FREQUENCY INVERTER

EM30

0,4kW – 7,5kW

Safety instructions Installation & operating manual

ENGLISH

EM30 – Rev.03 -D- SOFT Rev. 1.1x

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1) Common installation- and safety rules for BLU inverters, series EM30

IMPORTANT !!

This instruction manual explains rules for correct installation and safe operation of frequency inverters, series EM30 (denominated inverter, or drive in the following guidance). It is mandatory to follow exactly, what reported in this instruction manual.

This instruction manual must be read and fully understood before any action of installation or placing in operation of the inverter.
Anybody, who operates the inverter, or the machine, equipped with inverter, must have access to this operation manual, and must become familiar with drives technology, especially regarding safety and warning issues

All instructions in this manual must be observed, to:

Guarantee safety for humans and machinery
Allow safe function and reliable operation
Permit approvals and certifications
Keep manufacturers warranty in force

Following pictograms are used in this instruction manual:

DANGER-WARNING-CAUTION

ATTENTION: Life or health of the user are endangered or substantial damage to property may occur.

ATTENTION – OBSERVE

Measures, necessary for safe and trouble-free operation

Common:

DANGER

Frequency inverters operate with voltages, hazardous to humans
Depending on inverters protection degree (IP class) and mounting conditions, life parts may be accessible.
During heavy duty operation, and especially in case of malfunction, parts/surfaces of inverters or accessory may reach dangerous temperatures, which may result in personnel injury.
Inadmissible removal of covers or other parts of the inverter, improper use, and not qualified mounting or operation may result in high risk for personnel injury and/or machinery damage

DANGER

All activity for mounting, cabling, placing into operation and operation of the inverter must be done exclusively by proper educated and trained people.

The standards IEC 364 and/or CENELEC HD384, DIN VDE 0100 and all other national safety standards are to observe.

Trained people has specific professional training, knowledge of all relevant standards and safety rules and experience in application of electrical/electronic drive systems.
These professionals are in condition to judge assigned duties, and resulting risks.

Specified application of frequency inverters

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DANGER

The inverters, reported in this manual are components of electrical/electronic drive systems and determinate for integration in machines and plants only.

The EM30 inverter serves exclusively for the control and regulation of three phase motors (asynchronus / synchronus motors)
The connection of loads, other than above listed, may result in damage of the machinery, destruction of the inverter or connected equipment, and serious risk of personnel injury.

Observe specific standards and rules

DANGER

It is not allowed, to place in operation the plant, before the compliance with all standards of the machinery safety regulation (89/392/EWG) and the EMC rules (89/336/EWG) has been checked

Inverters are conformal with low voltage directive (73/231/EWG). Harmonized standards EN50178 (VDE160) and EN60439-1 (VDE0660, T. 500) are applied.

BLU DRIVES EM30 is a product with limited availability (in sense of IEC 61800-3). Frequency inverters may create high frequency noise, in case the operator is responsible for proper countermeasures.

Handling, transportation and storage

DANGER

Inverter components may become damaged and insulating distances may be reduced, as a result of improper transportation, handling or storage of the drive.
In this case, the inverter does not anymore comply with product specific standards and rules, and it is not allowed to place it into operation.
Therefore it is mandatory, to check the inverter for mechanical integrity, before installation and operation.
The inverter may contain components, sensitive to electrostatic discharge. Therefore avoid, touch components inside the drive.
It is recommended to store the inverter, using the original box.
If inverters are stored or out of use for more then one year, DC capacitors may lose their capacity. Please contact the inverter manufacturer for reformatting procedure

Installation of the inverter

DANGER

Frequency inverters EP66 must be mounted, following instructions in chapter*: Inverter mounting*
Only fixed installation is permitted.
Follow all effective standards and rules for correct grounding!!
All minimum distances to other inverters or components are to respect. Minimum distances are reported later on this manual.
Allow adequate air circulating, especially, in case of vertical mounting, one on top of the other.
Use proper shielded cables, for inverter control signals and feed back signals
Intrusion of dust, liquids, water, steam and aggressive gases must be excluded
Attention on adequate heat exchange of the cabinet
Use of the inverter in explosion risky area is not allowed

Electrical wiring of frequency inverters

DANGER HAZARDOUS CAPACITOR CHARGE

Attention: The entire plant must be disconnected from power, crosschecked for loss of voltage and locked before starting any work

The discharge time of the internal DC-LINK capacitors may take up to 5 minutes, it is not allowed to open the enclosures or to do any maintenance work during discharge cycle!!

LVD – DOUBLE INSULATON

All connection terminals for control and feed-back are <u>single insulated</u> in sense of EN50178.
In case of connection to external equipment with double insulation, the user has to provide proper arrangement, to guarantee double insulation in sense of EN50178 for the whole system

GROUNDING

EP66 inverters are designed for steady state installation, using fixed wiring. It is not allowed, to use power plug or similar mobile connection.
Depending on different EMC filter options, the leakage current to ground may exceed 3,5 mA. Therefore it is recommended to use earth connection wiring, with minimum section of $10mm^2$ (copper) or use double wiring (in sense of EN50178)

All grounding connections must be as short as possible, all leading to one common central point (star arrangement).

Long motor leads
A motor cable length, exceeding **30m**, may result in over-voltage spikes on the motor side. These peaks may damage the internal insulation of the motor.
The use of motor chokes, sinus filter or dV/dt limiting filters may prevent from risk of motor damage.
Generally it is recommended, to use inverter duty motors
In case of any doubt, please contact the manufacturer

All output filter components must have inverter manufactures approval

Insulation testing
In case of insulation testing of the whole network, it is recommended to disconnect the inverter and all optionally mounted filter components. Some components, used inside the inverter may impact measurement accuracy, o may become destroyed

All BLU inverters have to pass the insulation test, according to EN15178, during the final test procedure on the production line.

Potential equalization

If components with no galvanic insulation are used and connected to the inverter, proper measures are necessary, to guarantee potential equalization.

DANGER OF FIRE BURNS

Braking resistors
All kinetic energy of the system converts to heat, during braking cycle. This energy dissipates in the braking resistor.
Improper dimensioning of the braking resistor or insufficient heat exchange may result in high risk if fire

Also over-voltage on the input power supply my lead to high risk of fire

Therefore all braking resistor must have two thermistors, series connected, which contacts open in case of over-temperature, disconnecting the whole power supply, on inverters input terminals

Braking resistors surface may become very hot, even during normal operation. Therefore it is necessary to mount the resistor in a save location, using proper protecting cages.

IMPACT ON DIFFERENTAL CURRENT BRAKERS

Differential current breaker (FI)

The use of frequency inverters may delay or even inhibit the trigger of differential current breakers.

For life protection, all plant with inverters must have following:

Input wiring protection: Fuses or automatic over-current breaker (Dimensioning: see tables).

Differential current protection: "All-sensitive" protectors (breaker), minimum requirement type „B“ , mounted on all inverter power lines.
It is not permitted to connect other equipment on inverter power lines.

For single phase inverters (230V class) the use of differential current breaker type "A" or "F" is allowed.

The trigger current of the differential current breaker depends on the operating frequency, motor type, PWM frequency and the length of the motor cable
It is recommended, to use differential current breaker with 300 mA threshold (for industrial environment).

Basic rules for reliable and safe operation

-Proper dimensioning of the system (motor, inverter, mechanical elements).

-Check for correct inverters rated voltage, consider tolerances too

-Review all inverter and motor cabling, including correct terminal tightening torque (torque values: see table).

-Use proper cable for all control wiring, separate control cable from power cable, min. 15 cm distance. Use shielded cable for all control connections, exceeding 1 meter

-Twist wires to braking resistors or use shielded cables

-Shielded cables are recommended for motor connection too, especially with distances, exceeding 30 meters.

-Avoid earth loops, all earth connections should have large contact areas, all leading to one central grounding point (star connected)

IMPORTANT FOR SAVE INVERTER OPERATION

One separate circuit breaker is recommended for each inverter – allowing separate switch off of single inverters.

CHECK FOR PROPER INVERTER PROGRAMMING

Improper programming of the inverter may result in unpredictable behavior of the system and subsequent high risk of damage and/or personnel injury.

The inverter may be enabled for multiple automatic restart attempts in case of fault – delayed restart is possible.

Unpredictable systems reactions may become the result of internal inverter defects.
The inverter may ignore commands, speed, STOP instructions, or signals originated from external components.
The braking function of the inverter may fail.
Depending on the application, external safety components, working independently from the inverter, are required, to guarantee the safety of the whole system

Inverter protection-functions

Although the inverter is equipped with intelligent protections functions, the repetitive triggering of those functions may result in inverter damage.
The inverter is protected against output short circuit and earth fault, each displayed by a specific code on the display.
Repetitive earth faults and short circuits may damage the power stage of the inverter.
The motor must be fixed connected, in case, where interruption of the motor line is required (for safety reason), the circuit should open/close with inverter in STOP condition only (final stage disabled).
It is recommended, to keep the inverter powered on at all time, if for application reason repetitive power on cycling is required, it should not exceed one cycles every 5 minutes – otherwise contact the manufacturer.

Power-grid specification:
The inverter is build for symmetric three phase power supply systems, with voltage phase to earth/neutral not exceeding 300V.
A transformer can be used for adaptation to higher voltages.
For single phase inverters the maximum input voltage is 240V +15%, 400V class thee phase inverters can work up to 460V +15%.
Contact the inverter manufacturer, before connecting to unbalanced, floating, or unsymmetrical power systems.

Power supply – short circuit capability
Input chokes (Uk=4%) are recommended to connect the inverter on a power grid with high short circuit capability, this especially for continuous full load operation.
If the power supply capability exceeds by 20 times the inverter power, the use of chokes is mandatory.

Measurements on inverter input and output:
Current and voltage may have no sinus shaped waveform on inverters input/output side.
If improper testing instruments are used, the result may become inaccurate, or in worst case, the inverter and/or the test instrument may become destroyed.
On input side, the current waveform is composed by fundamental and harmonics, while on output side the voltage waveform is PWM modulated.
The used instruments must be able to handle the various signal waveforms. For simple measurements, a high quality moving iron instrument could be suitable.

FOR ANY QUESTION – CONTACT THE MANUFACTURER

The inverter manufacturer must be contacted in case of any question, regarding this safety/instruction manual, or if some parts of it have not been fully understood.

Please ask before installing or placing on operation the system.

This is mandatory, to avoid any risk for machinery damage and/or personnel injury.

EMC: Basics and recommendations for installation

The EM30 series inverters are electrical devices, designed for installation in industrial area.
EM30 inverters are not designed to work stand alone, these inverters are considered as part of a complex system, for this reason, no separate EMC marking is applied on the inverter.
The machine builder / system integrator is obligated to prove the compliance with actual EMC standards for the whole system.

Normally, the inverter integrated EMC filters are sufficient, to meet the actual EMC limits (this has been confirmed by measurements, performed by independent body).

Inverters EM30 are designed for use in "second environment", (in sense of EN61800-3).
This means installation in industrial area, where power supply is done via separate transformer.
For installation in "first environment" (residential area – public low voltage power grid), additional filter components may become necessary, to meet EMC rules.

EMC - adequate installation

Mounting in metal cabinet, if possible, the cabinet should be divided into power and control area, using metal shielding barrier, or similar

Connect all metal parts, grounding cables, cable shields on one central point, using the blank mounting plate as contact area.

Use 10mm^2 cables for potential equalization, "star" connected on one central point.
Please consider, that inverters and filters may have more than 3,5 mA leakage current, therefore use proper earth/ground conductors:

> **Grounding conductor min. 10 mm² (copper)**
> **Grounding connection with separate monitoring system, which disconnects automatically in case of fault.**
> **Dual grounding, using separate cable and terminals.**

Use shielded cables, wherever possible, with copper mesh, common cable steel protection is not working as shield.

Connect shields on large blank areas with potential equalization bars. Use special cable glands, with integrated contact brushes.
It is not allowed to extend cable shield, using single wire.

Mount all external filter components as close as possible to the noise source (inverter) – get perfect contact, mounting directly on the blank cabinet plate.

Keep all wiring as short as possible, separate different networks, min. 15 cm distance.
Different networks are: power supply, motor cable (incl. brake resistor), low voltage control wiring (control signals, feed-back, data line).

Twist all unshielded cables
Unused wires in cables should be connected to ground

Inverters with UL mark: Additional information

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2) Product data / product power range

Product naming convention

Basic product code:
EM30 0007 T3 J1

EM30 Inverter series (EM30)
0007 Inverter power code

Power code	0004	0007	0011	0015	0022	0030	0040	0050	0075
Rated power	0,4 kW	0,75 kW	1,1 kW	1,5 kW	2,2 kW	3,0 kW	4,0 kW	5,5 kW	7,5 kW

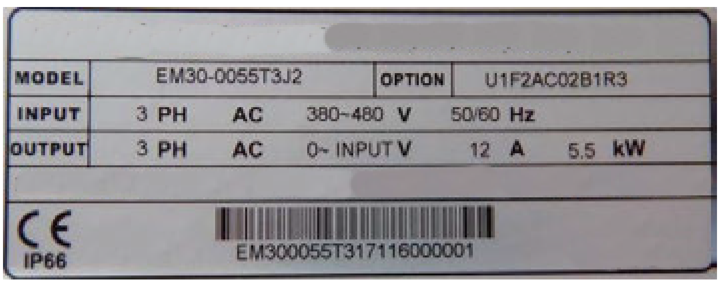
T3 Inverter rated voltage code:
T2=singlephase 220/240V +/-15%
T3=threephase 380/460V +/-15%
J1 Inverter framesize code (J1 / J2)

Optionals code:
U5 F2 AC02 B1 R3 M1 IC1

U5 Standards code:
U=UL
U1=CE
U5=CE+UL
F2 Fieldbus type:
( )=no fieldbus
F2=MODBUS
AC02 Operating panel:
AC01=Cinese style
AC02=International
B1 Brake chopper:
( )=no brake chopper
B1=chopper transistor integrated
R3 EMC Filter class:
( )=no filter build in
R3:C3 class filter inside
M1 Add on motor:
( ): single inverter unit
M1:inverter+asynchronus motor boundle
M2:inverter+PMM motor boundle
IC1 Mounting kit:
( )=motor terminal box mounting
IC1=wall mount, including wall mount kit

Nameplate

The adjacent picture shows a typical nameplate of an series EM30, three phase, 400V 5,5 kW inverter, 12A rated current, including following options: U1=(CE-standard) F2=(MODBUS), AC02=(global style keypad) B1= (Brake-chopper integrated) R3= (integrated EMC-Filter C3 class)



Mechanical construction

EM30 inverter are based on a die-cast aluminium frame. The frame has a flange attack, used to mount the inverter directly on the terminal-box of the motor.
Mounting is done by using specific adapter plates, depending on motor geometry *(see chapter: inverter mounting)*
The basic frame holds the cable conduit plate, the power- and motor terminals, the EMC filter and the capacitor assembly
Control and power section are placed in the inverters cover. This allow all heat to dissipate away from motor. Control connection, all I/O and field-bus terminals (removable) are on the power/control board in the cover.
The cover holds the keypad as well.

The pictures show an J2 size inverter

Technical data - inverter series E30

Power supply	Rated voltage	3-phase 380…460V +/- 15% - 1phase 230V +/- 15%
	Input frequency	44….67 Hz
	EMC filter	Integrated for 2. environment - optional for 1st environment
Output	Output voltage	0……...U-input
	Output frequency	0……...650 Hz
	Resolution of output frequency	0,01 Hz
	Overload capability	150% - 60 sec. / 10 Min
Control mode	PWM control-modes	V/Hz - Mode SENSORLESS VECTOR (SLV) – Speed / torque control Permanentmagnet Synchronus Motor PMM control
	PWM frequency	0,8.....16 kHz
	V/Hz characteristic	Linear, quadratic, and user-programmable curve – independent output voltage via setpoint
	Starting torque	150% rated torque at 0,5 Hz (in SLV mode)
	Torque boost	Automatic / manual
	Motor data input	Manual input / intelligent AUTOTUNING function
	Speed range	1:100 in SLV mode
	Speed precision	+/- 0,5% (SLV)
	Torque precision	+/- 5% (SLV)
	DC-Brake	Freq. threshold, duration and intensity programmable – DC injection
	Brake chopper	Integrated chopper transistor (Brake resistors – see product table)
Display	4 line LCD character display	For programming and visualization of different operating parameters
I/O Channels, control functions	Inverter control - Start/Stop	To configure: terminals / keypad/ serial link
	Digital control inputs	6 digital inputs (HIGH/LOW configurable), pulse input
	Speed / torque reference signal	Potentiometer/analogue input (terminals), via keypad, pulse input, serial link
	Analogue setpoint input	2 Analogue channels 0…10V, 0..(4)20 mA (with programmable offset and gain – to concatenate mathematically each other)
	Analogue outputs	2 analogue output channels, both programmable in gain, different functions to assign (0…10V, 0..20 mA)
	Digitale outputs	1 digital output (different functions to assign)
	Relays output	2 switchover contact 5 A 230 V (programmable for different functions)
	Interface	Serial link (MODBUS – ASCI/RTU)
	Special function - control options	Jog mode, 12V / 50 mA auxiliary power supply on terminals
		PI-control / Pump control, Master/Slave control, multipump control
		Fixed frequency control, programmable cycling frequency sequence "Catch on the fly function", AUTORESET/RESTART function
Protections with fault memory	Electrical protections	Overvoltage, undervoltage
		Overcurrent, overload, motor overload short circuit
		Phaseloss, moptor phase imbalance
	Thermal protections	Ovetemperature, motor I^2xt, motor PTC/KLIXON protection
Optionals	Operating panel	Remote keypad / programming tool
	Brake resistors	High power resistors for heavy duty operation
	Filter / chokes	PFC chokes – dv/dt limiting output filter - sinusfilter
	Parameter copy stick	USB Stick with parameter dublication function – USB/RS485 converter
	PC-Link Software (via MODBUS)	Special tool for programming, control and diagnostic (parameter set memory)
Environmental conditions	Protection	IP66
	Operating temperature	-10……+50 °C
	Humidity	Max. 90 % not condensing, no corrosion
	Elavation	1000 m - 1% derating / 100m above
	Vibration	Max. 4 g
Power range	Size **J1 - J2**	0,4……7,5 kW
Standards	EMC	EN61800-3(2004)
	Safety	EN61800-5-1 2003

Product range, framesizes:

230V single phase

Model	Rated power / current	Input current	Framesize	Dimension (WxHxD - mm)	Weight (kg)	Brake chopper	Min. brake resistance value
EM30-0004S2 J1	0,4 kW - 2,5A	5A	J1	190x270165	2,4	Integrated	80 Ohm
EM30-0007S2 J1	0,75 kW - 4,5A	9A			2,5		
EM30-0015S2 J1	1,5 kW - 7A	15A			2,7		
EM30-0022S2 J1	2,2 kW - 10A	22A			2,9		

400V three phase

Model	Rated power / current	Input current	Framesize	Dimension (WxHxD - mm)	Weight (kg)	Brake chopper	Min. brake resistance value
EM30-0007T3 J1	0,75 kW - 2 A	2,4A	J1	190x270165	2,4	Integrated	150 Ohm/150W
EM30-0015T3 J1	1,5 kW - 4 A	4,6A			2,5		
EM30-0022T3 J1	2,2 kW - 6,5 A	7A			2,7		
EM30-0030T3 J1	3,0 kW - 7 A	9A			2,9		
EM30-0040T3 J2	4,0 kW - 9 A	11A	J2	338228x194	6,0		
EM30-0055T3 J2	5,5 kW - 12 A	16A			6,1		75 Ohm/500W
EM30-0075T3 J2	7,5 kW - 17 A	20A			6,2		

Convection cooled

Note: The indicated RMS input current is approximative for direct connection to a power grid, having a short circuit capability of 10kA – For power supply above 10 kA we highly recommend the use of adequate input chokes (5% choke) to reduce the RMS current

3) Inverter mounting

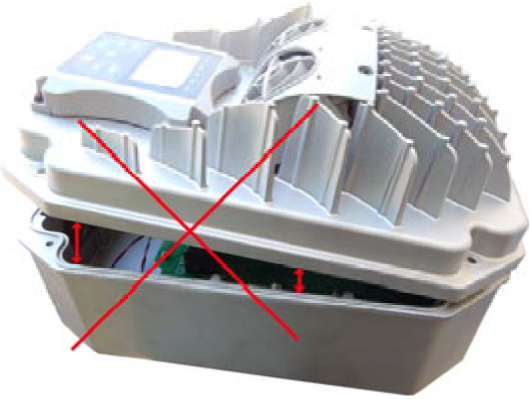
Please read all, what reported on chapter *1) Common installation- and safety rules for BLU inverters, series EM30* before proceeding with inverter mounting, cabinet wiring, and putting into service the system.

