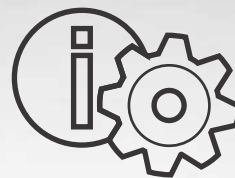# FREQUENCY INVERTER

EM30

0,4kW – 7,5kW

Safety instructions Installation & operating manual

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^{2}xt, 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			2,4		
EM30-0007S2 J1	0,75 kW - 4,5A	9A	J1	190x270165	2,5	Integrated	80 Ohm
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			2,4		
EM30-0015T3 J1	1,5 kW - 4 A	4,6A	J1	190x270165	2,5		150 Ohm/150W
EM30-0022T3 J1	2,2 kW - 6,5 A	7A			2,7		
EM30-0030T3 J1	3,0 kW - 7 A	9A			2,9	Integrated	
EM30-0040T3 J2	4,0 kW - 9 A	11A			6,0		
EM30-0055T3 J2	5,5 kW - 12 A	16A	J2	338228x194	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

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.
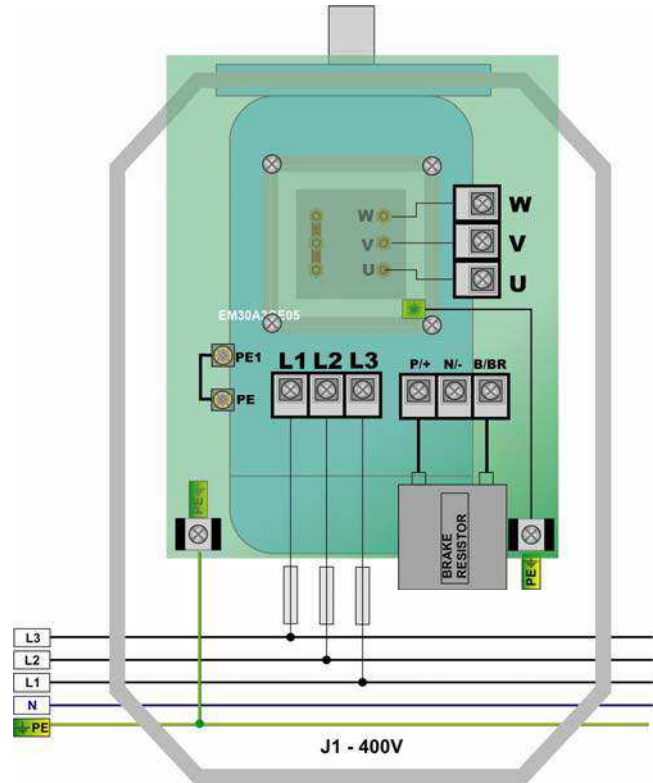
Power terminals:
There are different arrangements for power terminals, depending on inverter size and number of input phases.
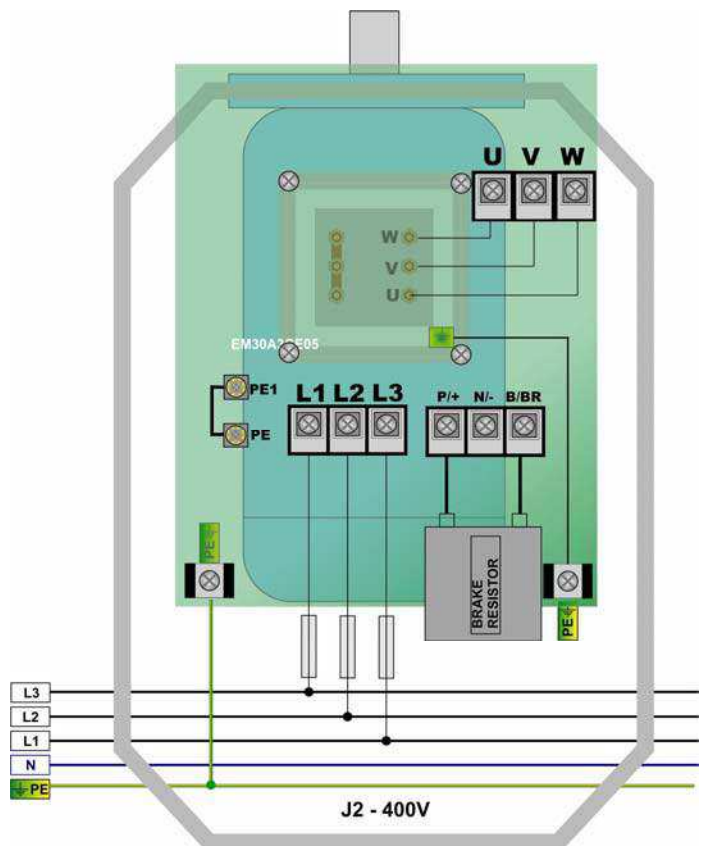
Inverter size J1 230V - 0,4...2,2 kW
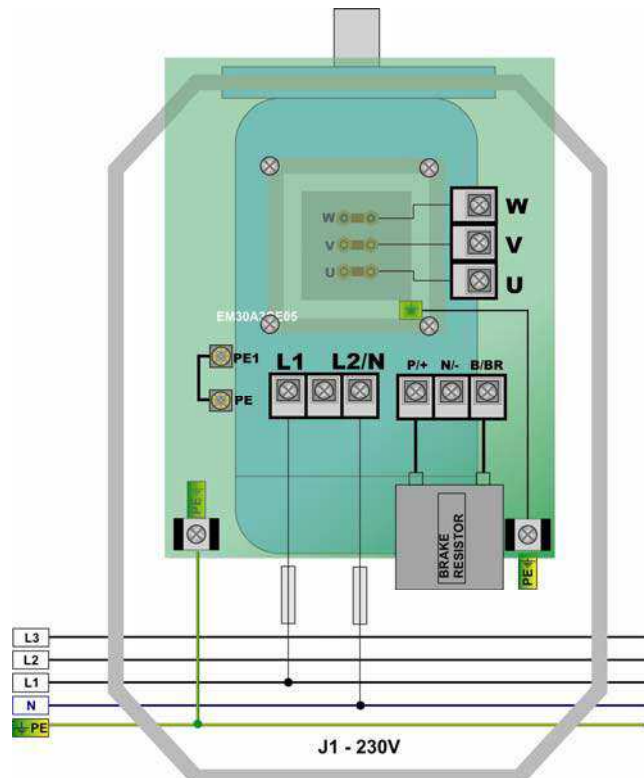
4) Electrical connections of EM30 inverters

