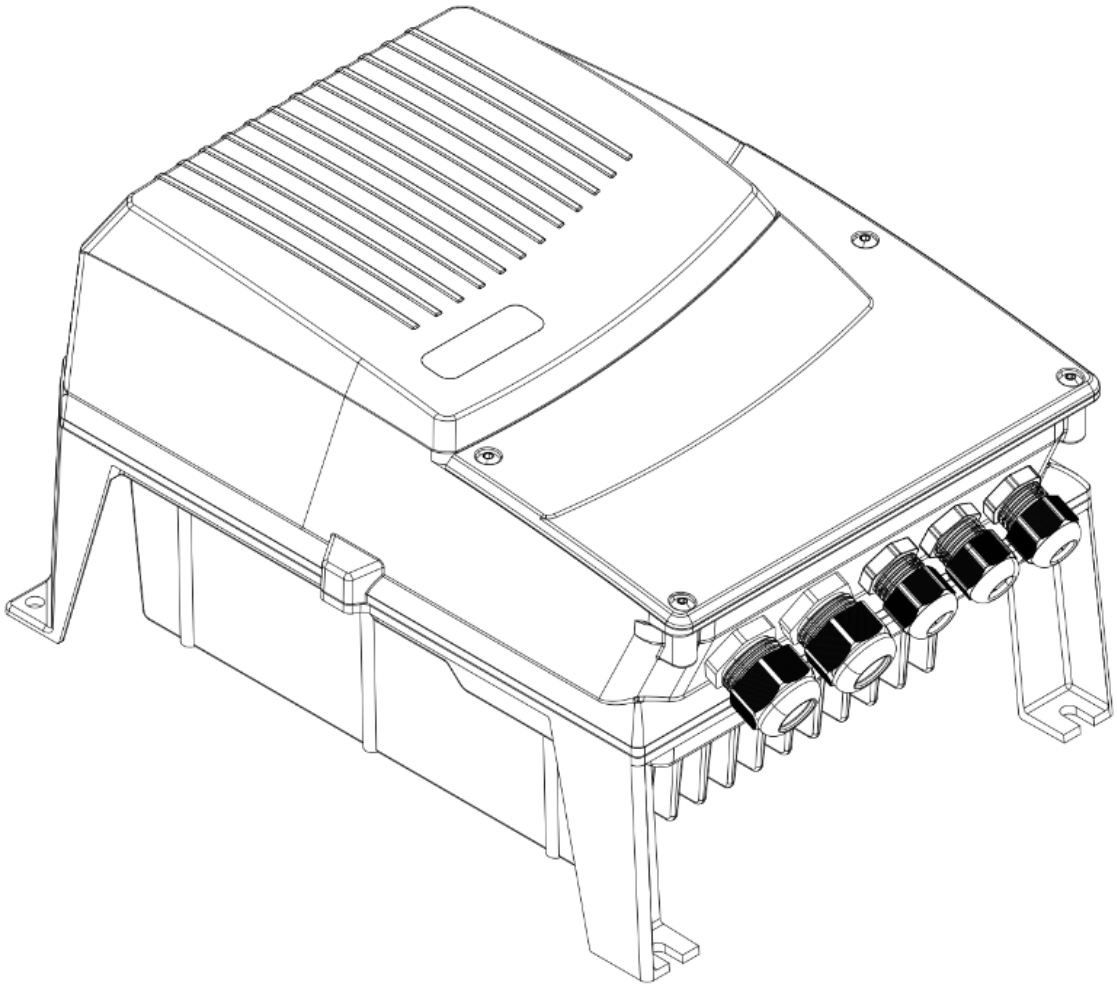
SPEED DRIVE 2.2KW



QUICK GUIDE

KMD2-0011

Rev.1.0 05/2024

KELD

1. INTRODUCTION.

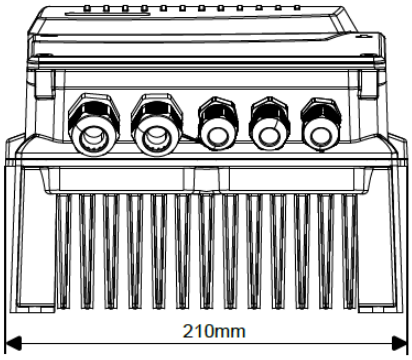
The KMD2 is a wall or cabinet mountable drive for controlling permanent magnet motors. This quick guide provides information for safe installation and commissioning of the frequency inverter.