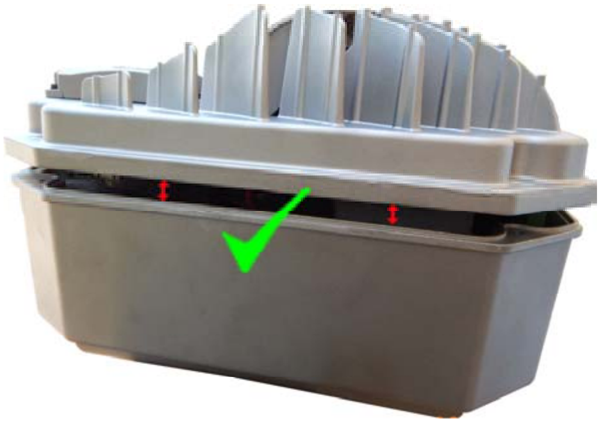
Motor mounting

EM30 inverters have IP66 Protection class and are build for direct mounting on the motor. The inverter can be mounted in any direction. The keypad can be rotated in 90° steps.
Depending on motor geometry, a specific mounting plate is required - mounting plates for some standard motors are available through the BLU options program.

To open the inverter enclosure, loose the 4 screws on the cover and carefully remove the cover. Please note, that on size J2, an internal fan is connected via cable to the base unit, this cable must be unplugged.

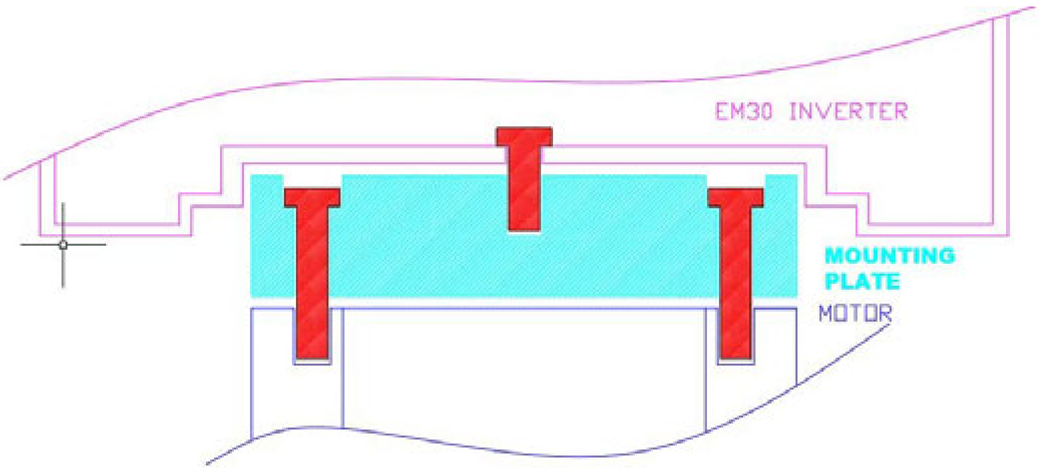
Attention: the cover must be removed carefully, uniform, do not twist, do not cant the inside connectors/plugs, take care on the fan connection on size J2





Please make sure, the motor terminal box has enough mechanical stability to support the inverter
It is absolutely not allowed to step on the inverter
In order to prevent from damage, it may be necessary to disconnect the keypad cable, before turning the keypad

The picture shows the mounting concept



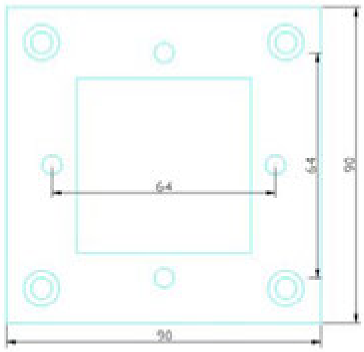
As a first step, the mounting plate must be fixed on the motors terminal box, using original gasket. After the mounting plate is in place, the inverter can be fixed on the plate, using adequate screws and gasket, coming with the plate kit.
Specific holes in the capacitor board allow access to the screws inside the inverter.
Cabling is done, using the middle hole on the capacitor board

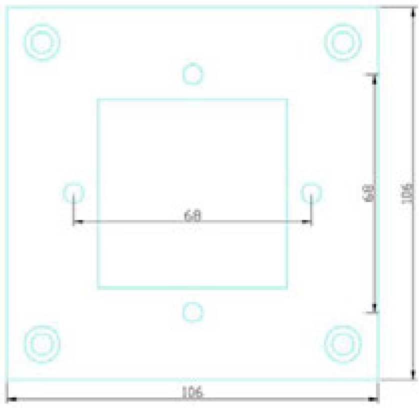
Warning: please make sure, no metal parts (screws, washer etc.) arte lost inside the inverter, during the mounting procedure - this may create short circuit and damage of the inverter.

Mounting plate:

The mounting plate dimensioning depends on the motor type, only the position of the threaded holes which are used to screw the inverter on the plate is fixed (see drawing below)

The indicated dimension is the maximum plate size for inverter size J1 and J2





Wallmount:

If wallmount is required, a specific wallmount kit is available - please refer to extra instruction

Maintenance and service:

Inverters of the EM30 series may have forced ventilation (depending on power range). The fans are maintenancefree and have protection degree IP66
Ventilation channels and heatsink fins should be checked for dirt and dust, and cleaned on a regular basis.

Provided that the inverter is working in respect of specified environmental conditions, provided that the inverter is used for proper application, and all instructions have been exactly followed for installation, putting in service and operation, the inverter does not need any additional maintenance.

4) Electrical connection of EM30 inverters

EM30 series inverter have IP66 class protection. All connection terminals are located inside the enclosure.

All control an power cables pass through a removable cable conduit plate, this plate can be used for shield connection as well, using proper cable glands with shield contacts.

Proper IP66 ready cable glands are required, to guarantee the IP66 protection degree.

Following holes are available on the cable conduit plate:

Framesize	Power terminals	Control terminals
J1	M20	M16
J2	M25	M16

For electrical wiring of the inverter, the cover must be removed, loosening all 4 cover screws, to get access to all terminals.

Attention!! Carefully remove the cover!!, there is a cable between inverter base and cover, this cable must be removed, to get the two parts separated.

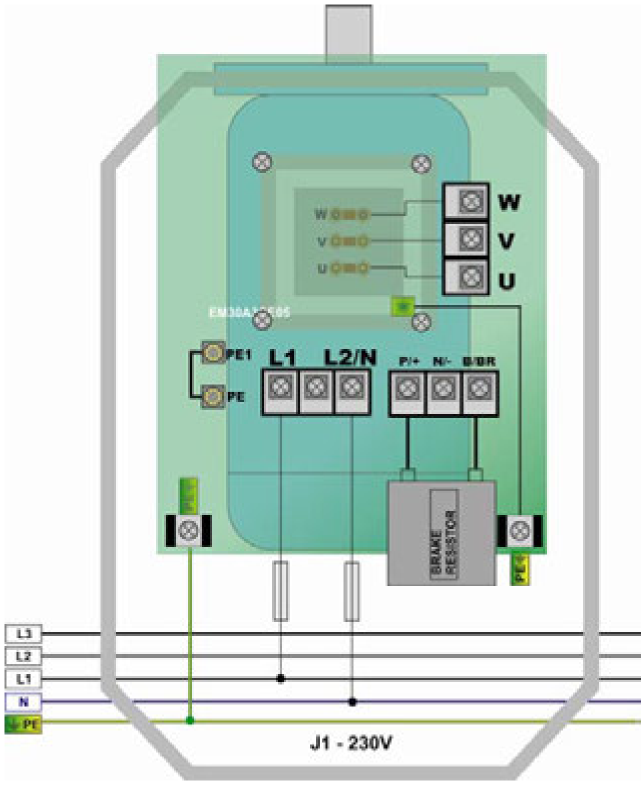
Power / Control terminal connection

EM30 inverters have separate terminals for power- and control-connection. Adequate cables are requested for wiring the inverter, all safety rules, reported in the first chapter of this manual are to observe.

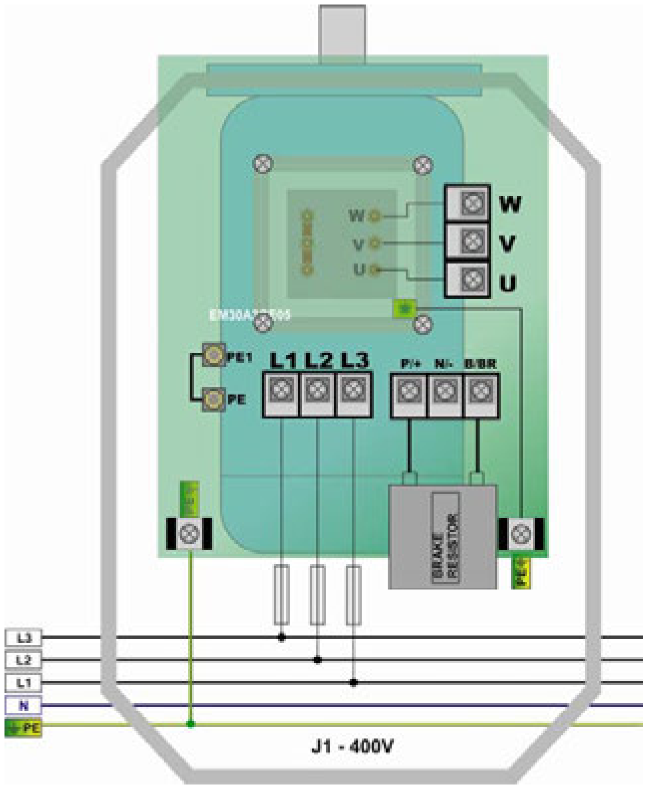
Power terminals:

There are different arrangements for power terminals, depending on inverter size and number of input phases.

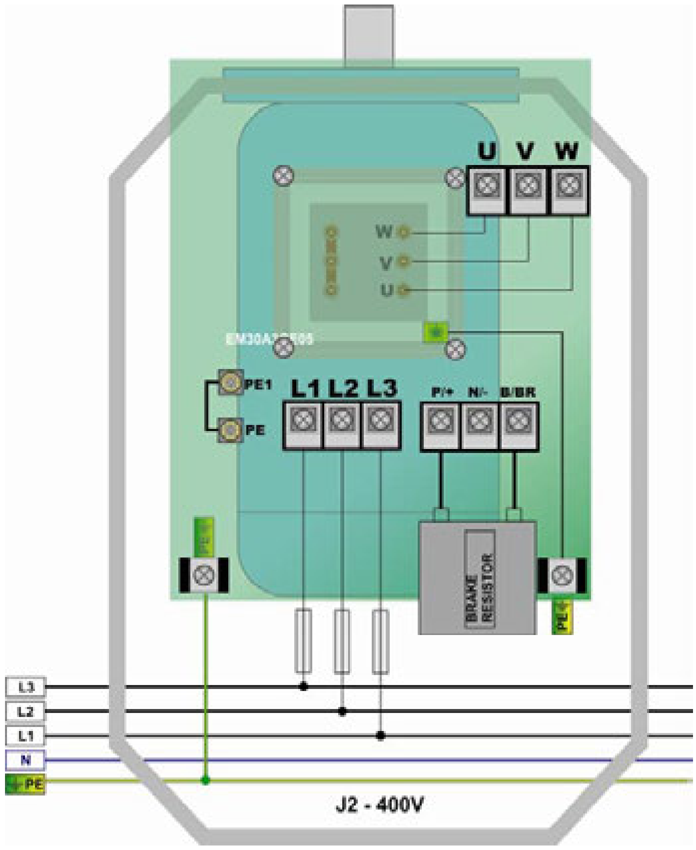
Inverter size J1 230V - 0,4...2,2 kW



Inverter size J1 400V 0,75 - 3,0 kW



Inverter size J3 400V 4,0 - 7,5 kW



Brake resistor:

EM30 inverters have build in chopper transistor as standard. An adequate brake resistor can be connected externaly. The maximus lenght of the cable is 2mt, crossection depends on the current through the resistor, calculated, considering the brake switch on voltage of 800V and the resistor value.

The minimum resistor value for single inverter power ranges is reported in table on chapter: *2) Product overview / Product data* – **the value in the table is the absolute minimum value – resistors with up to three times higher resistance value are allowed**.
Right dimensioning of the resistor, especially in sense of continuous power and peak power depends on the application (inertia, speed, brake cycle rate).

Attention: Adequate resistors are required, to meet IP66 protection degree

EURADRIVES accessories program offers special resistors for any kind of application.

ATTENTION!! All stored dynamic energy of the system is converted in heat, during the brake process - heat, dissipated in the brake resistor.
Overheating of the resistor, risk of burning and fire may be the consequence of improper dimensioning, wrong parameter setting, inverter fault or power supply over-voltage.
It is necessary to provide suitable electrical and mechanical protection of the brake resistor
The rules in chapter *1) Common installation and safety rules* are to observe.

EURADRIVES does not take any responsibility for any damage or risk, if improper brake resistors are used.

Recommended cable cross sections, fuses, terminal tightening torque

Inverter model	Input current	Cable cross section (mm^2 AWG) terminal tightening torque	Input fuses		
	A	mm^2 / AWG / lbs/inch	IEC 60269 gG (A)	UL-Klasse T (A)	Bussmann-Typ
EM30-0007T3 J1	2,4	2,5 / AWG14 /10	10A	10A	JJS10
EM30-0015T3 J1	4,6				
EM30-0022T3 J1	7				
EM30-0030T3 J1	9			15A	JJS15
EM30-0040T3 J2	11	2,5 / AWG12 /10,5	16A		
EM30-0055T3 J2	16	4 / AWG10 /19	25A	20A	JJS20
EM30-0075T3 J2	20			30A	JJS30
Control cables – all framesizes		0,75-1 AWG20 /2,7			

Earth/ground connection

Minimum earth/ground wiring cross section – for terminal connection

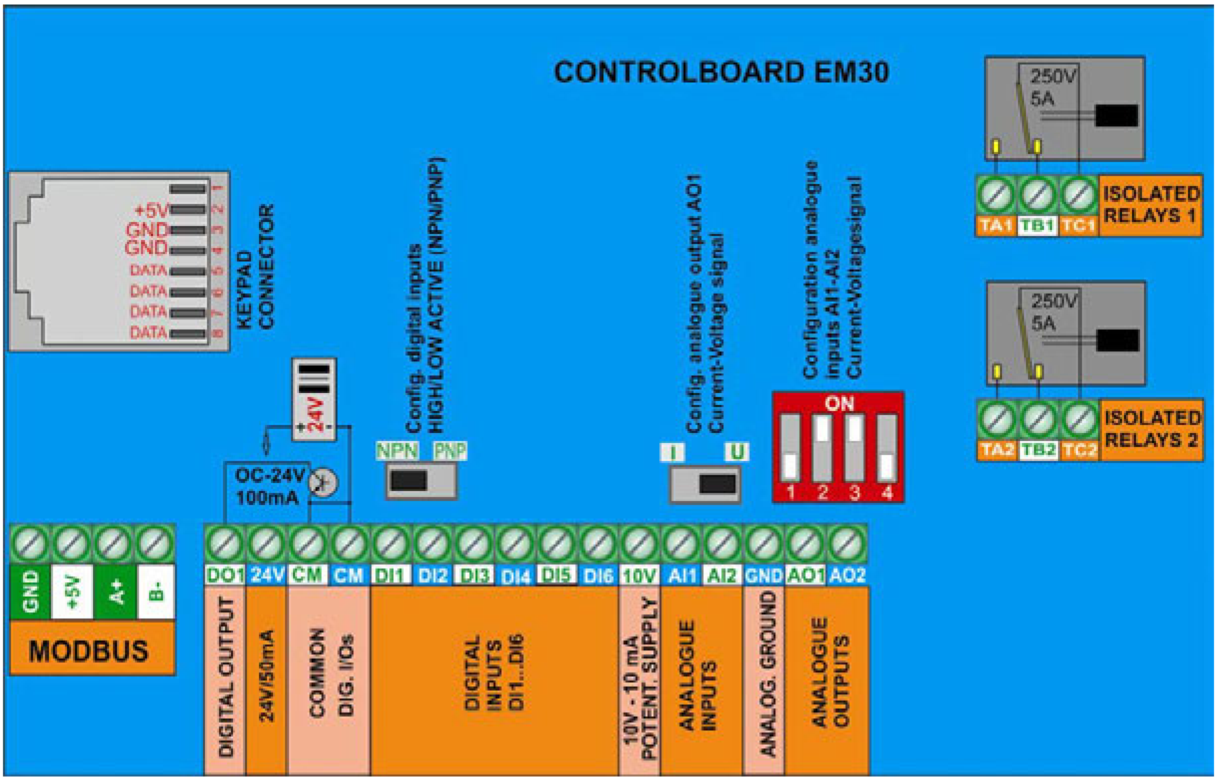
Motor wiring section: S (mm^2)	Minimum earth wiring cross ection ⏚/PE/E (mm^2)
$S \leq 16$	= S
$16 < S \leq 35$	min 16
$S > 35$	min S/2

Minimum earth/ground wiring cross section – for chassis connection (on designed "G" "GND" "GROUND" connection points)

Motor wiring section: S (mm^2)	Minimum earth wiring cross ection ⏚/PE/E (mm^2)
$S \leq 16$	AWG8 / 6,2

Control terminals – control board

Inverter size J1/ J2



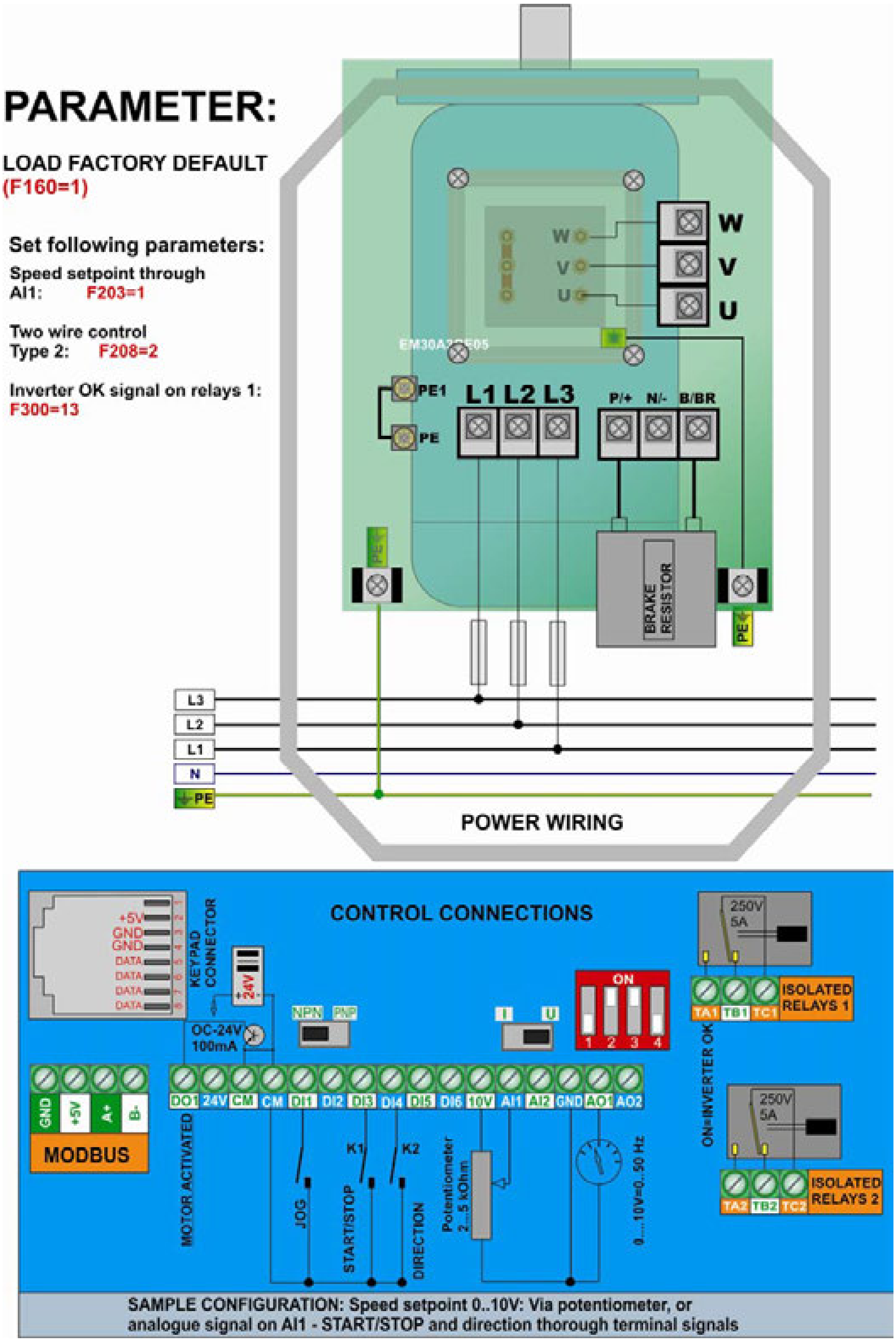
Control terminal function and factory default configuration

