

# EM-346 BRUSHLESS DC-MOTOR DRIVER 24-48V 8A



## FEATURES

- Three phase output
  - Speed and torque adjustment
  - Open/closed loop modes
  - Regenerative braking option
  - True 4Q-power stage
  - Braking resistor output
  - Current limit and trip
  - Symmetrical control option  $\pm 5V$  or  $\pm 10V$
  - Fault and overcurrent outputs
  - Good efficiency
  - Low EMC emissions
  - DIN-rail mountable
  - Rpm-pulse output option
- New in firmware version v1.4  
 + improved closed loop features ( param. 1)  
 + new operating mode options ( param. 11)  
 + one option added disable input ( param. 14 )  
 + control for magnetic brake ( param. 18 )

## GENERAL

EM-346-48V is a brushless DC-motor driver with hall sensor feedback. The unit has a mosfet power stage with good efficiency and it meets today's EMC requirements. The driver can be used with 120° commutation. This driver has true 4Q power stage, which makes it possible to use regenerative braking. In this braking method the supply voltage rises. This voltage rising can be controlled with a braking resistor. If using a battery supply, then the braking energy can be lead back to battery and a braking resistor is not needed. The unit has the basic digital command inputs like direction, brake, start/stop, disable and there are analog inputs for speed and current control. One digitally presetable second speed (speed-2) is possible to activate with digital command input. EM-346 has two NPN outputs for fault and overcurrent indication use. Some input and output functions can be modified with parameters. Driver includes overvoltage, undervoltage and overtemperature protection. These fault situations are indicated with fault on-board LED. Overtemperature and current limit situations can be reset with reset input, reset-timer or by setting analog speed control to value to 0.

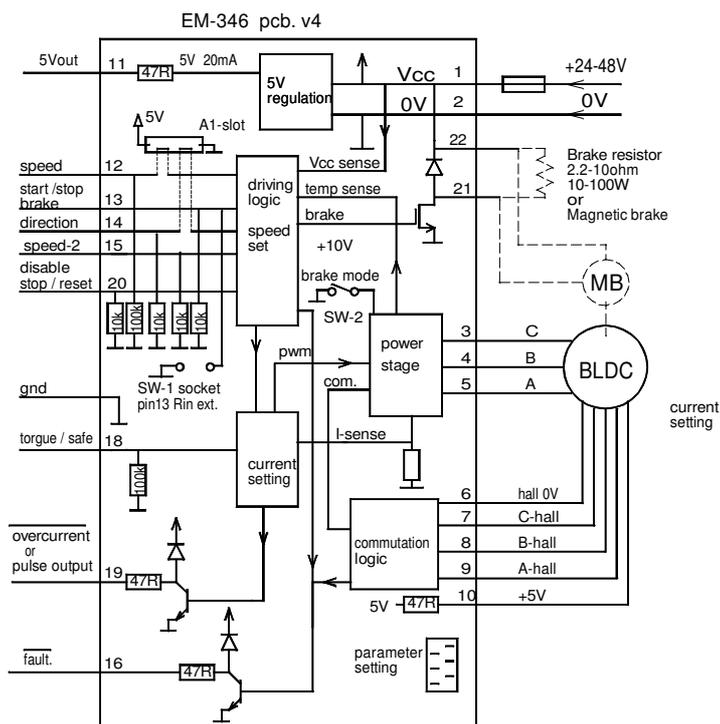
There are two control options for speed. Direct control ( open loop ) sets motor voltage in propotion to control voltage as with a standard DC-motor. Closed loop uses hall sensor feedback for speed control. This mode offers good speed regulation. Start and stop ramps work in both modes. Speed adjust range, closed loop rpm range and ramps can be set with parameters. Analog inputs are filtered so that they can also use PWM signal for controlling speed and current.

Settings can be done digitally with EM-236 interface unit or with Emen-Tool lite program installed in PC and EM-268 adapter cable. Parameters are stored into non-volatile memory of device. This interface unit can also monitor the current and rpm of motor.

