mains choke must be installed.

Failure to comply with this may cause damage to the frequency inverter due to impermissible currents in the components.

NOTICE EMC - Interference
The frequency inverter is a product which is intended for use in an industrial environment and is subject to sales restrictions according to IEC 61800-3. Use in a residential environment may require additional EMC measures.

For example, electromagnetic interference can be reduced by the use of an optional mains filter.

NOTICE Leakage and residual currents
Due to their principle of operation (e.g. due to integrated mains filters, mains units and capacitor banks), frequency inverters generate leakage currents. For the correct operation of the frequency inverter on a current sensitive RCD, the use of an all current sensitive earth leakage circuit breaker (Type B) compliant with EN 50178/VDE 0160 is necessary.

NOTE Operation on TN-/TT-/IT-networks
The motor- inverter is suitable for operation on TN or TT networks as well as for IT networks with the configuration of the integrated mains filter.

NOTE Maintenance
In normal use, frequency inverters are maintenance free.
The cooling surfaces must be regularly cleaned with compressed air if the ambient air is dusty.
In the event of taking out of service or storage for long periods, the capacitors must be re-formatted.
Failure to do this will damage these components and will cause a considerable reduction of the service life-including the immediate destruction of the frequency inverter.

2.5.3 WIRING GUIDELINES
Drivon has been developed for use in an industrial environment. In this environment, high levels of electromagnetic interference can act on the frequency inverter. In general, correct installation ensures safe and problem-free operation. To meet the limiting values of the EMC directives, the following instructions should be complied with:

1. Ensure that all equipment in the control cabinet is securely earthed using short earthing cables which have large cross sections and are connected to a common earthing point or earthing bar. It is especially important that each control unit which is connected to the electronic drive technology (e.g. an automatic device) has a short cable with a large cross section, which is connected to the same earthing point as the frequency inverter itself. Flat cables (e.g. metal stirrups) are preferable, as they have a lower impedance at high frequencies.

2. The bonding cable of the motor is factory connected to the earthing terminal of frequency inverter. The presence of a central earthing bar in the control cabinet and the grouping together of all bonding conductors to this bar normally ensures safe operation.

3. Where possible, shielded cables should be used for control circuits. The shielding at the cable end should be carefully sealed and it must be ensured that the wires are not laid over longer distances without shielding. The shields of analog setpoint cables should only be earthed on one side on the device.

4. The control cables should be installed as far as possible from power cables, using separate cable ducts, etc. Where cables cross, an angle of 90o should be ensured as far as possible.

5. Ensure that the contactors in the cabinet are interference protected, either by RC circuits in the case of AC contactors or by freewheeling diodes for DC contactors, for which the interference traps must be positioned on the contactor coils. Varistors for over voltage limitation are also effective. This interference suppression is particularly important when the contactors are controlled by the relay in the frequency inverter.

6. Shielded or armored cables should be used for the load connections (motor cable).The shielding or armoring must be earthed at both ends. If possible, earthing should be made directly to the electrically conducting mounting plate of the control cabinet or the screening angle of the EMC Kit.

The safety regulations must be complied with under all circumstances when installing the frequency inverter!

NOTE **Cable laying**
For all versions, make sure that the cables and the cable glands are carefully matched. Whenever possible, the cable should be proper addressed in the way that water is deflected away from the device (if necessary use loops). This is essential to ensure that the required protection class is maintained.

NOTICE **Interference and damage**
The control cables, mains cables and motor cables must be laid separately. Under no circumstances may they be installed in a common circuit or installation duct, in order to prevent interference.
The test equipment for high voltage insulations must not be used on cables that are connected to the motor controller. Failure to comply with this will cause damage to the drive electronics.

2.6 CERTIFICATIONS

2.6.1 EMC DIRECTIVE (EUROPEAN)
If Drivon is installed according to the recommendations in this manual, it meets (with PWM switching frequency of 2kHz) all EMC directive requirements, as per the EMC product standard for motor operated systems EN 61800-3.

2.6.2 UL/CSA DIRECTIVE
Approval for 230/400Vrms up to 1.5kW size is standard.

NOTE
"The device has to be mounted according to Motovario instructions."
"Use 80°C copper conductors only"
"Connection of copper cable with an insulation rating of at least 80°C" (only applies to connection cables (mains and motor cables but not control cables))

"These products are intended for use in a pollution degree 2 environment"

2.6.3 RoHS COMPLIANT
The frequency inverters and optional modules are designed to be RoHS compliant according to Directive 2011/65/EU.

2.7 PRODUCT VERSIONS
Drivon is designed in two separate versions based on two different power supply ranges in which several speed ranges are provided:

Version	Power supply	Power range	Speed ranges
DV123	1ph 230V	0.25 – 1.5 kW	30…..950 rpm 50…1450 rpm
DV340	3ph 400V	0.25 – 5.5 kW	30…..950 rpm 50…1450 rpm 30…1650 rpm 50…2450 rpm

Technical details concerning both Drivon versions are listed below.

Version 1ph 230V = 1 X 180…260VAC

This Drivon version is available in two speed ranges described by the following data tables.

• Speed range: 30-950 rpm

Drivon type code	P_n (kW)	M_n (Nm)	M_{acc} (Nm)	n_n (rpm)	I_n (A)	cos φ	J_{mot} (kg*cm²)	Inverter housing	Motor size
DV123-G1-0025S-TS71B	0,25	2,5	5,0	950	1,1	0,99	13,1	S	71
DV123-G1-0037S-TS80A	0,37	3,7	7,4	950	1,8	0,99	27	S	80
DV123-G1-0055S-TS80B	0,55	5,5	11,1	950	2,5	0,99	31,5	S	80
DV123-G1-0075S-TH90S	0,75	7,5	15,1	950	3,0	0,99	29,7	S	90
DV123-G1-0110S-TH90L	1,1	11,1	22,1	950	3,9	0,99	41,9	S	90
DV123-G1-0150S-TH100L	1,5	15,1	30,2	950	5,2	0,99	91,5	S	100

• **Speed range: 50-1450 rpm**

Drivon type code	P_n (kW)	M_n (Nm)	M_{acc} (Nm)	n_n (rpm)	I_n (A)	cos φ	J_{mot} (kg*cm²)	Inverter housing	Motor size
DV123-G2-0025S-TS71A	0,25	1,6	3,3	1450	1,1	0,99	8,9	S	71
DV123-G2-0037S-TS71B	0,37	2,4	4,9	1450	1,5	0,99	9,9	S	71
DV123-G2-0055S-TS80A	0,55	3,6	7,2	1450	2,0	0,99	22,4	S	80
DV123-G2-0075S-TH80B	0,75	4,9	9,9	1450	2,5	0,99	27	S	80
DV123-G2-0110S-TH90S	1,1	7,2	14,5	1450	3,5	0,99	26,6	S	90
DV123-G2-0150S-TH90L	1,5	9,9	19,8	1450	4,8	0,99	35,5	S	90

Version 3ph 400V = 3 x 320…530VAC

This Drivon version is available in four speed ranges described by the following data tables.

• **Speed range: 30-950 rpm**

Drivon type code	P_n (kW)	M_n (Nm)	M_{acc} (Nm)	n_n (rpm)	I_n (A)	cos φ	J_{mot} (kg*cm²)	Inverter housing	Motor size
DV340-G1-0025S-TS71B	0,25	2,5	5,0	950	0,7	0,99	13,1	S	71
DV340-G1-0037S-TS80A	0,37	3,7	7,4	950	1,2	0,99	27	S	80
DV340-G1-0055S-TS80B	0,55	5,5	11,1	950	1,6	0,99	31,5	S	80
DV340-G1-0075S-TH90S	0,75	7,5	15,1	950	2,0	0,99	29,7	S	90
DV340-G1-0110S-TH90L	1,1	11,1	22,1	950	2,5	0,99	41,9	S	90
DV340-G1-0150S-TH100L	1,5	15,1	30,2	950	3,4	0,99	91,5	S	100
DV340-G1-0220M-TH112M	2,2	22,1	44,3	950	4,7	0,99	217	M	112
DV340-G1-0300M-TH132S	3	30,2	60,3	950	6,0	0,99	330	M	132
DV340-G1-0400M-TH132MA	4	40,2	80,5	950	8,0	0,99	403	M	132
DV340-G1-0550M-TH132MB	5,5	55,3	110,6	950	11,0	0,99	483	M	132

• **Speed range: 50-1450 rpm**

Drivon type code	P_n (kW)	M_n (Nm)	M_{acc} (Nm)	n_n (rpm)	I_n (A)	cos φ	J_{mot} (kg*cm²)	Inverter housing	Motor size
DV340-G2-0025S-TS71A	0,25	1,6	3,3	1450	0,7	0,99	8,9	S	71
DV340-G2-0037S-TS71B	0,37	2,4	4,9	1450	1,0	0,99	9,9	S	71
DV340-G2-0055S-TS80A	0,55	3,6	7,2	1450	1,3	0,99	22,4	S	80
DV340-G2-0075S-TH80B	0,75	4,9	9,9	1450	1,6	0,99	27	S	80
DV340-G2-0110S-TH90S	1,1	7,2	14,5	1450	2,3	0,99	26,6	S	90
DV340-G2-0150S-TH90L	1,5	9,9	19,8	1450	3,2	0,99	35,5	S	90
DV340-G2-0220M-TH100LA	2,2	14,5	29,0	1450	4,5	0,99	56,5	M	100
DV340-G2-0300M-TH100LB	3	19,8	39,5	1450	6,1	0,99	75,5	M	100
DV340-G2-0400M-TH112M	4	26,4	52,7	1450	7,7	0,99	141	M	112
DV340-G2-0550M-TH132S	5,5	36,2	72,5	1450	10,0	0,99	250	M	132

• Speed range: 30-1650 rpm

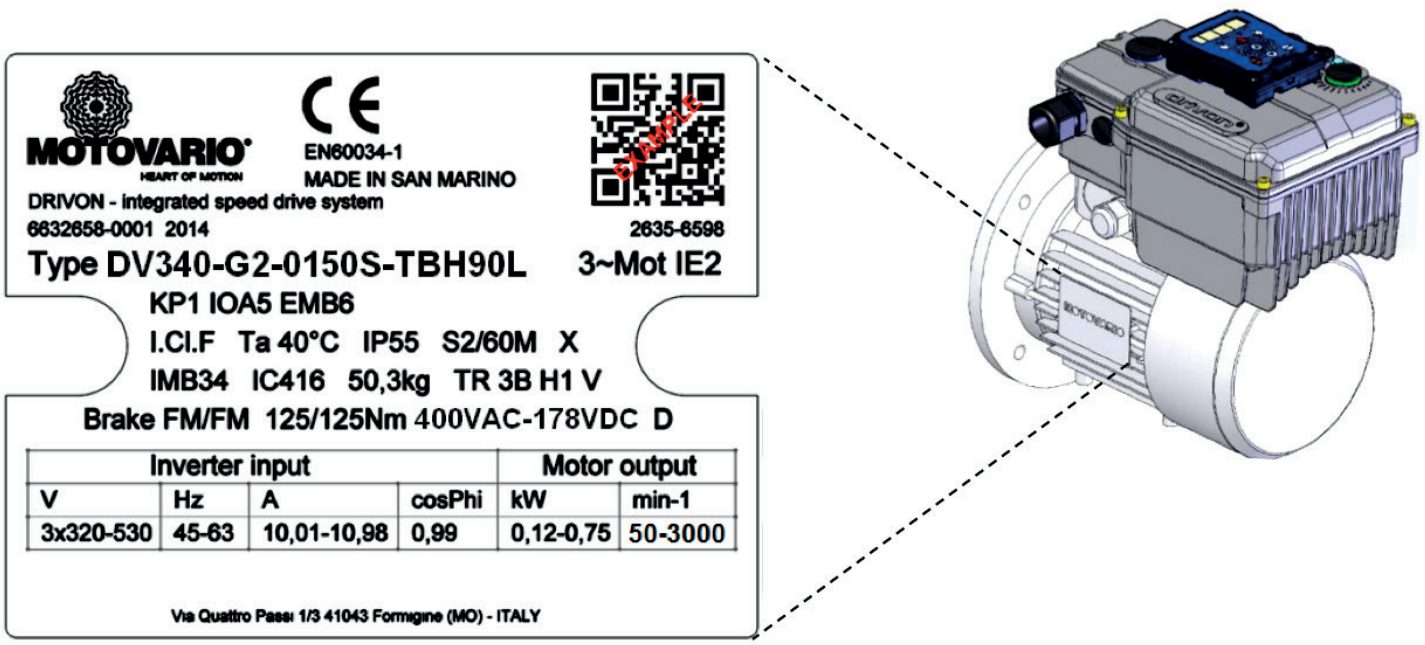
Drivon type code	P_n (kW)	M_n (Nm)	M_{acc} (Nm)	n_n (rpm)	I_n (A)	cosφ	J_{mot} (kg*cm²)	Inverter housing	Motor size
DV340-G3-0043S-TS71B	0,43	2,5	5,0	1650	1,3	0,99	13,1	S	71
DV340-G3-0064S-TS80A	0,64	3,7	7,4	1650	2,0	0,99	27	S	80
DV340-G3-0095S-TS80B	0,95	5,5	11,0	1650	2,8	0,99	31,5	S	80
DV340-G3-0130S-TH90S	1,3	7,5	15,1	1650	3,4	0,99	29,7	S	90
DV340-G3-0190M-TH90L	1,9	11,0	22,0	1650	4,4	0,99	41,9	M	90
DV340-G3-0260M-TH100L	2,6	15,1	30,1	1650	5,9	0,99	91,5	M	100
DV340-G3-0380M-TH112M	3,8	22,0	44,0	1650	8,1	0,99	217	M	112
DV340-G3-0520M-TH132S	5,2	30,1	60,2	1650	10,4	0,99	330	M	132

• Speed range: 50-2450 rpm

Drivon type code	P_n (kW)	M_n (Nm)	M_{acc} (Nm)	n_n (rpm)	I_n (A)	cos φ	J_{mot} (kg*cm²)	Inverter housing	Motor size
DV340-G4-0043S-TS71A	0,43	1,7	3,4	2450	1,2	0,99	8,9	S	71
DV340-G4-0064S-TS71B	0,64	2,5	5,0	2450	1,7	0,99	9,9	S	71
DV340-G4-0095S-TS80A	0,95	3,7	7,4	2450	2,3	0,99	22,4	S	80
DV340-G4-0130S-TH80B	1,3	5,1	10,1	2450	2,8	0,99	27	S	80
DV340-G4-0190M-TH90S	1,9	7,4	14,8	2450	3,9	0,99	26,6	M	90
DV340-G4-0260M-TH90L	2,6	10,1	20,3	2450	5,4	0,99	35,5	M	90
DV340-G4-0380M-TH100LA	3,8	14,8	29,6	2450	7,8	0,99	56,5	M	100
DV340-G4-0520M-TH100LB	5,2	20,3	40,6	2450	10,6	0,99	75,5	M	100

2.8 PRODUCT IDENTIFICATION

The motor-inverter Drivon is identified by means of its designation string where power supply, power rating, mechanical size, speed range and options are specified.
The Drivon nameplate with product type code is placed on the motor case but it refers to the complete system according to the sales catalogue:



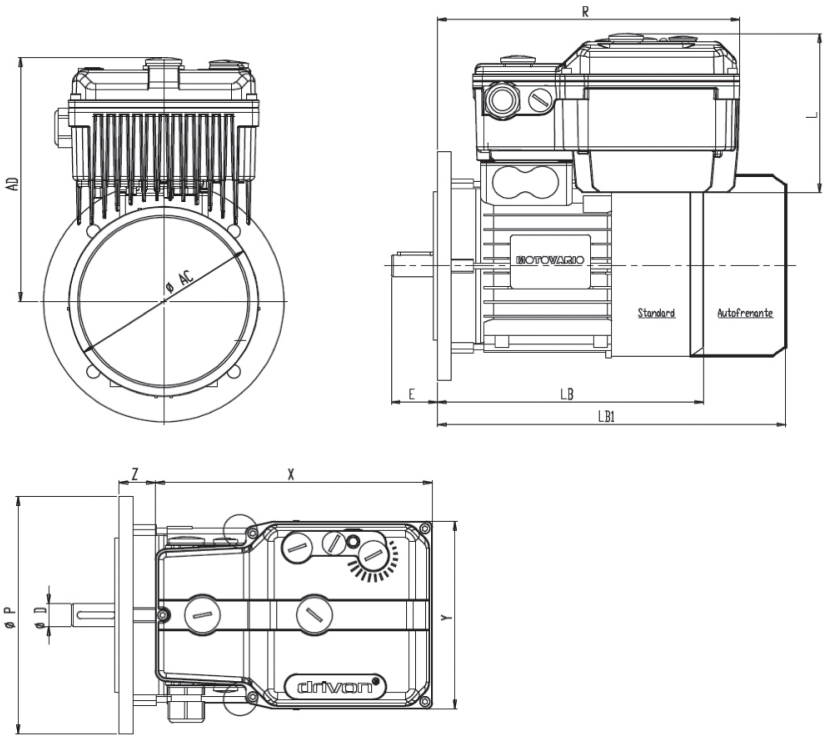
Example of type code:

DV340-G2-0150S-TBH90L-KP1-IOA5-EMB6

- Motor-inverter series
- Power supply version
- Speed range
- Power range
- Inverter housing
- Motor series
- Motor size
- Optional Keyoad on board
- Optional I/O - expansion on board
- Optional E.M. Brake control on board

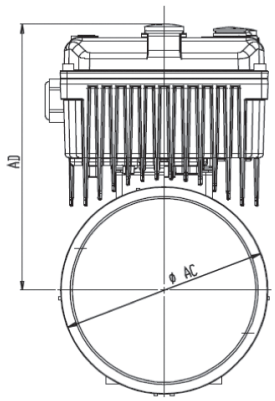
2.9 OVERALL DIMENSIONS

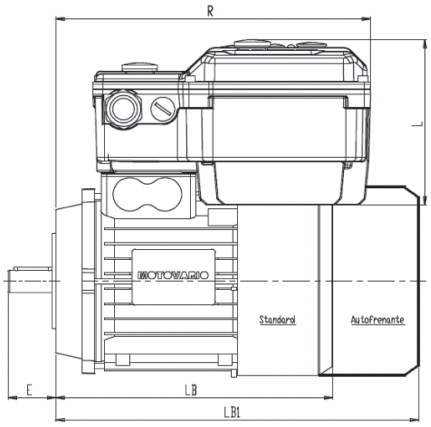
• B5 flange version

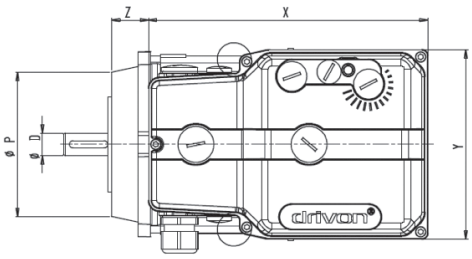


Motor Size	Inverter Size	X	Y	L	M	Z	R	AC	P	D	E	LB	LB1	AD
71	S	233	158	139	91	27	260	n139	n160	n14 J6	30	209	276	200
80						31	264	n158	n200	n19 J6	40	233	304	209
90S						42	275	n173		n24 J6	50	248	325	221
90L												273	350	
100						50	283	n191	n250	n28 J6	60	308	390	232
90S	M	258	193	152	102	33	291	n173	n200	n24 J6	50	248	304	215
90L												273	350	
100						41	299	n191	n250	n28 J6	60	308	390	224
112						44	302	n211				323	419	238
132S						58	316	n249	n300	n38 K6	80	372	462	276
132M												410	514	

• **B14 flange version**

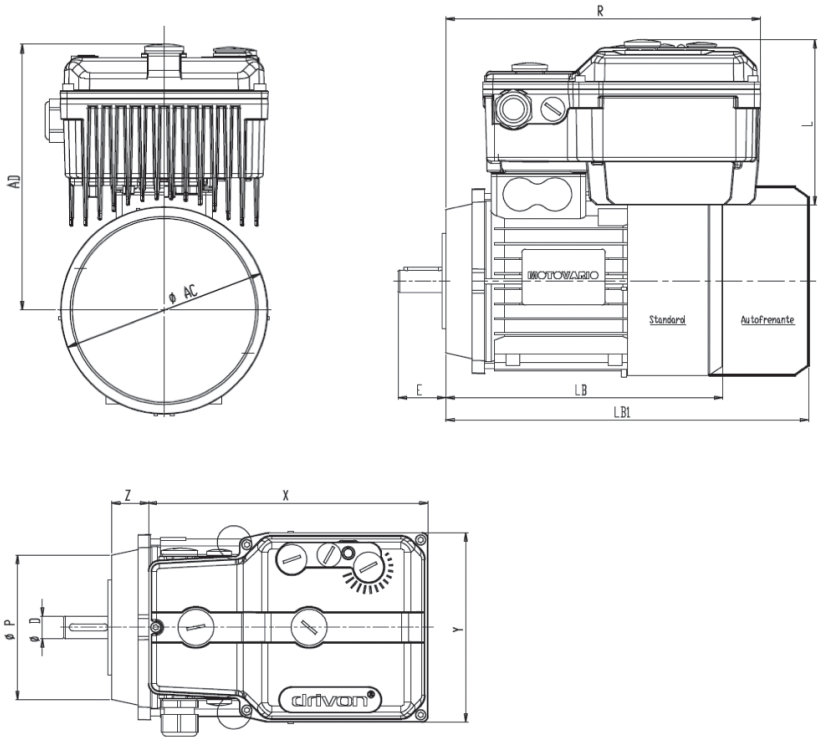






Motor Size	Inverter Size	X	Y	L	M	Z	R	AC	P	D	E	LB	LB1	AD
71	S	233	158	139	91	27	260	n139	n105	n14 J6	30	209	276	200
80						31	264	n158	n120	n19 J6	40	233	304	209
90S						42	275	n173	n140	n24 J6	50	248	325	221
90L												273	350	
100						50	283	n191	n160	n28 J6	60	308	390	232
90S	M	258	193	152	102	33	291	n173	n140	n24 J6	50	248	304	215
90L												273	350	
100						41	299	n191	n160	n28 J6	60	308	390	224
112						44	302	n211				323	419	238
132S						58	316	n249	n200	n38 K6	80	372	462	276
132M												410	514	

• **B3 foot version**



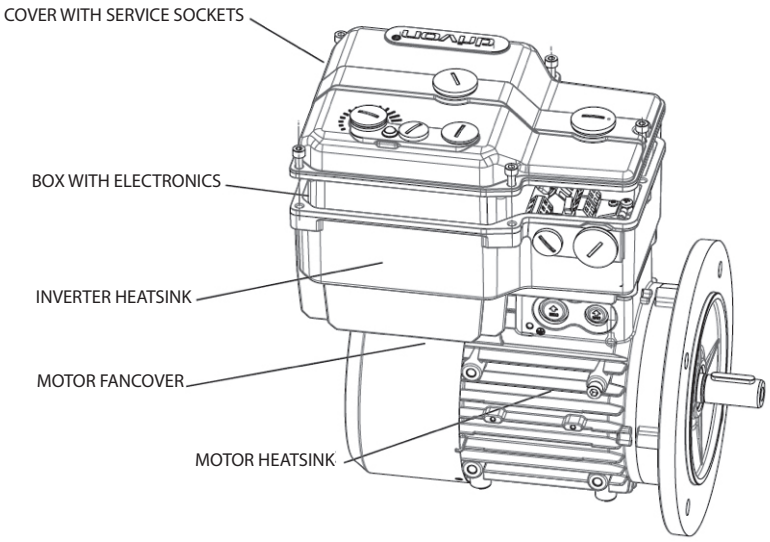
Motor Size	Inv. Size	X	Y	L	M	Z	R	AC	D	E	LB	LB1	AD	AB	C	BB	H
71	S	233	158	139	91	27	260	n139	n14 J6	30	209	276	200	132	44	90	71
80						31	264	n158	n19 J6	40	233	304	209	156	49	100	80
90S						42	275	n173	n24 J6	50	248	325	221	172	54		90
90L											273	350				125	90
100						50	283	n191	n28 J6	60	308	390	232	192	62	140	100
90S	M	258	193	152	102	33	291	n173	n24 J6	50	248	304	215	172	54	100	90
90L											273	350				125	90
100						41	299	n191	n28 J6	60	308	390	224	192	62	140	100
112						44	302	n211			323	419	238	221	69		112
132S						58	316	n249	n38 K6	80	372	462	276	260	87		132
132M											410	514					132

2.10 INVERTER HOUSING

Drivon electronics is housed within an aluminum case composed by two parts:

- lower deep box where all power and control circuits are contained
- upper flat cover where all the local service grips are available

The upper cover is designed to be in contact with user hands for local adjustment of inverter functions.



The cover temperature does not exceed 40°C but the heatsink can be much more warm.

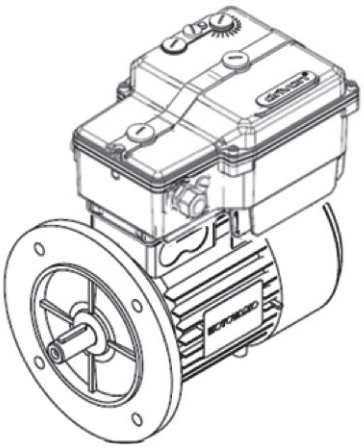
WARNING

During operation inverter and motor heatsinks can reach high temperature (more than 70°C).
Pay attention when handling.