Terminal	Type	Description	Hardware data	Parameter	DEFAULT
DO1	Digital / analogue outputs	Programmable digital output 1	Open-Collector output, max. 100mA-24V (referred on CM) – Pulse output	(F301) (F303)	Message F=>0Hz
TA1 TB1 TC1		Digital Relays output - isolated switchover contact	TC=COMMON TB=NORMAL CLOSED TA=NORMAL OPEN Max. Contact load: 5A/230V	(F300/F302)	Fault signal
TA2 TB2 TC2		Programmable digital relays output DO2		(F302)	Message F>0HZ
AO1		Programmable analogue output 1	To configure for voltage/current signal (reference: analogue ground GND) For current signal: set SWITCH to „I“	(F413---F426) (F431)	Output frequency 0…10V
AO2		Programmable analogue output 2	Current signal 0(4)...20 mA (reference analogue ground GND) >15kW only	(F427----F430) (F432)	Motor current 0...20mA
10V	DC 10V	10V, referred on analogue ground	10V supply for potentiometer or similar, max. current 20 mA		
AI1	Analogue - Inputs	Programmable analogue input 1	Set-point – current/voltage input for configuration see: *(Hardware and configuration of I/O channels)*	(F400-F405) (F418)	0…10V
AI2		Programmable analogue input 2	Set-point – current/voltage input for configuration see: *(Hardware and configuration of I/O channels)*	(F406-F411) (F419)	0..20 mA
GND		Analogue ground	Microprocessor ground, reference point for all analogue signals		
			24±1.5V, to CM; limited to 50mA, for powering of digital I/Os		
24V	DC 24V	Isolated 24V power supply	24±1.5V, to CM; limited to 50mA, for powering of digital I/Os		
DI1	Programmable digital inputs	Programmable digital input 1	HIGH/LOW active (NPN/PNP) selectable via hardware - see: *(Hardware and configuration of I/O channels)* Pulse signal input	(F316)	TIP Betrieb VOR
DI2		Programmable digital input 2	HIGH/LOW active (NPN/PNP) selectable via hardware - see: *(Hardware and configuration of I/O channels)* All digital I/O are floating, including 24V supply and CM	(F317)	NOTSTOP Extern
DI3		Programmable digital input 3		(F318)	Klemme (FWD)
DI4		Programmable digital input 4		(F319)	Klemme (REV)
DI5		Programmable digital input 5		(F320)	RESET
DI6		Programmable digital input 6		(F321)	Endstufen Freischaltung
CM CM	COMM	Common for digital I/O	Common for digital inputs and 24V aux. supply		
GND	RS 485	Analogue ground	Microprocessor ground, reference point for all analogue signals		
+5V		5V, 50 mA	5 V supply microprocessor level		
A+		Differential signal, positive	Standard: TIA/EIA-485(RS-485) Interface protokol: MODBUS Bd.Rate: 1200/2400/4800/9600/19200/ 38400/57600	(F900-F904)	9600
B-		Differential signal, negative			

Sample set-up for inverter 3 kW 400V J1

If parameter status is unknown, factory reset is recommended: Set parameter **F160 = 1**

Analogue speed reference 0....10V (potentiometer) through input channel AI1: Set **F203=1**
START/STOP command and inversion through terminal signals: set **F208=2** (two wire control)
"Inverter ready signal on relays 1 contact: **F300=13**
„Inverter enabled“ message on **DO1 F301=14** (already default set)
Frequency indication output: **AO1** 0…10V = 0-50 Hz **F423=1, F431=0** (already default set)

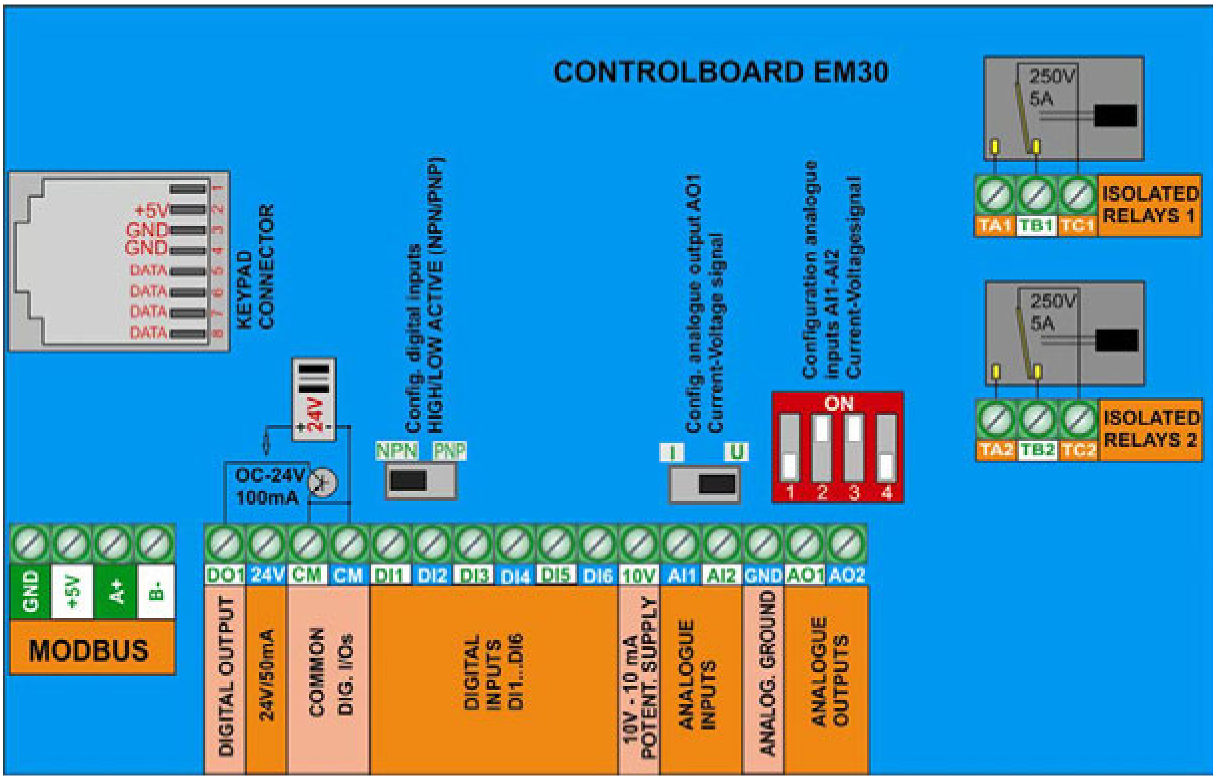


5) Control-board: hardware and I/O channel configuration

I/O channel configuration is a combination of hardware and software setting

For software parameter setting see chapter:
10) Parameter group 300: Configuration of digital I/O channels
11) Parameter group 400: Configuration of analogue I/O channels

EM30 Control-board

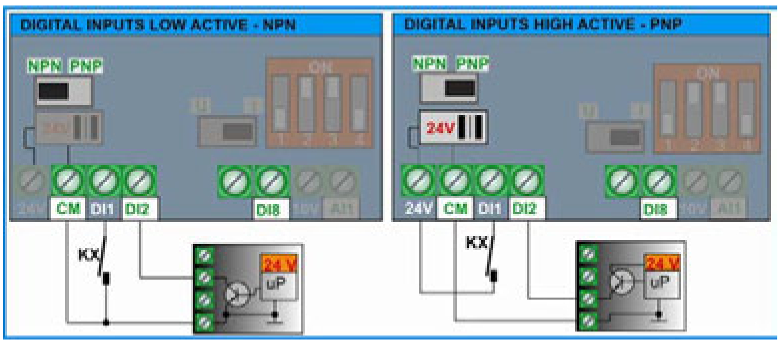


Digital input channels, PNP/NPN setting:

A total of 6 digital input channels DI1....DI6 are available. Programming the parameter **F316….F321, d**ifferent functions can be assigned to these inputs, description: see chapter *10) Parameter group 300: Configuration of digital I/O channels*
DI1 is preset for digital input and fast pulse signal input as well.

Attention: A function can be assigned to one single digital input only (no multiple inputs for same function allowed) If a function is already assigned to a certain input (due to factory set), this assignment must be deleted (set function-code 0), before assigning to another input.

HIGH/LOW active (PNP/NPN) control-mode selection: This selection is done via hardware setting of the **NPN-PNP DIP-SWITCH** on the control board.
All digital inputs are isolated from analogue ground, the **24 V (50mA)** auxiliary power supply may be used for input control in PNP mode. **CM** is the common reference point for all digital inputs**.**



Factory default setting: NPN

Analogue input channels:

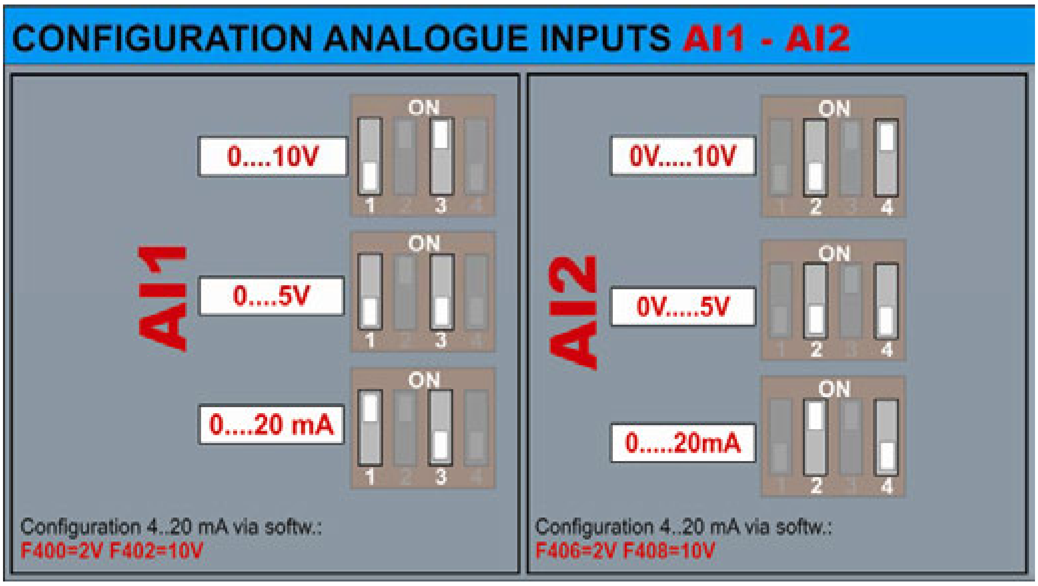
EM30 have two independent analogue input channels AI1 and AI2, both have a resolution of 12 Bit.
Signal type and level configuration is done by hardware setting on the control board, and corresponding parameter setting.

For software parameter setting see: ***11) Parameter group 400: Configuration of analogue I/O channels***

AI1 **Voltage signal input:** programmable for **0….10V, 0...5V and 0(4)...20mA - (4...20 mA:** offset, to set via software parameter – **F401**)
(*factory-default setting 0...10V)*

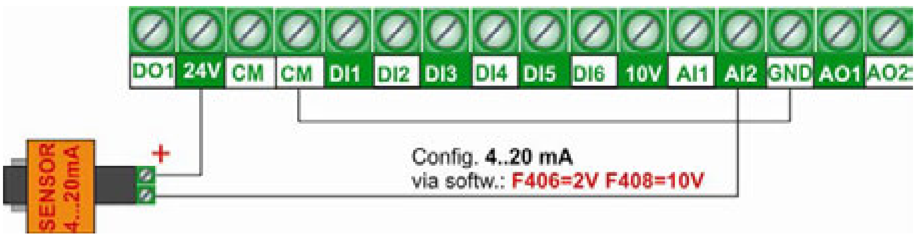
AI2 **Voltage/Current signal input:** to configure for **0…10V, 0...5V** or **0(4)...20 mA - (4...20 mA:** offset, to set via software parameter – **F406**)
(factory-default setting 0....20 mA)

Hardware configuration AI1-AI2



Input impedance for voltage control: 10 kOhm
Burden resistor for current loop: 250 Ohm

Two wire passive current mode sensors: Using the 10V potentiometer supply, the voltage drop across the sensor must not exceed 5V (20mA – 250 Ohm). It is possible, to use the 24V auxiliary supply, in this case, the 24V common (CM) must be connected to the analogue common (GND). Connecting digital ground with analogue ground may create more noise, especially, in cases, where long control cabling is used - shielded control cable are highly recommended in this case.
An isolated 24V/24V DC/DC converter can be used as sensor supply, to keep digital control potential floating (optional)**.**



Digital output channels:

Inverters of the EM30 series have two relay contact output, and one open collector output DO1, both are free programmable for different functions, assignation codes are set in parameters F300 – F302.

TA1-TB1-TC1 Relay output: isolated switch over contacts, max. contact-load: 2A 230V **(F300)**

DO1 Digital output: OPEN COLLECTOR, referred to **CM** - U/High=24V, max. sink-current 100mA. **(F301)**
DO1 may work as fast pulse signal output too, set via parameter **F303.** max. frequency 50 kHz, U_{ss}=24V

TA21-TB2-TC2 Relay output: isolated switch over contacts, max. contact-load: 2A 230V **(F302)**

Analogue output channels:

Two analogue output channels are available on inverters EM30: AO1 and AO2. This two channels can be mapped to different functions.

AO1 : Can be configured via hardware for **voltage-** or **current loop signal**

(signal conditioning **F423**, range selection **F424-F426**)
Function assignation code: Parameter **F431**

Following hardware settings are necessary for AO1

Factory default setting for AO1: 0...10V

AO2 : For **current loop** signal only

(signal conditioning: **F427**, range setting: **F428 - F430**
Function assignation code: **F432**

Factory default setting for AO2: **0...20mA**

Motor protection using PTC/KLIXON:

For simple applications and short motor cables (<5m) the digital inputs **DI1…DI6** can be used as PTC/NTC/KLIXON signal input channel.
For hardware set-up, see picture below, the value of the resistor depends on the PTC value, if KLIXON is used for motor protection, a 1 kOhm resistor, 1 WATT is recommended. Each digital input is programmable for PTC/KLIXON signal evaluation

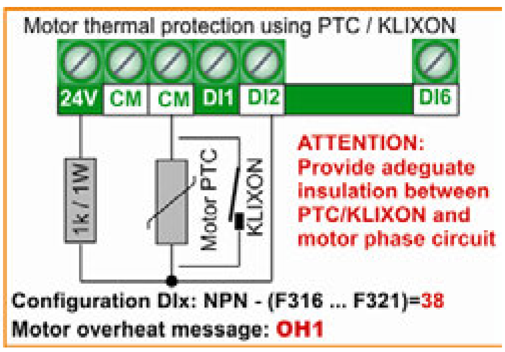
The trigger threshold is about 4 V – it means about 20V input signal level for PNP configuration - about 4V input signal level for NPN configuration.

If triggered, OH1 is the error code shown on the display

Function assignation parameter F316…F323:
code: 37 for normal open contact (NTC)
code: 38 for normal closed contact (PTC)

ATTENTION!!! Provide adequate insulation between PTC/KLIXON circuit and motor phases

Switching threshold for PTC:
For the configuration on right: about 20V between CM and DIx, this corrisponds to a PTC resistance value of apx. 6 kOhm



6) Operating panel – configuration and functions

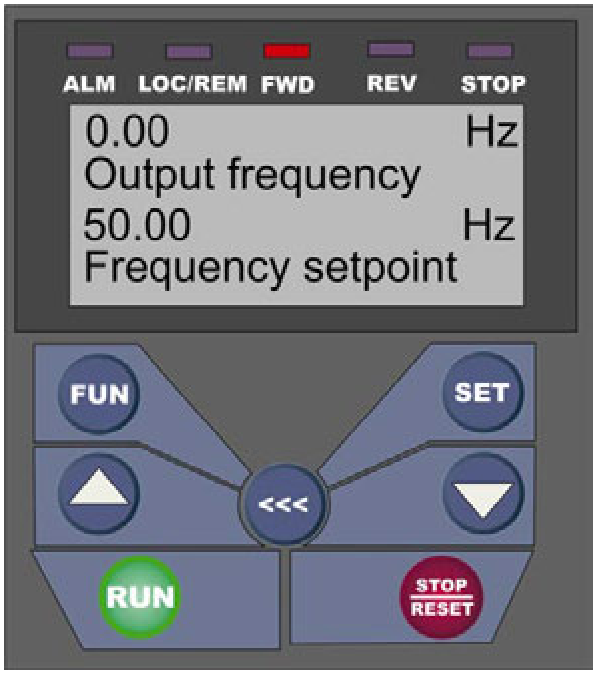
Inverter control, parameter setting, operating-parameter display and inverter-status information are all done by the operation panel.

The adjacent picture shows the different areas of the panel:

Inverter status indication

Backlight 4 Line character display
Parameter F646 to set backlight time
Language setting via parameter: F647

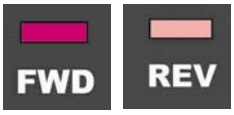
Keypad area for inverter control and parameter setting



Inverter status:

Inverter fault – detailed fault information on the text display

Inverter control via terminal signal / MODBUS – flashing in MODBUS mode



Drive started – actual direction indication

Drive in STOP mode, output frequency = 0

START/STOP key – if inverter is configured for keypad commands (F200/201)

SHIFT – to cycle through diggerent operating parameters in START/STOP mode (F131/132), Change decimal point in parameter counter in programming mode, cycle through the fault memory

FUN – to switch over in parametrizing mode

SET – Parameter selection (to modify),
Save function for changed parameter values (press SET again)

INC – DEC switch between different parameters (Parametercounter),
Increase/decrease of the selected parameter values (after selection via SET)

4 Line character display:

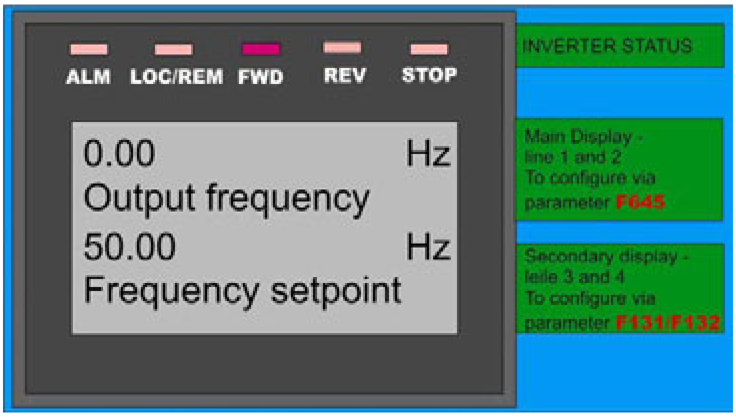
Three operating modes:

Normal operating mode:

Primary display, line 1 and 2:
The content of the display is defined by parameter
F645 – value, description and units of the defined operating parameter are shown

Secondary display in line 3 and 4: It displays various operating parameters in START/STOP mode. The definition is done via parameter F131/132.