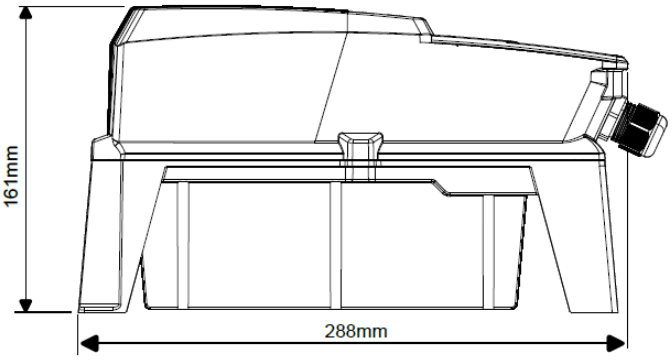
2. TECHNICAL DATA.

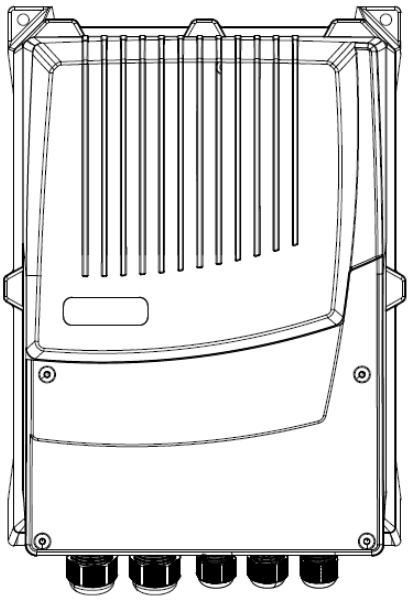
Power supply		
Power size	kW	2.2
Horsepower	Hp	3
Efficiency	%	>94%
Voltage	VAC	1x230Vac ±10%
Frequency	Hz	50/60
Max.imbalance voltage	%	±2
Supply current (max)	Arms	12
Power Factor		>0.99 (Active PFC)
Switching on supply voltage		Once every 2 minutes
Conductor cross-section	mm^2	1.5-2.5
Motor output		
Nominal shaft motor power	kW	2.2
Max.output voltage	Vac	3 x 265Vac
Max.output current	Arms	8.4
Frequency	Hz	0-400Hz
Environment		
Operational ambient temp.	°C	-20 ...40 (frost and condensation free)
Storage ambient temp.	°C	-40 ...60
Humidity	%	10...90 (non-condensing)
Maximum altitude	m	2000 (Derate above 1000m: 1% / 100m)
Protection rating		IP 66
Protection		
Input fuse (internal)	A	None
Impulse protection (internal)	kV	±1.0 (VDR protection)
Output protection		Short-circuit protection between phases
Overload protection		Power and current input, current ouput and temperature (derating)
Control Board		
Num. Digital Inputs		2
Digital Input Function		Start-stop, Reverse, Enable, Backup
Relay output rated load		250Vac 5A (2A inductive)
Num. Analog Inputs		1
Auxiliary voltage output	V	10
Auxiliary output max. current	mA	7.3
Analog Input type	V	0-10V (max.30Vdc)
Analog Input impedance	kΩ	20
Communication		RS-485-RTU
Conductor cross-section	mm^2	0.2-1.5