3. ASSEMBLY AND INSTALLATION

3.1 INSTALLING THE MOTOR-INVERTER

The motor-inverter is a compact object where electronic drive and motor are closely and jointly connected.



Frequency inverter is designed in various sizes depending on the motor. It is fitted on the motor top at Motovario factory and the user is not authorized to remove it.

In case of troubles, the whole system must be returned to Motovario company according to its after sales policy.

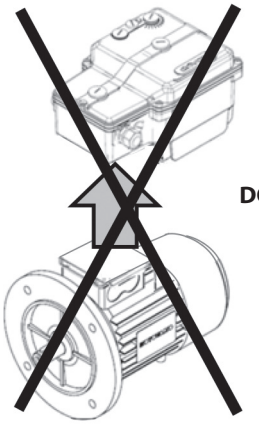
Drivon installation in the machine is in charge to the user and it consist of a mechanical assembly (flange side) and of an electrical wiring toward mains power supply and toward external electronic controllers.

A wall mounted version of the electronic part is under development and it will be available as option and delivered with special kit.

WARNING

Any attempt of disjunction between drive and motor is absolutely forbidden!

In case of voluntary removal by the user all warranty rights on the product will decay.



DON'T SEPARATE!

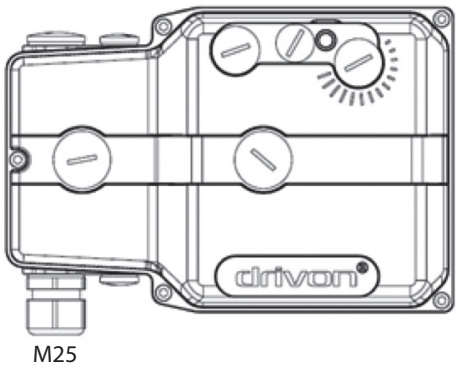
3.2 ELECTRICAL CONNECTION

Power and control wiring of Drivon can be carried out by means of cable glands. By default Drivon is equipped with power cable gland plugged in. When ordering, special quick connectors (power and control) can be required as option.

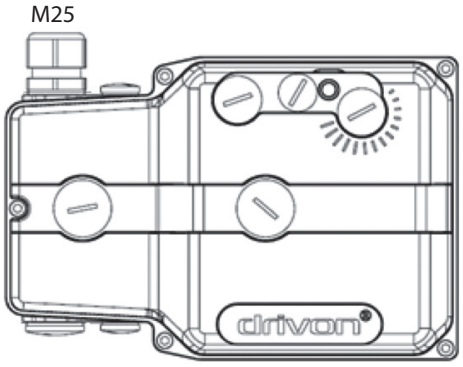
• POWER cable glands

Before Drivon using an external AC power supply must be connected to the inverter terminals according to its voltage rating.

Drivon default arrangement consists of M25 cable gland fitted on the left side of the housing.
The user is free to accept this layout or to change the cable gland position at his discretion to the most convenient inverter side.



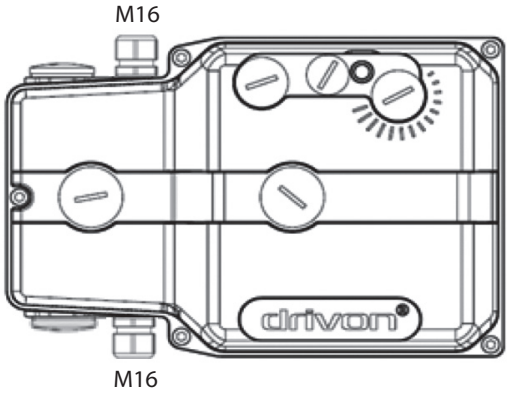
Power supply - Default layout



Power supply - Alternative layout

• SIGNAL cable glands

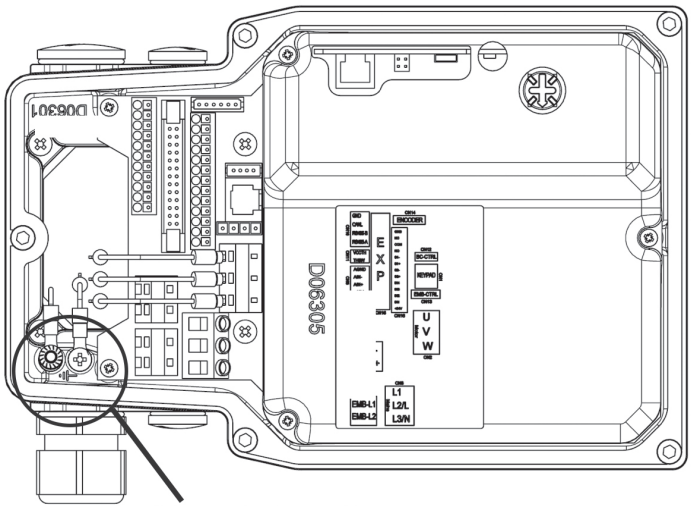
In case of signals exchange with external command sources the small M16-holes can be used in both inverter sides.
By default all M16 control holes are released with closed cap but they can be open according to the application requirements.



3.2.1 EARTH POINTS

DANGER **The devices must be earthed**

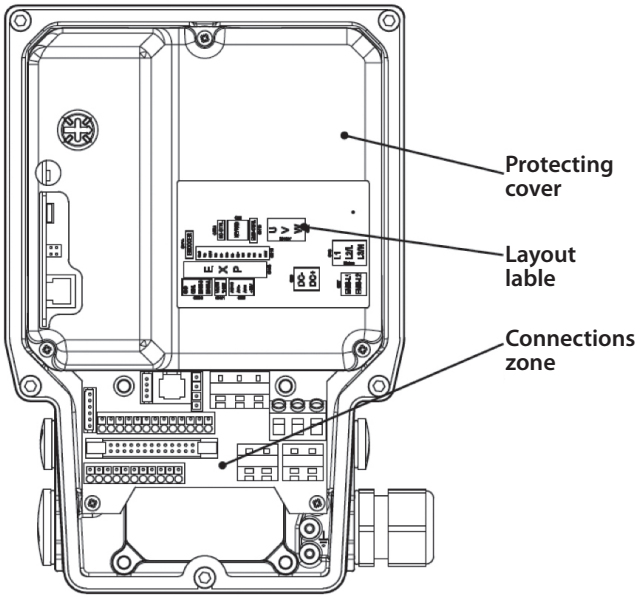
Safe operation of the devices requires that is installed and commissioned by qualified personnel in compliance with the instructions provided in this manual.
In particular, the general and regional installation and safety regulations for work on high voltage systems must be complied with as must the regulations concerning correct use of tools and the use of personal protection equipment.
Dangerous voltages can be present at the motor connection terminals even when the motor inverter is switched off. Always use insulated screw drivers on these terminal fields. Ensure that the input voltage source is not live before setting up or changing connections to the unit.
Make sure that the type and value of supply voltage is the proper one specified for the moto inverter.
The power cable from Mains contains also PE conductor which must be connected to inverter earth point.
Drivon PE points are located in the connector zone of the drive.



Drivon earth points position

3.2.2 INTERNAL CONNECTOR ACCESS

By opening the inverter housing no electronic component is visible because of a special protecting cover for user and product safeguard.
Only the connections zone is attainable by user in order to make every cabling activity.
The connections zone contains all power and control terminals for Drivon supply and command.
A label is affixed inside on the top of protecting cover where terminals layout is described.



Several terminals belong to the connection zone with different consignees according to the following criteria:

- **User-available** terminals
- **Motovario-reserved** terminals

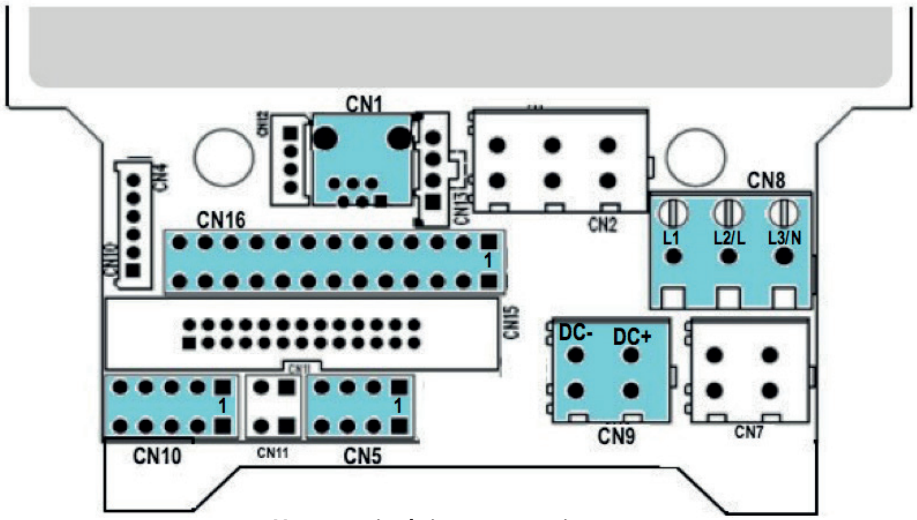
The user access is authorized only to a limited quantity of terminals.

3.2.2.1 USER TERMINALS

In the connection zone the following six connectors are available to the user:

	Connector number	Description
Power terminals	CN8	AC Power input
	CN9	DC-link
Signal terminals	CN5	Analog input
	CN7	Keypad (RJ11)
	CN10	RS485-CANopen
	CN16	Digital I/O + STO

All corresponding positions in the following figure are emphasized:



User terminals into connection zone (dark colour in the figure)

All other connectors not included in the list above are reserved only to Motovario for the product optional modules according to sales catalogue. In case of special application needs, their use can be also agreed with Motovario after a proper technical analysis.

Before and while the device is connected, the following rules must be observed:

1. Ensure that the mains supply provides the correct voltage and cable is suitable for the current required.
2. Ensure that suitable circuit breakers with the specified nominal current range are installed between the voltage source and the inverter.
3. The mains voltage can be directly attached at terminals L1-L2/N-L3 and PE (depending on the device)

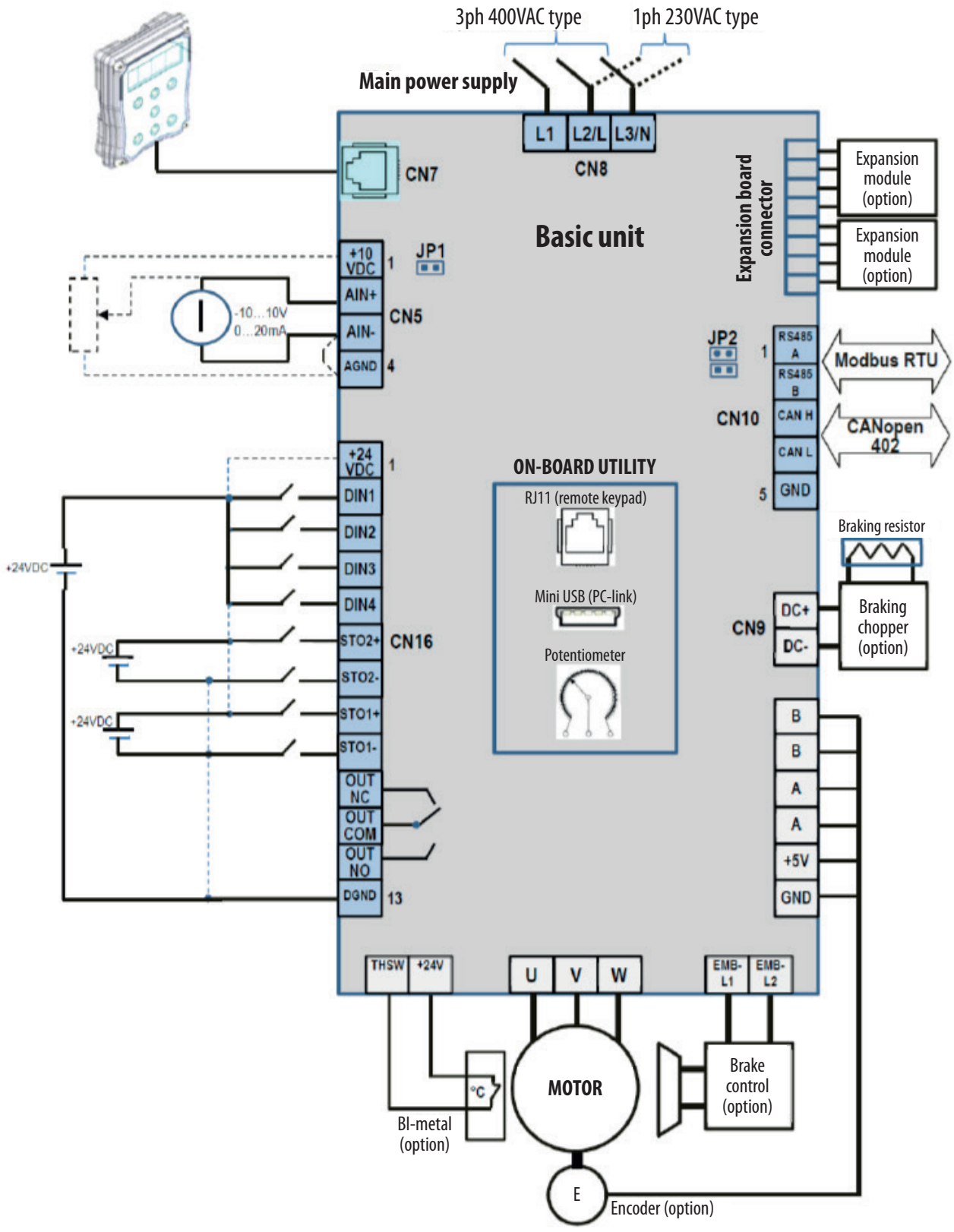
NOTICE **Connecting materials and tools**

When using wiring sleeves, the maximum connection cross section can be reduced.
Use a 5.5 mm slot-head screwdriver to connect the power unit.

NOTE **Connection cables**

Only use copper cables with class 1/75°C or equivalent for connection. Higher temperature classes are permissible.

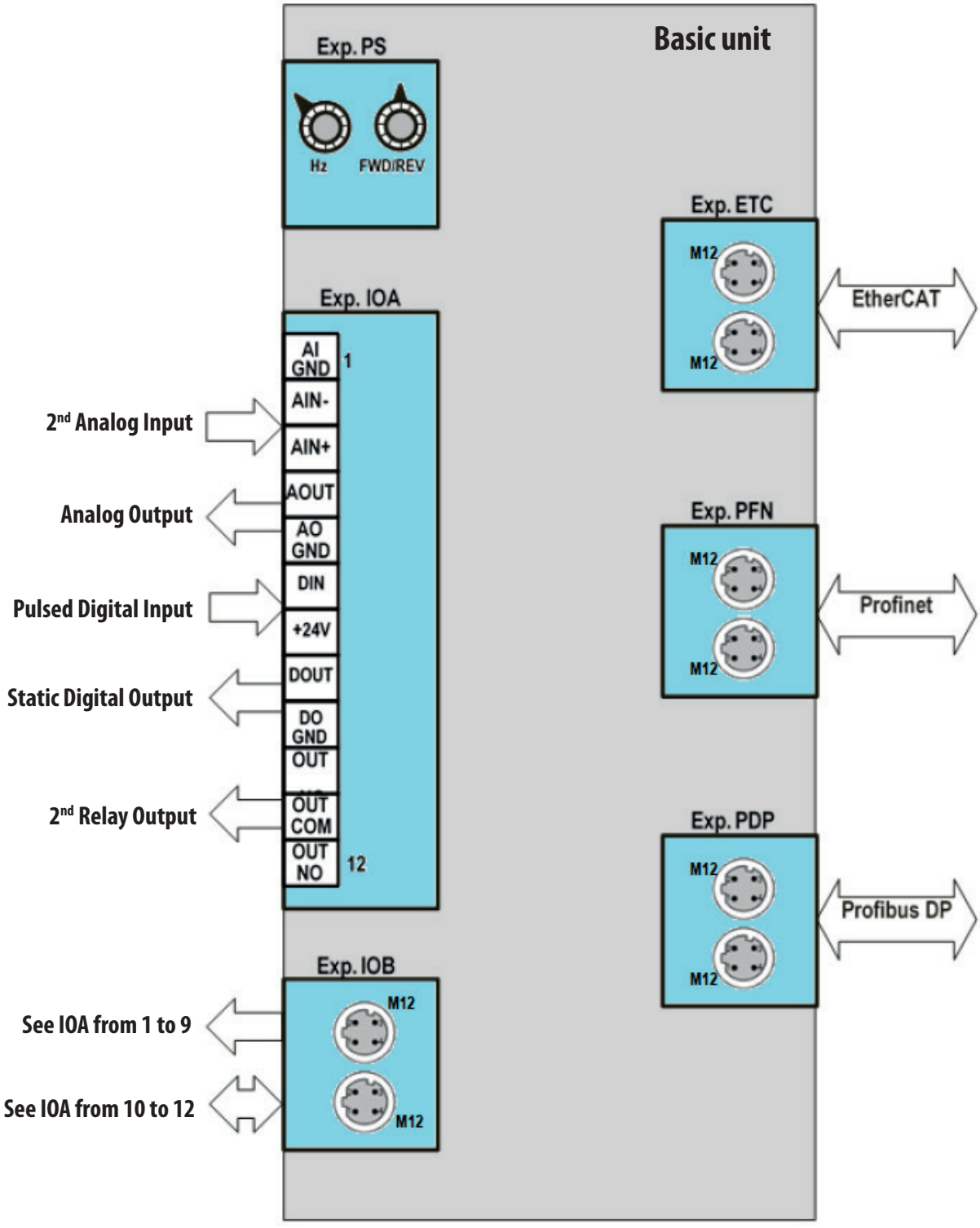
▸ **Basic-unit layout**



NOTE **User terminals in blue colour**

▸ **Expansion Modules layout (option)**

Starting from basic layout described in the previous scheme, additional modules can be applied to Drivon frame as option in order to extend its basic connections.
Each module is dedicated to a specific function and it must be assembled at Motovario factory.
For that reasons it has to be selected at time of order.



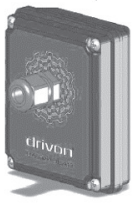
Basic unit equipped with additional optional modules

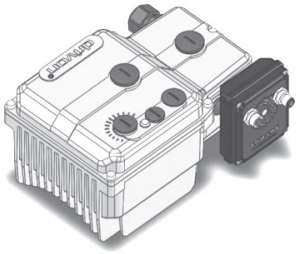
Two types of optional expansion modules are classified:

• **USER-INTERFACING expansion module**
The module is assembled over the inverter and it provides a connector or terminal or knob on which the user can interact


PS expansion


IOA expansion


IOB expansion


I/O and fieldbus interface to extend the basic function of inverter

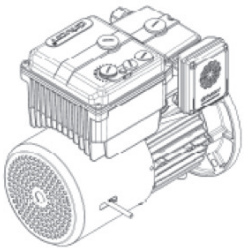

PDP expansion


ETC expansion

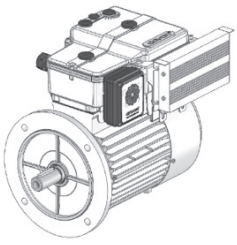

PFN expansion

• **MACHINE-INTERFACING expansion module**
The module is assembled over the inverter but it doesn't exchange any electric signal with the external user. Its signals are only closed inside the inverter.


EMB expansion

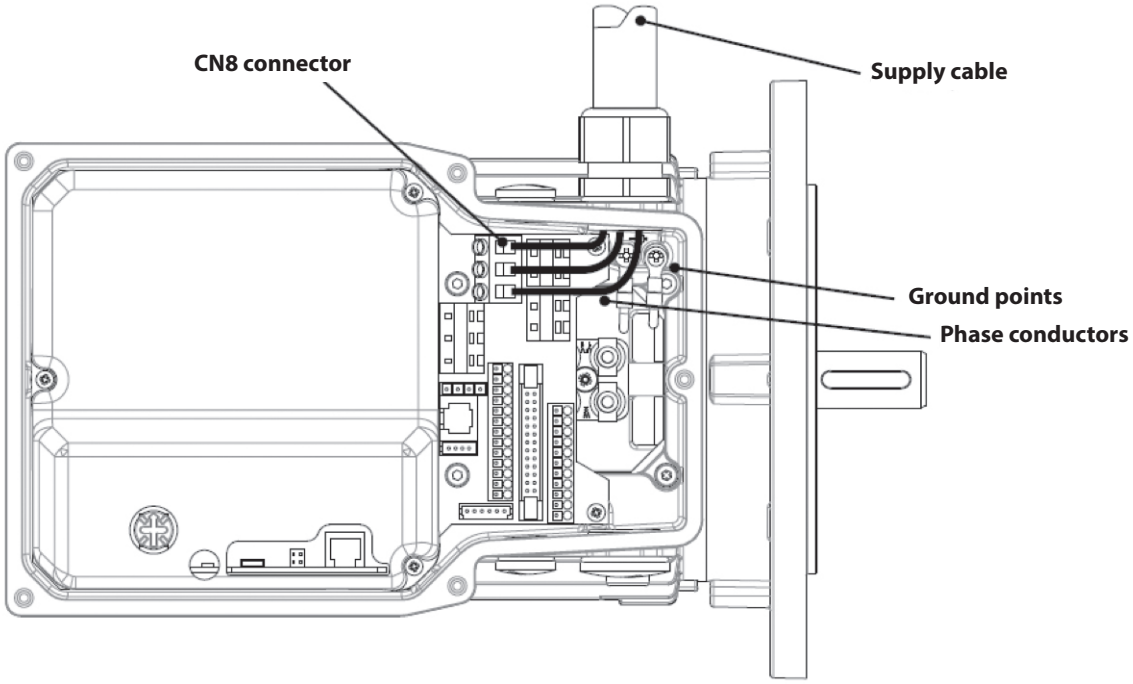

Brake-motor control by means of EMB optional module


BC expansion


Dynamic braking by means of BC optional module

3.2.2.2 POWER CONNECTORS

The power supply must be applied to the terminal CN8.
This terminal is always made with three electrical contacts but its cabling mode depends on Drivon version



The user must connect the supply cable phase conductors only to the terminals L1, L2, L3 (see CN8) and the Earth one to the dedicated earth points available inside the inverter housing.

1. To supply the inverter with mains voltage, it is necessary to remove the inverter cover by undoing the five M5 cross head captivated screws, thus gaining access to the terminals indicated as L1, L2, L3.

2. Introduce the power cables into the inverter housing through the cable glands.

3. Connect the cables to the terminals L1, L2, L3 and separate the earth connector.

4. Use only copper cables of Class 1 / 75°C. Use a 4-pole cable. If crimped terminals are used, they must be insulated.
   If crimped terminals are not used, the length of the bared wire must not exceed 5 mm.The minimum cable sections are shown in the following table:

Drivon power	Cable section
up to 1.5kW	2 mm^2
from 2.2kW	6 mm^2

5. When making the power supply and control connections, grommets which impede the passage of water to the interior of the inverter are recommended.
6. Ensure that the power source produces the correct voltage and that it is designed to provide the inverter's rated input current. Between the power supply and the inverter use an appropriate automatic protection switch with the specified rated current.

▸ CN8 - AC power input

This connector must be used to supply the inverter by Mains. Both Drivon 3ph and 1ph versions are equipped with a three screws terminal. Its wiring mode it depends on the number of conductors according to the following tables:

• Tri-phase, 400V model

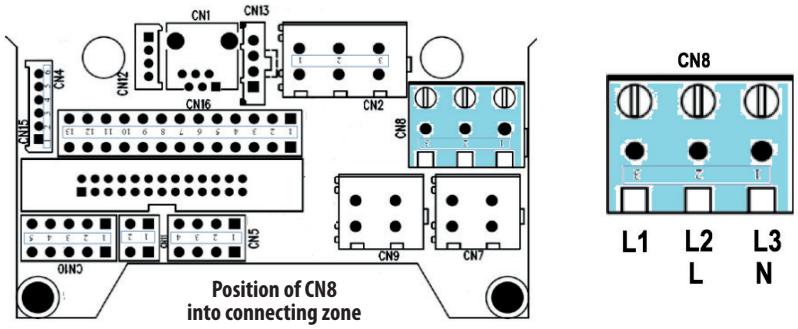
Input Terminal	Description	Nominal value
L1	Input power supply, phase L1	400Vac
L2	Input power supply, phase L2	400Vac
L3	Input power supply, phase L3	400Vac

Table 1: CN8 power input, phase sequence is not mandatory

• **Single phase, 230V model**

Input Terminal	Description	Nominal value
L	Input power supply, phase L	230Vac
N	Input power supply, neutral N	230Vac
-	NC	NC

Table 2: CN8 power input, phase position is mandatory but not the sequence



▸ **CN2 motor connector** (Motovario reserved; don't touch)

The motor connector CN2 (U, V, W) is already wired at Motovario factory and it should not be touched by the user.
Every tampering with motor wiring will void the warranty on the inverter-motor and the user will be responsible for any malfunctions.