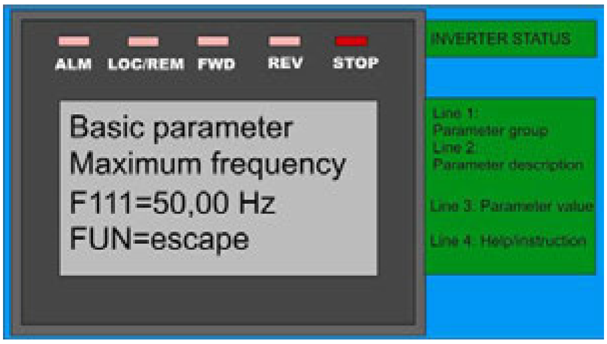
The  **key is used to cycle between all defined operating parameters**



In Programming mode, **the parameter group, the parameter description, the parameter number and the parameter value are shown on the display.**

Pressing  **und**   **keys, the parameter value may be changed,**  **again memorizes the new parameter value.**

Line 4: HELP and different selection options



Fault mode: **Line 1 and 2 show the actual fault**
Line 3: Fault history (Parameter F708, F709, F710).
The key  **is used to cycle through the history**

Error code description: see parameter group 700

Remote control:

The operating panel is removable.
A standard 8-pole LAN cable is used for connection (up to 10 meters)
Special cable gland kit is available (to guarantee the IP66 protection class)

7) Parameter setting

For easier parameter setting, the whole parameter list is divided into 11 parameter groups:

Parameter type	Parameter. Nr. Range	Group
BASIC parameter	F100 - F160	100
Inverter control, set-point source setup	F200 - F280	200
Function assignation to digital I/Os - diagnosis	F300 - F340	300
Analogue I/O signal configuration	F400 - F473	400
Fixed-frequency control, cycle control	F500 - F580	500
DC-Brake, limiting functions, auxiliary functions	F600 - F677	600
Fault handling – configuration of protection function	F700 - F760	700
Motorparameter, AUTOTUNING	F800 - F880	800
Serial link parameter set	F900 - F926	900
PID controller parameter, pump control functions	FA00 - FA80	A00
Torque / speed control	FC00 - FC51	C00
Reserved	FE00 - FE60	E00
Diagnosis	H000 - H019	H00

Selection of parameters:

Press the 

key to move to the programming level

Line 1 shows the parameter group, while the parameter description is shown in line 2.
Line 3 indicates the parameter number and the assigned parameter value

In programming level, the keys  **and**  **are used to switch between all different parameters.** 

key moves the parameter counter decimal point (to switch between single parameters and parameter groups)

key allows to select a parameter to modify, once selected, the keys   **increment/decrement the parameter value.**

again memorizes the changed parameter value

moves back to the normal operating mode

Parameter types:

Read only parameters: These parameters can not be changed, the tentative to modify will end up in **Err0** message – read-only parameters are listed in GRAY **characters**

Dynamic parameters: These parameters are allowed to modify with inverter in **START** and in **STOP** mode, listed in red bold characters on this description: Fxxx

Static parameters: To modify with inverter in **STOP** mode only, otherwise, **Err0** is displayed, static parameters are listed in red, italic bold characters as *Fxxx*
If parameter setting is not successful, a message and Err0 **will show up on the display**

Factory parameter reset: F160=1 (see chapter parameter group 100)

8) Parameter group 100: Basic parameter

F100 **Passwort**	**Range: 0 – 9999**	**Default: 8**

If F107=1 (password enabled): enter correct password, to unlock parameter modification function. Incorrect password results in **Err1** on the display

F102 **Rated current (A)**	**Range: 1.0 – 800.0**	**Factory set, depending on model, read only**
F103 **Rated power (KW)**	**Range: 0.2 – 800.0**	**Factory set, depending on model, read only**

F105 **Software version No.**	**Range: 1.00 - 10.00**	**Factory set, depending on model, read only**

F106 **Control algorythm**	**Selection: 0: Sensorless Vector (SLV) 1: Reserved 2: V/Hz mode 3: Simple Vector (Slip compensation) 6: Synchronus motor control**	**Default setting: 2**

0: SENSORLESS VECTORS can operate with one single motor only

2: V/Hz mode can work with more motors in parallel connection

3: Simple Vector Modus can operate with one single motor only

6: Control of PMM - Permanent Magnet Synchronus motors (single motor only)

Attention!!

All motor parameters must be set precisely, to guarantee correct function in SENSORLES VECTOR and SYNCHRONUS control mode (F106=0/3/6). Motor parameters can be set manually (see parameter group 800), The AUTOTUNING function is used to fine-tune parameters.

For drives applications with quadratic torque characteristic (pump, fan) the V/Hz setting is recommended (F106=2).
Inverter rated power should match motor power.
Catch on the fly function is in V/Hz mode available only.

F107 **Activation of password protection (for parametrizing)**	**Selection: 0: No password protection 1: Password protection**	**Default setting: 0**
F108 **Password setting**	**Range: 0 - 9999**	**Default setting: 8**

F109 **Start – frequency (Hz)**	**Range: 0.00 - 10.00 Hz**	**Default setting: 0.00 Hz**
F110 **Start – frequency duration (sec.)**	**Range: 0.0 - 10.0 sec.**	**Default setting: 0.0 sec.**

The inverter always starts running with the selected Start-frequency, if the target frequency is lower than the Start-frequency, **F109** will be ignored.

After the inverter gets a START command, it will remain at the Start-frequency, (set in **F110),** for the time, set in **F111.** After the delay, it will proceed with the acceleration ramp to reach the final frequency. The acceleration ramp does not take into account the start frequency delay time

The Start-frequency value is independent and not limited by the minimum frequency **F112.** In case **F109** is lower, than **F112,** the inverter will start running with the values in **F109** and **F110**. After the inverter reaches the minimum frequency **F112**, the values **F111** and **F112** are considered as frequency limits.

It is recommended, to chose Start-frequency lower than maximum frequency **(F111)**.

F111 **Maximum frequency (Hz)**	**Range: F113 - 650.0 Hz**	**Default setting: 50.00Hz**
F112 **Minimum working frequency (Hz)**	**Range: 0.00 - F113 Hz**	**Default setting: 0.50Hz**

The parameter **F111** limits the inverter output frequency

In SENSORLESS VECTOR mode it is recommended to limit the maximum frequency to 400 Hz

The parameter **F112** defines the minimum allowed output frequency. If speed reference corresponds to frequency lower than the value in **F112**, the inverter behaviour depends on Parameter **F224**:

F224=0: Inverter stops, **F224=1**: Inverter continues to run on F-min, defined by **F112**.

Attention!! Continuous operation at low speed may overheat the motor – forced ventilation is recommend

F113 **Internal speed reference (Hz)**	**Range: F112 - F111**	**Default setting: 50.00 Hz**

Virtual internal speed reference, it is selectable in the same way, as any external speed reference **(see F203, F204).** If selected **F203/204 = 0**, after the START command, the inverter will reach this speed value.

F114 **Acceleration ramp 1 (sec.)**	**Range: 0.1 – 3000 sec.**	**Default setting: 0.2 - 3.7KW, 5.0 sec. 5.5 - 30KW, 30.0 sec. > 37KW, 60.0 sec.**
F115 **Deceleration ramp 1 (sec.)**		
F116 **Acceleration ramp 2 (sec.)**		**Default setting: 0.2 - 3.7KW, 5.0 sec. 5.5 - 30KW, 30.0 sec. > 37KW, 60.0 sec.**
F117 **Deceleration ramp 2 (sec.)**		

Acceleration ramp: Time to reach 50 Hz, or F-max (it depends on **F119**)

Deceleration ramp: Time, to decelerate to 0 Hz, referred to 50 Hz, or F-max (depending on **F119**)

The second ramp set is selectable via programmable digital input (DI1...DI8) - **(F316...F323).**

F119 **Reference for Accel./Decel. ramp time**	**Selection: 0: 0 ... 50.00Hz 1: 0 ... F-max**	**Default setting: 0**

If **F119=0**, ramp time is the duration from 0 Hz to 50 Hz, If **F119=1** it is from 0 Hz to F-max.

F118 **Knee frequency (Hz)**	**Range: 15.00 - 650.0**	**Default setting: 50.00Hz**

Frequency, corresponding to the maximum inverter output voltage, the U/F characteristics reaches the horizontal range

Below the knee-frequency, the drive system operates in constant torque, above it works with constant power

ATTENTION!! Wrong setting of the Knee-Frequency may destroy the motor

F120 **Dead time during reversion (sec.)**	**Range: 0.0 – 3000 sec.**	**Default setting: 0.00 sec.**

If activated (>0), the inverter will stop at 0Hz during the reversing cycle, indicated as 0. on the display. (these parameter has no effect, if automatic frequency cycling is chosen).

This function may be useful, to avoid torque/current peaks during reversion

F122 **Reverse operation disable**	**Selection: 0: reversion enabled 1: reversion disabled**	**Default setting: 0**

if **F122=1** the inverter can operate in one rotating direction only, regardless of different other settings or control signals. A reversing command will result in inverter STOP

If inverter rotation is set to "reverse" by parameter (**F202=1**), and **F122** is set to "reversing disable", the inverter will not start

If "Catch on the fly" function is active, it will catch the motor, beginning with 0.0 Hz

F123 **Reversing enable with combined speed control**	**Selection: 0: disable 1: enable**	**Default setting: 0**

If in case of combined speed control, the speed result becomes negative (reverse rotation), this function may be used to enable/disable the reverse rotation of the motor. If disabled, in case of negative speed, the inverter output 0,0 Hz (Parameter **F122=1** overwrites this setting)

F124 **Jog frequency (Hz)**	**Range: F112 - F111**	**Default setting: 5.00 Hz**
F125 **Accel. ramp – Jog Mode (sec.)**	**Range: 0.1 – 3000 sec.**	**Default setting: 0.2 - 3.7KW: 5.0 sec. 5.5 - 30KW: 30.0 sec. > 37KW: 60.0 sec.**
F126 **Decel. ramp –Jog Mode (sec.)**		

Jog frequency is started, activating any of the programmable digital inputs DI1…DI6 (input JOG mode assignating code: **11=FWD,12=REW**)

Remark: In Jog mode the "catch on the fly" function is deactivated

F127/F129 **Cut-Off frequency A,B (Hz)**	**Range: 0.00 - 650.0**	**Default setting: 0.00 Hz**
F128/F130 **Cut-Off frequency window A,B (Hz)**	**Range: ±2.5 Hz**	**Default setting: 0.0 Hz**

Cut-Off frequency to avoid resonance problems – the inverter transits during accel. / decel. ramps through this frequency areas, but it cannot stay stable within this frequency ranges.

Display configuration (secondary display, line 3 and 4):

F131 **Display: Selection of operating parameters to display during „START“ status (Motor running)**	**0: Output frequency / parameter value 1: Motor speed (rpm) 2: Motor current 4: Motor voltage 8: DC-voltage 16: PID control feed back 32: Heatsink temperature 64: Counter 128: Speed (linear - calculated 256: PID set-point 512: Reserved 1024: Reseved 2048: Motor-Power 4096: Motor-Torque 8192: Reserved**	**Default setting: 0+1+2+4+8=15 (frequeny+speed+motor-voltage+motor-current+DC-voltage)**

To display a specific parameter, just set Parameter **F131** to one of the values in the table above, to display more parameters, the sum of all values must be set in **F131**

The 

key is used to cycle through the various selected parameter values

F132 **Display: Selection of operating parameters to display during „STOP“ status (Motor stopped)**	**0: Target frequency / Parameter (*F*xxx)** **1: Jog modus via keypad - HF-0** **2: Target motor speed (rpm)** **4: DC-voltage** **8: PID control feed back** **16: Heatsink temperature** **32: Counter** **64: PID set-point** **128: Reserved** **256: Reserved** **512: Torque control reference** **1024: Reserved** **2048: Reserved**	**Default setting: 0+2+4＝6**

With inverter in STOP mode, the display will always show the target frequency - flashing

Following table shows the units and display-mode for various parameters:

Motorspeed (rpm): (**NNNN**) integer value – the decimal point indicates values above 9999.
Motor Current **A (A.A)**
Motor-Voltage: **U (VVV)**
Counter status: (**ZZZZ**)
DC-Voltage: **u (VVV)**
Heatsink temperature: **H (TTT)**
Calculated speed **L(sss)**. Decimal point to indicate values above 999, two decimal points for values above 9999
PID controller Set-Point (normalized): **(o*.*)**
PID Feed-Back (normalized): **(b *.*)**
Motor-Power (normalized): **(x.x)**
Motor-Torque (normalized): **(m.m)**

Parameter, for calculated speed indication (display)

F133 **Transmission ratio**	**Range: 0.10 - 200.0**	**Default setting: 1.00**
F134 **Pulley diameter**	**0.001 – 1.000 (m)**	**Default setting: 0.001**

Example: Max. Frequency **F111=50.00Hz**, number of poles **F804=4**, transmission ration **F133=1.00**, pulley diameter R=0.05m (**F134=0,05**), calculation result: pulley circumference: 2πr =2×3.14×0.05=0.314 (meter), shaft speed: 60×frequency / (number of poles × transmission ratio) = 60×50/ (2×1.00) =1500rpm. For linear speed: speed (rpm) × pulley circumference = 1500×0.314=471(meter/second)

F136 **Slip compensation in V/Hz mode**	**Range: 0 - 10%**	**Default setting: 0**

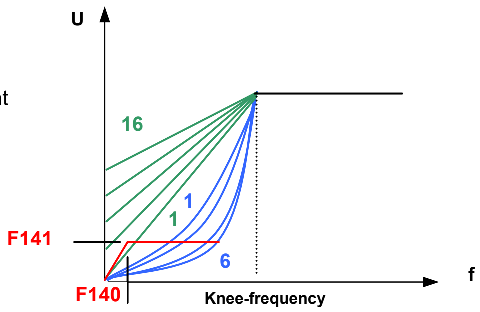
This parameter compensates the load-depending slip of the asynchronus motor – it works only in the stable area of the motor speed/torque characteristic
during the "catch on the fly" process this function is deactivated

F137 **Voltage frequency characteristic (for V/Hz mode only)**	**Selection: 0: Linear** **1: Quadratic** **2: User defined (6 - Punkt)** **3: Automatic** **4: Defined by separate voltage setpoint**	**Default setting: 3**
F138 **Lineare characteristic**	**Range: 1 - 20**	**Default: 0.2-3.7 kW : 7** **5.5-30 kW : 6** **37-75 kW : 5** **> 90 kW: 3**
F139 **Quadratic characteristic**	**Auswahl: 1 - 6**	**Default setting: 1**

Voltage increase on low frequencies is necessary to compensate the stator copper resistance.

With **F137=0** lineare voltage increase is chosen, suitable for constant torque load.

F137=1 quadratic increase, the right curve for load with quadratic characteristic, like pump and fan.



Voltage characteristic linear/quadratic/BOOST

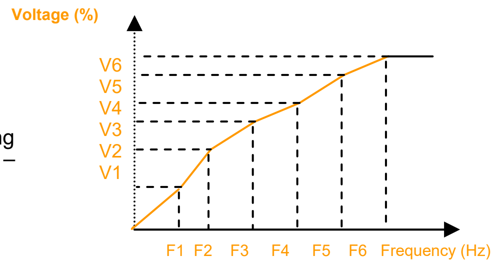
F137=2, serves to possible to program a user specific V/Hz curve – see table below

A total of 12 parameter are necessary to define the user specific curve **(F140 bis F151)** .

F140 **User defined frequency F1**	**Range: 0 - F142**	**Default setting: 1.00**
F141 **Assigned motor voltage V1**	**Range: 0 - 100%**	**Default setting: 4**
F142 **User defined frequency F2**	**Range:F140 - F144**	**Default setting: 5.00**
F143 **Assigned motor voltage V2**	**Range: 0 - 100%**	**Default setting: 13**
F144 **User defined frequency F3**	**Range: F142 - F146**	**Default setting: 10.00**
F145 **Assigned motor voltage V3**	**Range: 0 - 100%**	**Default setting: 24**
F146 **User defined frequency F4**	**Range: F144 - F148**	**Default setting: 20.00**
F147 **Assigned motor voltage V4**	**Range: 0 - 100%**	**Default setting: 45**
F148 **User defined frequency F5**	**Range: F146 - F150**	**Default setting: 30.00**
F149 **Assigned motor voltage V5**	**Range: 0 -100%**	**Default setting: 63**
F150 **User defined frequency F6**	**Range: F148 - F118**	**Default setting: 40.00**
F151 **Assigned motor voltage V6**	**Range: 0 - 100%**	**Default setting: 81**

Remark: V1<V2<V3<V4<V5<V6，F1<F2<F3<F4<F5<F6.

If **F137=3,** the slip compensation works in automatic – correct setting for all motor parameter is necessary to guarantee correct operation – AUTOTUNING may be used to find motor parameters, like inductance and stator resistance (see parameter group 8).



User programmable curve

WARNING!! High voltage increase on low speed may result in inverter over-current trip and/or motor overheating

F140 **BOOST knee-frequency (Hz)**	**Range: 0 – 5 Hz**	**Default setting: 1 Hz**
F141 **BOOST intensity (%)**	**Range: 0 – 25%**	**Default setting: 4 %**

BOOST function allow additional voltage increase on low speed – see graphic (for **F137=0** or **F137=1**).

F152 **Maximum motor voltage (at knee frequency – modulation degree)**	**Range: 10 – 100 ％**	**Default setting: 100 %**

This function is used to limit the maximum motor voltage – the percentage value refers to the corresponding input voltage (on 400 V power supply: 100%= 400 motor voltage)

F153 **PWM Frequency**	**Range:**	**Default setting:**
	800 Hz – 16.000 Hz	**Depending on power range**

Attention: Maximum allowed PWM frequency with full load: 10 kHz, for frequencies above derating is recommended, depending on power range and operating temperature - please contact your support engineer

F154 **Power supply voltage compensation**	**Selection: 0: deactivated 1: activated 2: deactivated during deceleration ramp**	**Default setting: 0**

This function keeps the motor-voltage stable and independent from power supply voltage fluctuation. It may stretch the deceleration phase, therefore it can be deactivated during deceleration only **(F154=2)**

F155 **Internal value for secondary speed reference**	**Range: 0…F111**	**Default setting: 0**
F156 **Polarity secondary speed ref. (direction)**	**Range: 0 (FWD) oder 1(REV)**	**Default setting: 0**
F157 **Secondary speed ref. readout**		**Read-only**
F158 **Secondary speed polarity readout**		**Read-only**

Internal digital reference for secondary speed reference - analogue to F113

F159 **„RANDOM" PWM modulation**	**Selection: 0: constant PWM frequency 1: „RANDOM" modulated PWM**	**Default setting: 1**

If **F159=0:** Inverter works with constant PWM frequency (as set in**F153)**
159=1: PWM frequency is "random" over-modulated.

F160 **Factory default reset**	**Selection: 0: Normal operation 1: Start factory default reset process**	**Default setting: 0**

Factory default reset procedure:

Select parameter F160**, press** 

, original parameter F160 value now is 0, press  **to set F160 to** 1
press 

again.

After a few seconds all factory default parameters are restored.

The value in F160 returns to 0, after the restore process is completed.

ATTENTION:

The factory default reset process will not reset the following parameters:

F400 F402 F406 F408 F412 F414 F421 F732 F742 F745 F901, and language selection

9) Parameter group 200: Inverter control

START / STOP / running direction:

Attention: RUN/STOP commands, as set in parameter F200 and F202 work with dynamic signals (pulses). In Europe it is more common to work with static signals (for safety reason). Therefore it is recommended to use RUN/STOP signals, defined by parameter F208 (two wire control) F208 overwrites parameter F200/201

F200 **START command source**	**Selection: 0: Keypad only** **1: Terminal input only** **2: Keypad + terminal input** **3: Serial link (MODBUS)** **4: Keypad + terminal + serial link**	**Default setting: 4**
F201 **STOP command source**	**Selection: 0: Keypad only** **1: Terminal input only** **2: Keypad + terminal input** **3: Serial link (MODBUS)** **4: Keypad + terminal + serial link**	**Default setting: 4**

F200 and **F201** are used to set the mode for inverter starting and stopping – via keypad key, digital input on terminals, MODBUS commands, or a combination of all three. All signals are dynamic, input pulses, are sufficient, to start/stop the inverter. **This parameters are valid only, if F208=0 (default), if F208>0, this setting will be ignored**

F202 **Rotation direction preset**	**Selection: 0: forward** **1: reverse** **2: depending on terminal signals**	**Default setting: 0**

If no other rotation direction signal (logic) present, the rotation depends on this parameter – e.g. in case of keypad control. Otherwise the direction depends on logical function of more direction signals
For **F208>0,** this setting will be ignored
If **(F500=2)** – automatic frequency cycling – this parameter is ignored

Selection of speed reference sources:

F203 **Primary speed reference source** **"X"**	**Selection:** **0:Internal reference (F113) with automatic memory (STOP)** **1: Analogue input AI1** **2: Analogue input AI2** **3: Pulse input DI1** **4: Fix-frequencies, terminal control (digital inputs)** **5: same as 1, (F113) but without memory at STOP** **6: reserved** **7: reserved** **8: reserved** **9: PID controller output** **10: MODBUS data**	**Default setting: 0**

F203=0: Inverter accelerates after the first START command to the frequency value F113, using ▼ ▲ keys, or proper configured digital terminal inputs, the user can vary the frequency, after a STOP command, the last frequency value will be automatically memorized. To activate the memorizing function in case of power-down too, it needs to set **F220=1.**
F203=1 - F203=2: this is the setting for speed reference through analogue channels AI1-AI2. Analogue channels may be configured for 0..10V, or 0(4)..20mA (on 250 Ohm). Configuration via DIP Switches on control board (see chapter: *5 Hardware and hardware configuration of I/O channels)*. Default: **AI1** = 0…10V, **AI2** = 0...20 mA. To realize 4...20mA, an offset can be programmed: **F406=2V**.
F203=3: Pulstrain as speed reference, max. 50 kHz on digital input **DI1**.