3. INSTALLATION

3.1. MECHANICAL DIMENSIONS

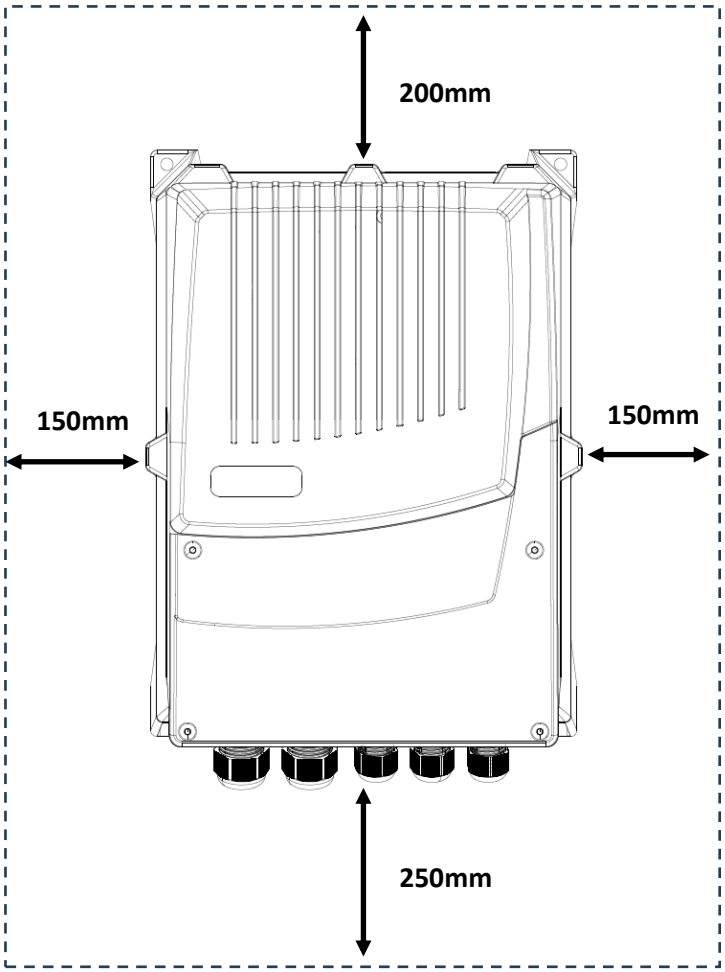






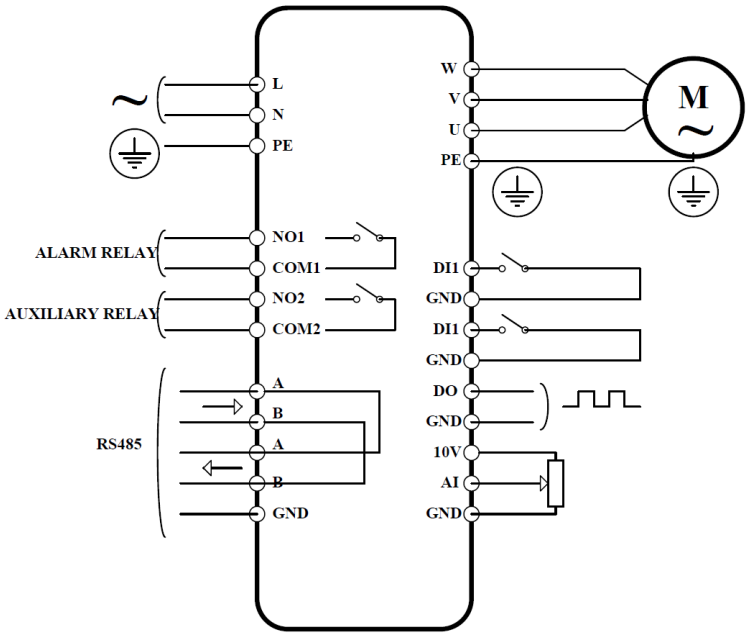
3.2. SAFETY INSTALLATION

- The drive must only be installed by qualified personnel.
- Never work on the drive, motor cable or motor when input power is applied. After disconnecting the input power, always wait for 5 minutes to let the intermediate circuit capacitors discharge before you start working on the drive, motor or motor cable.
- When the drive is connected to the mains, there is a risk that the motor could start unintentionally, causing a risk of dangerous situations and personal injuries.
- Before connecting mains voltage, drive, motor and fan components must be properly fitted, and covers and cable glands must be properly fitted and closed.
- Do not mount the drive on a flammable base.
- The mounting location should be free from vibration.
- Do not mount the drive in any area with humidity, corrosive airborne chemicals or potentially dangerous dust particles.
- Avoid mounting close to high heat sources or direct sunlight.
- The mounting location must be free from condensation
- Correct air clearance around the drive must be observed.