Output Terminal	Description	Value
U	Motor, phase U	0…V_{input}
V	Motor, phase V	0…V_{input}
W	Motor, phase W	0…V_{input}

Table 3: CN2: Power output connector, phase sequence is mandatory

▸ **CN9 DC-link bus connector** (Motovario reserved in case of braking chopper)

Standard use of this connector is dedicated to braking chopper (BC) optional module when ordered.
Alternatively, this connector can be used in order to make a parallel wiring of several Drivon units by means of DC power bus.

Output Terminal	Description	Value
DC-	VDC link, negative voltage	Vpp 300/800 VDC
DC+	VDC link, positive voltage	

Table 4: CN9: DC-link connector, phase sequence is mandatory

▸ **CN7 motor brake connection** (Motovario reserved in case of DC-brake motor)

When Drivon is equipped with brake-motor option, the inverter is completely autonomous in DC-brake management and control.

In order to get this function an additional electronic module must be assembled to the inverter by Motovario factory.

Output Terminal	Description	Value
EMB-L1	Brake Module power supply, phase 1	230Vac for 1PH 400Vac for 3PH
EMB-L2	Brake Module power supply, phase 2	

3.2.2.3 SIGNAL CONNECTORS

The signal connectors are made for signal exchanging with external electronic equipments. Drivon basic unit is equipped with digital inputs, analog input, relay output, Safe Torque Off input, CAN bus interface, RS485 interface.

The signal connectors are the same for all Drivon powers and versions.

To extend basic I/Os and fieldbus range, additional optional modules can be applied according to Drivon designation rules.

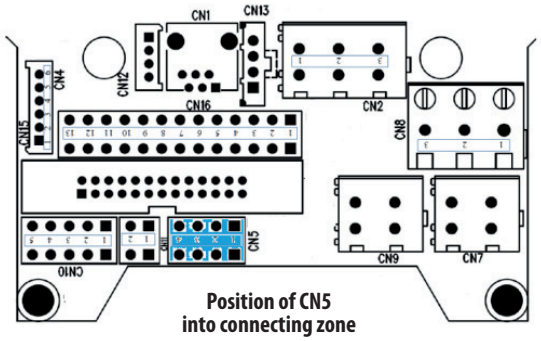
▸ **CN5 Analog input connector**

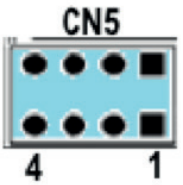
The standard Analog Input of Drivon is a differential-mode analog input able to receive floating external signals in the range -10V….+10V. The signal sign influences the direction of motor rotation.

The same input can also run in single-ended mode by fixing AIN+ or AIN- terminal to GND.

Pin number	Description	Value
1	10V power supply output	+10VDC load 50mA max
2	AIN+	0…10 V to gnd max
3	AIN-	-10…0 V to gnd max
4	AGND	Analog ground

Table 3: CN5 analog input connector

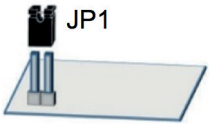




NOTE

The same analog input is configurable in Voltage (±10V) or in Current (0-20mA) mode by means of jumper JP1 available on the control board.

JP1	Signal type
OPEN (default)	-10V ... 10V
CLOSED	0 ... 20mA



▸ **CN11 Motor thermo-switch connector** (Motovario reserved in case of BI-metal thermal switch)

Drivon performs a I^2t algorithm able to stop the motor in case of its high and long-term current overload.

In order to increase the motor overheating protection a physical thermal bi-metal switch can be installed inside the winding as option (please, for ordering code refer to Drivon catalogue).

Its contact is wired directly into dedicated inverter connector and it must be done at Motovario factory.

Terminal	Description	Value
+24V	Thermo-switch input+	+24V load max50mA
THSW	Thermo-switch input-	+24V to gnd-IO 3,8mA

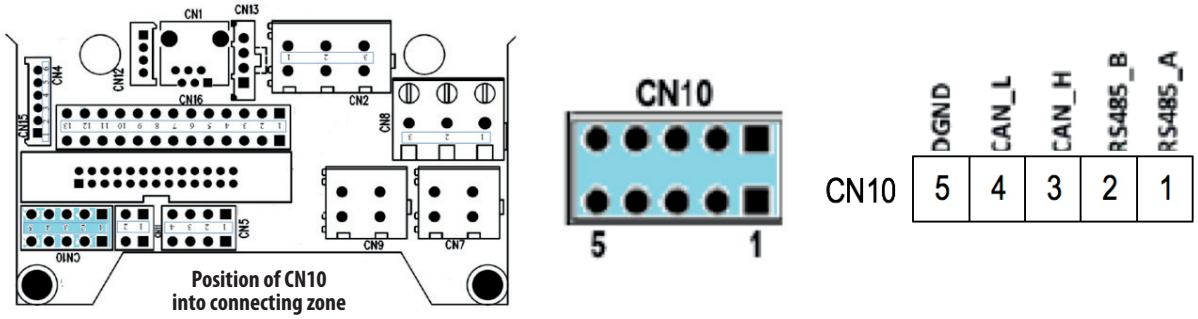
Table 4: CN5 Motor thermo-switch connector

▸ **CN10 Fieldbus connector** (Modbus RTU, CANopen DS402)

The same connector provides both RS485 and CAN terminals distributed over four separate contacts.
The jumper JP2 for 120 Ω bus termination resistance is located in the top of logic board and it is accessible after removal of the aluminum cover of the inverter.

Pin number	Description	Value
1	RS485-A, MODBUS	± 12V to DGND max
2	RS485-B, MODBUS	± 12V to DGND max
3	CANH, can open dominant high	± 12V to DGND max
4	CANL, can open dominant low	± 12V to DGND max
5	DGND, digital ground	

Table 5: CN5 Motor thermo-switch connector. Cabling the Canopen or Modbus it is mandatory to not connect the DGND of all the inverters together

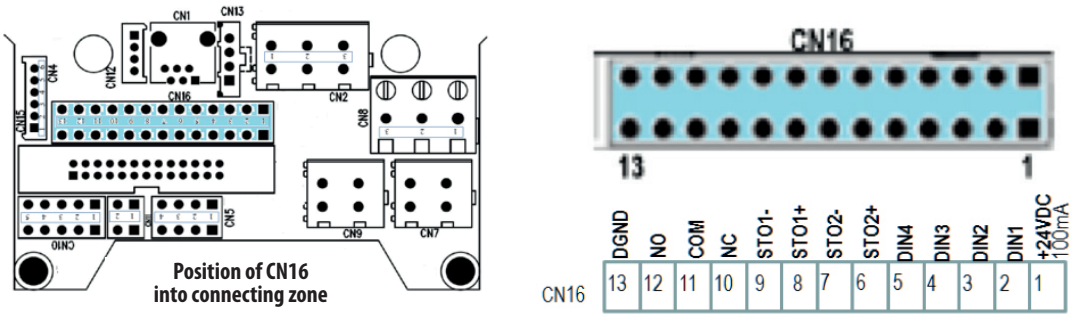


▸ **CN16 digital I/O connector**

This connector contains both multifunction digital inputs and digital output as well STO input. The STO digital inputs are dedicated to Safe Torque Off function according to redundant principle. They are isolated from I/O supply and must be activated to allow the inverter to run the motor.

Pin number	Description	Value
1	+24V, I/O supply output	+24V, load max 100mA
2	DIN1, 24V digital input	Input max 30V, 15mA
3	DIN2, 24V digital input	Input max 30V, 15mA
4	DIN3, 24V digital input	Input max 30V, 15mA
5	DIN4, 24V digital input	Input max 30V, 15mA
6	S2+, STO digital input	Input max 30V, 15mA
7	S2-, STO digital input	Input max 30V, 15mA
8	S1+, STO digital input	Input max 30V, 15mA
9	S1-, STO digital input	Input max 30V, 15mA
10	OUTNC, relay output normally close	48V, 2A max
11	OUC, relay output common	48V, 2A max
12	OUTNO, relay output normally open	48V, 2A max
13	GNDIO, I/O ground	

Table 2: CN16 digital I/O connector



▸ **CN4 encoder connector** (Motovario reserved)

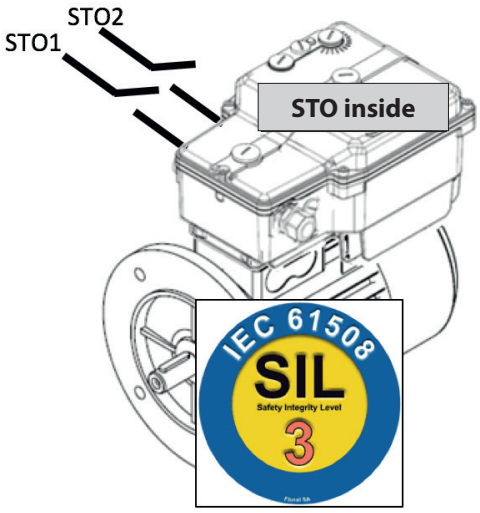
As option Drivon can be equipped with encoder feedback (Line Driver +5V, max 8192 pulses/rev) in order to increase the accuracy of the speed control loop.

This option have to be selected in time of order and must be assembled at Motovario factory. The encoder wires are cabled directly in a dedicated inverter connector and this operation is done at Motovario factory.

Pin number	Description	Value
1	B	± 12V to DGND max
2	B-	± 12V to DGND max
3	A	± 12V to DGND max
4	A-	± 12V to DGND max
5	+5V supply for the encoder	300mA max
6	DGND, digital ground	

Table 2: CN4 encoder connector

3.3 SAFE TORQUE OFF (standard built-in STO)
STO (Safe Torque Off) is a safety function integrated into Drivon circuits according to EN ISO 13849-1 and EN61508.

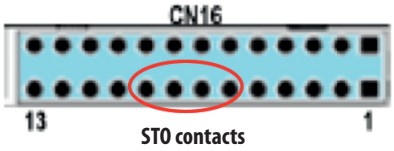


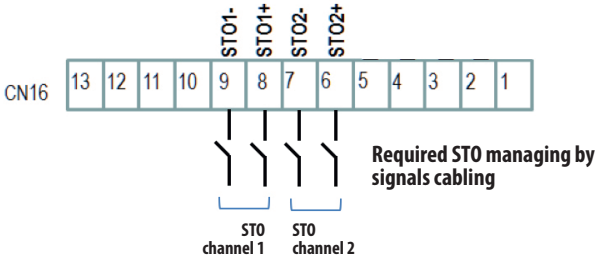
It consists of special circuits able to insulate electrically the motor from the inverter and they must be activated when necessary to avoid any risk of accidental motor restart.

STO circuits are equipped with an external interface through which the user is free to enable and disable Safe Torque Off function.

The STO enabling/disabling is done by means of two dedicated digital inputs (STO1, STO2) available over the connector CN16 (pins 6, 7, 8, 9).

Each STO channel is a differential type port that provides two terminals STO(+) and STO(-) to be linked to +24VDC and GND power supply.





The double STO-channel implies **REDUNDANT SAFETY** concerning motor motionless.

The STO channels are dedicated only to motor disconnection and they are independent on Start/Stop channels.

The Safe Torque Off is an internal function that must be properly managed by the user and it cannot be bypassed.

To activate or deactivate the Safe Torque Off, the following conditions must be taken into account:

▸ **Safe Torque Off DISABLING:**
- both STO inputs are normally supplied by internal or external 24VDC

▸ **Safe Torque Off ENABLING:**
- at least one STO channel is open

As soon as one STO channel is open, automatically and immediately the motor is disconnected from the inverter and every other command is neglected. After opening of STO contacts every intentional or accidental attempt of motor restart through the Start channels does not have any effect.

WARNING
The STO doesn't remove the inverter AC power input but only the current flow between motor and drive therefore after STO activation the inverter is still supplied.

WARNING
Simply leaving open just one STO terminal, the motor cannot run even if the Start command is done.

WARNING
In case of STO disabling while the motor is supplied and running, the motor shaft will be coast to stop.

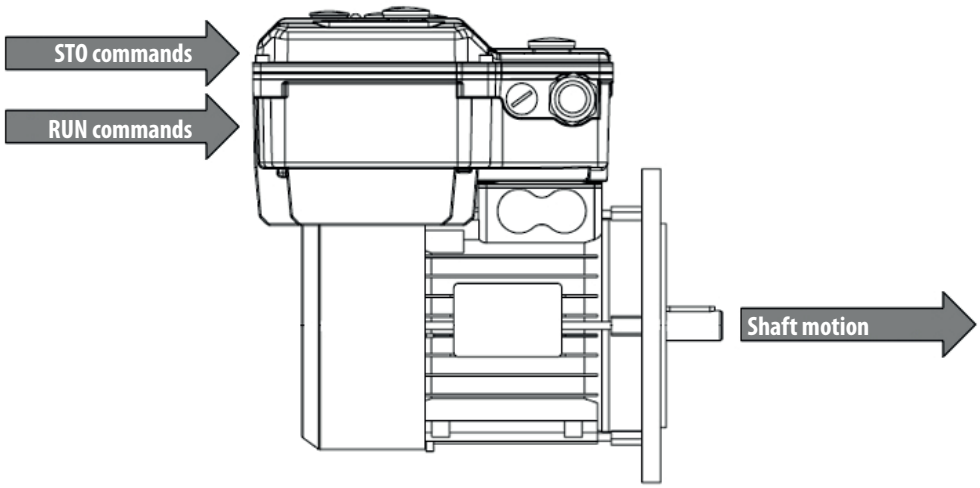
WARNING
From Motovario factory, Drivon is delivered with all open STO terminals, therefore the proper STO cabling is the user's responsibility.

WARNING
If the user doesn't provide any STO cabling, the motor will never be started even if the Start command is properly provided by keypad or digital input or fieldbus or some other signal source.

The Run command (by keypad or digital input or fieldbus) takes effect only if the STO channels are properly enabled according to the following table:

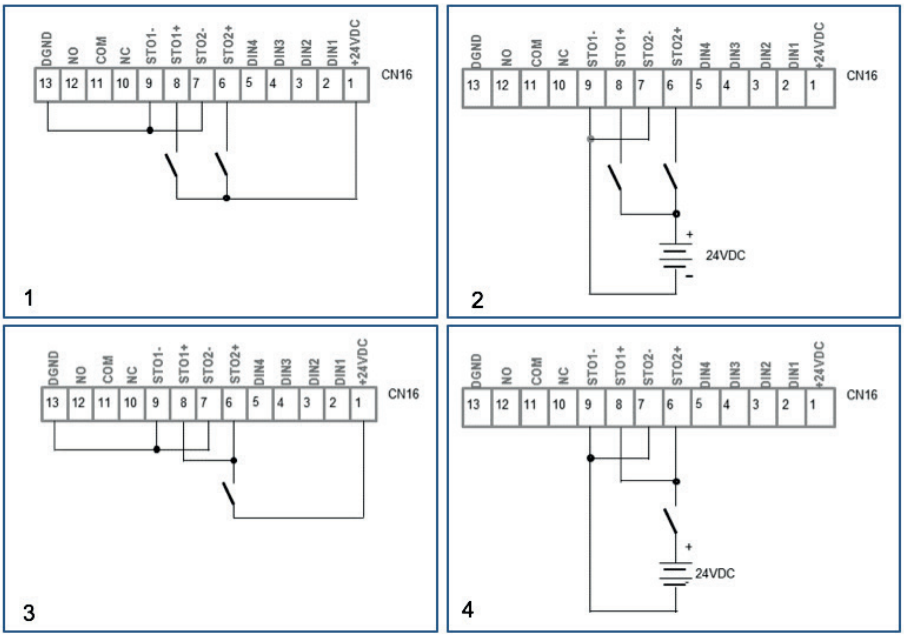
STO Channel 1	STO Channel 2	RUN channel	Motor status
OFF	OFF	ON	SAFETY MOTIONLESS
ON	OFF	ON	SAFETY MOTIONLESS
OFF	ON	ON	SAFETY MOTIONLESS
ON	ON	ON	RUNNING
OFF	OFF	OFF	SAFETY MOTIONLESS
ON	OFF	OFF	SAFETY MOTIONLESS
OFF	ON	OFF	SAFETY MOTIONLESS
ON	ON	OFF	STANDARD MOTIONLESS

As described, the Run command only isn't enough to put in run the motor.
If the STO cabling is missing the motor will never be moved.



Both STO and RUN commands are mandatory in order to get the motion of the motor shaft

Four examples of STO cabling have been described:



Examples of STO user connection

1. Two independent STO channels supplied by internal 24VDC power supply
2. Two independent STO channels supplied by external 24VDC power supply
3. Two parallel STO channels supplied by internal 24VDC power supply
4. Two parallel STO channels supplied by external 24VDC power supply

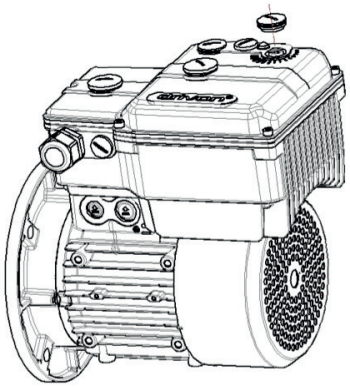
4. BASIC USER INTERFACES

4.1 BUILT-IN POTENTIOMETER POT (default setpoint source)

Without any additional equipment or instrument, Drivon provides an useful internal potentiometer for fast and temporary local speed adjustment.

By opening a specific cap on the inverter top, the user can easily turn by fingers or by screw-drive the potentiometer knob in order to select the desired frequency set point.

Using on-board potentiometer (POT), if IP55 degree or more is required, after knob adjustment the cap lock is recommended.



Build-in POT functions:
- Frequency setpoint (Hz)
- Electronic switch (Start/Stop)

By default Drivon is programmed to accept speed adjustment through integrated potentiometer.
If the user doesn't modify the factory parameter setting, the motor speed is regulated by means of this potentiometer.

Parameter	Value	Description
P001	0-POTENT	Reference from integrated potentiometer
P006	0….200 Hz	Frequency value at minimum anticlockwise position of potentiometer knob
P007	0….200 Hz	Frequency value at maximum clockwise position of potentiometer knob

However, in order to exploit all Drivon performances more optional equipments are required (i.e. Keypad).

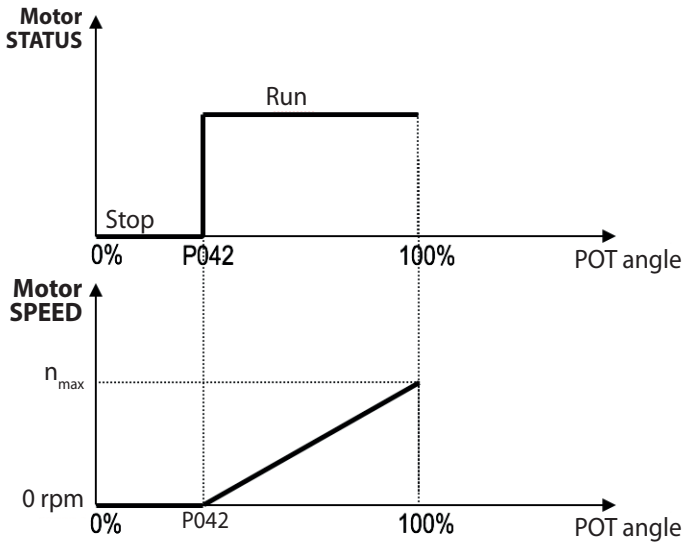
In addition to frequency setpoint adjustment, the integrated POT equipment is also able to provide the following useful functions:

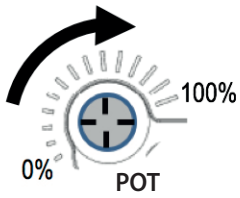
▸ Electronic switch function (Start/Stop by Potentiometer)

Same potentiometer can work as electronic switch for Start/Stop function.
Via potentiometer it is also possible to provide the switch-on and switch-off of the output frequency avoiding the use of an additional command source.
By turning the potentiometer in clockwise from 0-position the output frequency remains at 0 Hz until the knob reaches a pre-defined position from which the frequency stabilizes proportionally with potentiometer angle.

To setup the electronic switch the following parameter setting is required:

Parameter	Value	Description
P002	2-DIGIN+POT	If a digital input is permanently closed, when potentiometer signal is greater than P042 the motor starts; when potentiometer signal is lower than P042 the motor stops.
P042	0 … 100%	Potentiometer Start/Stop threshold when P002 = 2-DIGIN+POT

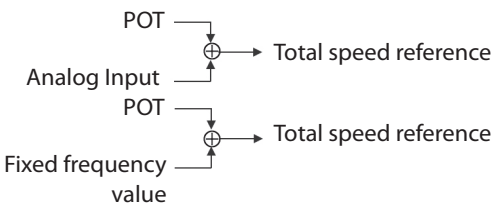




▸ Multi-source POT combination

The command of built-in potentiometer can be added to other commands coming from different setpoint sources according to the following table:

Source type	Speed reference	Required parameter setting
POT	Only by built-in potentiometer	P001 = 0
POT + AIN	Sum of built-in potentiometer with Analog Input signal	P001 = 5
POT + FF	Sum of built-in potentiometer with internal pre-selected fixed frequency	P001 = 6



WARNING
Like all other command sources, the built-in potentiometer can have effect only if the STO contacts are properly closed (see section 3.2).

4.2 KEYPAD
The KP keypad is an option (on-board) as well an accessory (remote use).
It provides 4-digit / 7-sement display with 7 user buttons.

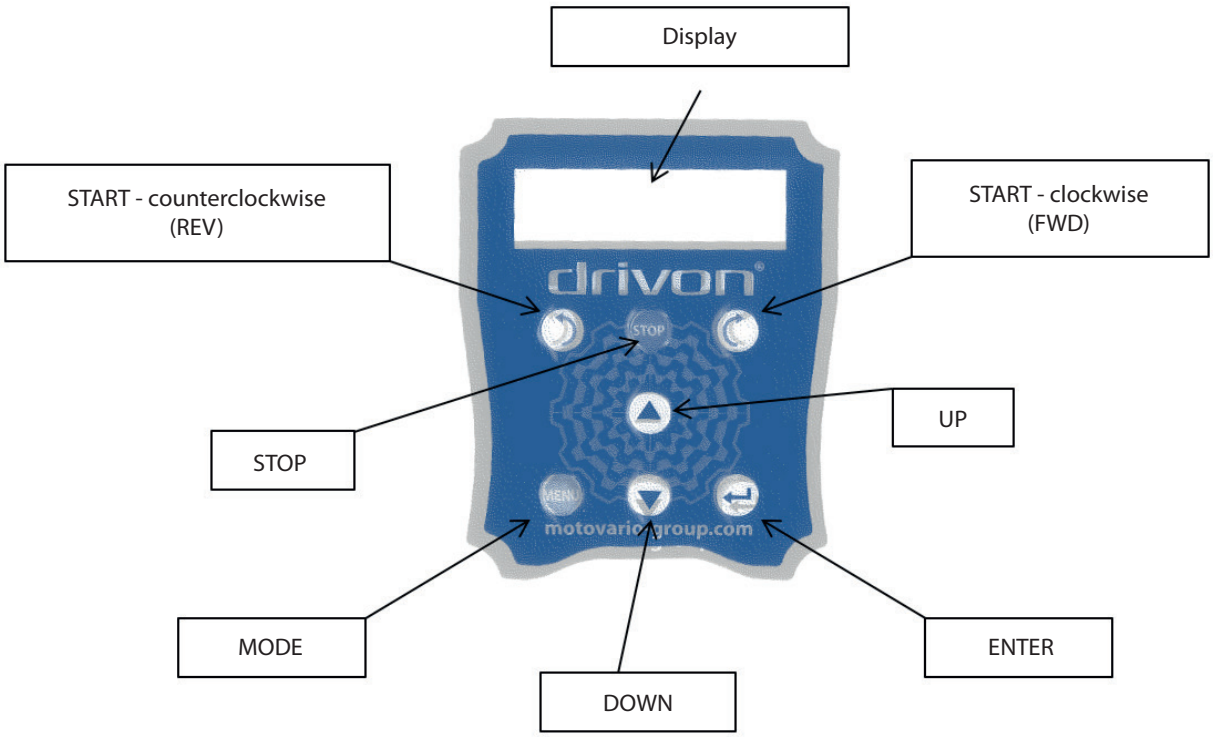
The keypad allows five different functions:

▸ **keypad functions:**

- **OPERATION** (commands, frequency reference, monitoring magnitudes operating motor and inverter)
- **CONFIGURATION** (read and write parameters)
- **COPY** (upload and download data set)
- **UTILITY** (Jog function)
- **DIAGNOSYS** (Alarm monitoring)

▸ **7-segments display and 7 buttons:**

All keypad functions are got by means of a display and seven buttons



- **START-FWD:** motor starts clockwise with ramp
- **START-REV:** motor starts counterclockwise with ramp
- **STOP:** motor stops with ramp
- **UP:** operating mode causes the increase of the frequency set point; in parameter mode allows the increase in the number of parameter and the parameter values; in "Copy Parameters" reads the contents of the inverter and saves to a memory area of the keyboard (chosen by the user among the four data sets available)
- **DOWN:** in operating mode causes the decrease of the set point frequency; in parameter mode allows the decrease of number of parameter and the parameter values as well as the scroll the menu; in "Copy Parameters" extracts a data set previously stored in the keyboard (chosen by the user among the four data sets available) and downloads it into the inverter
- **ENTER:** confirms operation
- **MODE:** Operating mode selection (Operation, Parameters, Copy, Utility)

▸ JOG function:

The JOG is a special way to provide a speed reference to Drivon with by-pass of all other command sources.