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

J1 - 400V

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

J2 - 400V

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)

PARAMETER:

LOAD FACTORY DEFAULT
(F160=1)

Set following parameters:
Speed setpoint through
AI1:   F203=1

Two wire control
Type 2:   F208=2

Inverter OK signal on relays 1:
F300=13

POWER WIRING

CONTROL CONNECTIONS
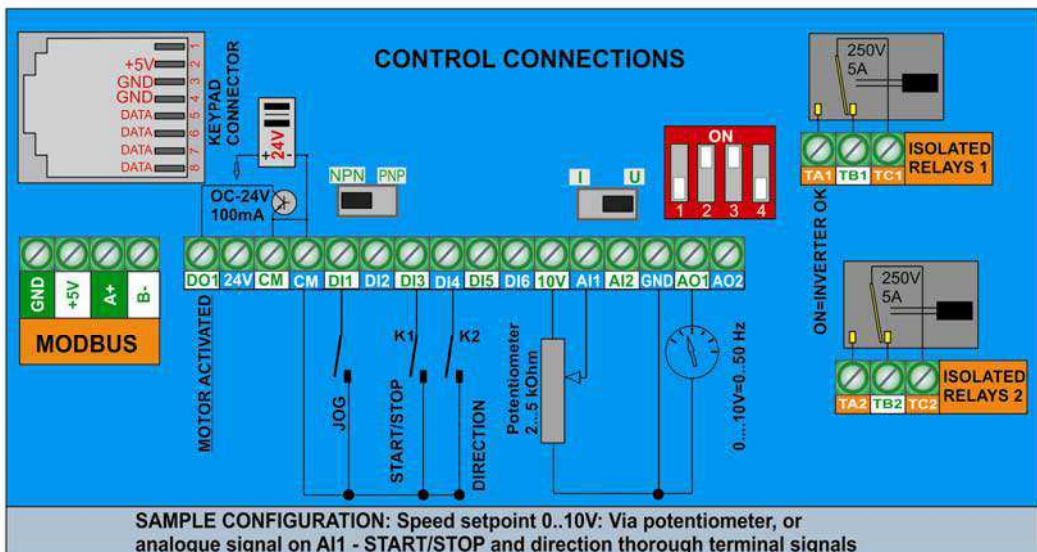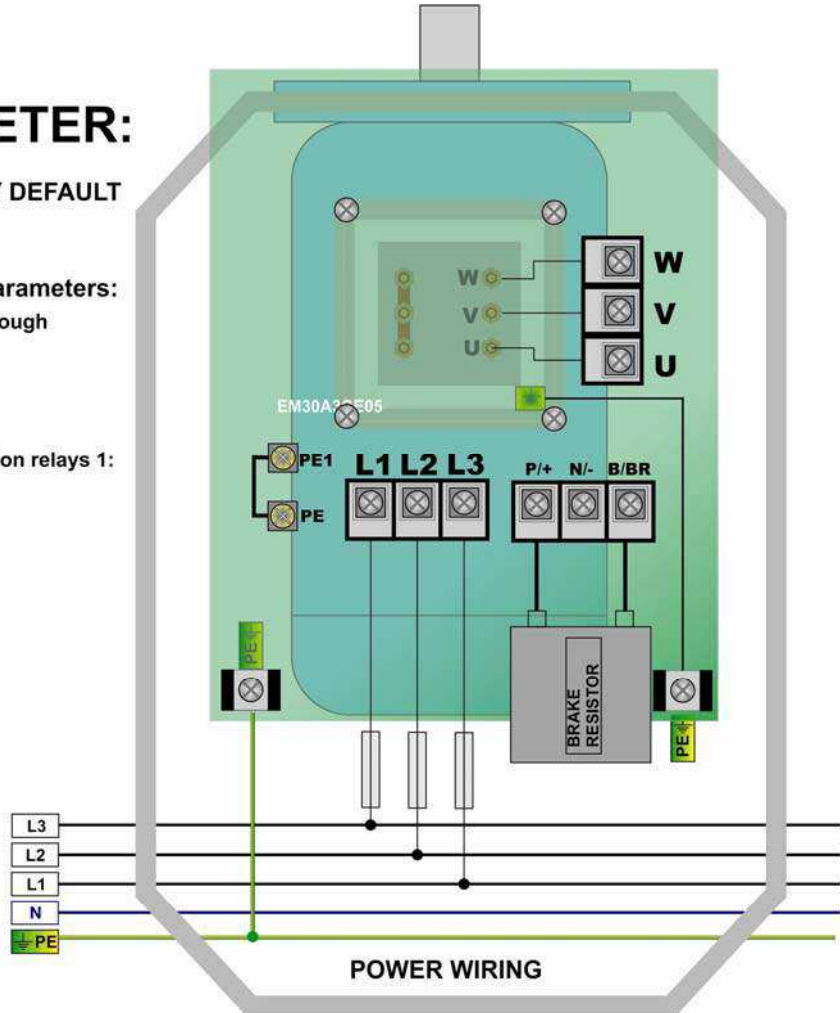
SAMPLE CONFIGURATION: Speed setpoint 0..10V: Via potentiometer, or
analogue signal on AI1 - START/STOP and direction thorough terminal signals

6) Operating panel – configuration and functions