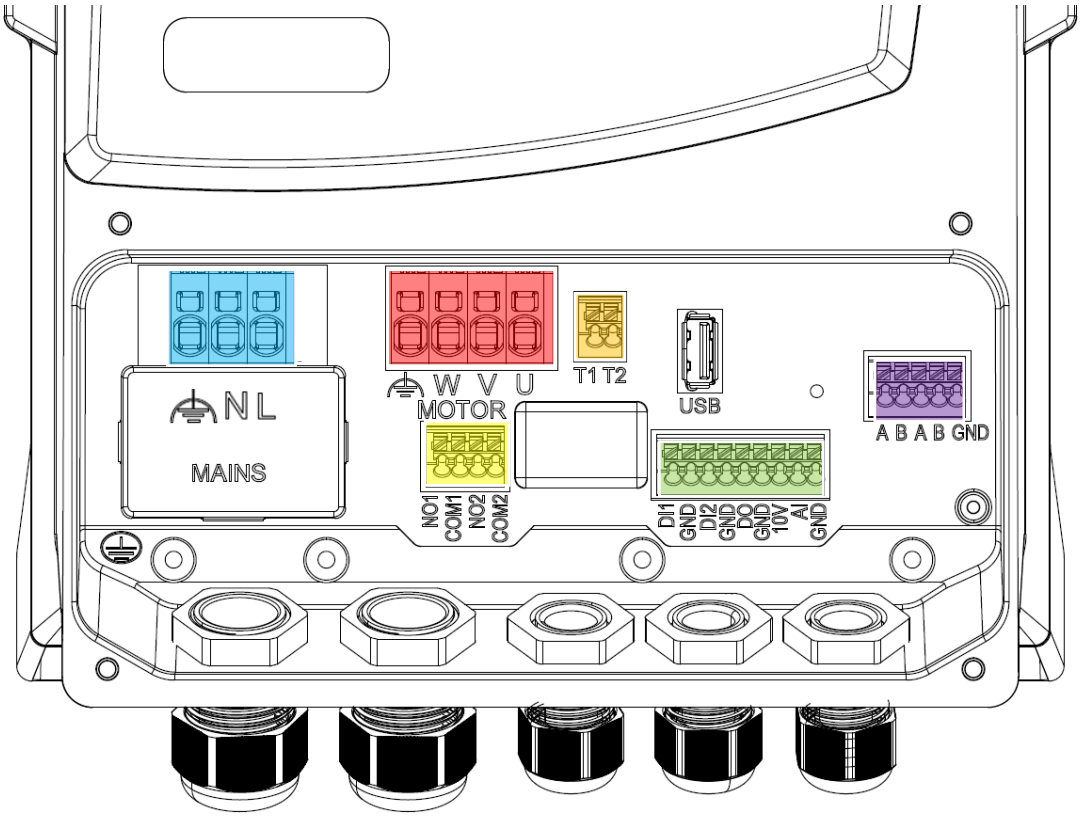


4. ELECTRICAL INSTALLATION

4.1. APPLICATION SCHEMATIC



4.2. CONNECTION DIAGRAM



Mains Power	
⏚	Earth
L	Mains Line
N	Mains Neutral
Motor Output	
⏚	Earth
W	W phase
V	V Phase
U	U Phase
Temperature sensor	
T1	Motor temperature sensor PT100 /PTC /Clixon
T2	Motor temperature sensor PT100 /PTC /Clixon
Relay Output	
NO1	Normally open alarm relay
COM1	Common alarm relay
NO2	Normally open auxiliary relay
COM2	Common auxiliary relay
I/O Connector	
DI1	Digital input 1
GND	Digital input 1 common
DI2	Digital input 2
GND	Digital input 2 common
DO	Digital output
GND	Digital output common
10V	+10V reference voltage
AI	Analog Input (0-10V)
GND	Analog Input common
Communication	
A	A RS485 signal
B	B RS485 signal
A	A RS485 signal
B	B RS485 signal
GND	RS485 common