During commissioning, when Drivon has been already programmed to be controlled by a specific command sources (e.g. Digital Input or Analog Input or Potentiometer or fieldbus or …), if necessary the speed control can be quickly switched to keypad buttons with absolute priority over all other previous command sources but without any parameter changing. When necessary to come back to previous command source, the same quick operation backwards can be done.

For example, even if the drive is set to run via Ethercat and all related parameters have been properly adjusted, a manual motor control could be temporary required before to start the automatic network process in order to keep an eye to mechanical behaviors.
When the Jog mode is enabled any attempt to control the motor by Ethercat is ignored.
After, as soon as the Jog mode is disabled the control command automatically passes to previous Ethercat source.
Jog function is included in the Utility menu of the keypad and it can be easily enabled.

▸ Copy function:

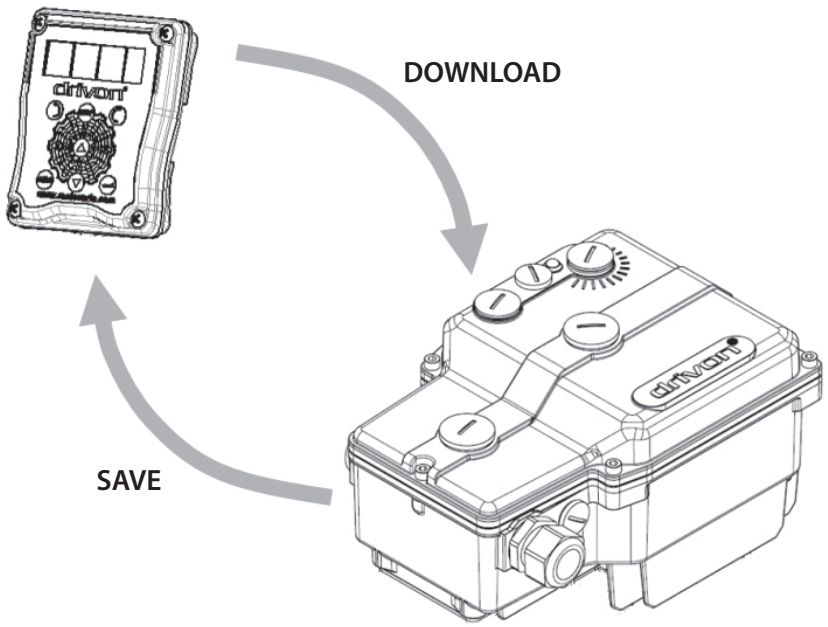
Easy "Copy and Paste" parameter setting is performed by keypad.

The keypad has got 4 distinct memory areas in which the user can store up to 4 distinct data sets acquired by the inverter (to a single VSD, or 4 inverters separate, at different times).

Into Copy menu two operation modes are available:

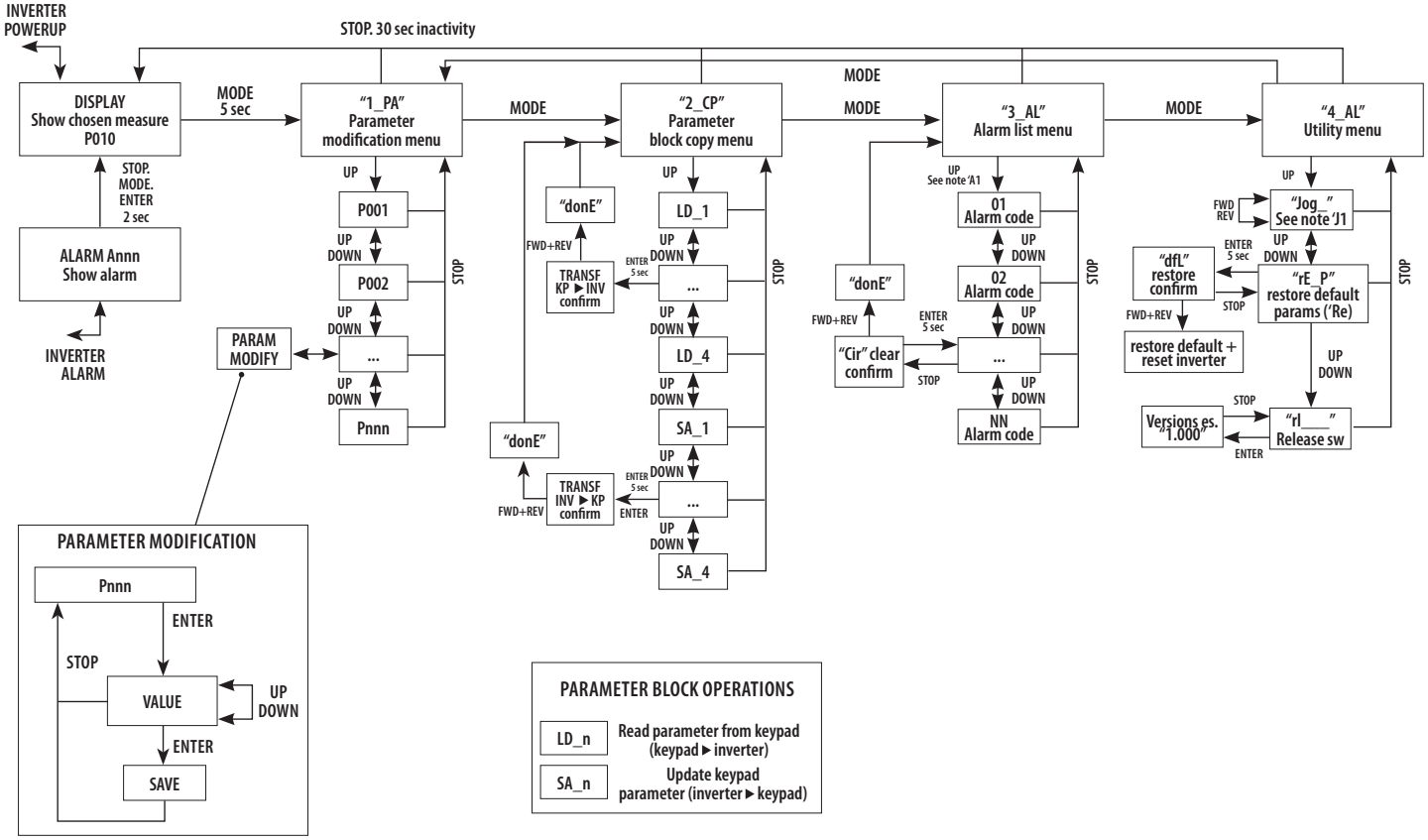
- **SAVE:**
the user can upload from the inverter the current configuration (inverter parameter set) and save it in a stable memory area of the keypad which is stored up also after inverter power-off. During the saving operation the user can choose one of four memory area. If this area already contains a previous data set it will be overwritten by the new one.

- **DOWNLOAD:**
the user can download the contents of one memory area into proper Drivon unit. The inverter receives the new parameter set and the old one is overwritten.



▸ Keypad flow-chart

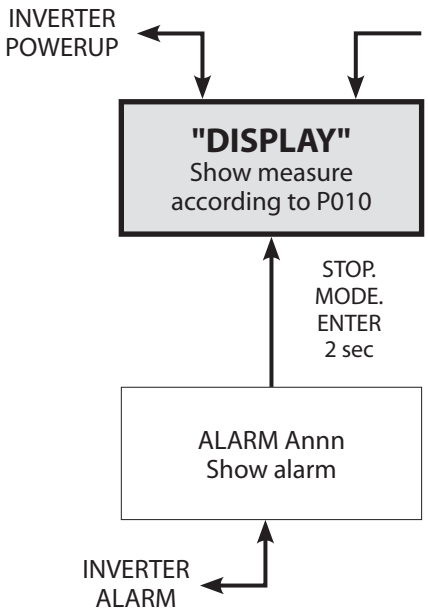
After power-on the keypad spontaneously goes in *Operation* mode and other functions can be carry **out according to the following scheme**:



The keypad operates in five different states.
The transition from one state to the other is done by buttons UP, DOWN, START_FWD, START_REV, STOP, ENTER, MODE.

• State "DISPLAY"
during Operative use of the inverter (while the motor is running) the display shows the actual value of one quantity user selectable by means of parameter P010 (see parameters list).

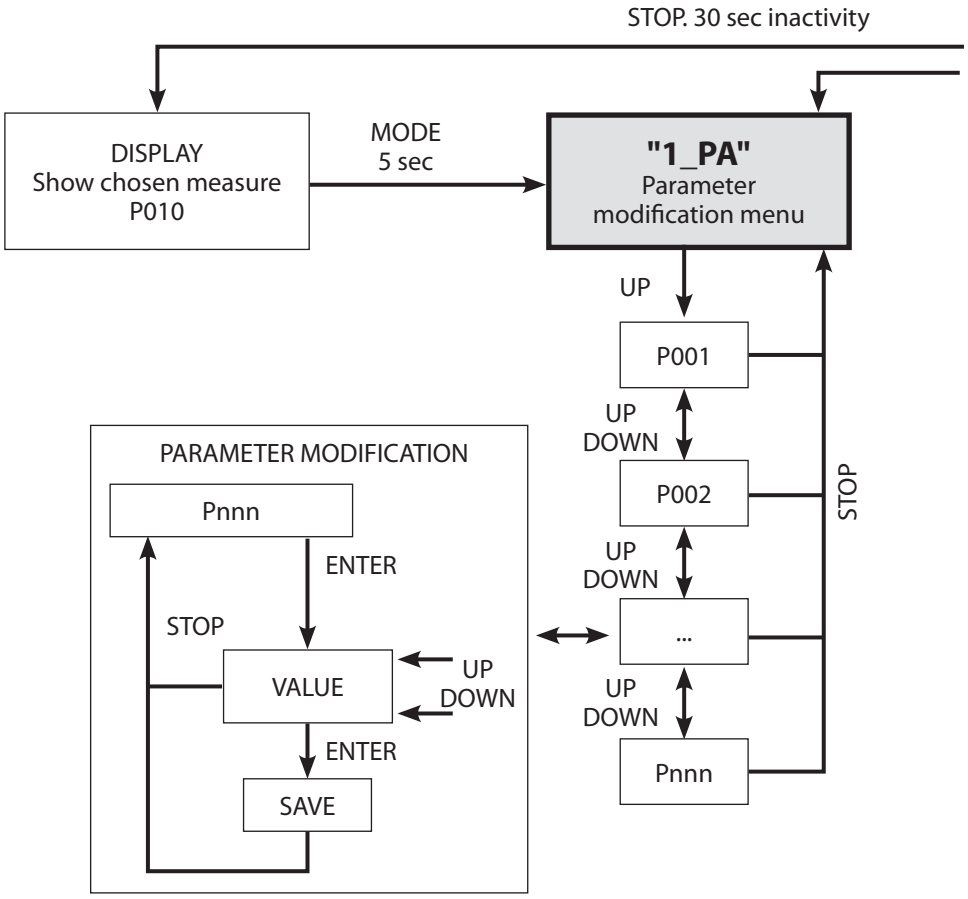
The buttons UP, DOWN, CLOCKWISE, COUNTER CLOCKWISE, STOP are used to start/stop/reverse/forward the motor and to adjust its frequency setpoint.



• State "1_PA"
inverter parameters selection and adjustment (reading and writing).
This menu is reachable from "Display" state by pressing MENU (Mode) button for 5 seconds. After STOP or after 30 seconds of buttons inactivity the "Display" state is automatically restored.

When "1_PA" is read over display, the user can push UP in order to show the first parameter P001, after that by UP or DOWN the next parameters can be shown.

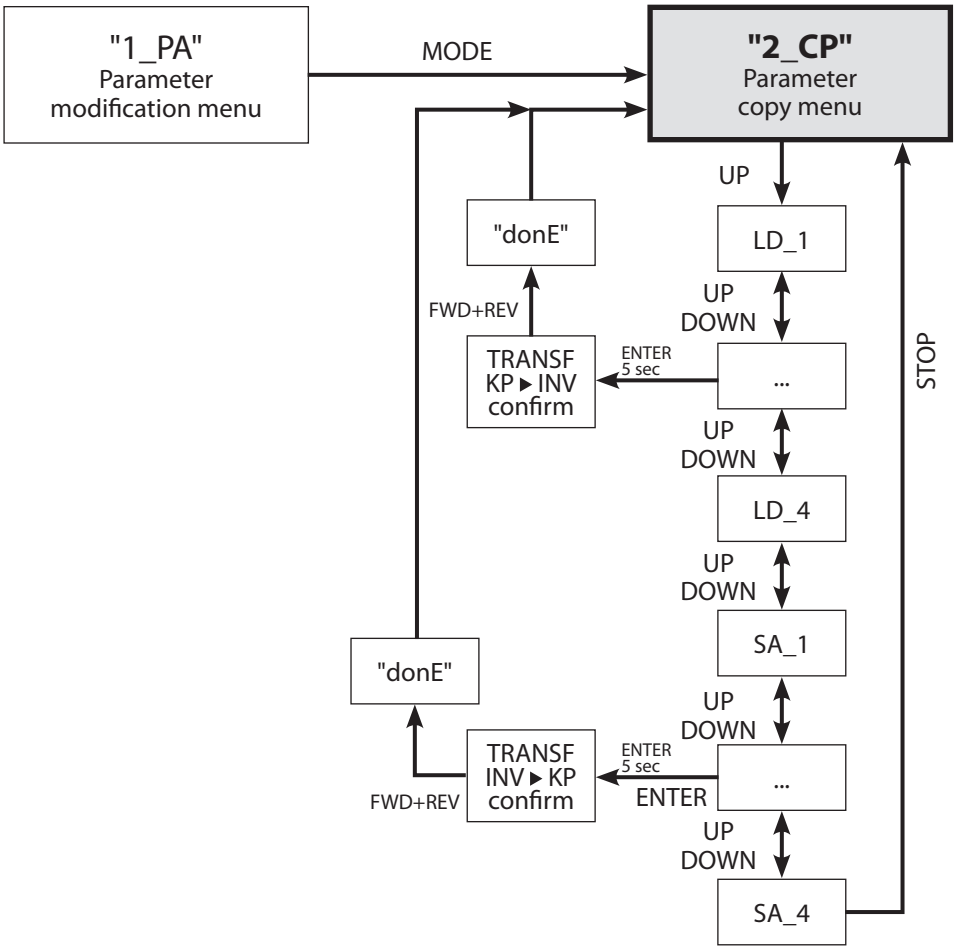
When the desired parameter number is reached, the ENTER button has to be pushed in order to read the current parameter value which can be confirmed by ENTER again or changed increasing or decreasing the current value by UP or DOWN. After value modification, it can be saved by ENTER. After that STOP has to be pressed in order to come back to the parameter number.

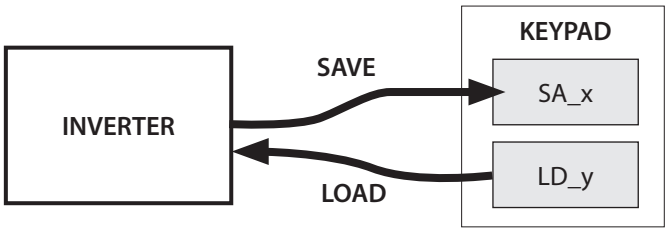


• State "2_CP"
parameter set copy and paste; 4 different flash memory area SA_n (n = 1, 2, 3, 4) are ready to store 4 different inverter data set; the same data can be extracted from LD_n (n = 1, 2, 3, 4) area and download into other inverters for their quick replaying.

This menu is reachable from "1_PA" state by pressing MENU (Mode).

When "2_PA" is shown the LD_1 area is selected. By pressing ENTER for 5 seconds the data set SA_1 is download into inverter, otherwise by pressing UP the LD_2 is selected, and so on until LD_4.
Above if UP is pressed, the SA_1 area is selected. By pressing ENTER for 5 seconds the inverter parameter set is upload and saved into SA_1, otherwise by pressing UP the SA_2 is selected, and so on until SA_4.





SAVE and LOAD functions

SA_1, SA_2, SA_3, SA_4 are the four different memory addresses where four different parameter setting can be stored.
LD_1, LD_2, LD_3, LD_4 are the four different memory addresses from where four different parameter setting can be extracted and download into inverter.

• State "3_AL"

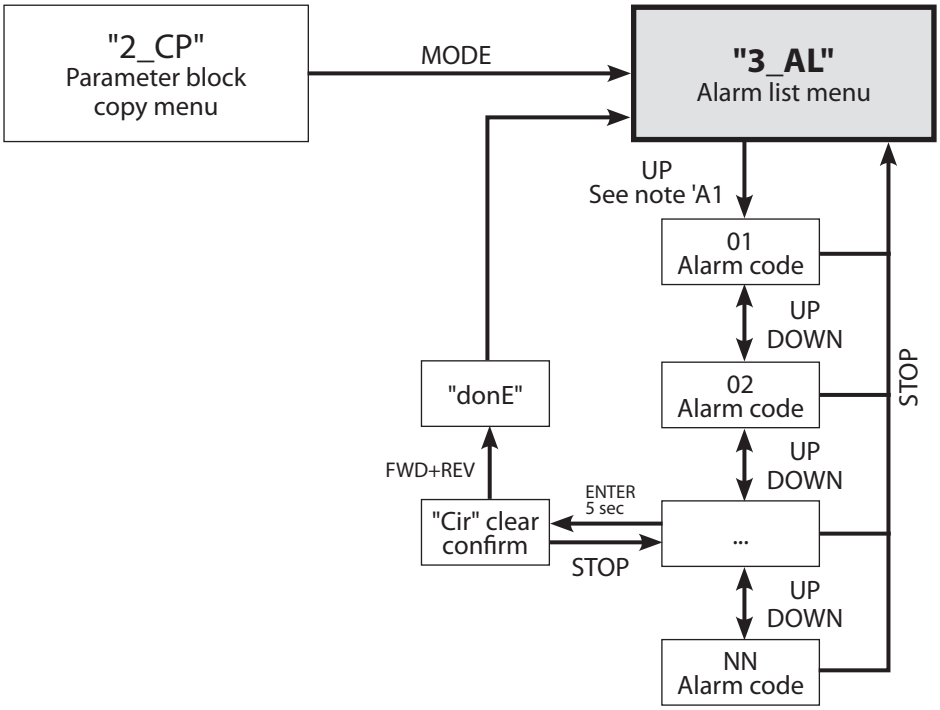
the alarm history can be displayed as a code list which can be also canceled.

The state "3_AL" is reachable from "2_CP" by means of MENU (Mode) button.

In "3_AL" a sequence of UP button can show the last alarm codes of the inverter.

When an alarm is selected, its historical information can be canceled by pressing ENTER for 5 seconds.

The message "donE" confirms the alarm has been removed from the list.

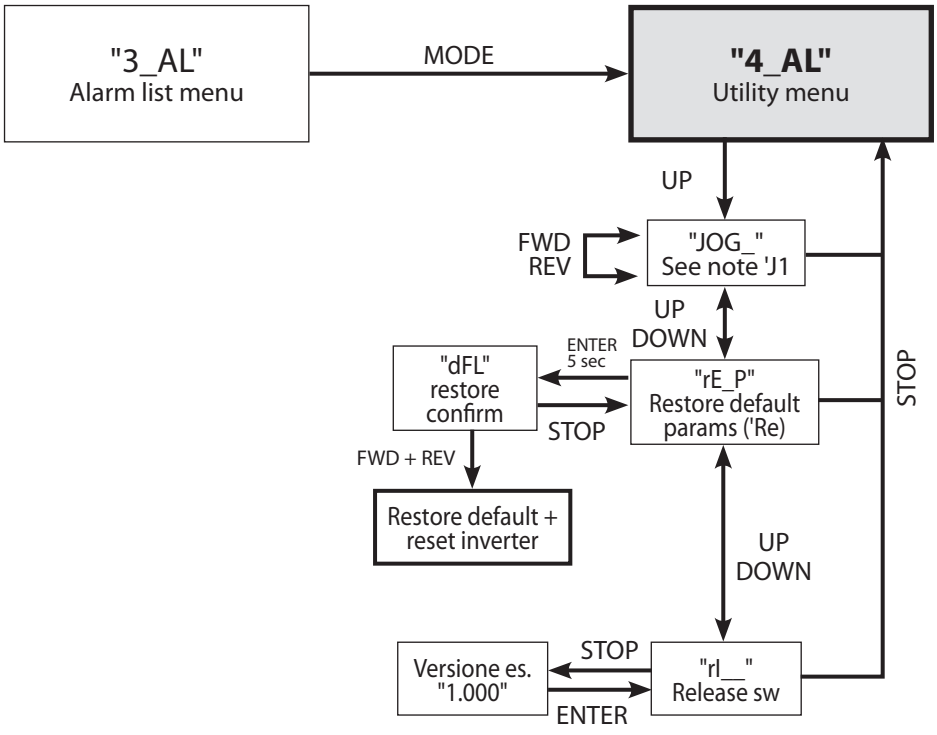


• State "4_UL"

additional inverter utilities can be enabled as:

- JOG
- Factory Reset
- Software release reading

The state "4_UL" is reachable from "3_AL" by means of MENU (Mode) button.

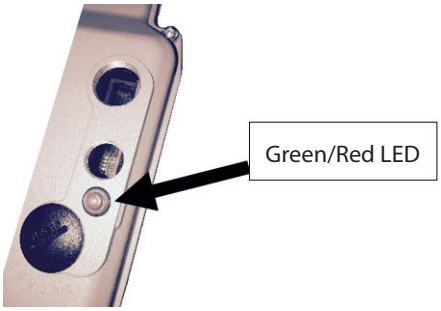


4.3 Status LEDs:
The motor inverter is equipped with a multi-color LED that can signaling the operating status of the inverter in accordance with the following table:

State LED	State corresponding inverter
Turned off	Voltage of the DC-link too low
Steady Red	Inverter on standby, Motor stop
Steady Green	Inverter run, motor run, frequency reference reached
Blink Green	Inverter run, motor run, frequency reference is still not reached
Blink red slow (1s, 50%)	Inverter in Fault , motor stopped
Blink red fast (100ms, 50%)	Warning inverter current, moving motor

The LED light is placed on the inverter top close to the other user sockets.

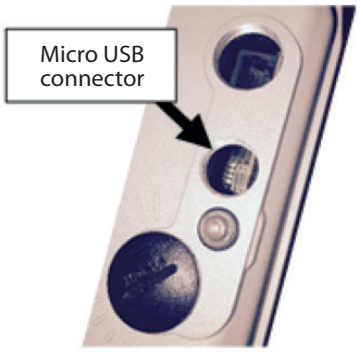
Thanks to its embossed shape the LED is visible from several view points in order to be an useful way for quick diagnostic in case of trouble.



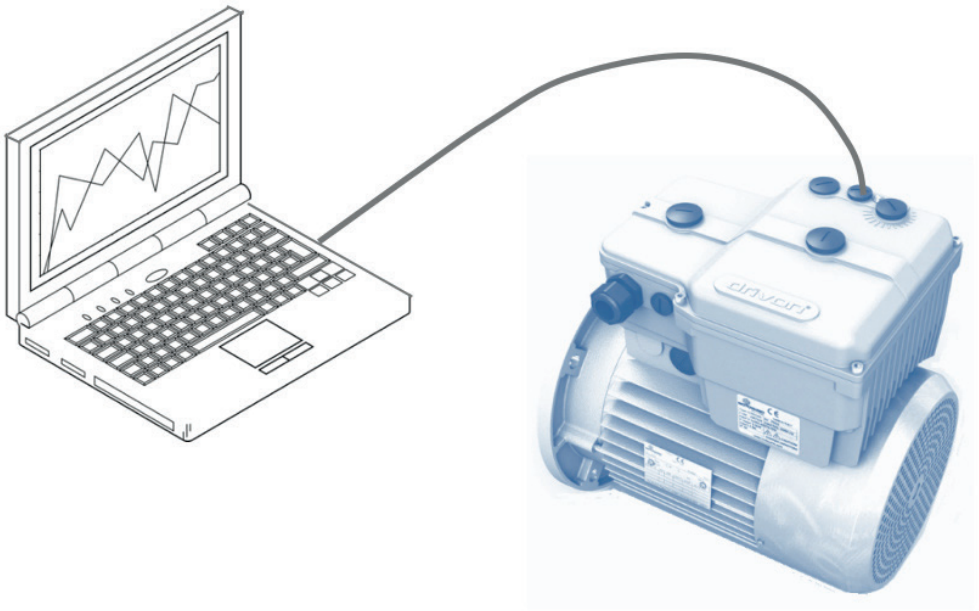
4.4 USB interface
Drivon is equipped with integrated USB port for remote managing by point-to-point serial communication channel.

On the inverter top a micro USB connector is accessible by opening a plastic cap M16 near the status LED.