F203=4: Up to 16 fix programmed frequencies, selectable via programmable digital inputs **DI1...DI6**

F203=5: Same function as F203=0: Internal reference **(F113)**, but no memory after STOP or power-down

F203=9: PID controller output works as speed reference origin (for PID controller applications))

F203=10: Speed reference through serial link (MODBUS)

F204 **Secondary speed-reference source "Y"**	**Selection: 0: Internal reference (F155) – with memory** **1: Analogue input AI1** **2: Analogue input AI2** **3:Reserved** **4: Fix-frequencies, terminal control (digital inputs)** **5: same as 1, (F155) but no memory** **6: PID controller output**	**Default setting: 0**

Secondary speed channel has the same function, as primary channel, if selected as the only reference. Setting parameter **F207,** both channels, primary and secondary can be concatenated each other.
If **F204=0**, the value in **F155** works as initial speed reference, if secondary channel is used alone, in this case the value in **F156** is ignored
If **F207=1** or **F207=3:** value in **F155** and **F156** are valid for the secondary speed reference source
F205 and **F206** determine the range of the secondary speed channel, if analogue channel **AI1** or **AI2** are used for sec. speed ref. input (F205=1 or 2)
If the potentiometer on the keypad panel is selected (F205=7), primary speed reference source is limited on fix-frequencies or MODBUS setting
It is not allowed to configure primary and secondary speed reference source through the same channel

F205 **Reference point for the range setting of the secondary speed reference channel, using AI1 or AI2**	**Selection: 0: referred on F-max** **1: referred on the primary speed channel "X"**	**Default setting: 0**
F206 **Range for secondary speed ref. „Y" (%)**	**Range: 0….100 %**	**Default setting: 100**

In case of combined speed control and secondary speed ref. input via **AI1** or **AI2**, parameter **F205** and **F206** determine the relation to the primary reference

Combined speed control – between primary and secondary speed reference

F207 **Output frequency as combination of primary ("X) and secondary ("Y") speed reference signal**	**Selection:** **0: X, only primary reference is used** **1: X+Y Sum of primary and secondary reference** **2: X or Y (terminal input selection)** **3: X or X+Y (terminal input selection)** **4: X (Fix-frequencies) and Y (analogue) combined** **5: X-Y Difference between primary and secondary value** **6: X+Y(F206-50%) * (value defined in F205)** **7: Fixed frequencies or F155**	**Default setting: 0**

If **F207=1:** X+Y, the sum of both channels is used – it is not allowed to use PID controller output for speed reference signals .
If **F207=3:** X or (X+Y) determine the output frequency, selection via terminal digital input. – is not allowed to use PID controller output is not allowed for speed reference signal.
If**F207=4:** Fix-frequencies are the primary speed source, with priority to the analogue speed reference input for example (F203=4 und F204=1).
If **F207=5:** The difference between both speed reference channels determine the output frequency – PID controller output is not usable.
If **F207=6:** output frequency is set according to X+X(F206-50%)*F205 – PID controller output is not allowed
If **F207=7:** output frequency is set by F155 and fixed frequencies - fixed frequencies have priority

Combination between different speed reference channels

F204 / F203	0 Internal digital set with memory	1 External Analogue input AI1	2 Extern Analogue input AI2	4 Fix-frequency selection	5 PID controller
0 Internal digital set with memory	○	•	•	•	•
1 External Analogue input AI1	•	○	•	•	•
2 Extern Analogue input AI2	•	•	○	•	•
4 Fix-frequency selection	•	•	•	○	•
5 Internal digital set without memory	○	•	•	•	•
9 PID controller	•	•	•	•	○
10 MODBUS	•	•	•	•	•

●: Allowed ○: Not allowed

-The automatic cycling frequency control algorithm cannot work in any combination with others

Two / Three wire control for START - STOP - DIRECTION:

This control mode overwrites the setting in F200, F201, F202

F208 **Activation special Two / Three wire control**	**Selection:** **0: Deactivated** **1: Two-wire, Type 1 (static)** **2: Two-wire, Type 2 (static)** **3: Three wire, Typ1 (Impulse / pushbutton control – dynamic)** **4: Three wire, Typ2 (Impulse / pushbutton control – dynamic)** **5: Pulse / pushbutton control (dynamic)**	**Default setting: 0**

F208=0: If Fixed-frequency control is required this mode must be deactivated!

If **F208>0:** functions **F200**, **F201** and **F202** are ignored.

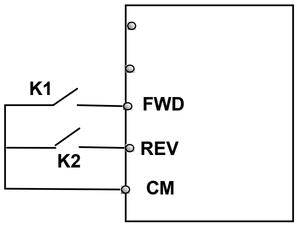
“FWD”, “REV” and “X” are digital terminal input signals for two / three wire control mode. This logical signals are assigned to DI1.....DI6 through parameters F316....F321

Assigning-code for DIxx: FWD=15, REV=16, X=17 – see chapter: ***Parameter group 300 – Digital I/O configuration***

F208=1: Two wire Type 1

K1=START forward (default on DI3)

K2=START reverse (default on DI4)



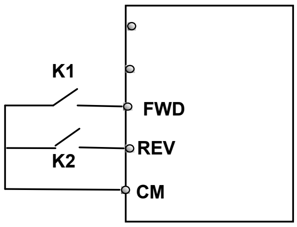
Truth table

K1	K2	
0	0	Stop
1	0	forward
0	1	reverse
1	1	Stop

F208=2: Two wire Type 2

K1=START (default on DI3)

K2=Rotating direction (default on DI4)



Truth table

K1	K2	
0	0	Stop
0	1	Stop
1	0	forward
1	1	reverse

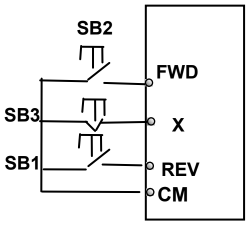
F208=3: Three wire Typ 1

Pulse/pushbutton control:

FWD(SB2)=START-impulse forward
FWD=NO

REV(SB1)=START-impulse reverse
REW=NO

X(SB3)=cancel impulse (STOP)
X=NC



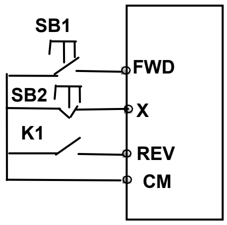
F208=4: Three wire Typ 2

Pulse/pushbutton control:

FWD(SB1)=START-impulse
FWD=NO

X(SB2)=cancel-impulse (STOP)
X=NC

K1=Direction

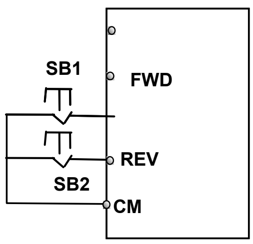


F208=5: Three wire Typ 3

Pulse/pushbutton control:

FWD (SB1) Impulse: START-forward / STOP
Toggle function
FWD=NO

REV (SB2) Impulse: START-reverse / STOP
Toggle function
REV=NO



F209 **"STOP" mode selection**	**Selection: 0: STOP controlled by deceleration ramp 1: Free-stop (uncontrolled) 2: STOP with DC injection**	**Default setting: 0**

If **F208=1:** STOP command disables the final stage, motor stops uncontrolled by inertia
If **F208=2:** STOP wit DC brake function (defined in **F600**, **F603, F605, F656)**

ATTENTION: In DC brake mode all kinetic energy will dissipate in the rotor. Cyclic use of DB braking, or braking of high inertial mass may overheat the motor.

F210 **Frequency resolution with motorpotentiometer control via keypad/terminals**	**Range: 0.01 - 2.00 Hz**	**Default setting: 0.01 Hz**

F211 **Variation speed in motorpotentiometer control mode via keypad/terminals**	**Range: 0.01 - 100.0 Hz/sec.**	**Default setting: 5.00 Hz/sec**

If **F203=0/5:** Inverter starts with initial frequency **F113** (memory with F203=0) – **F220=1,** to memorize with power-down too

F212 **Status memory with (208=3)**	**Selection: 0: deactivated 1: activated**	**Default setting: 0**

If activated, after power down or reset, the inverter will restart with the same status, as before (the previous start impulse forward/reverse was memorized)

F213 **Autostart after power-down**	**Selection: 0: deactivated 1: activated**	**Default setting: 0**
F214 **Inverter-Error AUTO-RESET**	**Selection: 0: deactivated 1: activated**	**Default setting: 0**
F215 **Power-on Autostart delay (sec.)**	**Bereich: 0.1…3000.0 sec.**	**Default setting: 60.0**

F213=1 will force the inverter to restart automatically in case of power off. On power-on, the inverter will restart with the same conditions, as before (frequency/direction). **F215** defines the delay time for power-on autostart.
Power-on autostart works only with **F208=0** (dynamic start command)

F214=1 will cause an automatic reset in case of inverter error. **F217** is the delay time for error-reset, while **F215** works as delay time for restart after error-reset.
Autostart is performed only if error occurs during START condition (motor running), in case of STOP condition, only error-reset will be done.
In case of deactivated automatic error-reset, manual reset (keypad/terminal signal) must be done

F216 **Number of error-reset tentative**	**Selection: 0 - 5**	**Default setting: 0**
F217 **Delay time for error-reset**	**Range: 0.0 - 10.0 sec.**	**Default setting: 3.0 sec.**

WARNING: Activation of AUTOSTART and/or AUTORESET may result in unexpected START up of the drive system!!

F219 **EEprom write protection under MODBUS control**	**Selection: 0: deactivated 1: activated**	**Default setting: 1**

Please note that **F219**, the EE-prom write protection it is activated by default (to prevent EE-prom from getting destroyed due to repetitive write operations). With this configuration all data sent by MODBUS are stored in the RAM only and get lost after power-down.
If inverter works with continuously varying parameter values, like speed reference, it is recommended, to work in the RAM only.

F220 **Memory function for speed and rotation direction in case of power-down**	**Selection: 0: deactivated 1: activated**	**Default setting: 0**

Valid in case of internal speed reference (**F113), (F155 – F156)**

F224 **F-min handling**	**Selectionl: 0: f<F-min: STOP 1: f<F-min: RUN with F-min**	**Default setting: 0**

F277 **Acceleration time 3 (sec.)**	**Range: 0,1 – 3000sec.**	**Default setting: depending on inverter size**
F278 **Decelaration time 3 (sec.)**		
F279 **Acceleration time 4 (sec.)**		
F280 **Decelaration time 4 (sec.)**		

10) Parameter group 300: Digital I/O configuration

Following digital I/O channels are available on EP66 inverters:

Digital inputs	**6 (DI1…DI6)**
Digital outputs	**1 (DO1) Open Collector 100 mA / 24 V**
Relay output	**2 Switch over contact 5 A 230V**
Pulse input	**DI1 to configure as pulse input**

Parameters F300-F302 (for outputs) and F316–F321 (for inputs) allow assignation of various functions to digital I/O channels

Function mapping for digital output channels:

F300 **Relays 1 output**	**Mapping for functions : 0…..45** **See table below**	**Default setting 1 (error)**
F301 **DO1 Digital output 1**		**Default setting 14 (Inv. enable)**
F302 **Relays 2 output**		**Default setting 5 (START-1)**

Value	Function	Description
0	**No function**	No function assigned
1	**Inverter error**	The output is active in case of inverter error
2	**Freq. threshold 1**	If output frequency reaches the threshold, the output will be activated, threshold, including hysteresis programmable with parameters **F307, F308, F309**
3	**Freq. threshold 2**	
4	**Inverter disable**	Free-STOP command on terminals (system in inertia)
5	**Inverter START-1**	Inverter in START mode, motor runs, (frequency > 0 Hz)
6	**DC Brake**	Inverter in DC-Brake mode
7	**Rampset 2 selection**	Second Accel/Decel. ramp set has been selected
8	**Counter final value**	Internal counter: The value, set by **F314** has been reached
9	**Counter intermediate**	The counter is in the range, delimited by **F315** and **F314**
10	**Inverter overload WARNING**	In case of inverter overload, a warning is set, after half the switch off delaytime has passed. Load reduction to cancel, otherwise overload trip **(OL1)**
11	**Motor overload WARNING**	Early warning in case of motor overload – similar function as (10) – if no load reduction, overload trip with **(OL2)** in the display
12	**Temp. Ramp stop**	Acce./Decel ramp temporarily stopped (Limiting function activated **F607...F610**)
13	**Inverter OK**	Inverter is powered on and ready without any error
14	**Inverter START - 2**	Inverter enabled, similar to **5** but also active with F=0 (final stage enabled)
15	**Target freq. reached**	Acce./Decel. ramp finished (final freq. reached) (hysteresis to set in **F312**)
16	**WARNING overtemp.**	At 80% of the temperature switch-off limit, inverter may trip with **(OH)** if no cooling
17	**Current limit**	Inverter has reached the current limit, programmable in **F310** and **F311**
18	**Analogue signal interruption**	Analogue input signal below the programmable threshold, (see **F741/742** and **F400/406**)
19	**Lack of water**	Lack of water, detected via motor curren (delayed) (see **FA26, FA27**) – Idling protection
20	**Prealarm lack of water**	Motor-current fallen below the programmed value (see **F754, F755**).
21	**Modbus-controlled**	Output controlled by MODBUS: Set code: **2005H = 1,** Reset code: **2005H=0**
22	**Modbus-controlled**	Output controlled by MODBUS: Set code: **2006H = 1,** Reset code: **2006H=0**
23	**Modbus-controlled**	Output controlled by MODBUS: Set code: **2007H = 1,** Reset code: **2007H=0**
24	**Watchdog**	Signal on programmed watchdog input missing
25-29	**Reserved**	
30	**Slave-Pump RUN**	Pump control modus: The slave pump has been activated
31	**Masterpump**	Pum control modus: The inverter controlled pump is running
32	**Pressure alarm**	Pum control modus: The pressure is beyond the limits, set by **FA03**
42	**Reserved**	
43	**MODBUS Timeout warning**	Modbus data not valid (see F907), reset via digital input (**60**)
45	**Freeze alarm**	Signal set with environment temperature below 0 °C

F303 Configuration DO1 as pulse output	Selection: 0: digital output 1: Pulse output	Default setting 0

F303=1: Output **DO1** is configured as fast pulse signal output, with maximum frequency of 50kHz. Signal configuration through parameter **F449 - F453**.

Activation and configuration of the "S" shaped ramp

F304 Initial progression	Range: 2.0....50%	Default setting 30%
F305 Final progression		
F306 "S" shaped ramp activation	Selection: 0=Linear ramp 1="S" ramp	Default setting 0

Frequency threshold setting

F307 Frequency threshold 1 (Hz)	Range: F112 - F111 (Hz)	Default setting 10Hz
F308 Frequency threshold 2 (Hz)		Default setting 50Hz
F309 Hysteresis	Range: 0…100%	Default setting 50 %

This are frequency thresholds for signalling through programmable digital outputs - function assignation: **2 / 3**.
Hysteresis to subtract from threshold value

Current threshold

F310 Current threshold (A)	Range: 0…1000 A	Default setting rated current
F311 Hysteresis current thresh.	Range: 0…100%	Default setting 10%

Current threshold, signalled through programmable digital outputs - function assignation: **17**.
Hysteresis to subtract from threshold value

F312 Hysteresis to end-frequency (Hz)	Range: 0.00…5.00 Hz	Default setting 0.00

Valid for the "end of ramp" message through digital outputs – output function assignation: **15**
Hysteresis to subtract from threshold value

Internal counter programming

F313 Divisor for input pulses	Range: 1…65000	Default setting 1
F314 Final counter value	Range: F315…65000	Default setting 1000
F315 Intermediate counter value	Range: 1…F314	Default setting 500

Programmable values, for counter status messaging signals, through digital outputs – functions assigned **8** / **9**
Function **8:** Output pulse is generated, at the counters final value
Function **9:** Output activated after the intermediate value is reached, deactivated at counters final value

Function mapping for digital input channels DI1 – DI6

F316 **Function assignation to DI1**	**Function mapping: 0….61**	**Default setting 11** (JOG-forward)
F317 **Function assignation to DI2**		**Default setting 9** (EMERGENCY-STOP EXT.)
F318 **Function assignation to DI3**		**Default setting 15** (TERMINAL "FORWARD")
F319 **Function assignation to DI4**		**Default setting 16** (TERMINAL "REVERSE")
F320 **Function assignation to DI5**		**Default setting 7** (RESET)
F321 **Function assignation to DI6**		**Default setting 8** (STOP-DISABLE)

Attention: One function can be assigned to one single digital input only (no multiple inputs) If a function is already assigned to a certain input (factory set), the assignment must be deleted (set assignment to 0), before assigning to another input.

Table: Functions of digital inputs

VALUE	Function	DESCRIPTION
0	No function	No function assigned, for unused inputs
1	START function	The input starts the drive system – same as **"RUN"** on keypad
2	STOP function	Input stops the system – same as **"STOP"** on keypad
3	Fix-frequency K1	15-Fix-programmed frequencies are selectable *(see table below 300-1)*
4	Fix-frequency K2	
5	Fix-frequency K3	
6	Fix-frequency K4	
7	RESET	General reset, error reset – same as **"STOP/RESET"** on keypad
8	STOP-DISABLE	**"Free STOP"** system stops with inertia (logical inversion: **F324**)
9	EMERGENCY STOP	Ext. Emerg. STOP signal, **ESP** on display (signal logic: **F325**)
10	RAMPSTOP	Inverter holds the actual frequency, independent from other signals (except STOP signal) – ramps are stopped
11	JOG foreward	JOG control, see **F124, F125** and **F126** for parametrizing
12	JOG reverse	
13	Motorpotentiometer	Motorpotentiometer-function, to increase/decrease frequency, (with internal speed reference **F203=0 / 5**, control parameter: **F113, F210, F211**).
14	Motorpotentiometer	
15	Terminal "FWD"	Assignation of terminal function **"FWD", "REV",** and **"X"** (see two/three wire control – parameter **F208**)
16	Terminal "REV"	
17	Terminal "X"	
18	BIT1 Ramp set	Selection of Acce./Decel. ramp set **(BIT1)** – (see *table 300-2)*
19	Reserved	--
20	M / n	Speed / Torque control mode selection
21	Reference source	Selection of different speed reference sources - combinations (see **F207**)
22	Counter input	DIxx works as counter input
23	Counter reset	To set the internal counter value to 0
24-29	Reserve	
30	Lack of WATER	IF **FA26=1,** this input will set the inverter in alarm mode **EP1** will show up on the display
31	Water OK	To reset the inverter alarm mode, caused by function 30
32	FIRE pressure	To select "Fire Mode" pressure setpoint (parameter **FA58**).
33	FIRE MODE	Activation of the "FIRE MODE" **(FA59)**
34	BIT2 Ramp set	Selection of Accel. / Decel. ramp set **(BIT2)** – (see *table 300-2)*
35	Parameterset (BIT1)	Selection of three different parameter-set **(BIT1)** – *(see Tab. 300-3)*
36	Parameterset (BIT2)	Selection of three different parameter-set **(BIT2)** – *(see Tab. 300-3)*
37	NTC / NO	Motor heath monitoring via **NTC** / **NO** contact (KLIXON)
38	PTC / NC	Motor heath monitoring via **PTC** / **NC** contact (KLIXON)
42	oPEn	Inverter disabling input
49	PID-STOP	Input causes temporary STOP of the internal PID controller
51	Alternative motor	Switch over to alternative motor parameters (FE00=2)
53	Watchdog	Watchdog control-pulse input – if missing, watchdor error occours
60	RS485 Timeout reset	To reset timeout error signal (dig. output assignation 42)
61	START/STOP	General RUN/STOP signal (static)

Fixed-frequencies selection – table 300-1

K4 6	K3 5	K2 4	K1 3	Frequency	Programming parameter
0	0	0	0		
0	0	0	**1**	**Fixed-frequency 1**	**F504/F519/F534/F549/F557/F565**
0	0	**1**	0	**Fixed-frequency 2**	**F505/F520/F535/F550/F558/F566**
0	0	1	1	Fixed-frequency 3	**F506/F521/F536/F551/F559/F567**
0	**1**	0	0	**Fixed-frequency 4**	**F507/F522/F537/F552/F560/F568**
0	1	0	1	Fixed-frequency 5	**F508/F523/F538/F553/F561/F569**
0	1	1	0	Fixed-frequency 6	**F509/F524/F539/F554/F562/F570**
0	1	1	1	Fixed-frequency 7	**F510/F525/F540/F555/F563/F571**
1	0	0	0	**Fixed-frequency 8**	**F511/F526/F541/F556/F564/F572**
1	0	0	1	Fixed-frequency 9	**F512/F527/F542/F573**
1	0	1	0	Fixed-frequency 10	**F513/F528/F543/F574**
1	0	1	1	Fixed-frequency 11	**F514/F529/F544/F575**
1	1	0	0	Fixed-frequency 12	**F515/F530/F545/F576**
1	1	0	1	Fixed-frequency 13	**F516/F531/F546/F577**
1	1	1	0	Fixed-frequency 14	**F517/F532/F547/F578**
1	1	1	1	Fixed-frequency 15	**F518/F533/F548/F579**

Please note: binary selection K1...K4 (F500=1) – for direct selection via K1...K4, use fixed-frequency 1, 2, 4 and 8
Direct selection of only 3 fixed frequencies: K1....K3 (F500=0)