4.3. PROTECTIVE EARTH CONNECTION

- Ground terminal PE must always be grounded.
- The leakage current generates in the ground connection is less than 3.5mA so it is not necessary to take reinforced grounding as indicated by EN/IEC61800-5-1.
- The diameter of the ground terminal must be at least equal than the diameter of the phase conductor.
- The motor ground must be connected to its dedicated ground connection.
- If a residual current device (RCD) is used for extra personal protection:
    - Use only RCD of Type B (detect AC and DC currents)
    - Use RCDs with an inrush delay may be necessary.
    - Dimension RCDs according to the system configuration and environmental considerations.
    - We advise to protect each drive with a separate RCD.
- Protective earthing of the drive in combination with the use of RCDs must always performed in accordance with applicable local and international standards and directives.

4.4. POWER SUPPLY CONNECTION

- Dimension the input power cables according to local regulations.
- Min. and max. wire section:
    - Spring-loaded push-in clamp, suitable for 0.25 mm^2 - 24 AWG up to 6 mm^2 - 8AWG
    - Recommended cable section 2.5mm2 AWG14
    - Use a bladed screwdriver, 0.6x3.5 mm max, to unlock
- The cable must be rated for at least 70ºC maximum permissible temperature of the conductor in continuous use.
- The conductivity of the PE conductor must be at least equal to that the phase conductor (same cross-sectional area)
- A shielded symmetrical cable is recommended.
- The assigned cable gland is M20 for cable diameters from 7 to 13mm.

4.5. MOTOR CONNECTION

- The motor cable must be connected to the terminals marked ‘U’, ‘V’, ‘W’ and ‘PE’.
- The motor ground must be connected to its dedicated ground connection.
- To meet the EMC requirements keep the motor cable as short as possible (less than 2.5m).
- A shielded symmetrical cable is recommended.
- The assigned cable gland is M20 for cable diameters from 7 to 13mm.

4.6. CONTROL TERMINAL CONNECTIONS

- Min. and max. wire section:
  - 0.2 - 1.5 mm^2 (24 - 16 AWG) solid or stranded cable.
- Do not reverse the input signal or connect the +10V to signal ground. The drive could be damaged.
- Do not apply signals with voltage outside the indicated limits, the drive could be damaged.
- Shielded cable is not necessary for I/O signal and communication cables. Twisted pair cables are recommended.
- Power and Control Signal cables should be routed separately where possible, and must not be routed parallel to each other.
- The assigned cable gland is M16 for cable diameters from 5 to 9mm.

4.7. EMC COMPLIANT INSTALLATION

- All models have built-in EMC filter.
- Always use shielded cables for Supply cable.
- Shielded cable is not necessary for I/O signal and communication cables.
- The auxiliary voltage output (10V) is not intended to be used as a power supply for other products, if used, the driver might not fulfill the EMC regulations.
- To comply with C1 category emissions an external filter may be required. The cable between the filter and the driver should be as short as possible.
- In a domestic environment this product may cause radio interference in which case supplementary mitigation measures may be required.
-

4.8. CIRCUIT BREAKER SELECTION

- Provide overload protection to avoid overheating of the cables in the installation. Overcurrent protection must always be carried out according to local and national regulations.
- The 1- phase models have an integrated power factor correction module, which gives the following advantages:
  - Increase in inverter power factor.
  - Reduction of RMS input current.
  - Reduction of voltage distortion in the supply network.
  - Increase of the useful life of the bus capacitors.
  - Reduction of harmonic current distortion, these models complies with EN 61000-3-2 class A.
  - Reduction of losses due to overheating due to high current peaks.
  - Avoid oversizing in protection devices.
- If a circuit breaker is used, a MCB 16A Type B is recommended.