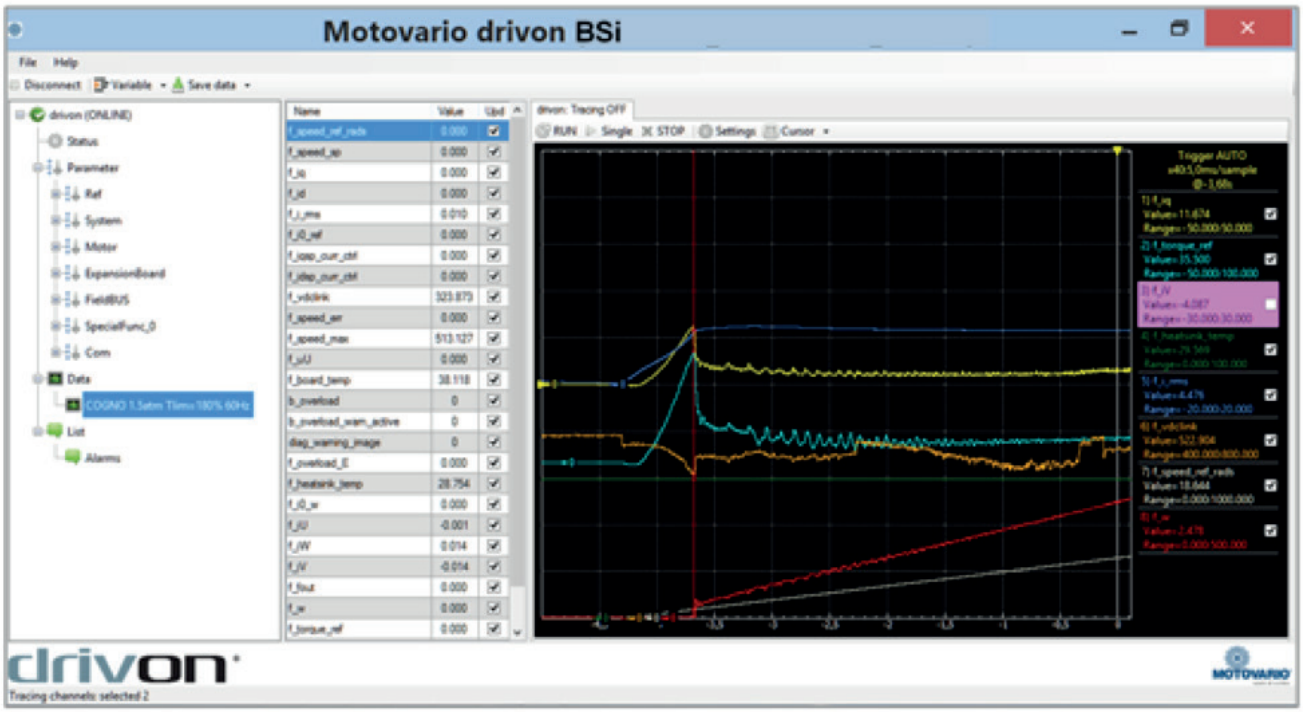
The USB channel is useful for the full control over the moto-inverter.



- **Functions via USB:**
  - Full parameters setting
  - Motor-inverter control
  - Motor-inverter monitoring
  - System diagnosis
  - Dataset managing
  - Graphical multitrack scope function



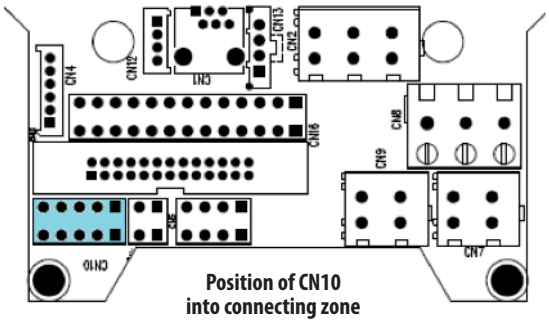
• PC software tool
To manage Drivon by USB channel the Motovario BSi software tool is downloadable from Internet web site.

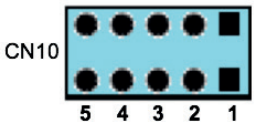


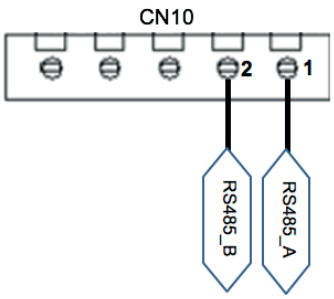
4.5 Modbus RTU

Drivon is equipped with RS485 Modbus RTU integrated standard.

Its terminal CN10 is placed in the connection zone of the inverter.



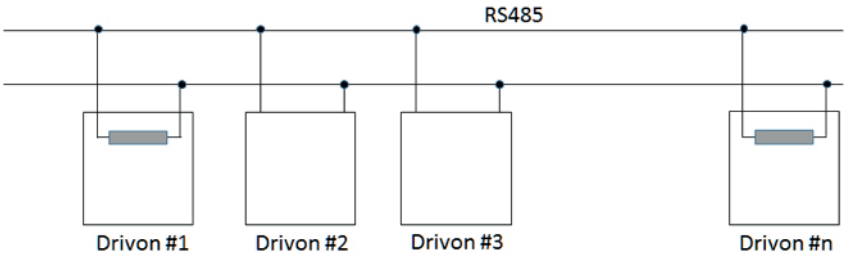


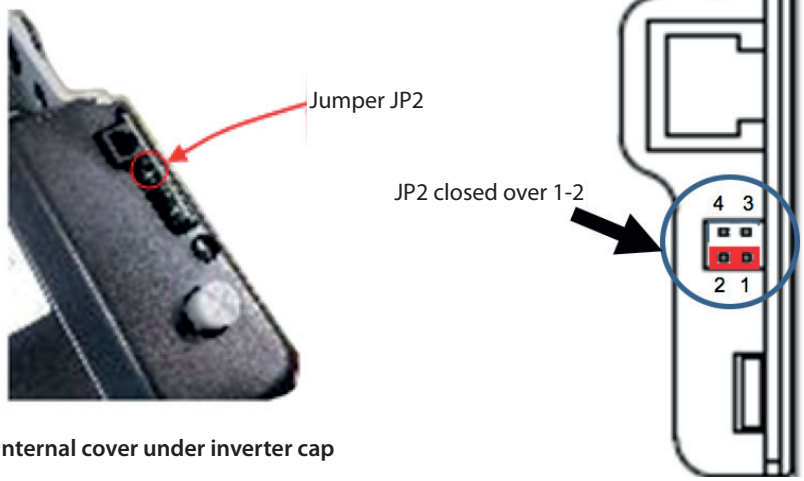


NOTE **For Modbus software registers see chapter 10.**
In case of first and last network node, the 120Ω resistor of termination must be inserted.

This resistor is already on board and it's accessible from the inverter top after alluminium cover removing.

By default the resistor is normally OFF.
To Set ON the resistor, the jumper JP2 must be closed according to following details:





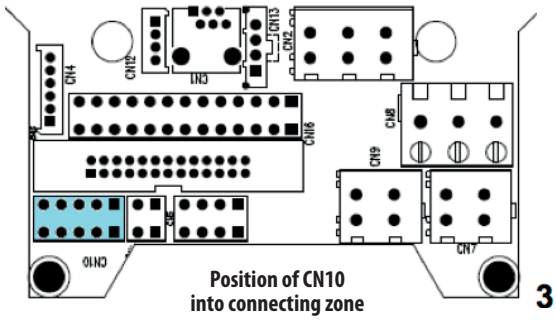
Internal cover under inverter cap

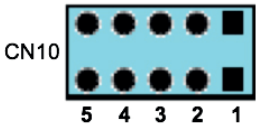
4.6 CANopen DS402

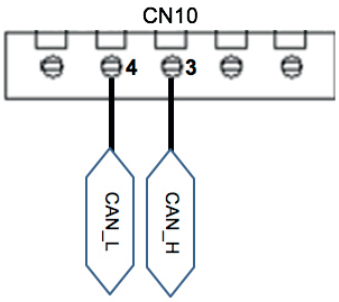
Drivon implements CANopen DS402 Velocity Mode integrated standard.

Motovario is CiA (CAN in Automation) member.

CANopen is available over the same connector CN10 to the contacts 3 and 4.





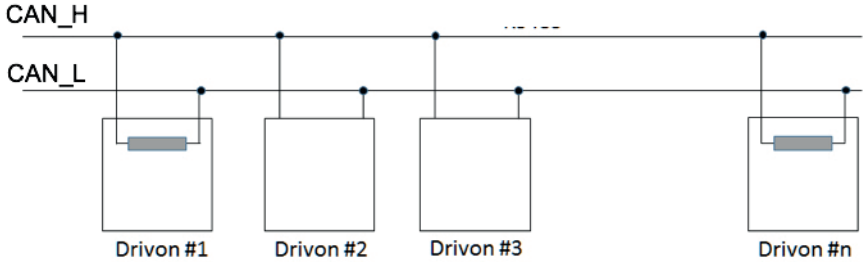


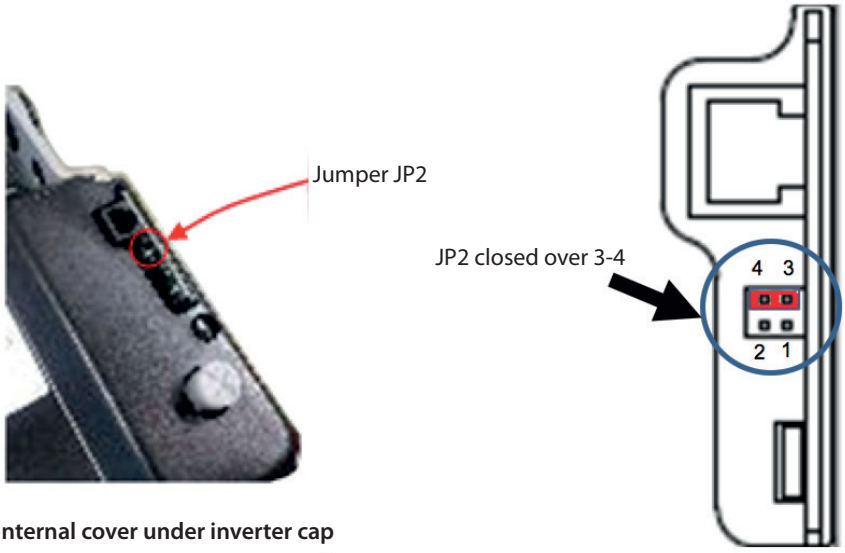
NOTE **For CANopen software Objects see chapter 9.**

In case of first and last network node, the 120Ω resistor of termination must be inserted.

This resistor is already on board and it's accessible from the inverter top after alluminium cover removing.

By default the resistor is normally OFF.
To Set ON the resistor, the jumper JP2 must be closed according to following details:



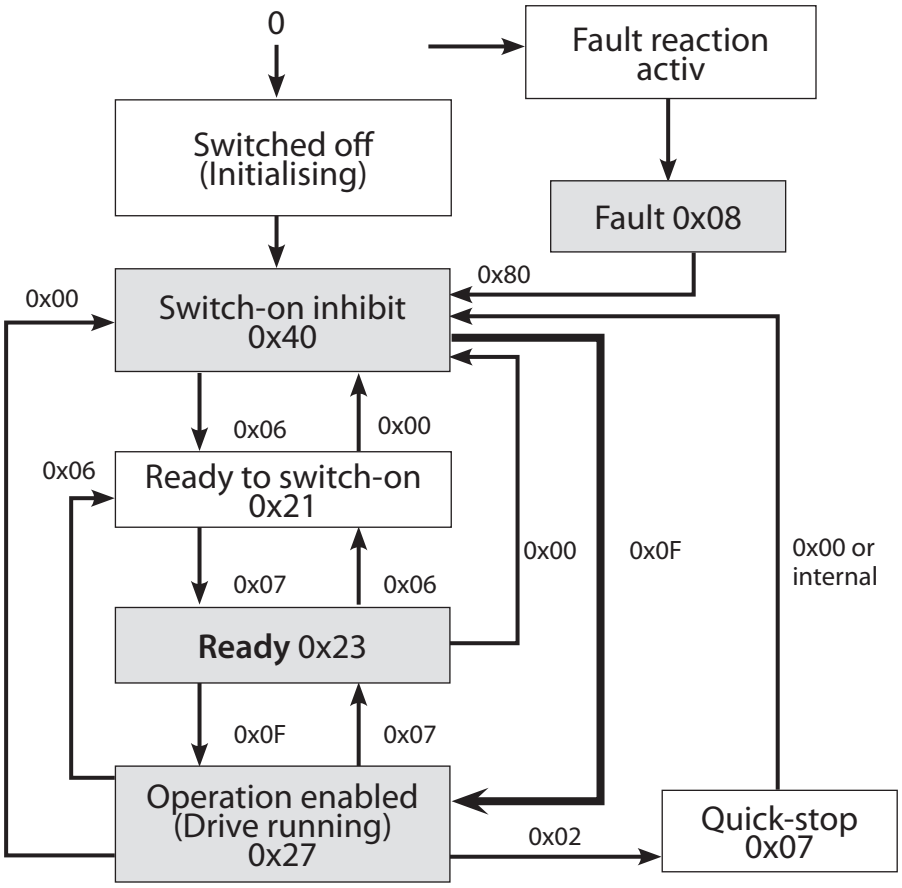


Internal cover under inverter cap

4.6.1 CANopen STATE MACHINE

Drivon CANopen is compliant with Drives Profile 4.0.2 Velocity Mode and its structure fulfils the State Machine control by means of NMT (Network Management) communication protocol.

According to State Machine requirements, Drivon meets the following state diagram:



To run the motor the right States sequence is mandatory. A state is reachable only if exists a link in the diagram above.
The transition between the different States is made by means of ControlWord (6040h) transmitted to the slave by the master.
In operational state the motor speed is adjusted by means of TargetSpeed (6042h).

▸ Pre-operationals State

Example of CAN_SDO-channels:

1) Speed-range setting:
0x6046 sub-index **0x1** = Velocity min amount (rpm) UNSIGNED32
(e.g. 0x00000064 = 100 rpm)

0x6046 sub-index **0x2** = Velocity max amount (rpm) UNSIGNED32
(e.g. 0x00000578 = 1400 rpm)

The values of *Velocity_min_amount* and *Velocity_max_amount* must be always positive even if the Target Speed is negative.

2) Ramp-slope setting:
the ramp is defined by the ratio DSpeed/DTime (speed_gap/time_range)

• Acceleration:
0x6048 sub-index **0x1** = Delta Speed (rpm) UNSIGNED32
(e.g. 0x000036B0 = 14.000 rpm)

0x6048 sub-index **0x2** = Delta Time (sec.) UNSIGNED16
(e.g. 0x0001 = 1 sec.)

(--> ramp = 14.000rpm/1s = 1.400rpm/0.1s --> the motor accelerates from 0 rpm to 1400 rpm in 0.1 seconds)

• Deceleration:
0x6049 sub-index **0x1** = Delta Speed (rpm) UNSIGNED32
(e.g. 0x000036B0 = 14.000 rpm)

0x6049 sub-index **0x2** = Delta Time (sec.) UNSIGNED16
(e.g. 0x0001 = 1 sec.)

(--> ramp = 14.000rpm/1s = 1.400rpm/0.1s --> the motor decelerates from 1400 rpm to 0 rpm in 0.1 seconds)

▸ Operational State

Both *ControlWord* (object 6040h) and *TargetSpeed* (object 6042h) must be sent by the master.
The ControlWord must be filled according to the object 6040h (see 9.1).
The TargetSpeed must be written in the object 6042h and it can be a decimal number with positive or negative sign. In case of binary or hexadecimal format, the TargetSpeed must be arranged according to Two's Complement:

Examples of CAN_PDO channel:

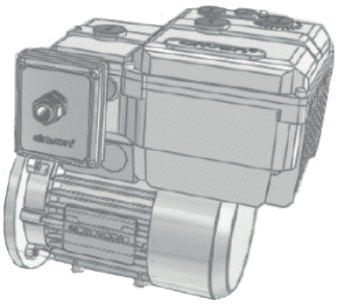
1) Forward direction by ControlWord
• Command sequence:
ControlWord (6040h) = 00000000 00000**11**0 = **0x06** (Drivon enabled)
ControlWord (6040h) = 00000000 00000**111** = **0x07** (Drivon stopped)
ControlWord (6040h) = 00000000 0000**1111** = **0x0F** (Drivon in run forward)
TargetSpeed (6042h) = 00000**01**0 **10111**00 = **2BC** (Drivon running at +700 rpm)

2) Reverse direction by ControlWord
• Command sequence:
ControlWord (6040h) = 0000**1**000 00000**11**0 = **0806** (Drivon enabled)
ControlWord (6040h) = 0000**1**000 00000**111** = **0807** (Drivon stopped)
ControlWord (6040h) = 0000**1**000 0000**1111** = **080F** (Drivon in run reverse)
TargetSpeed (6042h) = 00000**01**0 **10111**00 = **02BC** (Drivon running at -700 rpm)

3) Forward/Reverse speed control by TargetSpeed:
• Command sequence:
ControlWord (6040h) = 00000000 00000**11**0 = **0x06** (Drivon enabled)
ControlWord (6040h) = 00000000 00000**111** = **0x07** (Drivon stopped)
ControlWord (6040h) = 00000000 0000**1111** = **0x0F** (Drivon in run forward)
TargetSpeed (6042h) = **11111**001 **10**110000 = **FD76** (Drivon running at -650 rpm)
TargetSpeed (6042h) = 00000**11** 00**11**0100 = **0334** (Drivon running at +820 rpm)

5. EXPANSION MODULES

All expansion modules are options installed at Motovario factory.
They must be selected through proper designation string according to Drivon sales catalogue.
The module consists of an electronic board enclosed into IP66 dedicated housing which is fixed to the inverter frame.
A wide range of expansion modules is available with different layout and functions.

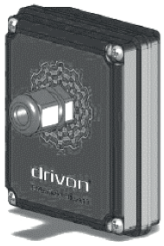


Drivon equipped with expansion module

5.1 I/O expansion

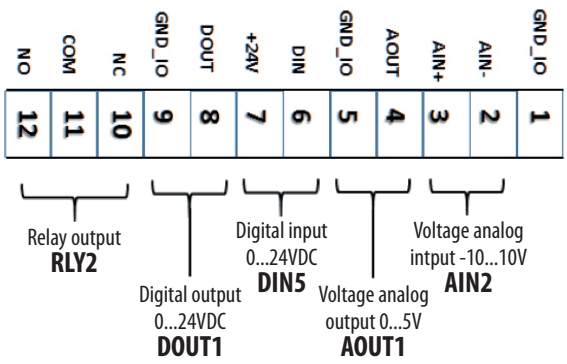
It's suggested when the number of standard I/O of the basic inverter has to be increased.
Concerning the user connector, the same module is available in two versions:

IOA type:

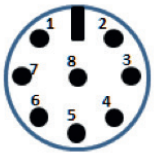


IOB type:

Terminals



M12 female



Pin	Description	Port
1	AGND	
2	Analog Input -	AIN2
3	Analog Input +	
4	Analog Output	AOUT1
5	DGND	
6	Digital Input	DIN5
7	24V Output	
8	Digital Output	DOUT1

M12 male

Pin	Description	Port
1	Relay COM	RLY2
2	Relay NC	
3	-	
4	Relay NO	

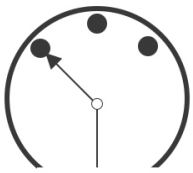
5.2 PS expansion (PotySwitch)

It's suggested when the motor-inverter has to be controlled by hand through external potentiometer and forward/reverse selector over inverter surface by preserving the IP66 enclosure protection.

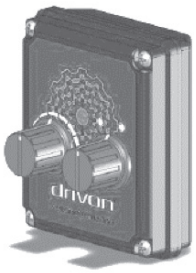
Potentiometer

Frequency setpoint

Switch



Forward/Stop/Reverse selection



5.3 ETC expansion (EtherCAT)

This module is required when the motor-inverter has to be used as slave in EtherCAT real time network.

EtherCAT® Technology Group

The ETC interface implements a CoE (CAN over EtherCAT) protocol by using *DS402 Velocity Mode* control profile and *State Machine* (see 4.6.1).

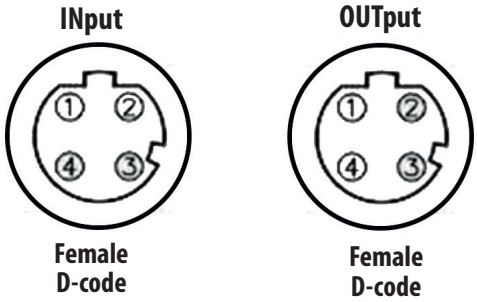
All inverter parameters are manageable via Ethercat according to the parameter access type.
They are always readable in line and in case of writing-type parameter also it can be modified by the master.

When installed at Motovario factory, this module is ready to use and it can be linked to Ethercat master.

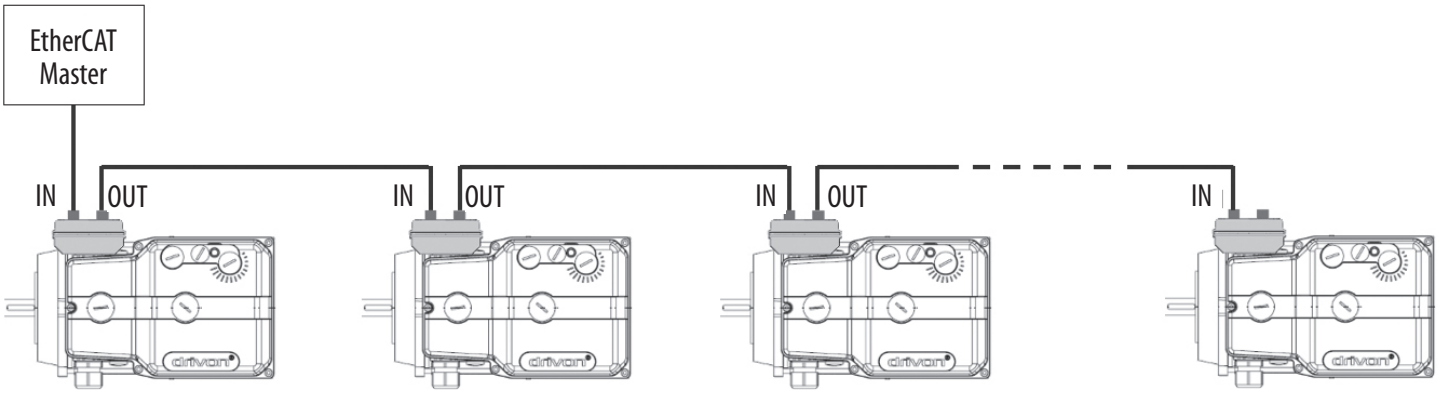
Motovario is an EtherCAT Group member.

▸ **Connectors**

Two M12 D-code connectors are located in the front side of the panel to make possible the daisy chain network link. The input way and the output way are mandatory.



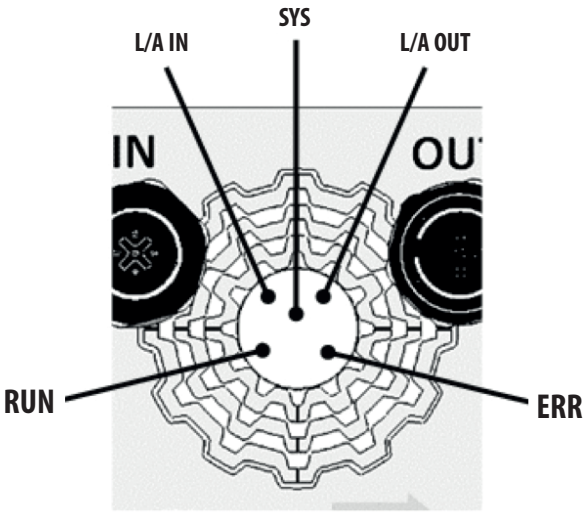
Pin	Input	Output
1	TxP0	TxP1
2	RxP0	RxP1
3	TxN0	TxN1
4	RxN0	RxN1



▸ **Status LEDs**

On the front side, at the center under transparent film between signal connectors, this module provides five LEDs for visual network status monitoring.

The following LEDs are provided:



LED disposition in the front face

LED name	Function	Color	Meaning
SYS	Internal system status	Green ON	Operating system running
		Off	Power supply is missing or defective hardware
RUN	Status of Ethercat State Machine	Off	Device in INIT state
		Green blinking	Device is in PRE-OPERATIONAL state
		Green single-flash	Device is in SAFE OPERATIONAL state
		Green ON	Device is in OPERATIONAL state
ERR	Status of Slave communication	Off	No error; device in working condition
		Red blinking	Invalid configuration
		Red single-flash	Local error
		Red double-flash	Application watch-dog timeout
L/A_IN	Link/Activity state of the physical Input line	Green ON	A link is established in INPUT channel
		Green flickering	The device is sending/receiving Ethercat frames via INPUT channel
		Off	No link established in INPUT channel
L/A_OUT	Link/Activity state of the physical Output line	Green ON	A link is established in OUTPUT channel
		Green flickering	The device is sending/receiving Ethercat frames via OUTPUT channel
		Off	No link established in OUTPUT channel

5.4 PDP expansion (Profibus)

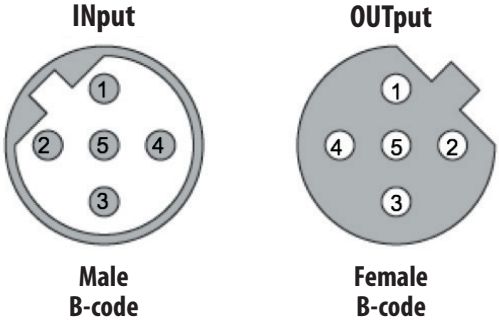
This module is required when the motor inverter has to be used as slave in Profibus DP-V1 fieldbus.
Motovario is a *Profibus and Profinet Consortium* member.