Accel./Decel. ramp selection - table 300-2

BIT1 Function assignation 18	BIT2 Function assignation 34	Accel./Decel. Ramp-set	Programming parameter
1	0	**Ramp set 1**	**F114 / F115**
0	0	**Ramp set 2**	**F116 / F117**
1	1	**Ramp set 3**	**F277 / F278**
0	1	**Ramp set 4**	**F279 / F280**

F324 **"STOP - DISABLE" logic selection (8)**	**Selection: 0=LOW active (NPN) 1=HIGH active (PNP)**	**Default setting 0**
F325 **"EMERGENCY -STOP EXTERN" logic (9)**		**Default setting 0**
F326 **Watchdiog delay time**	**Range: 0,1…30.000 sec.**	**Default setting10,0 sec**
F327 **Watchdog STOP mode**	**Selection: 0=free STOP 1=ramp STOP**	**Default setting 0**
F328 **Digital input filter factor**	**Range: 1…100**	**Default setting 10**

Logic inversion of digital inputs:

F340 **To invert the digital input logic**	**0: disabled 1: DI1 inverted 2: DI2 inverted 4: DI3 inverted 8: DI4 inverted 16: DI5 inverted 32: DI6 inverted**	**Default setting: 0**

To invert the logic of one digital input. To invert the logic of more inputs, the sum of the single inputs must be stored on this parameter (e.g. DI4 and DI6: 8+32=40)

F300....F339 **Diagnostic function**	**See chapter 19 - Diagnostic**

11) Parameter group 400: Analogue I/O channel configuration

The EM30 control board offers 2 independent analogue input channels. Each of them can be adapted to various input/output signals – all configuration must be done by software/hardware setting

Details and instruction for hardware setting: see chapter ***5) Control hardware and IO/ channel configuration***

Following instruction describes, how to set software parameters

Configuration of analogue speed reference channels AI1, AI2:

F400 **Range definition AI1 – lower limit (V)**	**Range 0.00V…F402**	**Default setting: 0.00V**
F401 **Assignation lower limit AI1**	**Range: 0…2**	**Default setting: 1.00**
F402 **Range definition AI1 – upper limit (V)**	**Range: F400…10.00V**	**Default setting: 10.00V**
F403 **Assignation upper limit AI1**	**Range: 0…2.00**	**Default setting: 2.00**
F404 **Gain factor AI1**	**Range: 0.0…10.0**	**Default setting: 1.0**
F405 **AI1 Filter factor AI1**	**Range: 0.1…10.0**	**Default setting: 0.10**

The speed range is defined by upper and lower limits, the area in between corresponds to 100% (example: F400=2, F402=8, 2…8V correspond to 0....100%)

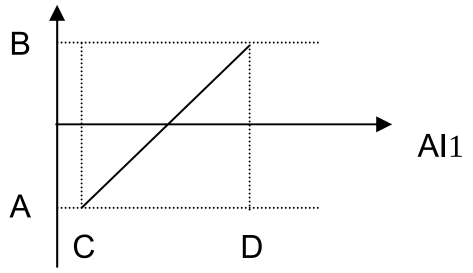
Parameter F401 and F403 are used to move the range limits (in %). Rules: 0 = -100%, 1 = 0%, 2 = +100%. (example: F401=0, F403=2 then 100% signal (the range between upper and lower limit) correspond to -100%...+100% reference). In this case 0...10V input signal corresponds to - 50 Hz…0Hz…+50 Hz).

A= (F401-1)*100%

B= (F403-1)*100%

C= F400

D= F402



Configuration examples:

Speed reference channel selected: AI1 - F203=1,
F-max:F111=50 Hz, F-min:F112=0Hz
All other: default set

Speed reference	Output frequency	F400	F401	F402	F403	F404	Hardware setting
0..10V	0Hz...+50 Hz	0.00V	1.00	10.00V	2.00	1.0	0...10V
0...10V	-50Hz....0Hz...+50Hz	0.00V	0.00	10.00V	2.00	1.0	0...10V
0...10V	-50Hz....0Hz	0.00V	0.00	10.00V	1.00	1.0	0...10V
0...10V	20Hz....50 Hz	0.00V	1.40	10.00V	2.00	1.0	0...10V
-10V...+10V	-50Hz...0Hz...+50 Hz	0.00V	0.00	10.00V	2.00	1.0	+/-...10V
0...20mA	0Hz....50Hz	0.00V	1.00	10.00V	2.00	1.0	0...20mA
4...20mA	0Hz....50Hz	2.00V	1.00	10.00V	2.00	1.0	0...20mA

Same configuration for AI2

F406 Range definition AI2 – lower limit (V)	Range 0.00V…F408	Default setting: 0.00V
F407 Assignation lower limit AI2	Range: 0…2.00	Default setting: 1.00
F408 Range definition AI2 – upper limit (V)	Range: F406…10.00V	Default setting: 10.00V
F409 Assignation upper limit AI2	Range: 0…2.00	Default setting: 2.00
F410 Gainfactor AI2 (%)	Range: 0.0…10.0	Default setting: 1.0
F411 Filter factor AI2	Range: 0.1…10.0	Default setting: 0.10

F418 0 HZ Dead band 0 Hz AI1	Range: +/- 0…0.50V	Default setting: 0.00
F419 0 HZ Dead band 0 Hz AI2	Range: +/- 0…0.50V	Default setting: 0.00

0 Hz dead band: If frequency crosses 0Hz range (depending on signal range setting), 0 Hz output frequency will result, within the 0 Hz dead band.

F437 Analog filter hysteresis	Range: 1…100	Default setting: 10

Higher hysteresis value will result in a more stable system, but with longer reaction time on changing speed reference signal

Pulse speed reference signal input configuration:

Configuration is done in the same way, as for analogue speed reference signal. DI1 is predetermined as pulse signal input channel. DI1 selection is done automatically, if pulse reference signal is selected as speed reference source. Maximum input frequency: 50 kHz.

F440 Min. pulse frequency (kHz)	Range: 0.00…F442	Default setting: 0.00 kHz
F441 Assignation min. frequency	Range: 0.00…F443	Default setting: 1.00
F442 Max. pulse frequency (kHz)	Range: F440…50.00 kHz	Default setting: 10.00 kHz
F443 Assignation min. frequency	Range: Max（1.00，F441）…2.00	Default setting: 2.00
F445 Filter factor pulse input	Range: 0…100	Default setting: 0
F446 0 Hz dead-band	Range: 0…+/- F442	Default setting: 0.00

Range configuration and dead band selection will be done in the same way, as for analogue input signals

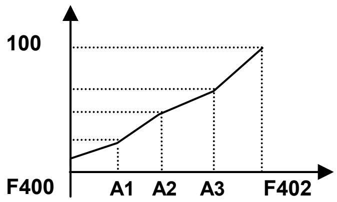
Non-linear characteristic for analogue channels

A non-linear characteristic can be assigned to analogue input channels AI1 and AI2. Programming is done in sense of the table below

F460 Characteristic AI1	Selection: 0=linear 1=non-linear	Default setting: 0
F461 Characteristic AI2	Selection: 0=linear 1=non-linear	Default setting: 0
F462 input level 1 for AI1	Range: F400 - F464	Default setting: 2.00V
F463 Assignation input level 1 (%)	Range: F401 - F465	Default setting: 1.20
F464 input level 2 for AI1	Range: F462 - F466	Default setting: 5.00V
F465 Assignation input level 2 (%)	Range: F463 - F467	Default setting: 1.50
F466 input level 3 for AI1	Range: F464 - F402	Default setting: 8.00V
F467 Assignation input level 3 (%)	Range: F465 - F403	Default setting: 1.80
F468 input level 1 for AI2	Range: F406 - F470	Default setting: 2.00V
F469 Assignation input level 1 (%)	Range: F407 - F471	Default setting: 1.20
F470 input level 2 for AI2	Range: F468 - F472	Default setting: 5.00V
F471 Assignation input level 2 (%)	Range: F469 - F473	Default setting: 1.50
F472 input level 3 for AI2	Range: F470 - F412	Default setting: 8.00V
F473 Assignation input level 3 (%)	Range: F471 - F413	Default setting: 1.80

Assignation of intermediate pints, in the same way as for endpoints

(0= -100%, 1=0%, 2=+100%)



Analogue output configuration AO1, AO2

F423 Signal type configuration output AO1 current/voltage signal	Selection: 0=0…5V 1=0…10V, 0…20mA * 2=4…20mA *	Default setting: 1
F424 Inverter output frequency assigned to minimum output signal on AO1	Range: 0.0…F425	Default setting: 0.05 Hz
F425 Inverter output frequency assigned to maximum output signal on AO1	Range: F424…F111	Default setting: 50.00 Hz
F426 Gain factor AO1	Range: 0…120%	Default setting: 100

) The DIP-SWITCH U/I must be set, to get current signal on AO 1 output – see chapter *5) Control hardware and IO/ channel configuration

F427 Signal type configuration output AO2 current signal only	Selection: 0=0…20 mA 1=4…20mA	Default setting: 0
F428 Inverter output frequency assigned to minimum output signal on AO2	Range: 0.0…F429	Default setting: 0.05 Hz
F429 Inverter output frequency assigned to maximum output signal on AO2	Range: F428…F111	Default setting: 50.00 Hz
F430 Gain factor AO2	Range: 0…120%	Default setting: 100

F431 Assignation of operating parameters to AO1	Selection: 0=Motor frequency 1=Motor-current normalized on 2xI-n) 2=Motor-voltage (normalized on 230/400V) 3=AI1 4=AI2 5=Impulse input 6=Torque – normalized to m-n 7=Set via MODBUS 8=Target frequency 9=Calculated speed 10=Torque (motoric)	Default setting: 0
F432 Assignation of operating parameters to AO2		Default setting: 1

Assignation motor current: The full range corresponds to 0…2x inverter rated current
Assignation motor voltage: The full range corresponds to the inverter rated voltage (230V/400V)

F433 Multiplier for motor voltage meter	Range: 0.01…5* rated value	Default setting: 2.0
F434 Multiplier for motor current meter		Default setting: 2.0
F437 Filter factor analogue output	Range: 1....100	Default setting: 10

Pulse output DO1:

Digital output terminal DO1 can be programmed via F303 as pulse signal output – configuration is made in a similar way, as for analogue outputs

F449 Max. frequency pulse output DO1	Range: 0.00…50.00 kHz	Default: 10.00 kHz
F450 0-point offset (%)	Range: 0.0…100.0 %	Default: 0.0%
F451 Multiplier	Range: 0.00…10.00	Default: 1.00
F453 Assignation of operating parameters to DO1	Selection:0=Motor frequency 1=Motor-current normalized on 2xI-n) 2=Motor-voltage (normalized 230/400V) 3=AI1 4=AI2 5=Impulse input 6=Torque – normalized to m-n 7=Set via MODBUS 8=Target frequency 9=Calculated speed 10=Torque (motoric)	Default setting: 0

12) Parameter group 500: Fixed-frequency, automatic cycling frequencies

Up to 15 fixed-frequencies are selectable on EM30 inverters, including individual ramp and direction setting. Automatic cycling sequence for up to 8 fixed-frequencies can be set, including ramp, direction, run- and pausing time.

Set parameter F203=4 (F204=4), to select fixed frequency mode:

F500 **Fixed-frequency mode selection**	**Selection:** **0: 3 Fixed frequencies are available - direct terminal selection** **1: 15 Fixed frequencies available, binary coded (K1, K2, K3, K4 - terminal)** **2: Up to 8 Fixed frequencies – auto-cycling mode**	**Default: 1**

RUN/STOP control in fix.freq. mode: If **(F208=0)** via keypad, or via dig input, function assignement: **61.**
alternative: F208=1/2, FWD/REV mapping for dig. input required

Activation of fixed frequency controlmode: F203=4 (F204=4)

F203	F500	Fixed frequency mode	Description
4	0	**3 Fixed frequencies direct selection**	To combine with analogue control, fixed-frequencies have priority
4	1	**15 Fixed frequencies binary selection**	To combine with analogue control, fixed-frequencies have priority
4	2	**Up to 8 auto-cycling fixed frequencies**	Independent mode, no manual frequency control is possible during cycle, except STOP command – **F501, F502, F503** are the auto-cycling parameters

Auto-cycling parameter:

F501 **Number of different frequencies for auto-cycling function**	**Selection: 2…8**	**Default setting: 7**
F502 **Number of automatic cycles**	**Range: 0….9999** **0 = Endless cycling**	**Default setting: 0**
F503 **Status after cycle completed**	**Selection: 0: Stop** **1: Keep last valid frequency**	**Default setting: 0**

Programming of the individual fixed-frequencies:

	Acceleration ramp fixed-frequencies 1 - 15 (0,1…3000sec.)	Deceleration ramp fixed-frequencies 1 - 15 (0,1…3000sec.)	Rotation fixed-frequencies 1 - 15 – (0=FWD, 1=REV)	Auto-cycle - duration for fixed-frequencies 1 - 8 (0,1…3000sec.)	Auto-cycle – pausing time for fixed-frequencies 1 - 8 (0,1…3000sec.)		**Default setting:** **Accel./Decel. time, depending on inverter model**
F504 **Fixed-frequency 1 (Hz)**	**F519**	**F534**	**F549**	**F557**	**F565**		**Default: 5.00Hz**
F505 **Fixed-frequency 2 (Hz)**	**F520**	**F535**	**F550**	**F558**	**F566**		**Default: 10.00Hz**
F506 **Fixed-frequency 3 (Hz)**	**F521**	**F536**	**F551**	**F559**	**F567**	**Range for F504 – F518: F112 ....F 111**	**Default: 15.00Hz**
F507 **Fixed-frequency 4 (Hz)**	**F522**	**F537**	**F552**	**F560**	**F568**		**Default: 20.00Hz**
F508 **Fixed-frequency 5 (Hz)**	**F523**	**F538**	**F553**	**F561**	**F569**		**Default: 25.00Hz**
F509 **Fixed-frequency 6 (Hz)**	**F524**	**F539**	**F554**	**F562**	**F570**		**Default: 30.00Hz**
F510 **Fixed-frequency 7 (Hz)**	**F525**	**F549**	**F555**	**F563**	**F571**		**Default: 35.00Hz**
F511 **Fixed-frequency 8 (Hz)**	**F526**	**F541**	**F556**	**F564**	**F572**		**Default: 40.00Hz**
F512 **Fixed-frequency 9 (Hz)**	**F527**	**F542**	**F573**				**Default: 5.00Hz**
F513 **Fixed-frequency 10 (Hz)**	**F528**	**F543**	**F574**				**Default: 10.00Hz**
F514 **Fixed-frequency 11 (Hz)**	**F529**	**F544**	**F575**				**Default: 15.00Hz**
F515 **Fixed-frequency 12 (Hz)**	**F530**	**F545**	**F576**				**Default: 20.00Hz**
F516 **Fixed-frequency 13 (Hz)**	**F532**	**F546**	**F577**				**Default: 25.00Hz**
F517 **Fixed-frequency 14 (Hz)**	**F532**	**F547**	**F578**				**Default: 30.00Hz**
F518 **Fixed-frequency 15 (Hz)**	**F533**	**F548**	**F579**				**Default: 35.00Hz**

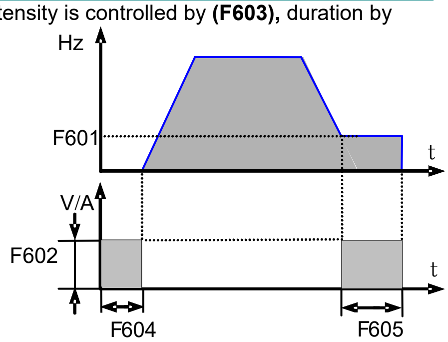
Warning: Function REV (assignation 16) with F208=2 inverts rotation

13) Parameter group 600: DC-Bake control / Aux. functions

DC-Brake function parameters:

F600 DC-Brake function activation	Selection: 0: DC-Brake deactivated 1: DC injection before START 2: DC injection after STOP 3: Before START and after STOP	Default setting 0
F601 Frequency threshold for DC-injection	Range: 0.2…5.0 Hz	Default setting 1.00 Hz
F602 Intensity DC-Brake START F603 Intensity DC-Brake STOP	Range: 0…100%	Default setting 10
F604 DC-Brake duration START F605 DC-Brake duration STOP	Range: 0.0 - 30.0 sec.	Default setting 0.5 sec.

DC Brake can be used as an alternative to ramp controlled STOP **(F209=2).** Intensity is controlled by **(F603),** duration by **(F605)**.



Attention!! Improperly programmed DC-Brake function may result in inverter overcurrent trip and/or motor overheating

In case of braking by DC injection all kinetic energy will be dissipated in the motor rotor. Repeatedly use of the DC brake function may result in motor overheating

Message "DC-Brake active" may be configured through digital output – assignation code 6

Current- Voltage limiting functions

Limiting functions for current and voltage are available in standard E2000 inverters

Current limiting function: To program a motor current threshold. If motor current reaches the threshold (F608) during acceleration, the acceleration ramp will delay, until current drops below the limit.
If current exceed the limit at target frequency (ramp completed), the frequency will be reduced, if necessary, down to the minimum frequency.
Current limiting function is always deactivated during deceleration ramp.

Voltage limiting function: To limit the DC-link voltage increase, due to energy regeneration during deceleration phase. If voltage reaches the limit (F609), the limiting function will stretch the deceleration ramp.

The limiting status of the inverter can be signalized through any programmable digital output. Aassignation code: 12

F607 Activation limiting functions	Selection: 0 deactivated 1..2: reserved 3: current/voltage 4: voltage 5: current	Default setting: 3
F608 Current limit (% rated current)	Range: 60…200 %	Default setting: 160 %
F609 DC voltage limit (% rated voltage)	Range: 60…200 %	Default setting: 140 %
F610 Max. duration if limiting status (sec.)	Bereich: 0.1…3000.0 sec.	Default setting: 5.0 sec.

If limiting status of the inverter takes longer than time, set in F610, the system will stop, signalized by OL1 on the display

Brake Chopper control (internal brake chopper)

F612 **Max. duty-cycle chopper**	**Range: 0…100 %**	**Default setting: 100 %**

"Catch on the fly" function: To get already spinning motor controlled (V/Hz mode only)

F613 **Activation of the function**	**Selection: 0: Function deactivated 1: Always active 2: Active after POWER_ON**	**Default setting: 0**
F614 **Scan process starting from:**	**Selection: 0: Last memorized frequency 1: Starting from f-max 2: Starting from 0HZ**	**Default setting: 0**
F615 **Scan speed**	**Range: 1…100**	**Default setting: 20**

F620 **Brenschopper Disable after STOP**	**Range: 0,0…3000 sec.**	**Default setting: 5,0 sec.**

F620=0,0: Brake chopper may activate in STOP mode as well (if DC voltage rises), if **F620>0:** brake chopper function will deactivate in STOP mode after the time in F620.

Parameter Copy functions

F638 **Parameter Copy**	**Selection: 0: Copy function disabled 1: Enabled, with identical powersize/voltage range 2: Always enabled**	**Default seting: 1**
F639 **KopyCode**	**3000....3499**	**READ ONLY**
F638 **Parameter selection for copy function**	**Selection: 0: All parameter 1: Motor parameter (F8xx) excluded**	**Default setting: 1**

Please refer to copy STICK description

F644 **Keypad copy**	**Range 0: disable 1:Upload parameters 2:Dopwnload parameters**	**Default setting: 0**

Parameter set copy to/from keypad - after setting 1/2, RUN key starts the process

Attenuation function to prevent from torque oscillation (motor vibration at low frequencies)

F641 **Anti-oscillation-function activation**	**Range 0: disable 1%....100% activated**	**Default setting: 10%**

It works in V/Hz mode only **(F137=0,1,2)**, "Catch on the fly" function to deactivate **(F613=0)**

Main display configuration

F645 Selection of operating parameters, to display in line 1 and 2	Selection: 0.....33 Description see table	Default setting: 0

F645	Operating parameter	Description
0	Output frequency	
1	Speed	
2	Speed setpoint	
3	Motor current	
4	Motor voltage	
5	DC-Voltage	
6	PID Setpoint	
7	PID Feedback	
8	Heatsink temperature	
9	Counter value	
10	Calculated speed	
11	Primary reference	
12		
13	Secondary reference	
14		
15	I-Q	
16	I-D	
17	Torque	
18	Torque setpoint	
19	Motor power	
20	Output power	
21	Inverter status	
22	DI terminal status	
23	DO termial status	
24	Cykle step	
25	AI1 terminal value	
26	AI2 terminal value	
27	Reserve	
28	Reserve	
29	Frequency Pulse input	
30	Frequency Pulse output	
31	Analogue output 1	
32	Analogue output 2	
33	Power on hours	

F646 Backlight ON-time	Range: 0...100	Default setting: 100

F646=100: Backlight always ON

F647 Language selection	Selection: 0: Chinese 1: English 2: German	Default setting: 2

Power drop compensation

F657 Activation of the power drop compensating function	Selection: 0: deactivated 1: activated	Default setting: 0
F658 Compensation ramp: Accel.	Range: 0,0.......3000sec. – 0,0=F114	Default setting: 0,0 sec
F659 Compensation ramp: Decel.	Range: 0,0.......3000sec. – 0,0=F115	Default setting: 95
F660 Voltage threshold to start compensation function	Range: 230V Inverter: 215V.......F661 400V Inverter: 400V.......F661	Default: 230V Inverter: 250V 400V Inverter: 450V
F661 Voltage threshold to stop compensation function	Range: 230V Inverter: F660.......300V 400V Inverter: F660......530V	Default: 230V Inverter: 270V 400V Inverter: 480V
F662 Time for voltage checking during process	Range: 0,0.......10sec.	Default setting: 0.3

In case if power drop (short interruptions), the inverter try to compensate the DC voltage. If the voltage falls below the threshold, programmed in **F660,** the inverter try to keep the DC voltage constant, performing controlled deceleration (inertial energy fed back). If DC voltage reaches the value in **F661,** the inverter will continue with normal operation, heading to the target frequency. Accel./Decel. ramp, programmed in **F658** and **F659** are in function during the compensation process.