5. MODBUS CONFIGURATION.

- The drive can be configured via modbus rs485. The default parameters for serial communication are:
  - Baud rate 9600
  - Bit data 8
  - No parity
  - Stop bits 2
  - Drive address 1

5.1. HOLDING REGISTERS.

Par.	Description	Min.	Max.	Def.	Units
Special					
#0	**Special**	**0**	**32767**	**0**	
	Triggers special commands in the drive. This parameter is not stored in memory. It's used to restore the default firmware parameters, by writing a "2" and to reset any alarm by sending a "1".				
Application parameters					
#1	**Min. RPM**	**10**	**9000**	**200**	**rpm**
	Minimum speed at which the motor will be controlled				
#2	**Max. RPM**	**10**	**9000**	**650**	**rpm**
	Maximum speed for the motor and application				
#3	**Acceleration**	**1**	**9000**	**20**	**rpm/s**
	Determines the maximum acceleration rate that the drive will impose to the motor [rpm/s]. The correct value depends both on the motor and the load.				
#4	**Deceleration**	**1**	**9000**	**20**	**rpm/s**
	Determines the maximum deceleration rate that the drive will impose to the motor [rpm/s]. The correct value depends both on the motor and the load.				
#5	**Coast speed**	**0**	**9000**	**4500**	**rpm**
	Speed bellow which the motor will be coasting when a zero speed is set				
#6	**Resonance range [1] start**	**0**	**9000**	**4500**	**rpm**
	Configure in case of mechanical resonance; Start of the resonance band				
#7	**Resonance range [1] end**	**0**	**9000**	**4500**	**rpm**
	Configure in case of mechanical resonance; End of the resonance band				
#8	**Resonance range [2] start**	**0**	**9000**	**4500**	**rpm**
	Configure in case of mechanical resonance; Start of the resonance band				

#9	**Resonance range [2] end**	**0**	**9000**	**4500**	**rpm**
	Configure in case of mechanical resonance; End of the resonance band				
#10	**Fixed speed setting**	**0**	**9000**	**0**	**rpm**
	If fixed speed setting is selected by "input type", this speed will be the set speed as soon as the inverter is powered up.				
#11	**Speed threshold low**	**0**	**9000**	**4500**	**rpm**
	Minimum speed for PWM output mode 3				
	Sampling frequency for the motor phase current.				
I/O configuration					
#18	**Input type**	**0**	**6**	**6**	
	It configures how the speed is set: 0 -Modbus 1-Analog 2-Parameter 3-Percent 4-Not used 5-Not used 6-Analog-Backup				
#19	**Rotation**	**0**	**1**	**0**	
	Reverse the motor rotation: 0-Forward 1-Reverse				
#20	**Dig. In. config.**	**0**	**3**	**2**	
	Digital input 1 configuration: 0-None 1-Start 2-Reverse/Backup 3- Reverse/Backup, Start				
#21	**Potentiometer min**	**0**	**100**	**32**	**V*10**
	Below this voltage, the potentiometer will be considered zero				
#22	**Potentiometer max**	**0**	**100**	**100**	**V*10**
	Above this voltage, the potentiometer will be considered 10V				
#23	**Relay output**	**0**	**5**	**0**	
	Relay 1 output mode: 0-Drive running 1-Drive healthy 2-At speed 3-Faulted 4-Over threshold 5-Inside range				

#29	**Modbus ADDR**	**1**	**247**	**1**	
	Modbus address for RS485 communication, has to be unique in the bus. Communication will be lost when changed until master is configured				
#30	**Modbus Par/Stop**	**0**	**2**	**0**	
	Parity and bit stop configuration: 0-8-None-2 1-8-Odd-1 2-8-Even-1				
#31	**Baudrate**	**96**	**1152**	**1152**	**bps/100**
	Modbus baudrate: 96-9600bps 192-19200bps 384-38400bps 576-57600bps1152-115200bps				
#32	**Com timeout**	**0**	**6000**	**0**	**s**
	Communication timeout. If the inverter doesn't receive communication for this period of time, it stops the motor with an alarm				
Current / Power limits					
#37	**Max. current**	**100**	**13000**	**11000**	**mA**
	Is the maximum peak value of the line current [A]. The algorithm will never drive the motor while in closed loop over this value. If the load requires more current than the maximum, the motor speed will automatically be decreased so it's never surpassed.				
#38	**Maximum Power**	**0**	**3100**	**2550**	**W**
	Is the maximum power the Drive will allow [W], if the load on the motor increases over the maximum power, the speed will be reduced automatically. The dynamic behavior of this control loop is determined by the Power Kp and Ki ,parameters, allowing the adjustment of the overload response.				
#39	**Max PFC current**	**0**	**125**	**115**	**A*10**
	Is the maximum input current the Drive will allow, if the load on the motor increases over the maximum PFC current, the speed will be reduced automatically. The dynamic behavior of this control loop is determined by the Input current Kp and Ki parameters, allowing the adjustment of the overload response.				
Dynamics / speed stability					
#45	**Max err rpm**	**1**	**9000**	**25**	**rpm**
	Maximum allowed error between set and real speed before increasing the speed in the same sing as the error				
#46	**Speed low filter**	**0**	**500**	**100**	**s*1000**
	Speed filter constant time for low speeds				