▸ **Node addressing**

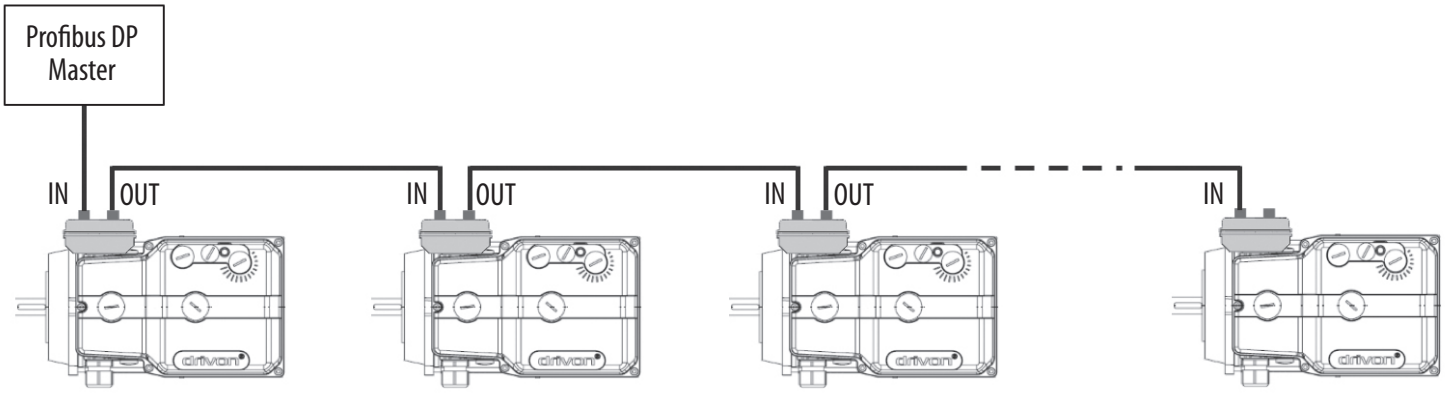
Profibus node ID is assigned through software parameter P142
(see chapter 6) available at the User level of Drivon parameters.

▸ **Connectors**

Two M12 B-code connectors are available in the front side of the module
in order to make possible the Input and the Output of the network cable in daisy chain.
The corresponding pins are in parallel link



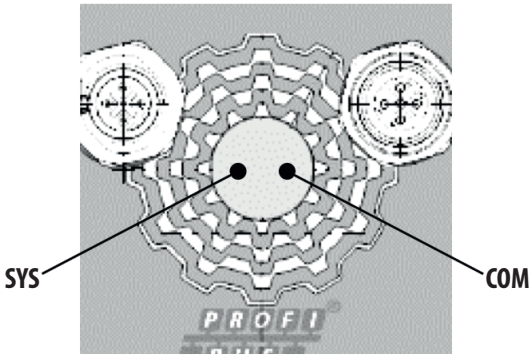
Pin	Input	Output
1	n.c.	n.c.
2	RxP	RxP
3	n.c.	n.c.
4	TxN	TxN
5	PE	PE



▸ **Status LEDs**

Two LEDs are placed in the front face of the module in order to allow the visual monitoring of the network status.

The following LEDs are provided:



LED disposition in the front face

LED name	Function	Color	Meaning
SYS	Internal system status	Green ON	Operating system running
		Off	Power supply is missing or defective hardware
COM	Status of Profibus DP communication	Green ON	Run, cycling communication
		Red ON	Wrong configuration at Profibus DP slave
		Red flashing cyclic	Stop, non communication, connection error
		Red flashing acyclic	Not configured

According to Profibus DP standard, Drivon supports the following Process Peripheral Objects (PPO1, PPO2, PPO3, PPO4):

	Communication Channel				Process Data Channel					
	PKE	IND	PWEh	PWEI	PZD1	PZD2	PZD3	PZD4	PZD5	PZD6
PP01										
PP02										
PP03										
PP04										

PPO-type selection is automatic by Profibus master and it's not necessary any Drivon parameter setting.
During network configuration the Drivon GSD file must be upload into Profibus master.

Enquiry telegram from Master to Slave:

Communication Channel				Process Data Channel					
PKW area				PZD area					
PKE	**IND**	**PWE**	**PWE**	**PZD 1**	**PZD 2**	**PZD x**	**PZD x**	**PZD x**	**PZD x**
		PWEh	PWEl	STW	HSW	Outx	Outx	Outx	Outx

PWE = parameter value
STW = control word
HSW = frequency reference
Outx = data to be written into slave

Reply telegram from Slave to Master:

Communication Channel				Process Data Channel					
PKW area				PZD area					
PKE	**IND**	**PWE**	**PWE**	**PZD 1**	**PZD 2**	**PZD x**	**PZD x**	**PZD x**	**PZD x**
		PWEh	PWEl	ZSW	HIW	Inx	Inx	Inx	Inx

HIW = actual frequency
Inx = data to be read from slave

6. SOFTWARE PROGRAMMING

NOTICE **Software Version**
The following parameters are related to **V1.045** Drivon software version.
Possible changes are possible in function of periodic inverter firmware upgrades.

6.1 PARAMETER LIST

P#	Description	Access level	Default	Restorable
P001	**Frequency reference source:** 0= Potentiometer 1 = Up / down via keypad 2 = Up / down via digital inputs (moto-potentiometer) 3 = Fixed frequency FF0 (P020) 4 = Analog Input AIN 5 = Analog input + on board POT 6 = Fixed frequency + on board POT 7 = Input signal 0-300kHz (requires optional adapter) 8 = Modbus (register 1020h) 9 = CANopen (object 6042h) 10 = Integrated PI-regulator [analog feedback on AIN] (see also P036) 11 = Analog Input AIN1 on I/O optional board 12 = Fixed frequency FF0 (P020) when forward, fixed frequency FF1 (P021) when reverse	0-USER	0	1
P002	**Run command source:** 0= Keypad 1 = Digital Inputs 2 = Digital Inputs bridged + potentiometer threshold (P042) 3 = Modbus (register 1023h)	0-USER	1	1
P003	**Safe-torque-off (STO) mode** 0 = run on the rising edge of STO 1 = run at high level of STO	1-ADVAN	1	1
P004	**Minimum reference value (%)** [0.0 …..100.0 %] Indicates the percentage of the input reference associated to the minimum frequency reference (P006)	0-USER	0.0	1

P#	Description	Access level	Default	Restorable
P005	**Maximum reference value (%)** [0.0 …..100.0 %] Indicates the percentage of the input reference associated to the maximum frequency reference (P007)	0-USER	100.0	1
P006	**Minimum frequency reference (Hz)** [0.0 ….. 360.0 Hz] Indicates the minimum value of frequency of the motor	0-USER	0.0	1
P007	**Maximum frequency reference (Hz)** [0.0 ….. 360.0 Hz] Indicates the maximum value of frequency of the motor	0-USER	50.0	1
P008	**Acceleration time (sec)** [0.1, …., 600.0 s] Indicates time required to reaches the set Maximum frequency reference (P007). In the case of a potentiometer or analog input, the parameter indicates the acceleration from 0% to 100% of the reference frequency	0-USER	10.0	1
P009	**Deceleration time (sec)** [0.1, …., 600.0 s] Indicates time required to reaches the set Minimum frequency reference (P007). In the case of a potentiometer or analog input, the parameter indicates the acceleration from 0% to 100% of the reference frequency	0-USER	10.0	1
P010	**Information shown on keypad display** 0 = Speed reference value (rpm] 1 = Current speed reference applied (rpm] 2 = Motor speed (rpm] 3 = Output torque (%] 4 = Output torque current (Arms] 5 = Magnetizing current (Arms] 6 = Frequency reference value (Hz] 7 = Current frequency reference applied (Hz] 8 = Output frequency (Hz] 9 = DC bus voltage 10 = RMS output voltage (Vrms] 11 = RMS output current (Arms] 12 = I^2T percentage for overload calculation (%] 13 = Analog Input (%] 14 = Potentiometer value (%] 15 = Digital input status (*) 16 = Digital output status (*) 17 = Canopen status DSP402 (*) (*) scale factor has no effect	0-USER	5	1
P011	**DIN1 – Digital_Input_1 operation mode** 0 = No operation 1 = Enable Run (@ last running direction) 2 = Direction of rotation 3 = Enable Run Forward 4 = Enable Run Reverse 5 = UP moto-potentiometer 6 = DOWN moto-potentiometer 7 = Fixed frequency – value of Bit 0 (first bit selection) 8 = Fixed frequency – value of Bit 1 (second bit selection) 9 = Fixed frequency – value of Bit 2 (third bit selection) 10 = Fixed frequency – value of Bit 3 (fourth bit selection) 11 = Stop with deceleration ramp (P041) 12 = Stop with maximum current 13 = User alarm 14 = Alarm Reset (if possible) 15 = Stop in Forward on the signal LEVEL 16 = Stop in Reverse on the signal LEVEL 17 = Start in Forward on the signal RISING EDGE 18 = Start in Reverse on the signal RISING EDGE 19 = Stop in Forward on the signal RISING EDGE 20 = Stop in Reverse on the signal RISING EDGE	0-USER	1	1

P#	Description	Access level	Default	Restorable
P012	**DIN2 – Digital_Input_2 operation mode** (see P011 list)	0-USER	2	1
P013	**DIN3 – Digital_Input_3 operation mode** (see P011 list)	0-USER	7	1
P014	**DIN4 – Digital_Input_4 operation mode** (see P011 list)	0-USER	8	1
P015	**RLY1 – Relay Output operation mode** 0 = Inverter running 1 = Inverter alarm 2 = Torque limitation reached 3 = Direction of motion (1 = fwd, rev = 0) 4 = Reference frequency reached 5 = Frequency threshold exceeded 6 = Reference threshold exceeded 7 = RMS current threshold exceeded 8 = Torque current threshold exceeded 10 = STO status 11 = Input 1 status 12 = Input 2 status 13 = Input 3 status 14 = Input 4 status 15 = CANopen (object 60FEh) 16 = Modbus (object 1011h) 20 = Generic warning 21 = Under voltage warning 22 = Overload warning 23 = Derating warning for overload 24 = Torque limiting warning	0-USER	0	1
P016	**Torque limits source selector** 0 = Fixed parameter values (P017, P018) 1 = Analog input AIN1 and/or AIN2 (if I/O expansion board is not assembled the second limit is done by fixed value P017 or P018) 2 = Integrated POT potentiometer (only for positive torque limit; the negative torque limit is done by fixed value P018)	0-USER	0	1
P017	**Positive Torque Limit (MSUP) % when P016 = 0** [0.0, …, 199.9] Applicable value. 200.0% means without limitation	0-USER	200.0	1
P018	**Negative Torque Limit (MINF) % when P016 = 0** [-199.9, …., 0.0] Applicable value. -200.0% means without limitation	0-USER	-200.0	1

<table>
<tr><th>P#</th><th>Description</th><th>Access level</th><th>Default</th><th>Restorable</th></tr>
<tr><td>P020</td><td>Fixed frequency FF0 (Hz)
– DIN binary combination 0b0000
Through 4 digital inputs the moto-inverter can be driven at 16 different frequency values selectable by digital input binary combination:

<table>
<tr><th colspan="4">Digital input combination</th><th>Output freq.</th></tr>
<tr><th>DIN4</th><th>DIN3</th><th>DIN2</th><th>DIN1</th><th>Hz</th></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>OFF</td><td>FF0</td></tr>
<tr><td>OFF</td><td>OFF</td><td>OFF</td><td>ON</td><td>FF1</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ON</td><td>OFF</td><td>FF2</td></tr>
<tr><td>OFF</td><td>OFF</td><td>ON</td><td>ON</td><td>FF3</td></tr>
<tr><td>OFF</td><td>ON</td><td>OFF</td><td>OFF</td><td>FF4</td></tr>
<tr><td>OFF</td><td>ON</td><td>OFF</td><td>ON</td><td>FF5</td></tr>
<tr><td>OFF</td><td>ON</td><td>ON</td><td>OFF</td><td>FF6</td></tr>
<tr><td>OFF</td><td>ON</td><td>ON</td><td>ON</td><td>FF7</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>OFF</td><td>FF8</td></tr>
<tr><td>ON</td><td>OFF</td><td>OFF</td><td>ON</td><td>FF9</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td><td>OFF</td><td>FF10</td></tr>
<tr><td>ON</td><td>OFF</td><td>ON</td><td>ON</td><td>FF11</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>OFF</td><td>FF12</td></tr>
<tr><td>ON</td><td>ON</td><td>OFF</td><td>ON</td><td>FF13</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>OFF</td><td>FF14</td></tr>
<tr><td>ON</td><td>ON</td><td>ON</td><td>ON</td><td>FF15</td></tr>
</table>
</td><td>0-USER</td><td>37.5</td><td>1</td></tr>
<tr><td>P021</td><td>Fixed frequency FF1 (Hz)
– DIN binary combination 0b0001
(see table of parameter P020)</td><td>0-USER</td><td>37.5</td><td>1</td></tr>
<tr><td>P022</td><td>Fixed frequency FF2 (Hz)
– DIN binary combination 0b0010
(see table of parameter P020)</td><td>0-USER</td><td>25.0</td><td>1</td></tr>
<tr><td>P023</td><td>Fixed frequency FF3 (Hz)
– DIN binary combination 0b0011
(see table of parameter P020)</td><td>0-USER</td><td>12.5</td><td>1</td></tr>
<tr><td>P024</td><td>Fixed frequency FF4 (Hz)
– DIN binary combination 0b0100
(see table of parameter P020)</td><td>0-USER</td><td>0.0</td><td>1</td></tr>
<tr><td>P025</td><td>Fixed frequency FF5 (Hz)
– DIN binary combination 0b0101
(see table of parameter P020)</td><td>0-USER</td><td>0.0</td><td>1</td></tr>
<tr><td>P026</td><td>Fixed frequency FF6 (Hz)
– DIN binary combination 0b0110
(see table of parameter P020)</td><td>0-USER</td><td>0.0</td><td>1</td></tr>
<tr><td>P027</td><td>Fixed frequency FF7 (Hz)
– DIN binary combination 0b0111
(see table of parameter P020)</td><td>0-USER</td><td>0.0</td><td>1</td></tr>
</table>

P#	Description	Access level	Default	Restorable
P028	**Fixed frequency FF8 (Hz)** – DIN binary combination 0b1000 (see table of parameter P020)	0-USER	0.0	1
P029	**Fixed frequency FF9 (Hz)** – DIN binary combination 0b1001 (see table of parameter P020)	0-USER	0.0	1
P030	**Fixed frequency FF10 (Hz)** – DIN binary combination 0b1010 (see table of parameter P020)	0-USER	0.0	1
P031	**Fixed frequency FF11 (Hz)** – DIN binary combination 0b1011 (see table of parameter P020)	0-USER	0.0	1
P032	**Fixed frequency FF12 (Hz)** – DIN binary combination 0b1100 (see table of parameter P020)	0-USER	0.0	1
P033	**Fixed frequency FF13 (Hz)** – DIN binary combination 0b1101 (see table of parameter P020)	0-USER	0.0	1
P034	**Fixed frequency FF14 (Hz)** – DIN binary combination 0b1110 (see table of parameter P020)	0-USER	0.0	1
P035	**Fixed frequency FF15 (Hz)** – DIN binary combination 0b1111 (see table of parameter P020)	0-USER	0.0	1
P036	**Reference frequency source for integrated PI regulator:** 0-reference from integrated potentiometer 1-reference from up/down keypad keys 2-reference varied by digital input UP/DOWN (moto-potentiometer) 3-reference from fixed frequency FF0 (P020) 8-reference from Modbus register 1020h 11-reference from Analog Input AIN1 over I/O-expansion board (PI-feedback connected to AIN) NOTE: when enabling CanOPEN interface (P190-CanOPEN_ENABLE=1) reference will come from Canopen object 6042h	0-USER	0	1
P037	**AIN1-Analog Input Offset as PI-regulator feedback** [-300.0 ÷ 300.0] (only valid with P001 = 11)	0-USER	0	1
P038	**AIN1-Analog Input Gain as PI-regulator feedback** [-3000.0 ÷ 3000.0] (only valid with P001 = 11)	0-USER	1	1
P039	**PI-regulator Proportional gain (Kp)** [0.000 ÷ 30.000] (only valid with P001 = 11)	0-USER	1	1

P#	Description	Access level	Default	Restorable
P040	**PI-regulator Integral gain (Ki)** [0.000 ÷ 30.000] (only valid with P001 = 11)	0-USER	0	1
P041	**Emergency deceleration ramp** (sec) [0.1 ÷ 600.0] Deceleration ramp time when P011/12/13/14 = 11 (emergency stop via Digital Input)	1-ADVAN	2.0	1
P042	**Electronic switch voltage threshold** (%) When POT voltage exceeds this value, the motor will be started: POT < P042 ⟶ motor STOP POT ≥ P042 ⟶ motor RUN + Speed Adjustment Valid only if P002=2 (Run command via POT integrated potentiometer)	0-USER	5.0	1
P043	**AIN1-Analog Input signal type:** 0 = voltage 0-10V 1 = voltage -10….+10V 2 = current 0-20mA 3 = current 4-20mA NOTE: to switch from "voltage mode" to "current mode" the jumper JP1 also must be used: JP1 = open ⟶ voltage mode JP1 = closed ⟶ current mode	0-USER	3	1
P044	**AIN1-Analog Input Filter** (sec) Analog Input response time: [0.01 ÷ 10.0] s	1-ADVAN	0.01	1
P045	**AIN1-Analog Input Offset** (%) Analog Input offset correction: [-9.99 ÷ 9.99] % 0.0 = no correction	1-ADVAN	0.00	1
P046	**AIN1-Analog Input Gain** (%) Analog Input gain correction [90.0 ÷ 110.0] % 100.0 = no correction	1-ADVAN	100.0	1
P047	**Rise Time 0% to 100% for moto-potentiometer** (sec) [0.1 ÷ 600.0] s (only valid if P001 = 2 and P011/P012/P013/P014 = 5)	1-ADVAN	10.0	1
P048	**Fall Time 0% to 100% for moto-potentiometer** (sec) [0.1 ÷ 600.0] s (only valid if P001 = 2 and P011/P012/P013/P014 = 6)	1-ADVAN	10.0	1
P049	**Rise Time 0% to 100% for keypad** (sec) [0.1 ÷ 600.0] s (only valid if P001 = 1)	1-ADVAN	10.0	1
P050	**Fall Time 100% to 0% for keypad** (sec) [0.1 ÷ 600.0] s (only valid if P001 = 1)	1-ADVAN	10.0	1
P051	**User coefficient for display scaling** [0.01 ÷ 10.0] (personal reading scale suitable for process)	0-USER	1.00	1

P#	Description	Access level	Default	Restorable
P052	**Stopping mode during deceleration ramp** 0 = standard 1 = DC-current injection 2 = HF-current injection	1-ADVAN	0	1
P053	**Frequency threshold for current injection** (Hz) [0.0 ÷ 360.0] Hz Frequency level for current-injection activation during ramp-down (only if P052 > 0)	1-ADVAN	1.0	1
P056	**Skip-frequency function enabling** Resonant damaging frequency bands can be skipped automatically by the inverter: 0 = skip-frequency function disabled 1 = skip-frequency function enabled	1-ADVAN	0	1
P057	**First skip frequency** (Hz) [0.0 ÷ 360.0] Hz Centre of first frequency band to be skipped	1-ADVAN	0	1
P058	**First skip frequency window (**Hz) [0.0 ÷ 10.0] Hz Width of first frequency band to be skipped (operating range around P057)	1-ADVAN	0.2	1
P059	**Second skip frequency** (Hz) [0.0 ÷ 360.0] Hz Centre of second frequency band to be skipped	1-ADVAN	0	1
P060	**Second skip frequency window** (Hz) [0.0 ÷ 10.0] Hz Width of second frequency band to be skipped (operating range around P058)	1-ADVAN	0.2	1
P061	**Motor flying-restart** 0 = disabled 1 = enabled (after stop, motor restarts again from current frequency)	1-ADVAN	0	1
P062	**DC-current injection during deceleration ramp** (%) Amount of DC-current injection as % of motor nominal current: [0.0 ÷ 100.0] % (valid only if P052 = 1)	1-ADVAN	50%	1
P064	**RLY1-Relay switching threshold when P015 = 7** [0.0 ÷ 200.0] % of motor rated current	1-ADVAN	50%	1
P065	**RLY1-Relay switching threshold when P015 = 8** [0.0 ÷ 200.0] % of rated torque	1-ADVAN	50%	1
P066	**RLY1-Relay switching threshold when P015 = 5** [0.0 ÷ 360.0] Hz actual frequency	1-ADVAN	25.0	1
P067	**RLY1-Relay switching threshold when P015 = 6** [0.0 ÷ 100.0] % of frequency reference	1-ADVAN	50%	1
P068	**Ramp type** (Linear or S-curve): 0=L+L (L during Acc + L during Dec) 1=L+S (L during Acc + S during Dec) 2=S+L (S during Acc + L during Dec) 4=S+S (S during Acc + S during Dec)	0-USER	0	1

P#	Description	Access level	Default	Restorable
P069	**Round time of S-ramp** (sec) Time to go from 0 to the maximum acceleration [0.1 ÷ 600.0] s (only valid if P068 = 1, 2, 4)	0-USER	0.5	1
P070	**JOG frequency** (Hz) Pre-defined frequency when Jog function is operated by keypad: [0.0 ÷ 360.0] Hz	1-ADVAN	50.0	1
P071	**JOG acceleration time** (sec) Pre-defined time from 0Hz to Jog frequency by keypad: [0.1 ÷ 600.0] s	1-ADVAN	10.0	1
P072	**JOG deceleration time** (sec) Pre-defined time from Jog frequency to 0Hz by keypad: [0.1 ÷ 600.0] s	1-ADVAN	10.0	1
P073	**Inverter behaviour during Current Overload** 0-ALARM: system will stop the motor and generates OVERLOAD alarm 1-DERATING: system automatically will reduce maximum torque to RATED value (speed reduction is expected)	1-ADVAN	0	1
P074	**Overload detection threshold** (%) [100 ÷ 200] % of motor rated current Overload condition is met if motor current is greater than 'P074-OverloadAlrPerc' for a time of 'P075-OverloadAlrTime'	1-ADVAN	1,5	1
P075	**Overload detection time** (sec) [10 ÷ 3600] s Overload condition is met if motor current is greater than 'P074-OverloadAlrPerc' for a time of 'P075-OverloadAlrTime'	1-ADVAN	60	1
P076	**Overload warning message level** (%) [0 ÷ 100] % of maximum OVERLOAD energy When overload energy counter reaches the warning level, the keypad will show OVERLOAD warning and the status LED will be flashing. While on OVERLOAD warning, keypad will show alternatively selected measure and warning indication.	1-ADVAN	50	1
P078	**Duration of DC-current injection (P062) after deceleration ramp** (sec) [0.0 ÷ 60.0] s (only valid if P052 = 1)	1-ADVAN	2.0	1
P079	**Duration of residual motor excitation after deceleration ramp** (sec) [0.0 ÷ 60.0] s (only valid if P052 = 0 and 2)	1-ADVAN	2.0	1
P080	**Inverter carrier frequency** 0 = 2 kHz 1 = 4 kHz 2 = 8 kHz (available only if ≤ 1.5kW) 3 =10 kHz (available only if ≤ 1.5kW)	1-ADVAN	2	0
P082	**Control mode** 0 = V / f scalar 1 = Sensorless Field Oriented	1-ADVAN	0	1
P083	**Frequency_1 of V/f pattern** (%) First frequency point over V/f curve [0.0 ÷ 200.0] % of motor rated frequency (only valid if P082 = 0) Rated frequency is computed as follows: - Drivon 230V: f_rated=50.0Hz - Drivon 400V G1 and G2: f_rated = 50 Hz - Drivon 400V G3 and G4: f_rated=87Hz	1-ADVAN	0.0	1