Inverter control, parameter setting, operating-parameter display and inverter-status information are all done by the operation panel.
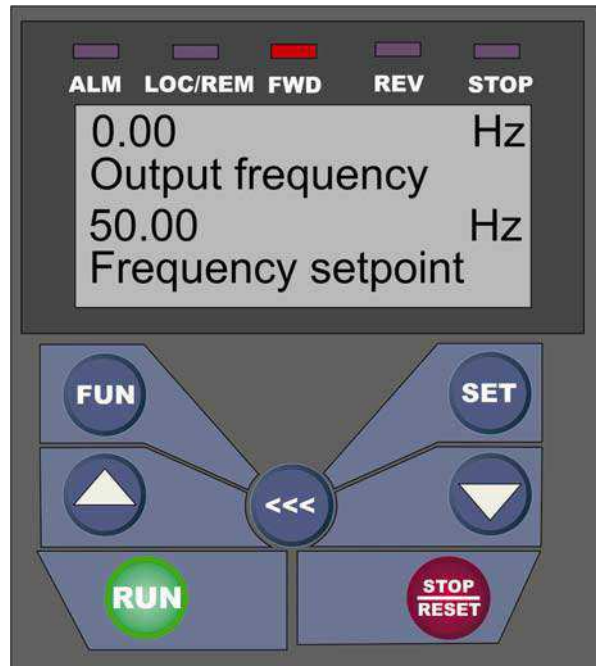
The adjacent picture shows the different areas of the panel:

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)**

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 [FUN] **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)

[SET] **key allows to select a parameter to modify, once selected, the keys** [▲] [▼]

increment/decrement the parameter value.

[SET] **again memorizes the changed parameter value**

[FUN] **moves back to the normal operating mode**