Independent motorvoltage control via separate setpoint

For special applications, the motor voltage may be controlled independently from output frequency (F137=4)

F671 Source for voltage setpoint	Selection: 0: Intern - F672 1: AI1 2: AI2 3: Reserved 4: MODBUS - 2009H 5: Pulse input 6: PID 7...10: Reserviert	Default setting: 0
F672 Internal voltage setpoint	Range: 0,0.......100%	Default setting: 100%
F673 Lower limit motor voltage (%)	0%...F674	Default setting : 0%
F674 Upper limit motor voltage (%)	F673...100%	Default setting : 100%
F675 Voltage rise timet (sec.)	0.0....3000	Default setting : 5.0
F676 Voltage drop time (sec.)	0.0....3000	Default setting : 5.0

F677 STOP mode for independent motor voltage control	Selection: 0: Voltage and frequency drop simultaneously 1: Voltage drops first 2: Frequency drops first	Default setting: 0

14) Parameter group 700: Error handling and protection functions

Programmable delay for STOP- DISABLE with STOP signal through terminal

F700 **Delay selection**	**Selection: 0: immediate STOP/DISABLE 1: with delay**	**Default setting: 0**
F701 **Delay time setting (sec.)**	**Range: 0.0…60.0 sec.**	**Default setting: 0.0 sec.**

only for signal through terminal (digital input) (**F201=1/2/4, F209=1**)

Fan control mode

F702 **Fan control mode setting**	**Selection: 0: temperature-controlled 1: ON with inverter on power 2: ON with inverter in START mode**	**Default setting: 2**

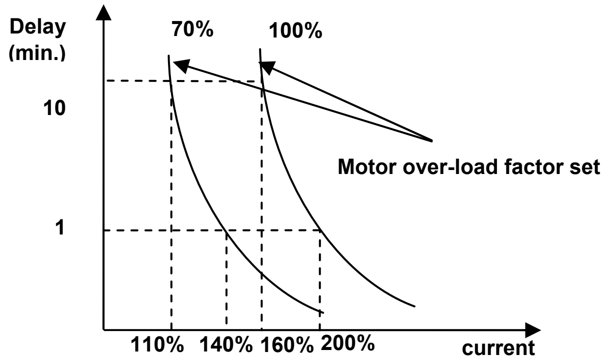
Inverter- / Motor over-load protection

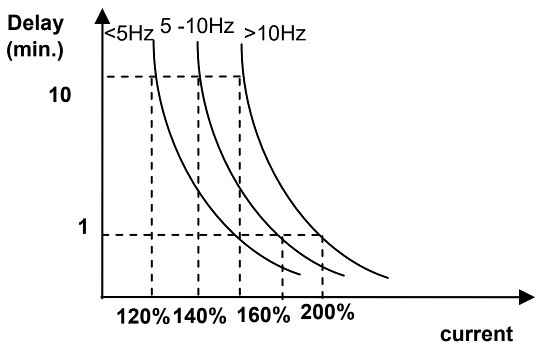
Free programmable threshold values for warning signal before inverter/motor overload fault.
Digital outputs, to program for warning messages (function mapping code 10 / 11)

F704 **Threshold for warning INVERTER OVERLOAD (%) 10**	**Range: 50 - 100%**	**Default: 80 %**
F705 **Threshold for warning MOTOR OVERLOAD (%) 11**	**Range: 50 – 100%**	**Default: 80 %**
F706 **Threshold for INVERTER overload trip (%)**	**Range: 120 – 190%**	**Default: 150 %**
F707 **Threshold for motor overload trip (%)**	**Range: 20 – 100%**	**Default: 100 %**

% values refer to relative motor / inverter rated values
All warnings are delayed, depending on overload grade
Warning for motor overload depends on working frequency too

Following graphics, to show warning delay characteristic:





ERROR history

Error codes ON DISPLAY (error memory code)

CODE	Description	Resaon	Remedy
OC (2)	Over-current – hardware detected	Too short ramps, short circuit on output motor defect, system blocked, wrong motor parameter setting	Increase Accel/Decel ramp time Check cabling / motor Check mechanical system Reduce BOOST Check motor parameter setting
OC1 (16)	Over-current – software detected		
OC2 (67)	Over current – software detected		
GP (26)	Ground protection error	Short circuit to ground	Check cable / motor
OL1 (5)	Inverter overload	Overload	Reduce load Check for right dimensioning
OL2 (8)	Motor overload	Overload	
OE (3)	DC-link over-voltage	Input power over-voltage Too high inertia Deceleration ramp too short Improper PID controller parameter	Check for correct supply voltage Inverter rated voltage correct?? Use larger brake resistors Increase deceleration time
PF1 (4)	Input phase-loss	One input-phase missing	Check power supply
PF0 (17)	Phase-unbalance output	Motor-phase / cabling interrupted	Check cabling / check motor
LU (6)	Undervoltage	Voltage on DC_Link too low	Check power supply
OH (7)	Inverter overheat	Environment temperature too high Poor cabinet heat-exchange Inverter / heatsink polluted PWM frequency too high Motor cable too long	Check for environment / working conditions Insert all parameters correctly Check for correct inverter mounting
OH1 (35)	Motor overheat	Motor PTC signal triggered	
AErr (18)	Analogue signal interruption	The analogue signal value is below the lower limit, programmed in **F4xx** parameters	Inspect control cabling Insert correct parameters for analogue signal lower limit Measure reference signal source
EP (20) EP2 (20) EP3 (19)	Inverter under-load / idling	Idling Lack of water Mechanical system broken	Check mechanical drive system Reestablish water supply
nP (22)	Pump control: Pressure beyond limits	Pressure beyond limits Inverter in SLEEP mode	Insert correct pump controller parameters – open water flow
CE (45)	MODBUS time-out	MODBUS signal missing	Check MODBUS cabling / source – MODBUS parameter setting
ESP (11)	Esternal emergency	The external emergency signal has been triggered	
ERR0	Parametrizing error	Parameter change not accepted	Stop inverter for parameter setting
ERR1	Wrong password	No or wrong password input Parameter change not allowed	Insert correct password
ERR2 (13)	Autotuning error	Motor can not free rotate during dynamic testing cycle	Separate motor from drive system
ERR3 (12)	Overcurrent in STOP condition	Hardware failure	Visual inspection of internal cabling Contact BLU service-center
ERR4 (15)	Current sensor error	No current signal on control board	Visual check of internal cabling, contact BLU service-center
ERR5 (23)	PID ERROR	PID controller error, due to improper PID parameter	Set PID parameter correctly
ERR6 (49)	Watchdog Timeout	Timeout caused by missing watchdog signal	Check signal on dig. input - assign digital input to watchdog function
EEP (47)	EEPROM error	EEPROM write/read error	Replace control board
oPEn	Inverter disable	oPEn input has been triggered	----
CE1 (53)	Keypad error	Keypad disconnected	Check keypad cable

Inverter general fault message through digital output:
Function assignation code 1: **Inverter error** message
Function assignation code 13: **Active "Inverter OK"** message (relays contact TA-TC closed if inverter OK)

Error memory readout:

F708 Last fault	Fault code: see table above	F711 Frequency at last fault (Hz) F712 Current at last fault (A) F713 DC-Link voltage at last fault (V)
F709 Fault last but one		F714 Frequency at fault last but one (Hz) F715 Current at fault last but one (A) F716 DC-Link voltage at fault last but one (V)
F710 Fault last but two		F717 Fault last but two (Hz) F718 Current at fault last but two (A) F719 DC-Link voltage at fault last but two (V)

Error event counters:

F720 Overcurrent	OC	
F721 Overvoltage	OE	
F722 Overtemperature	OH	
F723 Overload	OL1	

Protection functions – configuration

Activation of phase-loss, under-voltage and temperature monitoring

F724 Input phase-loss monitoring	Selection: 0: deactivated 1: activated	Default setting: 1 (T2/T3 models)
F725 Under-voltage reset	Selection: 1: manual reset 2: autoreset	Default setting: 2
F726 Over-temperature monitoring	Selection: 0: deactivated 1: activated	Default setting: 1
F727 Output phase-loss monitoring	Selection: 0: deactivated 1: activated	Default setting: 1

Delay for inverter error trip

F728 Delay phase-loss detection (sec.)	Range: 0.1 - 60.0 sec.	Default setting: 0.5 sec.
F729 Delay for under-voltage detection (sec.)	Range: 0.1 - 60.0 sec.	Default setting: 5.0 sec.
F730 Delay for over-temperature detection (sec.)	Range: 0.1 - 60.0 sec.	Default setting: 5.0 sec.
F732 Threshold for under-voltage detection (V) (DC-Link voltage)	Range: 0.1 – 450V	230V inverter: 215 V 400V inverter: 400 V

Overcurrent detection via software OC1

F737 Software controlled overcurrent detection	Selection: 0: deactivated 1: activated	Default setting: 1
F738 Software current limit (rated current unit)	Range: 0.50 - 3.00	Default setting: 2.5
F739 SW over-current inverter-trip counter OC1		

Analogue signal interruption detection

F741 Analogue signal interruption – fault handling mode	Selection 0: deactivated 1: STOP and AErr on display 2: STOP without any message on display 3: Inverter continue running with f-min 4: Reserved	Default setting: 0
F742 Threshold for detection (%)	Range: 1…100 %	Default setting: 50%

Message via digital output (function code 18)
If **F400** / **F406** set lower than 0.01V interruption detection is deactivated (a minimal value of 1V is recommended)
Detection threshold is referred to lower limits for analogue input signals, set in parameters **F400 / F406**

Overheat warning level

F745 Warning threshold (%)	Range: 0...100%	Default setting: 80

Heatsink over-temperature warning (message via digital output (function code 16)

Temperature depending PWM reduction

F745 Threshold for automatic PWM reduction °C	Range: 60...72°C	Default setting: 65°C0
F747 Temperature depending carrier frequency reduction	Selection: 0: deactivated 1: activated	Default setting: 1

With temperature depending PWM frequency-reduction activated **(F747=1)**, inverter will start to decrease PWM frequency gradually, as heatsink reaches the temperature set in **F746**
If PWM frequency is configured for "RANDOM" (**F159=1**), temperature depending PWM adaption is always deactivated

ATTENTION:!! If sinus output filters are used, the automatic PWM reduction function must be deactivated F747=0

Idling detection

F754 Threshold for idling detection (%)	Range: 0...60 sec.	Default setting: 0.5 sec.
F755 Delay time for idling detection (sec.)	Range: 0...60 sec.	Default setting: 0.5 sec.

Message via digital output (function code 20)

Earth fault detection

F760 Ground short monitoring	Selection 0: disable 1: enable	Default setting: 1

Reversing mode setting

F761 Reversing mode (F=0 / F-START)	Selection 0: through F=0 1: through F-start (F109)	Default setting: 0

F761=0: Reversing goes through f=0 (with deathtime **F120**)
F761=0: Reversing goes through f=Start **(F109)**, (without deathtime **F120**)

15) Parameter group 800: Autotuning – Motor data programming

EP66 inverter are designed to drive standard asynchronus motor and Permanent Magnet synchronus motors as well

Smart AUTOTUNING functions help for easy and quick setup

Basic data for Asynchronus and Synchronus motors

F800 **Automatic motor-data measurement (AUTOTUNING)**	**Selection: 0: AUTOTUNING deactivated 1: START dynamic AUTOTUNING 2: START static AUTOTUNING**	**Default setting: 0**
F801 **Motor-rated power (kW)**	**Range: 0.2…1000 kW**	
F802 **Motor-rated voltage (V)**	**Range: 1…440 V**	
F803 **Motor-rated current (A)**	**Range: 0.1…6500 A**	
F804 **Number of poles (p)** (read only!!)	**Automatically calculated**	
F805 **Rated speed (rpm)**	**Range: 1…30000 U/min**	
F810 **Motor-rated frequency (Hz)**	**Range: 1.0…300.0 Hz**	**Default setting: 50.00Hz**

Please note: F804=read only parameter - automatically set by F805/F810 ratio

Attention: All motor data must be programmed exactly, as reported on motor nameplate.
Especially for SENSORLESS VECTOR OPERATION, precise motor data entry is mandatory, to guarantee reliable function of the drive

Other specific data may be measured with AUTOTUNING function:

F800=0: No AUTOTUNING, after parameter F801...F803, F805 and F810 are set, standard values are chosen for remaining parameters

F800=1: Dynamic AUTOTUNING – motor without load. After input of motor nameplate data in **F801…F805** and **F810,** the process can be started in the following way:

> **Set F800=1, press RUN key; The automatic process starts now, „TEST“ shown on display, after a few seconds, the motor will accelerate and decelerate, with ramps, programmed in F114 and F115. After completion of the cycle, all motor data will be stored, and F800 will reset to 0**

F800=2: Static AUTOTUNING, if there is no way to separate the motor from the load, static data measurement is available – the motor will not rotate during the cycle, and it is not allowed, to rotate it. Following, to start the static cycle:

> **Set F800=2, press RUN key; The automatic process starts, „TEST“ shown on display, after a few seconds it will terminate; All values for rotor resistance main inductivity and leakage inductivity are stored automatically on parameters F806 to F808, F800 will reset to 0.**

Autotuning results for ASYNCRONUS motors

F806 **Stator resistance (Ohm)**	**Range: 0.001…65.00 Ohm**	
F807 **Rotor resistance (Ohm)**	**Range: 0.001…65.00 Ohm**	
F808 **Leakage inductivity (mH)**	**Range: 0.01…650.0 mH**	
F809 **Main inductivity (mH)**	**Range: 0.1…6500 mH**	

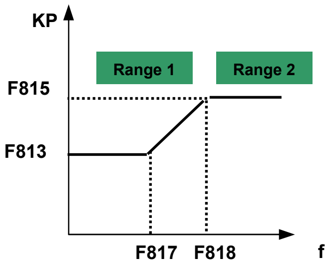
If parameter **F801** (Motor rated power) is changed, all parameters **F806…F809** are reset to default values, a following AUTOTUNING process, as described above may used for fine tuning.

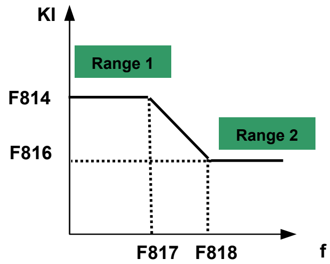
SENSORLESS VECTOR speed controller (for asynchronus motor only)

F812 Start excitation time (sec.)	Range: 0…30.0 sec.	Default setting: 0.3
F813 Proportional gain in frequency range 1 KP1	Range: 1…100	Default setting: 30
F814 Integration time in frequency range 1 KI1	Range: 0.01…10.00	Default setting: 0.5
F815 Proportional gain in frequency range 2 KP2	Range: 1…100	Default setting: Depending on inv. model
F816 Integration time in frequency range 2 KI2	Range: 0.01…10.00	Default setting: 1.00
F817 Range 1 end frequency	Range: 0…F111	Default setting: 5.00 Hz
F818 Range 2 start frequency	Range: F817…F111	Default setting: 50.00 Hz
F819 Controller precision	Range: 50…200	Default setting: 100
F820 Speed loop filter constant	Range: 0…100	Default setting: 0
F844 Idle current (A)	Range: 0,1 A.…F803	Default setting: depending on size

F817, F818: Parameter for frequency depending PID parameter selection

ATTENTION!! Improper setting of speed regulating parameters may result in system instability.
This may cause malfunction of the machine and / or damage of mechanical parts





It is highly recommended to keep factory default parameters, slight modification, to optimize the system must be done with caution.

Parameter for permanent magnet syncronus motor control (F106=6)

After input of basic motor parameters (F801...F810), this parameters may be input manually, or using AUTOTUNING procedure as described above:

F861 PMM Control mode	0:standard 1:high frequency	Default setting 0
F870 Motor feed back electrical force	V/1000 rpm	
F871 Induktivity D-axis (Ohm)		
F872 Induktivity Q-axis (Ohm)		
F873 Stator resistance (Ohm/Phase)		
F876 Idling current (% rated current)		Default setting 20%
F877 Frequency compensation idle current (%)		Default setting 0%
F878 Threshold idle current compensation (Hz)		Default setting 10Hz%
F879 Haevy load boost current (% rated current)		Default setting 0%
F880 Scan-rate controller		Default setting 0,2 sec.

16) Parametergroup 900: RS485 hardware and interface parameters

Please refer on specific MODBUS manual, for protocol, control algorithm, control registers, and other details

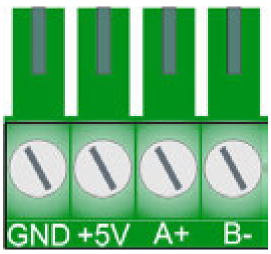
F900 **Inverter adresss**	**Selection: 1…255: fixed adresses 0: adress set via BUS**	**Default setting: 1**
F901 **RS485 operation mode**	**Selection: 1: ASCII protocol 2: RTU protocol**	**Default setting: 2**
F902 **Number of STOP bit**	**Selection: 1 - 2**	**Default setting: 2**
F903 **Parity check**	**Selection 0: no check 1: ODD parity 2: EVEN parity**	**Default setting: 0**
F904 **Baudrate**	**Selection: 0: 1200 1: 2400 2: 4800 3: 9600 4: 19200 5: 8400 6: 57600**	**Default setting: 3**
F905 **MODBUS Time-out**	**Range: 0.0.....3000 sec.**	**Default: 0.0 sec**
F907 **M-BUS Time-out warning**	**Range: 0.0.....3000 sec.**	**Default: 0.0 sec**
F930 **Keypad TimeOut**	**Range: 0.0.....10 sec.**	**Default: 1.0 sec**

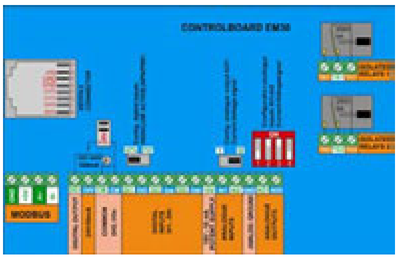
F905: MODBUS time-out, in case of missing MODBUS command within the timeframe, set in **F905** inverter will STOP for safety reason and CE will appear on the display. For **F905=0**, the safety function is disabled.
F907: MODBUS time-out warning. If **F907>0**, and MODBUS signal is missing for the time, set by **F907**, the inverter will send an error warning trough a programmable digital output (mapping code **43**).
This signal may be reset via digital input (mapping code **60**).
F930: Keypad timeout: If activated (F930>0), in case the keypad is disconnected, the inverter stops aftrer the delay set in **F930** CE1 error message

Hardware MODBUS - interface :

All BLU Drives inverter are equipped with a unique RS485 connector. This port is used for inverter control via MODBUS and for parametrizing the inverter, using PC software or COPY STICK.

The picture below shows the pin-out of the 4 pole plug and the position of the connector





An auxiliary power supply, based on microprocessor ground delivers 50 mA / 5V

The MODBUS connector is located left hand of the control connector bloc

17) Parameter group A00: PID controller parameter

An integrated PID-controller is available on standard EM30 inverters. It is suitable for simple closed loop control projects.
For more demanding projects, like Booster stations using multi-pump control, cascade control or Master/Slave interaction, specific hard-/software options are available.