<table>
<tr><th>P#</th><th>Description</th><th>Access level</th><th>Default</th><th>Restorable</th></tr>
<tr><td>P084</td><td>Voltage_1 of V/f pattern (%)
First voltage point over V/f curve
[0.0 ÷ 120.0] % of motor rated voltage
(only valid if P082 = 0)
Rated voltage is computed as follows:
- Drivon 230V: V_rated = 230Vac
- Drivon 400V: V_rated = 400Vac</td><td>1-ADVAN</td><td>10.0</td><td>1</td></tr>
<tr><td>P085</td><td>Frequency_2 of V/f pattern (%)
Second frequency point over V/f curve
[0.0 ÷ 200.0] % of motor rated frequency
(only valid if P082 = 0)</td><td>1-ADVAN</td><td>10.0</td><td>1</td></tr>
<tr><td>P086</td><td>Voltage_2 of V/f pattern (%)
Second voltage point over V/f curve
[0.0 ÷ 120.0] % of motor rated voltage
(only valid if P082 = 0)</td><td>1-ADVAN</td><td>15.0</td><td>1</td></tr>
<tr><td>P087</td><td>Frequency_3 of V/f pattern (%)
Third frequency point over V/f curve
[0.0 ÷ 200.0] % of motor rated frequency
(only valid if P082 = 0)</td><td>1-ADVAN</td><td>50.0</td><td>1</td></tr>
<tr><td>P088</td><td>Voltage_3 of V/f pattern (%)
Third voltage point over V/f curve
[0.0 ÷ 120.0] % of motor rated voltage
(only valid if P082 = 0)</td><td>1-ADVAN</td><td>50.0</td><td>1</td></tr>
<tr><td>P089</td><td>Frequency_4 of V/f pattern (%)
Fourth frequency point over V/f curve
[0.0 ÷ 200.0] % of motor rated frequency
(only valid if P082 = 0)</td><td>1-ADVAN</td><td>100.0</td><td>1</td></tr>
<tr><td>P090</td><td>Voltage_4 of V/f pattern (%)
Fourth voltage point over V/f curve
[0.0 ÷ 120.0] % of motor rated voltage
(only valid if P082 = 0)</td><td>1-ADVAN</td><td>100.0</td><td>1</td></tr>
<tr><td>P091</td><td>Restore parameters default value
0) disabled
1) restore Motovario default values</td><td>1-ADVAN</td><td>0</td><td>0</td></tr>
<tr><td>P093</td><td>Digital input PNP/NPN mode selection
Each digital input can be configured as PNP or NPN mode independently on the other ones
<table>
<tr><th>Value (*)</th><th>DIN4</th><th>DIN3</th><th>DIN2</th><th>DIN1</th></tr>
<tr><td>0</td><td>PNP</td><td>PNP</td><td>PNP</td><td>PNP</td></tr>
<tr><td>1</td><td>PNP</td><td>PNP</td><td>PNP</td><td>NPN</td></tr>
<tr><td>10</td><td>PNP</td><td>PNP</td><td>NPN</td><td>PNP</td></tr>
<tr><td>11</td><td>PNP</td><td>PNP</td><td>NPN</td><td>NPN</td></tr>
<tr><td>100</td><td>PNP</td><td>NPN</td><td>PNP</td><td>PNP</td></tr>
<tr><td>101</td><td>PNP</td><td>NPN</td><td>PNP</td><td>NPN</td></tr>
<tr><td>110</td><td>PNP</td><td>NPN</td><td>NPN</td><td>PNP</td></tr>
<tr><td>111</td><td>PNP</td><td>NPN</td><td>NPN</td><td>NPN</td></tr>
<tr><td>1000</td><td>NPN</td><td>PNP</td><td>PNP</td><td>PNP</td></tr>
<tr><td>1001</td><td>NPN</td><td>PNP</td><td>PNP</td><td>NPN</td></tr>
<tr><td>1010</td><td>NPN</td><td>PNP</td><td>NPN</td><td>PNP</td></tr>
<tr><td>1011</td><td>NPN</td><td>PNP</td><td>NPN</td><td>NPN</td></tr>
<tr><td>1100</td><td>NPN</td><td>NPN</td><td>PNP</td><td>PNP</td></tr>
<tr><td>1101</td><td>NPN</td><td>NPN</td><td>PNP</td><td>NPN</td></tr>
<tr><td>1110</td><td>NPN</td><td>NPN</td><td>NPN</td><td>PNP</td></tr>
<tr><td>1111</td><td>NPN</td><td>NPN</td><td>NPN</td><td>NPN</td></tr>
</table>
(*) decimal value (no binary)</td><td>1-ADVAN</td><td>0</td><td>1</td></tr>
</table>

P#	Description	Access level	Default	Restorable
P097	**BC expansion board presence** 0) not present 1) present (Motovario reserved)	0-USER	0	1
P098	**EMB expansion board presence** 0) not present 1) present (Motovario reserved)	0-USER	0	1
P099	**I/O expansion board presence** 0) not present 1) present (Motovario reserved)	0-USER	0	1
P100	**AIN2 (Expansion Analog Input) Operation Mode** 0) 0V..10V 1) -10V..+10V 2) 0..20mA 3) 4..20mA WARNING: please check JP1 jumper for proper operation: - 0) and 1) require JP1 open - 2) and 3) require JP1 closed (only if I/O expansion board is installed)	0-USER	3	1
P101	**AIN2 (Expansion Analog Input) Filter** (sec) [0.01 ÷ 10.00] s (only if I/O expansion board is installed)	1-ADVAN	0.01	1
P102	**AIN2 (Expansion Analog Input) Offset** (%) [-9.99 ÷ 9.99] % (only if I/O expansion board is installed)	1-ADVAN	0.00	1
P103	**AIN2 (Expansion Analog Input) Gain** (%) [90.0 ÷ 110.0] % (100.0 means no correction) (only if I/O expansion board is installed)	1-ADVAN	100.0	1
P104	**DOUT1 (Expansion Digital Output) Operation mode** (only if I/O expansion board is installed) 0- switch when inverter RUN condition is true 1- switch when inverter is in ALARM 2- switch when inverter is in TORQUE LIMITING 3- switch when motor is running in REVERSE direction (speed less than 0) 4- switch when TARGET FREQUENCY is reached 5- switch when ACTUAL FREQUENCY THRESHOLD P107 is reached 6- switch when FREQUENCEY REFERENCE THRESHOLD P108 is reached 7- switch when RMS CURRENT THRESHOLD P105 is reached 8- switch when TORQUE CURRENT THRESHOLD P106 is reached 10- digital output will replicate STO input 11- digital output will replicate DIN1 input 12- digital output will replicate DIN2 input 13- digital output will replicate DIN3 input 14- digital output will replicate DIN4 input 15- digital output will be set by CANopen object 60FEh 16- digital output will be set by Modbus register 1011h 20- digital output will set by EVERY WARNING 21- digital output will be set by UNDER VOLTAGE WARNING E001 22- digital output will be set by OVERLOAD WARNING E002 23- digital output will be set by RUNNING DERATING WARNING for overload 24- digital output will be set by LIMITING TORQUE WARNING 25- digital output will REPEAT the FREQUENCY REFERENCE as pulse train from 10Hz (freq. min) to 1kHz (freq. max)	0-USER	25	1

P#	Description	Access level	Default	Restorable
P105	**DOUT1 (Expansion Digital Output) Switching Threshold when P104 = 7** (%) [0.0 ÷ 200.0] % of motor rated current (only if I/O expansion board is installed)	1-ADVAN	0,5	1
P106	**DOUT1 (Expansion Digital Output) Switching Threshold when P104 = 8** (%) [0.0 ÷ 200.0] % of motor rated torque (only if I/O expansion board is installed)	1-ADVAN	0,5	1
P107	**DOUT1 (Expansion Digital Output) Switching Threshold when P104 = 5** (Hz) [0.0 ÷ 360.0] Hz actual frequency (only if I/O expansion board is installed)	1-ADVAN	25.0	1
P108	**DOUT1 (Expansion Digital Output) Switching Threshold when P105 = 6 (%)** [0.0 ÷ 100.0] % of frequency max (only if I/O expansion board is installed)	1-ADVAN	0,5	1
P109	**DIN5 (Expansion Digital Input) Maximum pulse train frequency** (kHz) Setpoint source by high frequency pulse train over DIN5 [1 ÷ 100] kHz (only if I/O expansion board is installed)	1-ADVAN	1	1
P110	**RLY2 (Expansion Relay Output) Operation Mode** (only if I/O expansion board is installed) 0- switch when inverter RUN condition is true 1- switch when inverter is in ALARM 2- switch when inverter is in TORQUE LIMITING 3- switch when motor is running in REVERSE direction (speed less than 0) 4- switch when TARGET FREQUENCY is reached 5- switch when ACTUAL FREQUENCY THRESHOLD P107 is reached 6- switch when FREQUENCEY REFERENCE THRESHOLD P108 is reached 7- switch when RMS CURRENT THRESHOLD P105 is reached 8- switch when TORQUE CURRENT THRESHOLD P106 is reached 10- digital output will replicate STO input 11- digital output will replicate DIN1 input 12- digital output will replicate DIN2 input 13- digital output will replicate DIN3 input 14- digital output will replicate DIN4 input 15- digital output will be set by CANopen object 60FEh 16- digital output will be set by Modbus register 1011h 20- digital output will set by EVERY WARNING 21- digital output will be set by UNDER VOLTAGE WARNING E001 22- digital output will be set by OVERLOAD WARNING E002 23- digital output will be set by RUNNING DERATING WARNING for overload 24- digital output will be set by LIMITING TORQUE WARNING	0-USER	0	1
P111	**RLY2 (Expansion Relay Output) Switching Threshold when P110 = 7** [0.0 ÷ 200.0] % of motor rated current (only if I/O expansion board is installed)	1-ADVAN	0,5	1
P112	**RLY2 (Expansion Relay Output) Switching Threshold when P110 = 8** [0.0 ÷ 200.0] % of rated torque (only if I/O expansion board is installed)	1-ADVAN	0,5	1
P113	**RLY2 (Expansion Relay Output) Switching Threshold when P110 = 5** [0.0 ÷ 360.0] Hz actual frequency (only if I/O expansion board is installed)	1-ADVAN	25.0	1
P114	**RLY2 (Expansion Relay Output) Switching Threshold when P110 = 6** [0.0 ÷ 100.0] % of frequency max (only if I/O expansion board is installed)	1-ADVAN	0,5	1

P#	Description	Access level	Default	Restorable
P115	**AOUT1 (Expansion Analog Output) Maximum RMS-Voltage when P121 = 10** [1.0 ÷ 500.0] % (only if I/O expansion board is installed)	1-ADVAN	200	1
P116	**AOUT1 (Expansion Analog Output) Maximum DC-link Voltage when P121 = 9** [1.0 ÷ 500.0] % of maximum DC-link voltage (only if I/O expansion board is installed)	1-ADVAN	200	1
P117	**AOUT1 (Expansion Analog Output) Maximum Frequency when P121 = 6, 7, 8** [1.0 ÷ 500.0] % of maximum frequency (only if I/O expansion board is installed)	1-ADVAN	100	1
P118	**AOUT1 (Expansion Analog Output) Maximum RMS-Current when P121 = 4, 5, 11** [1.0 ÷ 500.0] % of rated current (only if I/O expansion board is installed)	1-ADVAN	200	1
P119	**AOUT1 (Expansion Analog Output) Maximum motor Torque when P121 = 3** [1.0 ÷ 500.0] % of rated torque (only if I/O expansion board is installed)	1-ADVAN	200	1
P120	**AOUT1 (Expansion Analog Output) Maximum motor Speed when P121 = 0, 1, 2** [1.0 ÷ 500.0] % (only if I/O expansion board is installed)	1-ADVAN	100	1
P121	**AOUT1 (Expansion Analog Output) Operation Mode** (only if I/O expansion board is installed) The Analog Output can be programmed to carry out the following values: 0 - speed reference after ramps as RPM 1 - speed reference with ramps as RPM 2 - motor actual speed as RPM 3 - motor actual torque as % on rated torque 4 - motor actual Iq current as Arms 5 - motor actual Id current as Arms 6 - input frequency reference after ramps 7 - input frequency reference with ramps 8 - actual frequency output 9 - actual DC voltage of DC-link 10 - actual AC output voltage 11 - actual RMS output current 12 - actual Energy Overload percentage 13 - actual Analog Input percentage 14 - actual On-board Potentiometer percentage	1-ADVAN	0	1
P122	**RLY1- Relay Output switching inversion** The relay is switched when the event P015 occurs or when it doesn't occur: 0 = Relay switches when condition P015 is true 1 = Relay switches when condition P015 is false	1-ADVAN	0	1
P125	**Temperature threshold for PT100 alarm** (°C) [-50 ÷ 200] °C (upper hysteresis value) (only if I/O expansion board is installed)	0-USER	120	1
P126	**Recovery temperature threshold after PT100 alarm** (°C) [-50 ÷ 200] °C (lower hysteresis value) (only if I/O expansion board is installed)	0-USER	90	1
P127	**PT100 reading enable** 0) disabled 1) enabled (only if I/O expansion board is installed and PT100 thermal sensor is wired)	1-ADVAN	1	1

P#	Description	Access level	Default	Restorable
P130	**Braking-resistor control enable** 0) disabled 1) enabled (only if BC expansion module is installed and P097 = 1)	1-ADVAN	0	1
P131	**Braking-resistor ON Voltage-Threshol**d (%) Upper hysteresis value [97.40 ÷ 98.70] % of overvoltage threshold Overvoltage threshold: 440VDC in case of Drivon DV123 760VDC in case of Drivon DV340 (only if BC expansion module is installed)	1-ADVAN	98.70	1
P132	**Braking-resistor OFF Voltage-Threshold** (%) Lower hysteresis value [97.40 ÷ 98.70] % of overvoltage threshold (see P131) (only if BC expansion module is installed)	1-ADVAN	95.00	1
P135	**Mechanical-brake control enable** 0) disabled 1) enabled (only if EMB expansion module is installed)	1-ADVAN	1	1
P136	**Delay time from starting ramp-up and mechanical brake release** (sec) [0.000 ÷ 5.000] s (only if EMB expansion module is installed)	1-ADVAN	0	1
P137	**Delay time from mechanical brake release and motor deenergized after ramp-down** (sec) [0.000 ÷ 5.000] s (only if EMB expansion module is installed)	1-ADVAN	0	1
P138	**Frequency threshold during ramp-down to lock the mechanical brake** (Hz) [0.1 ÷ 5.0] Hz (only if EMB expansion module is installed)	1-ADVAN	1	1
P140	**Fieldbus expansion board presence** (only if Ethercat or Profinet or Profibus expansion board is installed) 0) not present 1) present	0-USER	0	1
P142	**Profibus DP node address** [1 ÷ 254] (only if Profibus DP expansion board is installed)	0-USER	2	1
P143	**Profibus DP image data format**: 0) LSB First 1) MSB First	1-ADVAN	0	1
P148	**Keypad setpoint automatic backup during power-off** When keypad is used as setpoint source, during power-off the actual frequency value is automatically stored in the flash memory and it will be restored during next power-on: 0 = no backup 1 = frequency backup during power-off (the frequency setpoint is saved only if stable for at least 5 seconds before power-off)	1-ADVAN	0	1
P149	**Frequency backup recovery percentage** (%) In case of P148 = 1 the frequency backup is recovered and the motor is restarted with a percentage of the previous value: [0.00 ÷ 100.00] % of P148	1-ADVAN	0.00	1
P181	**Modbus RTU enabling** 0-Disabled 1-Enabled (*2)	1-ADVAN	0	1

P#	Description	Access level	Default	Restorable
P182	**Modbus RTU node address** [1 ÷ 255] (*2)	1-ADVAN	1	1
P183	**Modbus RTU data mode** 0 = 8-N-2 (8 bits data, no parity, two stop bits) 1 = 8-E-1 (8 bits data, even parity, one stop bit) 2 = 8-O-1 (8 bits data, odd parity, one stop bit) (*2)	1-ADVAN	0	1
P184	**Modbus RTU baud rate** 0=9600 1=19200 2=38400 3=57600 4=115200 (*2)	1-ADVAN	0	1
P190	**CanOPEN enabling** 0-Disabled 1-Enabled (*2)	1-ADVAN	0	1
P191	**CanOPEN Node-ID** [1 ÷ 127] (*2)	1-ADVAN	1	1
P192	**CanOPEN baud rate** 1=20kbps 2=50kbps 3=125kbps 4=250kbps 5=500kbps 6=1000kbps (*2)	1-ADVAN	4	1
P202	**User access level to Drivon parameters after Power ON** ▪ USER ▪ ADVANCE	1-ADVAN (*1)	0	0
P210	**Number of consecutive auto-reset attempts in case of resettable system fault** [0…50]	1-ADVAN	0	1
P211	**Delay-time between 2 consecutive auto-reset** (sec) [0.5 ….. 30.0] s	1-ADVAN	2.0	1
P212	**Delay-time after occurred fault-reset before a new auto-reset cycle** (sec) [0.5 …. 1800.0] s	1-ADVAN	120.0	1
P220	**Maximum allowed speed-error rate** (%) [10.0 ….. 150.0] % of nominal speed	1-ADVAN	150	1
P221	**Maximum allowed time at maximum speed-error** (sec) [0.1 ….. 600.0] s	1-ADVAN	10.0	1
P222	**Maximum allowed error of estimated-speed vs. encoder-speed** (%) [10.0 ….. 150.0] % of nominal speed	1-ADVAN	150	1
P223	**Maximum allowed time at maximum speed-encoder-error** (sec) [0.1 …. 600.0] s	1-ADVAN	1.0	1

(* 1) The level can be set by user when USER to the current user level;
eg. if the current user level is ADVANCE then you can set P202 to ADVANCE next time you turn the card will be at the ADVANCE layer.
(*2) Differently to all the other parameters, the change of these parameters has effect only after inverter restart.

6.2 FACTORY RESET

After any parameter adjustment, always the user can restore the original parameter setting delivered by Motovario.
Two ways are possible to get factory reset:

- **By keypad:**
  1) push MENU button at least for 5 seconds
  2) push MENU button several time until "*4_UL*" appears on the display
  3) push UP button several time until "*rE_P*" appears on the display
  4) push ENTER button at least for 5 seconds until "*dFL*" appears on the display
  5) push at the same time the buttons CLOCKWISE and COUNTERCLOCKWISE until "*done*" appears on the display and wait for "*rE_P*" message appears again
  6) push MENU button to reach other functions or push STOP button to restore the operative mode

- **By BSi software tool:**
  Access to Advance level and set the parameter P091 = 1

After reset all parameters of User and Advance level will be restored to factory value.

7. OPERATIONAL NOTES

▸ **Enabling axis:**

the entry of safe-torque-off (STO) must be properly enabled to allow the driving of the power stage is necessary to connect them to work (possibly at a fixed power if not used). Use parameter P003, you can select whether the opening is on the front or on the level of STO; if you do not use the STO is to set P003 = 1 to automatically start at boot-axis, when this is the STO but not the RUN modulation is OFF. The entry of STO is called "ENABLE" indicating that its presence is necessary but not sufficient for certification of the power stage.

▸ **Start the motor [RUN):**

the start condition can come from different sources selectable through P002.

- **Keypad:** Using the arrow keys you can start the axis in FWD or REV or stop by the STOP button

- **Digital Input:** The approval is given by the digital inputs in two ways
  - START + DIR_REV: the level of the START indicates the motor has started, the level of the direction indicates the direction of travel [high means reverse)
  - START_FWD and / or START_REV: the level of the two inputs indicates the start of the motor in one of two directions; if both inputs are high, the start is inhibited
  - It can use the START and START_FWD / REV: in this case the motor starts is if there is either one of the two signals START START_FWD or START_REV

- The modulation is activated when both ENABLE RUN that are active; during the movement of the motor, if the RUN mode is deactivated, the motor will be decelerated according to a preset ramp and deceleration at the end of the power stage will be switched off

▸ **Frequency reference:**

P001 is decided by the reference source frequency; except for the fixed reference FF0 and references from CANopen / Modbus, the reference is scaled by the parameters P004 / 005/006/007 defining the minimum and maximum percentage value and the minimum and maximum frequency value; appropriately setting the parameters is possible to obtain high frequencies with low reference and low frequencies with high reference [think to a pressure regulation by controlling the regime of a pump); in the case of fixed frequency source from FF0, the value set in P020 is directly used as the reference frequency value if no digital input of fixed frequency selection is active.

▸ **Fixed frequencies:**

the system provides the ability to set up to 16 fixed frequencies; to use fixed frequencies must be configured as digital inputs bits frequency selection. fixed [using only one input can be selected frequencies 2, 4 inputs with two frequencies, with three inputs and 8 frequencies with four inputs 16 frequencies)

- With P001 = 3 [freq. Fixed), with binary combination "0000", the output frequency will be equal to the parameter P020 [fixed frequency 0)
- With binary combination "0001" = 1 to "1111" = 15 is selected the corresponding fixed frequency from 1 to 15
- If P001 <> 3, you can still use the freq. fixed from 1 to 15 as "override" of reference:
  - if the binary combination of fixed frequency is 0, the reference will be used parameterized by P001, for example. AIN or potentiometer.
  - if the binary combination of fixed frequency is from 1 to 15, the output frequency will depend on the parameter freq. corresponding fixed.

▸ The parameters at the user level 0 and 1-USER-Advanc can also be set from the keypad; if you perform a restore operation parameters from keypad, only the parameters 0 and 1-USER-ADVANCE will be restored.

8. TABLE OF ALARMS

The following table shows the list of alarms that lead to shutdown of the inverter; the alarm condition is indicated on the keypad and on the status page of the PC interface.

Each alarm is also logged in the alarm list queried by means of the keypad [see alarm menu) or via the PC interface.

#	Alarm	Description	Reset
0	NoAlarm	No alarm present	--
A001	ALR_USER	User alarm forced to PC interface	Manual
A002	ALR_DATAFLASH	Alarm flash data	Manual
A003	ALR_OVERVOLT	Overvoltage Alarm voltage dc power	Auto [*1)
A004	ALR_OVERCURR_HW	Alarm detected by the hardware overcurrent protection	Auto [*1)
A005	ALR_OVERCURR_SW	Alarm overcurrent detected by software	Auto [*1)
A006	ALR_OVERTEMP_BOARD	Over temperature alarm control electronics	Auto [*1)
A007	ALR_OVERTEMP_HEATSINK	Over temperature alarm power electronics	Auto [*1)
A008	ALR_OVERLOAD	Alarm motor overload	Auto [*1)
A009	ALR_SPEED_TRACKING	Alarm error for speed control	Auto [*1)
A090	ALR_EXT_DIG	Forced alarm from digital input	Manual
A100	ALR_PWR_MODEL	Alarm output not recognized	Manual
A101	ALR_MOT_MODEL	Alarm motor model unknown	Manual
A102	ALR_MOT_INCOMPAT	Alarm engine incompatible with the power detected	Manual
A103	ALR_MOT_COPY	Alarm copy parameters in the motor table custom	Manual
A104	ALR_MOT_COPY_SPEED	Alarm copy motor parameters for the speed loop in custom motor	Manual
A105	ALR_1MS_OR	Alarm task execution 1ms	Manual
A106	ALR_10MS_OR	Alarm task execution 10ms	Manual
A110	ALR_PARTUNE_CURRLOOP	Alarm auto-tuning, calibration loop current	Manual
A111	ALR_PARTUNE_RS_ESTIM	Alarm auto-tuning, estimated Rs	Manual
A112	ALR_PARTUNE_LM_ESTIM	Alarm auto-tuning, estimate Lm	Manual
A113	ALR_PARTUNE_TAUROT_EST	Alarm auto-tuning, estimate TauRot	Manual
A114	ALR_PARTUNE_PARSAVE	Alarm auto-tune, saving parameters	Manual

[*1) for automatically resettable fault are allowed a maximum of P210 reset attempts after which the alarm must be reset manually.

8.1 KEYPAD WARNING TABLE

The following table shows the messages can be displayed on keypad during normal operation.

#	Description	Return Condition
E001	Under voltage, the supply voltage is below the minimum Because the operation is disabled, the keypad will display "E001" permanently	Supply voltage greater than the minimum required
E002	Overload: the motor is working more than the nominal conditions; according to the parameters defined, the persistence of the alarm overload can lead to overload or derating	Motor load is reduced below the nominal

9. CANopen DS402

9.1 OBJECTS TABLE

The following table shows the list of the CANopen objects implemented in Motovario Drivon system; for objects 1000h ... 5FFFh refer to CiA DS301, while the objects 6000h ... 7FFFh refer to CiA DS402, profile velocity mode.

The parameters are mapped to addresses from 2000h to 21FFh, as represented for the interface to PC BSI and then indicated in the file MsD_ Params.xml.

Please note that all parameters can be read, but [as with the numeric keypad) only as USER or ADVANCE [in writing) can be modified by the CANopen as it does not require a password.
Please note that not all parameters affect the operation of the CANopen as similar functionality is already provided for compulsory registers DSP402.