#47	**Speed high filter**	**0**	**500**	**100**	**s*1000**
	Speed filter constant time for high speeds				
#48	**Speed Kp**	**0**	**32767**	**2500**	
	Proportional constant for the motor speed control loop				
#49	**Speed Ki**	**0**	**32767**	**1000**	
	Integral constant for the motor speed control loop				
#50	**V regen**	**100**	**400**	**200**	
	Voltage set during regeneration mode				
Motor parameters					
#56	**Pole couples**	**1**	**24**	**8**	
	Number of pairs of poles of the motor				
#57	**Stator Resistance**	**0**	**32767**	**102**	**Ω*100**
	Motor phase resistance (half of whatever is measured between two motor phases) Is best to use the value measured by the drive during tuning and not the actual motor resistance as the motor tuning will have into account also the cable and other internal errors. In some motors the stator resistance will increase due to internal heating, if this effect is very high, it can be beneficial to tune the motor a second time while it's hot				
#58	**Synch. Inductance**	**0**	**32767**	**83**	**mH*10**
	Is the motor inductance as measured by the Drive during tuning [mH]. In theory should be near $\frac{1}{2} \cdot (Ld + Lq)$ but the final value can be adjusted depending on the motor behavior at different speeds. Usually higher torque requirements will result in an inductance lower than the initial measured value.				
#59	**P.M. Flux**	**0**	**32767**	**2900**	**mWb*10**
	Is the permanent magnets flux as measured by the Drive during tuning				
#60	**Current Kp**	**0**	**32767**	**116**	
	Proportional constant of the current control loop. Is determined during the tuning stage and usually should be leaved as it is.				
#61	**Current Ki**	**0**	**32767**	**65**	
	Integral constant of the current control loop. Is determined during the tuning stage and usually should be leaved as it is.				
#62	**Startup Id reference**	**0**	**13000**	**3200**	**A*1000**
	Id reference during startup				
#63	**pll_k1**	**0**	**32767**	**100**	
	Observer Phase Locked Loop constant k1.				
#64	**pll_k2**	**0**	**32767**	**5000**	
	Observer Phase Locked Loop constant k2.				
#65	**pll_k3**	**0**	**32767**	**15**	

#66	**Kp af**	**0**	**32767**	**1600**	***100**
	Proportional gain of observer PI. Observer gains. Very small or very big gains lead to not start the motor. To check these parameters are well adjusted, both maximum speed operation and startup should be checked and run in stable way. The lower speed you want to run the motor, the lower need to be the constants.				
#67	**Ki af**	**0**	**32767**	**400**	***100**
	Integral gain of observer PI.				
#68	**Shortcircuit comps**	**0**	**1**	**1**	
	Use of the uC internal short-circuit comparators				
#69	**Block speed**	**0**	**9000**	**150**	**rpm**
	Threshold for locked rotor alarm. Speed under it is detected blocking or rotor stuck				
#70	**Rotor locked level**	**0**	**10**	**5**	**%/10**
	Ratio of max current above which the motor is considered locked				
#71	**Block alarm time**	**0**	**32767**	**200**	**s*100**
	Timeout for locked rotor alarm				
#72	**Power Kp**	**0**	**32767**	**200**	
	Power limit proportional control loop				
#73	**Power Ki**	**0**	**32767**	**50**	
	Power limit integral control loop				
#74	**Kp input current**	**0**	**32767**	**150**	
	Input current limit proportional control loop				
#75	**Ki input current**	**0**	**32767**	**12**	
	Input current limit integral control loop				
Temperature					
#81	**Sampling Freq.**	**4000**	**16000**	**13000**	**Hz**
	Frequency for current sampling, with ratio=1 it also equals the switching frequency				
#82	**Frequency reduction**	**0**	**12000**	**5000**	**Hz**
	Switching frequency reduction when motor speed increases over threshold				
#83	**Fr. red. turn on speed**	**0**	**9000**	**2000**	**rpm**
	Speed threshold over which the switching frequency will be reduced				
#84	**Temp Hyst.**	**0**	**200**	**100**	**ºC*10**
	Hysteresis for all temperature alarms				
#85	**Derating margin**	**10**	**1000**	**50**	**ºC*10**