FA00 **Controller configuration**	**Selection: 0: closed loop control – single pump control 1: Simple Master/Slave Mode 2: Simple Master/Slave with interchange**	**Default setting: 0**

FA00=0: Suitable for standard closed loop control projects (single pump pressure control).
FA00=1: Simple cascade control, first pump variable, slave pump fixed speed (direct grid connected)
FA00=2: Simple cascade control, first pump variable, slave fixed speed, with pump interchange (time set by **(FA25)**

Channel configuration for set-point and feed-back (see graphic on following page)

FA01 **PID set-point channel**	**Selection: 0: internal reference (value in FA04) 1: Analogue input AI1 2: Analogue input AI2 4: Frequency (pulse input)**	**Default setting: 0**
FA02 **PID feed-back source/channel**	**Selection: 1: Analogue input AI1 2: Analogue input AI2 3: Frequency (pulse input) 4: Reserved 5: Motor current 6: Output power 7: Output torque**	**Default setting: 1**

FA03 **Upper controller limit (% of set-point)**	**Range: 0.0…100.0 %**	**Default setting: 100.0**
FA04 **Internal set-point value (%)**	**Range: FA05....FA03 %**	**Default setting: 50.0**
FA05 **Lower controller limit (% of set-point)**	**Range: 0.0…100.0%**	**Default setting: 0.0**

If the controller works beyond the limits in **FA03** - **FA05** inverter will be disabled and **(nP)** on display

FA06 **PID controller polarity**	**Selection: 0: Positive 1: Negative**	**Default setting: 1**

Negative setting e.g. for pressure, flow control

Sleep mode

FA07 **Automatic sleep mode**	**Selection: 0: activated 1: deactivated**	**Default setting: 1**
FA09 **Frequency threshold for sleep mode activation**	**Range: between F112...F111**	**Default setting: 5.00 Hz**
FA10 **Time delay for sleep mode activation (sec.)**	**Range: 0…500 sec.**	**Default setting: 15 sec.**
FA11 **Delay-time for restart from sleep mode**	**Range: 0…3000 sec.**	**Default setting: 3.0 sec.**

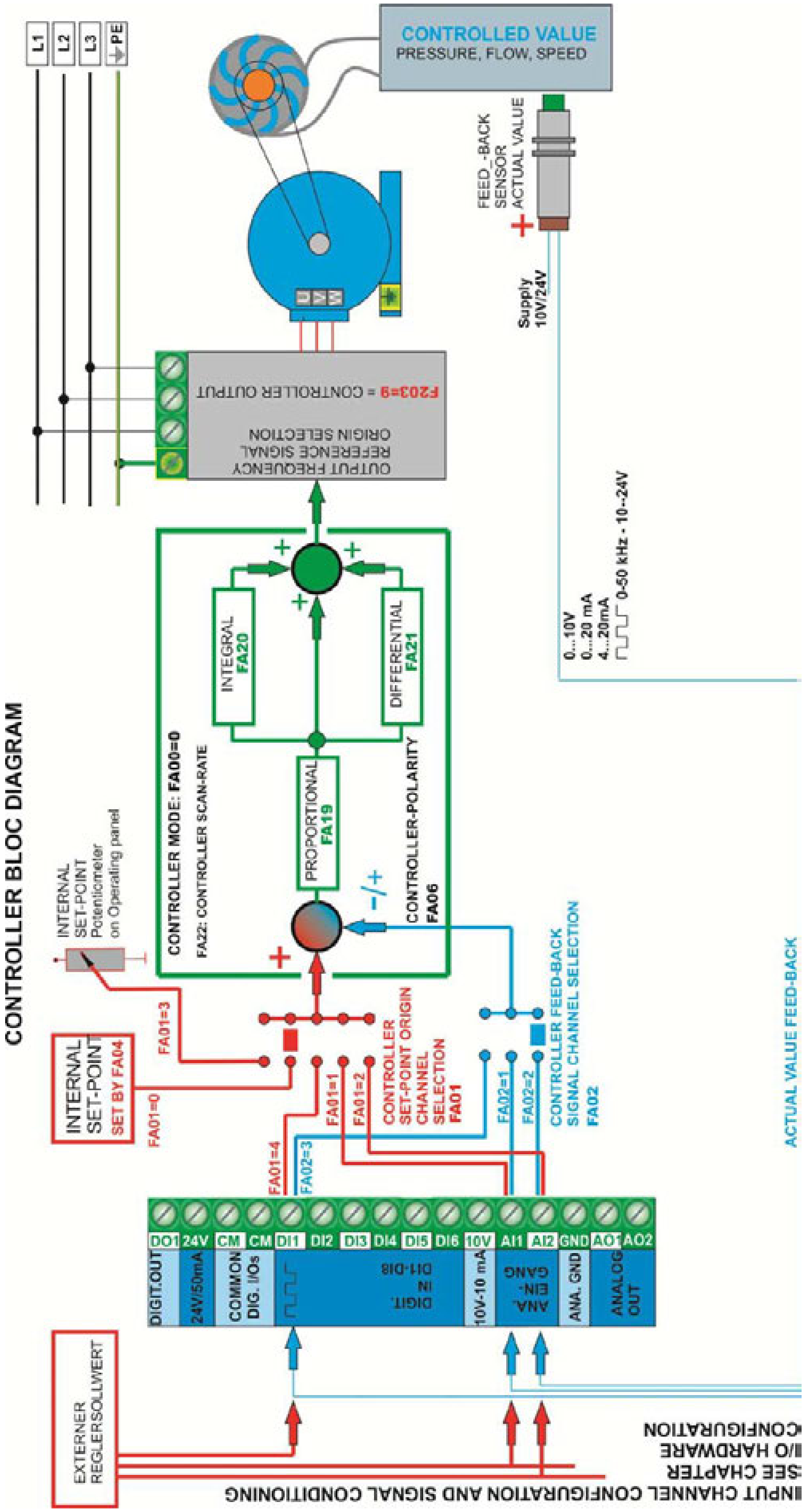
If the inverter runs for a programmed time, (set by **FA10)** below the minimum frequency, (set by **FA09**), it will stop and enter in sleep mode, displayed as **nP**. (feed-back value must stay within programmed limits FA03-FA04).
After fed back (pressure) falls below the value in **(FA05),** inverter will restart again, after the delay-time in **(FA11)**
This is for simple application only, sleep frequency must be set accurately (find out zero flow frequency), to get right sleep at "zero flow". For more reliable zero flow detection, optional soft-/hardware solutions are available.

FA12 **Maximum working frequency in PID**	**Range: FA09.....F111 (Hz)**	**Default setting: 50 Hz**

This parameter limits the maximum working frequency in PID mode

FA18 **Variable set-point allowed**	**Selection: 0: deactivated 1: activated**	**Default setting: 1**

If **FA18=0:** It is not possible, to change the fixed set-point in **(FA04)** during controller operation


CONTROLLER BLOC DIAGRAM
L1
L2
L3
PE
CONTROLLED VALUE
PRESSURE, FLOW, SPEED
FEED -BACK
SENSOR
ACTUAL VALUE
Supply
10V/24V
0...10V
0...20 mA
4...20mA
0-50 kHz - 10--24V
OUTPUT FREQUENCY
REFERENCE SIGNAL
ORIGIN SELECTION
F203=9 = CONTROLLER OUTPUT
INTEGRAL
FA20
DIFFERENTIAL
FA21
PROPORTIONAL
FA19
CONTROLLER MODE: FA00=0
FA22: CONTROLLER SCAN-RATE
CONTROLLER-POLARITY
FA06
-/+
INTERNAL
SET-POINT
Potentiometer
on Operating panel
FA01=3
INTERNAL
SET-POINT
SET BY FA04
FA01=0
FA01=1
FA01=2
FA01=4
FA02=3
FA02=1
FA02=2
CONTROLLER
SET-POINT ORIGIN
CHANNEL
SELECTION
FA01
CONTROLLER FEED-BACK
SIGNAL CHANNEL SELECTION
FA02
ACTUAL VALUE FEED-BACK
DO1 24V CM CM DI1 DI2 DI3 DI4 DI5 DI6 10V AI1 AI2 GND AO1 AO2
DIGIT.OUT
24V/50mA
COMMON
DIG. I/Os
DIGIT.
IN
DI1-DI8
10V-10 mA
ANA.
EIN-
GANG
ANA. GND
ANALOG
OUT
EXTERNER
REGLERSOLLWERT
INPUT CHANNEL CONFIGURATION AND SIGNAL CONDITIONING
SEE CHAPTER
I/O HARDWARE
CONFIGURATION

PID controller parameter setting

FA19 **Proportional gain P**	**Range: 0.00…10.00**	**Default setting: 0.3**
FA20 **Integration time I (sec.)**	**Range: 0.1…100.0 sec.**	**Default setting: 0.3 sec.**
FA21 **Differential time D (sec.)**	**Range: 0.00…10.00**	**Default setting: 0.0 sec.**
FA22 **Controller cycle time / scan-rate (sec.)**	**Range: 0.1…10.0 sec.**	**Default setting: 0.1 sec.**

Reversing lock for negative controller results

FA23 **Reversing lock**	**Selection 0: Reversing not allowed** **1: Reversing allowed**	**Default setting: 0**

Master / Slave interchange

FA24 **Interchange time: units**	**Selection: 0: hours** **1: minutes**	**Default setting: 0**
FA25 **Interchange time setting (hours / min.)**	**1....9999**	**Default setting: 100 h**

Idling / lack of water protection

FA26 **Lack of water protection concept**	**Selection: 0: No protection** **1: Sensor signal through digital input** **2: Controller algorithm** **3: Motor idling current detection**	**Default setting: 0**
FA27 **Current limit for lack of water detection (% of rated current)**	**Range: 10…150 %**	**Default setting: 80%**
FA28 **Recheck delay time (sec.)**	**Range 0.0…3000 sec.**	**Default: 60 sec.**
FA66 **Delay time for lack of water message (FA26=3)**	**Range: 0…60 sec.**	**Default setting: 2 sec.**

FA26=1: Lack of water is triggered through digital input (function assignation code 30) – it will stop the inverter and display **EP1**. The „Water OK“ signal through a different digital input (function assignation code 31) will reset the system. FA26=1: there is no delay for fault trigger.
FA26=2: In case the controller reaches the maximum frequency, and the motor current still remains below the value in **FA27,** the controller will interpret the situation as lack of water. **EP2** will show up on the display. The inverter will stop immediately.
FA26=3: Detection via motor current measuring only. If the motor current falls below the value in **FA66,** the fault will be triggered with delay, set in **FA66.** Inverter will stop and **EP3** will show up on the display.
FA28 Recheck time, timeframe for the inverter to recheck, if lack of water condition still persists, before it restarts. It is anytime possible to reset the system, pressing. 

Controller dead band +/- % of the set point

FA29 **Dead band setting (% of set-point)**	**Range: 0.0 - 10.0 %**	**Default setting: 2.0**

If the feed-back (actual value) stays within the dead band, the controller does not make any activity, and it keeps the output frequency constant. The FA29 parameter is used also for starting/stopping the fixed speed pump – see below

Dual pump booster control (one pump inverter controlled, one pump fixed speed)

FA30 **Delay-time to start inverter pump (sec.)**	**Range: 2.0 - 999.9 sec.**	**Default setting: 20.0**
FA31 **Delay-time, to start fixed speed pump (sec.)**	**Range: 0.1 - 999.9 sec.**	**Default setting: 30.0**
FA32 **Delay-time to stop fixed speed pump (sec.)**	**Range: 0.1 - 999.9 sec.**	**Default setting: 30.0**

If the feed-back value (actual value) exceeds the limits, given by FA29, the fixed pump will be started or respectively stopped. Start /Stop delay time is set by **FA31** and **FA32.**

PID controller secondary parameter set

FA38 **Proportional gain (2) P**	**Range: 0.00…10.00**	**Default setting: 0.3**
FA39 **Integration time (2) I (sec.)**	**Range: 0.1…100.0 sec.**	**Default setting: 0.3 sec.**
FA40 **Differential time (2) D (sec.)**	**Range: 0.00…10.00**	**Default setting: 0.0 sec.**
FA40 **PID parameter switchover mode**	**Selection:** **0: no switchover** **1: reserved** **2: depending on PID deviation**	**Default setting: 0**

Reversing lock for negative controller results

FA42 **Switchover threshold 1**	**Range: FA05...FA43**	**Default setting: 0**
FA43 **Switchover threshold 1**	**Range: FA42...FA03**	**Default setting: 0**

For PID deviation below **FA42**, first PID parameter set is used, above **FA43** second PID parameter set is activated, between **FA42** and **FA 43** parameter values are interpolated.

Emergency functions

FA59 **Emergency funtion mode**	**Selection: 0: disable** **1: FIREMODE 1** **2: FIREMODE 2**	**Default setting: 0**
FA60 **Frequency for emergency**	**Range: F112…F111**	**Default setting: 50 Hz**
FA58 **Emergency pressure**	**Range: 0.0….100%**	**Default setting: 80%**

Emergency function is activated via specific terminal signal (33), all protection functions are disabled, during emergency operation, fault reset, with automatic restart is activated.

FIREMODE 1 Inverter runs with the frequency given by setpoint
FIREMODE 2, Inverter runs with frequency given by **FA60**

Emergency pressure may be activated by digital input (32)

FA62 **Reset options**	**Selection: 0: no RESET possible** **1: via trigger input**	**Default setting: 0**

If FA62=1: Inverter may reset to normal operation, if emergency conditions on trigger input disappear

18) Parameter group C00: Speed / Torque control

Attention: this settings are for SLV mode only F106=0

Two different control modes are available on EM30 inverters: Speed-control mode and Torque-control mode

FC00 **Speed / Torque control mode selection**	**Selection: 0: Speed control** **1: Torque control** **2: Speed/Torque – terminal selected**	**Default setting: 0**

FC00=0: The output frequency is set by the speed reference value. Torque depends on the load. Torque limit can be set by parameter **FC28....FC35**
FC00=1: Torque controlled by set-point value. Speed depends on the load condition. Maximum speed can be limited by parameter **FC22...FC25**
FA00=2: A digital input signal is used, to switch over between the two control modes (function assignation code: 20)

FC01 **Delay-time for speed/torque switchover (sec.)**	**Range: 0,0....1,0 sec.**	**Default setting: 0,1 sec.**

FC02 **Torque ramp-up/down time**	**Range: 0,1....100 sec.**	**Default setting: 1 sec.**

Torque rise/fall time 0...100%

Set-point origin for torque control

FC06 **Set-point origin for torque control**	**Selection: 0: Internal setting FC09** **1: Analogue input AI1** **2: Analogue input AI2** **3: Analogue input AI3** **4: Pulse signal input** **5: Reserved**	**Default setting: 0**

FC07 **Torque range, referred to rated motor torque**	**Range: 0.0…3,000**	**Default setting: 3,000**
FC09 **Internal torque reference value (%)**	**Range: 0…300.0 %**	**Default setting: 100 %**

FC07: Torque range, corresponding to 0-100% set-point signal
FC09: Internal torque set-point value

Torque boost for low frequencies (additional torque for heavy start-up condition))

FC14 **Torque increase signal origin**	**Selection: 0: Internal set FC17** **1: Analogue input AI1** **2: Analogue input AI2** **3: Analogue input AI3** **4: Pulse signal input** **5: Reserved**	**Default setting: 0**

FC15 **Torque increase in (%) motor rated torque**	**Range: 0.0…0,5**	**Default setting: 0,5**
FC16 **Frequency threshold for torque BOOSTS (%) f-max.**	**Range: 0…100 %**	**Default setting: 10 %**
FC17 **Internal setting for torque BOOST value**	**Range: 0..50,0%**	**Default setting: 10 %**

FC15: 100% of torque BOOST signal correspond to the % of rated motor torque value, set in FC15
FC16: The threshold for torque boost

Speed limiting for inverter, working in torque control mode:

FC22 Speed limiting set-point origin forward	Selection: 0: Set by FC23 1: Analogue input AI1 2: Analogue input AI2 3: Analogue input AI3 4: Pulse signal input 5: Reserved	Default setting: 0
FC23 Internal speed limiting value forward	Range: 0...100 %	Default setting: 10%

FC24 Speed limiting set-point origin reverse	Selection: 0: Set by FC25 1: Analogue input AI1 2: Analogue input AI2 3: Analogue input AI3	Default setting: 0
FC25 Internal speed limiting value reverse	Range: 0...100 %	Default setting: 10%

(All values are referred to f-max –F111)

Torque limiting for inverter working in speed control mode

FC28 Torque limiting signal source motor mode	Selection: 0: Set via FC30 1: Analogue input AI1 2: Analogue input AI2 3: Analogue input AI3 4: Pulse signal input 5: Reserved	Default setting: 0
FC29 Reference: 100% of limiting signal to motor rated torque	Range: 0,0....3,000	Default setting: 3,000
FC30 Internal torque limiting value motor mode (%)	Range: 0....300% %	Default setting: 200%

(All referred on motor rated torque)

FC33 Torque limiting signal source generator mode	Selection: 0: Set via FC35 1: Analogue input AI1 2: Analogue input AI2 3: Analogue input AI3 4: Pulse signal input 5: Reserved	Default setting: 0
FC34 Reference: 100% of limiting signal to motor rated torque	Range: 0,0....3,000	Default setting: 3,000
FC35 Internal torque limiting value generator mode (%)	Range: 0....300% %	Default setting: 200%

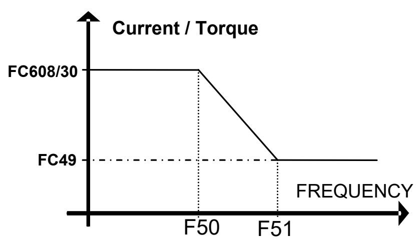
(All referred on motor rated torque)

+

Torque / Current limit for field wakening area

FC 48 Activation of secondary limiting	Selection: 0: Limiting fixed 1: Depending on frequency threshold	Default setting: 0
FC49 Sekundary torque/current limit (%)	Range: 50...200 %	Default setting: 120%
FC50 Start transition frequency (Hz)	Range: 1.0 Hz....FC51	Default setting: 15 Hz
FC51 End transition frequency (Hz)	Range: FC50...F111 Hz	Default setting: 30 Hz

In V/Hz mode: To limit motor current in the field wakening area
In SLV mode: To limit torque in the field wakening area



19) EP66 Diagnostic tools

Analogue/Digital input status monitoring

F330 — **Digit input** **Digital output** **Analogue input** **Analogue output**	**The logical status of digital I/O channels is shown in 8+3 graphical blocs (dark=ON)** **The value of the analogue inputs is displayed from 0...4096** **Analogue outputs are displayed from 0...100 %**

Digital/Analogue output status stimulation

F335 **Relays output**	**Using keys ▼ and ▲ the digital outputs can be switched ON/OFF**
F336 **DO1**	
F337 **DO2**	
F338 **AO1**	**Using keys ▼ and ▲ it is possible to set the analogue outputs in the range from 0.....4096**
F339 **AO2**	

Operating parameter inquiry - parameter groupe Hxx

H000	**Frequency setpoint (STOP) / output frequency (RUN)**
H001	**Speed setpoint (STOP) / actual speed (RUN)**
H002	**Motor current**
H003	**Motor voltage**
H004	**DC-Link voltage**
H005	**PID controller feed-back**
H006	**Heatsink temperature**
H007	**Counter**
H008	**Calculated speed**
H009	**PID controller setpoint**
H012	**Output power**
H013	**Torque**
H014	**Torque setpoint**
H017	**Step number with autocycling fixed frequencies**
H018	**Frequency pulse input**
H019	**Feed-back (Hz)**
H020	**Feed-back (r/min)**
H021	**Monitoring AI1**
H022	**Monitoring AI2**
H025	**Power on hours**
H026	**Operating hours**
H027	**Frequency pulse input (Hz)**
H028	
H029	
H030	**Primary setpoint (Hz)**
H031	**Secondary setpoint (Hz)**

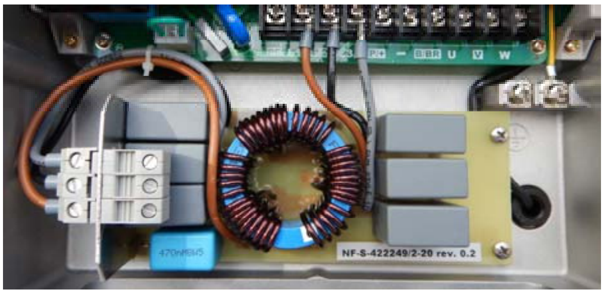
20) Options

Options build inside the inverter:

Attention!! BLU does not take any responsibility in case of unprofessional modification of the inverter, or use of inappropriate optional components

EMC Options:

EMC class C3 is standard for all EM30 inverters. For use in residential area, a C1 filter kit is available.
The filter is designed for inverter mounted directly on the motor or close to the motor, maximum cable lenght 1 meter
The additional filter kit fits inside the inverter.



Following EMV components have been approved and certified for EMC class C1:

Framesize	C1 Filter kit	Motor cable:
J1		
J2		

Attention!! All additional filter components (input/output) must be approved by BLU Drives. Mounting must be done by professional people.

In case of not professional installation or use of improper components, BLU Drives cannot guarantee for the proper filter class, and will not assume any responsibility for damage on the inverter or on other components of the system. Warranty will become void in this case.

NOTES

NOTES

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