Index	Sub	Object	Description	Unit	Access	Type
1000h	0	Device Type	Device type as DS301/DSP402		RO	U32
1001h	0	Error Register	Error register bit0: pending alarm bit1: current alarm bit2: tension alarm bit3: temperature alarm		RO	U8
1003h	ARR	Pre-defined error	Error signaled by EMCY service			U8
	0	Number of errors	Number of signaled EMCY; write = to clear		RW	U8
	1	Error code	Most recent error code signaled		RO	U32
	…					
	N	Error code	Oldest error code signaled		RO	U32
100Ch	0	Guard Time	Node guarding check time	ms	RW	U16
100Dh	0	Life Factor	Node guarding life factor	units	RW	U8
1014h	0	EMCY COB-ID	Cob-id for EMCY service		RO	U32
1015h	0	EMCY Inhibit time	EMCY send minimum repeat time	100us	RW	U16
1018h	REC	Identity Object	Device information			
	0	Largest subidx	Number of elements		RO	U8
	1	Vendor ID	CiA listed manufactor ID		RO	U32
	2	Product Code	Product identification code		RO	U32
	3	SW Revision	Software edition code		RO	U32
	4	Serial number	Device serial number		RO	U32
1400h … 1403h	REC	PDO Com. Params	Receive PDO 1 … 4 communication parameters			
	0	Largest subidx	Number of elements		RO	U8
	1	COB-ID	RxPDO identifier [see Cobid section)		RW	U32

Index	Sub	Object	Description	Unit	Access	Type
	2	Transmission Type	RxPDO transmission type [see transmit type section)		RW	U8
	3	Not used			-	-
	4	Reserved			-	-
	5	Not used			-	-
1600h … 1603h	REC	PDO Rx Mapping	Receive PDO 1 … 4 mapping configuration [see PDO Mapping section)			
	0	Largest subidx	Number of elements		RO	U8
	1	Mapped object	1st mapped object/subindex		RW	U32
	...					
	8	Mapped object	8th mapped object/subindex		RW	U32
1800h … 1803h	REC	PDO Com. Params	Transmit PDO 1 … 4 communication parameters			
	0	Largest subidx	Number of elements		RO	U8
	1	COB-ID	TxPDO identifier [see Cobid section)		RW	U32
	2	Transmission Type	TxPDO transmission type [see transmit type section)		RW	U8
	3	Inhibit Time	Minimum time between async transmission	100us	RW	U16
	4	Reserved			-	-
	5	Event Time	Cyclical transmission type for async tx pdo	1ms	RW	U16
1A00h… 1A03h	REC	PDO Tx Mapping	Transmit PDO 1 … 4 mapping configuration [see PDO Mapping section)			
	0	Largest subidx	Number of elements		RO	U8
	1	Mapped object	1st mapped object/subindex		RW	U32
	...					
	8	Mapped object	8th mapped object/subindex		RW	U32
2000h	0	Parameter	Access to parameter [Index – 2000h)		RW	S16
2001h	0	Parameter	Access to parameter [Index – 2000h) P001 List values: see parameter table above		RW	S16
2002h	0	Parameter	Access to parameter [Index – 2000h) P002 List values: see parameter table above		RW	S16
2003h	0	Parameter	Access to parameter [Index – 2000h) P003 List values: see parameter table above		RW	S16
2004h	0	Parameter	Access to parameter [Index – 2000h) P004 Numeric value. Unity:0.1		RW	S16
2005h	0	Parameter	Access to parameter [Index – 2000h) P005 Numeric value. Unity:0.1		RW	S16

Index	Sub	Object	Description	Unit	Access	Type
2006h	0	Parameter	Access to parameter [Index – 2000h) P006 Numeric value. Unity:0.1		RW	S16
2007h	0	Parameter	Access to parameter [Index – 2000h) P007 Numeric value. Unity:0.1		RW	S16
2008h	0	Parameter	Access to parameter [Index – 2000h) P008 Numeric value. Unity:0.1		RW	S16
2009h	0	Parameter	Access to parameter [Index – 2000h) P009 Numeric value. Unity:0.1		RW	S16
200Ah	0	Parameter	Access to parameter [Index - 2000h) P010 List values: see parameter table above		RW	S16
200Bh	0	Parameter	Access to parameter [Index - 2000h) P011 List values: see parameter table above		RW	S16
200Ch	0	Parameter	Access to parameter [Index - 2000h) P012 List values: see parameter table above		RW	S16
200Dh	0	Parameter	Access to parameter [Index - 2000h) P013 List values: see parameter table above		RW	S16
200Eh	0	Parameter	Access to parameter [Index – 2000h) P014 List values: see parameter table above		RW	S16
200Fh	0	Parameter	Access to parameter [Index - 2000h) P015 List values: see parameter table above		RW	S16
2010h	0	Parameter	Access to parameter [Index - 2000h) P016 List values: see parameter table above		RW	S16
2011h	0	Parameter	Access to parameter [Index – 2000h) P017 Numeric value. Unity:0.1		RW	S16
2012h	0	Parameter	Access to parameter [Index – 2000h) P018 Numeric value. Unity:0.1 Negative values are calculated as two's complement		RW	S16
2013h	0	Parameter	Access to parameter [Index - 2000h) P019 List values: see parameter table above		RO	S16
2014h	0	Parameter	Access to parameter [Index – 2000h) P020 Numeric value. Unity:0.1		RW	S16
2015h	0	Parameter	Access to parameter [Index – 2000h) P021 Numeric value. Unity:0.1		RW	S16
2016h	0	Parameter	Access to parameter [Index – 2000h) P022 Numeric value. Unity:0.1		RW	S16
2017h	0	Parameter	Access to parameter [Index – 2000h) P023 Numeric value. Unity:0.1		RW	S16
2018h	0	Parameter	Access to parameter [Index – 2000h) P024 Numeric value. Unity:0.1		RW	S16
2019h	0	Parameter	Access to parameter [Index – 2000h) P025 Numeric value. Unity:0.1		RW	S16
201Ah	0	Parameter	Access to parameter [Index – 2000h) P026 Numeric value. Unity:0.1		RW	S16
201Bh	0	Parameter	Access to parameter [Index – 2000h) P027 Numeric value. Unity:0.1		RW	S16
201Ch	0	Parameter	Access to parameter [Index – 2000h) P028 Numeric value. Unity:0.1		RW	S16
201Dh	0	Parameter	Access to parameter [Index – 2000h) P029 Numeric value. Unity:0.1		RW	S16

Index	Sub	Object	Description	Unit	Access	Type
201Eh	0	Parameter	Access to parameter [Index – 2000h) P030 Numeric value. Unity:0.1		RW	S16
201Fh	0	Parameter	Access to parameter [Index – 2000h) P031 Numeric value. Unity:0.1		RW	S16
2020h	0	Parameter	Access to parameter [Index – 2000h) P032 Numeric value. Unity:0.1		RW	S16
2021h	0	Parameter	Access to parameter [Index – 2000h) P033 Numeric value. Unity:0.1		RW	S16
2022h	0	Parameter	Access to parameter [Index – 2000h) P034 Numeric value. Unity:0.1		RW	S16
2023h	0	Parameter	Access to parameter [Index – 2000h) P035 Numeric value. Unity:0.1		RW	S16
2024h	0	Parameter	Access to parameter [Index - 2000h) P036 List values: see parameter table above		RW	S16
2025h	0	Parameter	Access to parameter [Index – 2000h) P037 Numeric value. Unity:0.01		RW	S16
2026h	0	Parameter	Access to parameter [Index – 2000h) P038 Numeric value. Unity:0.1		RW	S16
2027h	0	Parameter	Access to parameter [Index – 2000h) P039 Numeric value. Unity:0.001		RW	S16
2028h	0	Parameter	Access to parameter [Index – 2000h) P040 Numeric value. Unity:0.001		RW	S16
2029h	0	Parameter	Access to parameter [Index – 2000h) P041 Numeric value. Unity:0.1		RW	S16
202Ah	0	Parameter	Access to parameter [Index – 2000h) P042 Numeric value. Unity:0.1		RW	S16
202Bh	0	Parameter	Access to parameter [Index - 2000h) P043 List values: see parameter table above		RW	S16
202Ch	0	Parameter	Access to parameter [Index – 2000h) P044 Numeric value. Unity:0.01		RW	S16
202Dh	0	Parameter	Access to parameter [Index – 2000h) P045 Numeric value. Unity:0.01		RW	S16
202Eh	0	Parameter	Access to parameter [Index – 2000h) P046 Numeric value. Unity:0.1		RW	S16
202Fh	0	Parameter	Access to parameter [Index – 2000h) P047 Numeric value. Unity:0.01		RW	S16
2030h	0	Parameter	Access to parameter [Index – 2000h) P048 Numeric value. Unity:0.1		RW	S16
2031h	0	Parameter	Access to parameter [Index – 2000h) P049 Numeric value. Unity:0.1		RW	S16
2032h	0	Parameter	Access to parameter [Index – 2000h) P050 Numeric value. Unity:0.1		RW	S16
2033h	0	Parameter	Access to parameter [Index – 2000h) P051 Numeric value. Unity:0.01		RW	S16
2034h	0	Parameter	Access to parameter [Index - 2000h) P052 List values: see parameter table above		RW	S16
2035h	0	Parameter	Access to parameter [Index – 2000h) P053 Numeric value. Unity:0.1		RW	S16

Index	Sub	Object	Description	Unit	Access	Type
2036h	0	Parameter	Access to parameter [Index - 2000h) P054 List values: see parameter table above		RO	S16
2037h	0	Parameter	Access to parameter [Index – 2000h) P055 Numeric value. Unity:1		RO	S16
2038h	0	Parameter	Access to parameter [Index - 2000h) P056 List values: see parameter table above		RW	S16
2039h	0	Parameter	Access to parameter [Index – 2000h) P057 Numeric value. Unity:0.1		RW	S16
203Ah	0	Parameter	Access to parameter [Index – 2000h) P058 Numeric value. Unity:0.1		RW	S16
203Bh	0	Parameter	Access to parameter [Index – 2000h) P059 Numeric value. Unity:0.1		RW	S16
203Ch	0	Parameter	Access to parameter [Index – 2000h) P060 Numeric value. Unity:0.1		RW	S16
203Dh	0	Parameter	Access to parameter [Index – 2000h) P061 Numeric value. Unity:0.1		RW	S16
203Eh	0	Parameter	Access to parameter [Index – 2000h) P062 Numeric value. Unity:0.1		RW	S16
203Fh	0	Parameter				
2040h	0	Parameter	Access to parameter [Index – 2000h) P064 Numeric value. Unity:0.1		RW	S16
2041h	0	Parameter	Access to parameter [Index – 2000h) P065 Numeric value. Unity:0.1		RW	S16
2042h	0	Parameter	Access to parameter [Index – 2000h) P066 Numeric value. Unity:0.1		RW	S16
2043h	0	Parameter	Access to parameter [Index – 2000h) P067 Numeric value. Unity:0.1		RW	S16
2044h	0	Parameter	Access to parameter [Index - 2000h) P068 List values: see parameter table above		RW	S16
2045h	0	Parameter	Access to parameter [Index – 2000h) P069 Numeric value. Unity:0.1		RW	S16
2046h	0	Parameter	Access to parameter [Index – 2000h) P070 Numeric value. Unity:0.1		RW	S16
2047h	0	Parameter	Access to parameter [Index – 2000h) P071 Numeric value. Unity:0.1		RW	S16
2048h	0	Parameter	Access to parameter [Index – 2000h) P072 Numeric value. Unity:0.1		RW	S16
2049h	0	Parameter	Access to parameter [Index - 2000h) P073 List values: see parameter table above		RW	S16
204Ah	0	Parameter	Access to parameter [Index – 2000h) P074 Numeric value. Unity:1		RW	S16
204Bh	0	Parameter	Access to parameter [Index – 2000h) P075 Numeric value. Unity:1		RW	S16
204Ch	0	Parameter	Access to parameter [Index – 2000h) P076 Numeric value. Unity:1		RW	S16
204Dh	0	Parameter				
204Eh	0	Parameter	Access to parameter [Index – 2000h) P078 Numeric value. Unity:0.1		RW	S16

Index	Sub	Object	Description	Unit	Access	Type
204Fh	0	Parameter	Access to parameter [Index – 2000h) P079 Numeric value. Unity:0.1		RW	S16
2050h	0	Parameter	Access to parameter [Index - 2000h) P080 List values: see parameter table above		RO	S16
2051h	0	Parameter	Access to parameter [Index - 2000h) P081 List values: see parameter table above		RO	S16
2052h	0	Parameter	Access to parameter [Index - 2000h) P082 List values: see parameter table above		RW	S16
2053h	0	Parameter	Access to parameter [Index – 2000h) P083 Numeric value. Unity:0.1		RW	S16
2054h	0	Parameter	Access to parameter [Index – 2000h) P084 Numeric value. Unity:0.1		RW	S16
2055h	0	Parameter	Access to parameter [Index – 2000h) P085 Numeric value. Unity:0.1		RW	S16
2056h	0	Parameter	Access to parameter [Index – 2000h) P086 Numeric value. Unity:0.1		RW	S16
2057h	0	Parameter	Access to parameter [Index – 2000h) P087 Numeric value. Unity:0.1		RW	S16
2058h	0	Parameter	Access to parameter [Index – 2000h) P088 Numeric value. Unity:0.1		RW	S16
2059h	0	Parameter	Access to parameter [Index – 2000h) P089 Numeric value. Unity:0.1		RW	S16
205Ah	0	Parameter	Access to parameter [Index – 2000h) P090 Numeric value. Unity:0.1		RW	S16
...						
2096h	0	Parameter	Access to parameter [Index - 2000h) P150 List values: see parameter table above		RO	S16
2097h	0	Parameter	Access to parameter [Index - 2000h) P151 List values: see parameter table above		RO	S16
2098h	0	Parameter	Access to parameter [Index – 2000h) P152 Numeric value. Unity:0.01		RO	S16
2099h	0	Parameter	Access to parameter [Index – 2000h) P153 Numeric value. Unity:1		RO	S16
209Ah	0	Parameter	Access to parameter [Index – 2000h) P154 Numeric value. Unity:0.01		RO	S16
209Bh	0	Parameter	Access to parameter [Index – 2000h) P155 Numeric value. Unity:0.01		RO	S16
209Ch	0	Parameter	Access to parameter [Index – 2000h) P156 Numeric value. Unity:0.01		RO	S16
209Dh	0	Parameter	Access to parameter [Index – 2000h) P157 Numeric value. Unity:0.01		RO	S16
209Eh	0	Parameter	Access to parameter [Index – 2000h) P158 Numeric value. Unity:0.001		RO	S16
209Fh	0	Parameter	Access to parameter [Index – 2000h) P159 Numeric value. Unity:0.001		RO	S16
20A0h	0	Parameter	Access to parameter [Index – 2000h) P160 Numeric value. Unity:0.1		RO	S16
20A1h	0	Parameter	Access to parameter [Index – 2000h) P161 Numeric value. Unity:0.01		RW	S16

Index	Sub	Object	Description	Unit	Access	Type
20A2h	0	Parameter	Access to parameter [Index – 2000h) P162 Numeric value. Unity:0.01		RW	S16
...						
20AAh	0	Parameter	Access to parameter [Index - 2000h) P170 List values: see parameter table above		RO	S16
...						
20B5h	0	Parameter	Access to parameter [Index - 2000h) P181 List values: see parameter table above		RW	S16
20B6h	0	Parameter	Access to parameter [Index – 2000h) P182 Numeric value. Unity:1		RW	S16
20B7h	0	Parameter	Access to parameter [Index - 2000h) P183 List values: see parameter table above		RW	S16
20B8h	0	Parameter	Access to parameter [Index - 2000h) P184 List values: see parameter table above		RW	S16
...						
20BEh	0	Parameter	Access to parameter [Index - 2000h) P190 List values: see parameter table above		RW	S16
20BFh	0	Parameter	Access to parameter [Index – 2000h) P191 Numeric value. Unity:1		RW	S16
20C0h	0	Parameter	Access to parameter [Index - 2000h) P192 List values: see parameter table above		RW	S16
...						
20C8h	0	Parameter	Access to parameter [Index – 2000h) P200 Numeric value. Unity:1		RO	S16
20C9h	0	Parameter	Access to parameter [Index – 2000h) P201 Numeric value. Unity:1		RO	S16
20CAh	0	Parameter	Access to parameter [Index - 2000h) P202 List values: see parameter table above		RW	S16
..						
20D2h	0	Parameter	Access to parameter [Index – 2000h) P210 Numeric value. Unity:1		RW	S16
20D3h	0	Parameter	Access to parameter [Index – 2000h) P211 Numeric value. Unity:0.1		RW	S16
20D4h	0	Parameter	Access to parameter [Index – 2000h) P212 Numeric value. Unity:0.1		RW	S16
...						
20DCh	0	Parameter	Access to parameter [Index – 2000h) P220 Numeric value. Unity:0.1		RW	S16
20DDh	0	Parameter	Access to parameter [Index – 2000h) P221 Numeric value. Unity:0.1		RW	S16
20DEh	0	Parameter	Access to parameter [Index – 2000h) P222 Numeric value. Unity:0.1		RW	S16
20DFh	0	Parameter	Access to parameter [Index – 2000h) P223 Numeric value. Unity:0.1		RW	S16
...						

Index	Sub	Object	Description	Unit	Access	Type
21FFh	0	Parameter	Access to parameter P511 [*1)		RW	S16
3000h	0	Ain0	Analog input 0: range mapping: 0%...100% >> 0 … 32767		RO	S16
3001h	0	Ain1	Analog input 1 range mapping: 0%...100% >> 0 … 32767		RO	S16
3002h	0	Ain2	Analog input 2 range mapping: 0%...100% >> 0 … 32767		RO	S16
3003h	0	Pot	Potentiometer value range mapping: 0%...100% >> 0 … 32767		RO	S16
3004h	0	TBoard	Logic board temperature	0.1°C	RO	S16
3005h	0	THeatsink	Power board temperature	0.1°C	RO	S16
3006h	0	Pel	Delivered electric power	W	RO	S16
6040h	**0**	**Control Word**	Dsp402 Control word 0 = Standby / Shut down 1 = Disable voltage / Enable voltage 2 = Rapid stop / Enable operation 3 = Enable / Disable operation 4 = Rapid stop / No rapid stop 5 = Stop run-up encoder / Enable run-up encoder 6 = Disable / Enable setpoint 7 = 0 / Acknowledge fault 8 = Reserved 9 = Reserved 10 = Reserved 11 = Rotation right / Rotation left 12 = Reserved 13 = Reserved 14 = Reserved 15 = Reserved		RW	U16
6041h	**0**	**Status Word**	Dsp402 Status word 0 = Not on standby /Standby 1 = Not ready / Ready 2 = Operation disabled / Enabled 3 = No fault / Fault 4 = Voltage enabled / Voltage disabled 5 = Rapid stop active / No rapid stop 6 = No switch-on lock / Switch-on lock 7 = No warning / Warning 8 = Reserved 9 = Local control / Bus control 10 = Setpoint not reached / Setpoint reached 11 = Setpoint not limited / Setpoint limited 12 = Reserved 13 = Reserved 14 = Reserved 15 = Reserved		RO	U16

Index	Sub	Object	Description	Unit	Access	Type
6042h	**0**	**vl_target_velocity**	Velocity mode target speed	rpm	RW	S16
6043h	**0**	**vl_velocity_demand**	Velocity mode demand value [speed reference after ramp generation)	rpm	RO	S16
6044h	**0**	**vl_control_effort**	Velocity mode actual speed value - In forward direction value is positive - in Reward direction value is negative	rpm	RO	S16
6046h	**ARR**	**vl_minmax_amount**	Velocity mode saturation values			
	0	**Largest subidx**	Number of elements		RO	U8
	1	**vl_min_amount**	Velocity mode min target speed	rpm	RO	U32
	2	**vl_max_amount**	Velocity mode max target speed	rpm	RO	U32
6048h	**ARR**	**vl_velocity_acceleration**	Velocity mode acceleration			
	0	**Largest subidx**	Number of elements		RO	U8
	1	**Delta_speed**	Delta speed for defining acceleration	rpm	RW	U32
	2	**Delta_time**	Delta time for defining acceleration	S	RW	U16
6049h	**ARR**	**vl_velocity_deceleration**	Velocity mode deceleration			
	0	**Largest subidx**	Number of elements		RO	U8
	1	**Delta_speed**	Delta speed for defining deceleration	rpm	RW	U32
	2	Delta_time	Delta time for defining deceleration	S	RW	U16
605Ah	**0**	**Quickstop_option_code**	Quickstop option code 2 = QUICKSTOP 6 = QUICKSTOP_AND_STAY		RW	U16
6060h	**0**	**Mode_of_operation**	Dsp402 mode of operation 1= VelocityMode		RW	U16
6061h	**0**	**Mode_of_operation_ display**	Dsp402 mode of operation display 1= VelocityMode		RO	U16
6064h	**0**	**Actual position**	Dsp402 actual position of the motor shaft		RO	U32
6075h	**0**	**Actual motor current**	Dsp402 output current to the motore	A	RO	U32
6076h	**0**	**Actual torque**	Dsp402 motor torque	Nm	RO	U32
6077h	**0**	**Actual torque percentage**	Dsp402 motor torque as percentage of the nominal	%	RO	U32
6078h	**0**	**Actual current percentage**	Dsp402 output current percentage	%	RO	U32
6079h	**0**	**Dc link circuit voltage**	Dsp402 dc link circuit voltage		RO	U32
60FDh	**0**	**Digital Inputs**	Digital input image object bit0 … bit15: reserved bit16: DIN1 bit17: DIN2 bit18: DIN3 bit19: DIN4 bit20 … bit 31: reserved		RO	U32

Index	Sub	Object	Description	Unit	Access	Type
60FEh	**REC**	**Digital Outputs**	Digital output image object			
	0	**Largest subidx**	Number of elements		RO	U8
	1	**OutputImage**	Output image: bit0 … bit15: reserved bit16: DOUT1 bit17 … bit31: reserved Note: output will change only if corresponding bit in OutputMask is set.		RW	U32
	2	**OutputMask**	Output image mask: bit0 … bit15: reserved bit16: DOUT1 mask bit17 … bit31: reserved		RW	U32

[*1) See parameter list for meaning, unit measure and access level.

10. MODBUS RTU

10.1 REGISTERS TABLE

Using the Modbus RS485 you can read some of the inverter measures and give some commands.

Parameters access mode:
- R/W: the parameter can be read and written
- R: the parameter can be read only

The hexadecimal addresses are indicated by the letter 'h'; 1000h = 4096

Address Modbus	Default	Access	Description
4096 - 1000h	[*1)	R	Analog Input Value AIN0 0.0 … 1.0 ⟶ 0 … 32767
4097 - 1001h	[*1)	R	Analog Input Value AIN1 0.0 … 1.0 ⟶ 0 … 32767
4098 - 1002h	[*1)	R	Analog Input Value AIN2 0.0 … 1.0 ⟶ 0 … 32767
4099 - 1003h	[*1)	R	State Potentiometer 0.0 … 1.0 ⟶ 0 … 32767
4100 - 1004h	[*1)	R	Temperature value of the card [0.1 of degree)
4101 - 1005h	[*1)	R	Value heatsink temperature [0.1 of degree)
4112 - 1010h	[*1)	R	Status of digital inputs: bit0: IN1 bit1: IN2 bit2: IN3 bit3: IN4 bit4 … 15: not used
4113 - 1011h	0000h	R/W	State Digital Output bit0: OUT1 bit1 … bit15: not used NOTE: You must "P015 = 16" to set the digital output via Modbus RTU
4114 - 1012h	0000h	R	Torque currently delivered in thousandths of the nominal motor
4115 - 1013h	0000h	R	Rms current at the inverter output, in hundredths of Ampere

Address Modbus	Default	Access	Description
4116 - 1014h	0000h	R	DC bus voltage, in tenths of volt
4128 - 1020h	0000h	R/W	Target speed [rpm] NOTE: You must "P001 = 8" to adjust the setpoint from Modbus RTU
4129 - 1021h	0000h	R	Target speed upstream of the ramps [rpm] - Forward into the reading is positive - To reverse the value is negative
4130 - 1022h	0000h	R	Target speed downstream of the ramps [rpm] - Forward into the reading is positive - To reverse the value is negative
4131 - 1023h	0000h	R	Actual motor speed [rpm] - Forward into the reading is positive - To reverse the value is negative
4132 - 1024h	0000h	R	State of the trajectory generator 0 = OFF: I am not enabled ENABLED = 1: enabled and I'm waiting to run 2 = HALTED: inverter active, a zero reference 3 = ACCEL: inverter acceleration 4 = DECEL: inverter deceleration 5 = STEADY: drive at a constant speed 6 = STOPPING: drive is stopped by switching off
4133 - 1025h	0000h	R/W	Run command from the Modbus bit0: run by Modbus bit 1: Reverse direction [0 = fwd, rev = 1) bit 2 ... Bit 15: Not used NOTE: You must "P002 = 3" in order to give the RUN via Modbus RTU
4144 - 1030h	0000h	R	Alarm current 0 = no alarm pendant 1 ... 255 = current alarm code [see list alarms)
4145 - 1031h	0000h	R/W	Alarm reset command from the Modbus bit 0: alarm reset [reset = 1) ... bit15 bit 1: not used **NOTE: the reset occurs on the rising edge of bit0**
8192 - 8703 2000h…21FFh	xxxx	R/W [*2)	Gateway parameters: register 2001h >> parameter P001 register 2002h >> parameter P002 ... register 2046h >> parameter P070 ...

(*1): The initial value depends on the physical state of the channel

(*2): the range of possible values depends on the particular parameter; Refer a similar function to access parameters for CANopen.

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