#86	**Max temp MOD**	**300**	**1400**	**900**	**°C*10**
	Maximum allowed power module temperature				
#87	**Max temp PCB**	**250**	**1200**	**800**	**°C*10**
	Maximum allowed temperature on the PCB				
Configurable limits					
#93	**Min rpm limit**	**0**	**9000**	**60**	**rpm**
	Password protected limit for minimum speed				
#94	**Max rpm limit**	**0**	**9000**	**630**	**rpm**
	Password protected limit for maximum speed				
#95	**Max Curr Limit**	**100**	**13000**	**11000**	**mA**
	Password protected limit for current				
#96	**Max power limit**	**0**	**3100**	**2550**	**W**
	Password protected limit for power				
#97	**Max PFC current**	**0**	**125**	**115**	**A*10**
	Password protected limit for input current				
#98	**Level 2 password r0**	**0**	**65335**	**0**	
	Will read 0 unless user access level is >=2				
#99	**Level 2 password r1**	**0**	**65335**	**0**	
	Will read 0 unless user access level is >=2				
#100	**Level 2 password r2**	**0**	**65335**	**0**	
	Will read 0 unless user access level is >=2				
#101	**Level 2 password r3**	**0**	**65335**	**0**	
	Will read 0 unless user access level is >=2				

6. OPERATION.

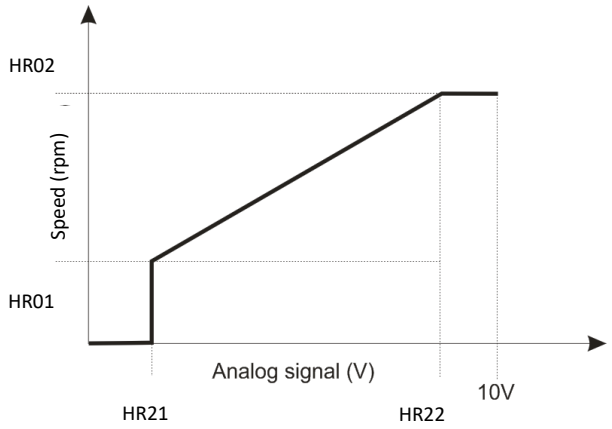
6.1. ANALOG CONTROL.

To select the analog input working mode, select parameter HR18 'Input type' to 'Analog'.

The control signal must be connected into the ANALOG INPUT and the reference to GND. This analog input could be:

- An external 0-10V signal. The input impedance is 20KΩ.
- A potentiometer. The available +10V power supply of the driver is intended to be used with a potentiometer of minimum 2KOhm, with a max absorbed current of 5mA.
- An external 4-20mA signal. It is necessary to add 0.1% precision resistances between the ANALOG INPUT and GND. The value of the resistance should be 500 Ω -> V signal ranges from 2V to 10V.

Through this setting the fan speed is proportional to the analog voltage input. The relationship between control voltage and fan speed is configured through parameters: HR01 Min.RPM, HR02 Max.RPM, HR21 Potentiometer min, HR22 Potentiometer max; and is described in the figure:



6.2. MODBUS CONTROL

To select the analog input working mode, select parameter HR18 'Input type' to ‘Modbus’.
Configure communication according to the parameters:

- HR29 Modbus ADDR
- HR30 Modbus Par/Stop
- HR31 Baudrate

Once communication is established, simply write the desired speed using the address ‘10002’.

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