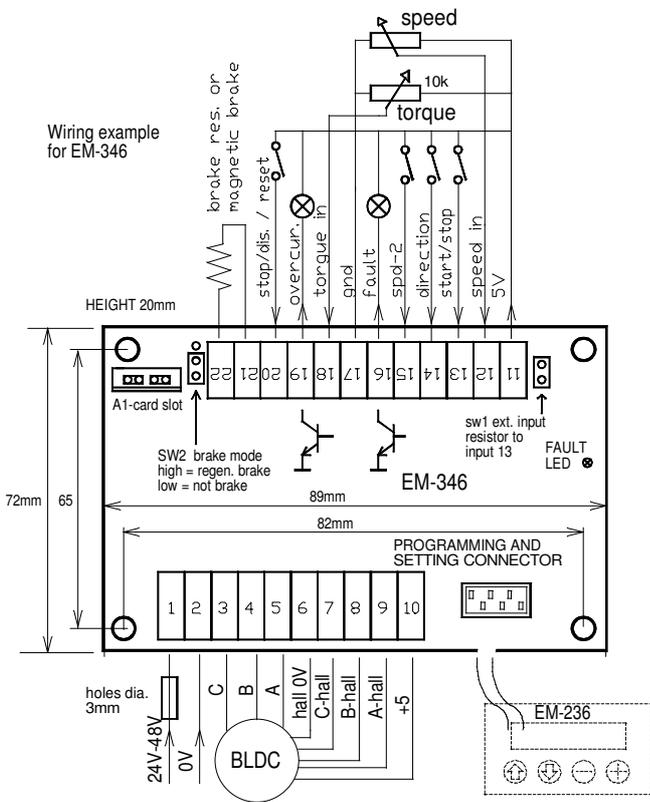
Device can be installed in DIN-rail base and some enclosure options are also available.

## TECHNICAL DATA

Supply voltage 24-48V ( 20-56Vdc )  
 Overvoltage shutdown 60V  
 Idle current typ. 30mA  
 Max current 8A cont ( Tamb. 40 °C )  
 Max current peak 25A ( max 2s )  
 Max brake output current 10A  
 Pwm frequency typ. 16kHz  
 Overtemperature temp. shutdown 90°C  
 Current limit setting 0.1-25A ( step 0.1 A )  
 Current limit analog scale 0-5V = 0-25A  
 Logic level of digital inputs  
 "off" = 0-1V or open / "on"= 4-30V  
 Input impedance of logic inputs 10k  
 Response time of digital input 2ms  
 Analog input range 0-5V up to 0-10V  
 Input impedance of analog inputs 100k  
 Input filter of analog input 100Hz  
 Hall input max. pulse freq. 600Hz  
 Overcur. and fault outputs NPN max 50mA  
 EMC-measured for industrial and household env.  
 PCB material flammability class UL94V-0  
 Dimensions 89x73x32mm  
 Weight 200g



Wiring example for EM-346



SETTABLE PARAMETERS ( prog. EM-346-48 v1.4)

EM-346 parameters are set with interface unit EM-236 or with Ementool-Lite and EM-268.

- Mode: 0-2 ( 0 )  
0= open loop , 1= closed loop " fast " 2= closed loop " slow " see also param. 8 and 9 for dynamic settings
- Closed loop range 0-4 ( 3 )  
0=15000rpm, 1=7500rpm, 2=5000rpm 3=2500rpm, 4=1500rpm above ranges is for 4 -pole motor ( 2-pole pair ). For the motor with higher number of poles the max. rpm is smaller in the ratio of number of poles
- Start ramp 0-5s / 0-50 ( 1s )
- Stop ramp 0-5s / 0-50 ( 1s )
- I-trip delay 0.01-2.5s / 0-255 0=no trip ( 0.2s )
- Scale start speed 0-25.5% / 0-255 ( 0 )
- Scale gain 0-2.55 / 0-255 ( 200 )
- Closed loop dynamic P-factor 1-200 ( 5 )  
or RfI compensation in open open loop
- Closed loop dynamic I-factor 1-200 ( 5 )
- Braking current limit 1-18A / 1-18 ( 18 )
- Pins 13 and 14 input mode 0-4 ( 1 )  
0=Stop / start pin 13 / dir. pin 14  
1= Start / stop pin 13 / dir. pin 14  
2= Start / brake pin 13 / dir. pin 14 ( without ramp )  
3= Start FW pin 13 / start BW pin 14 ( continuous )  
4= Start FW pin 13 / start BW pin 14 ( impulse )
- Current limit 0.1-25A / 0 1 -250 ( 40 )  
0= Current setting with pin 18
- Speed-2 or Local/Bus input mode 0-100 ( 50 )  
0= stop input with rising edge ( with ramp )  
1= brake input with rising edge ( without ramp )  
2-9 = not in use  
10-100 = speed-2 preset value
- I-trip reset and disable input ( 0 )  
0= I-trip reset only with disable input  
1= I-trip reset with disable in and with speed in to 0  
2= I-trip reset with disable in and with dir. input  
3= I-trip reset with new start command or speed set to zero.  
Disable input works as emerg. input, Releasing the disable input does not cause start, it requires a new start command  
10-200 = Timer reset 1-20s. ( 0 )
- Over temp reset mode ( 0 )  
0= Only with disable input  
1= With speed input change 0 to up and values 10-200 timer reset 1-20s.
- I-trip and overcurrent indication ( 0 )  
0= I-trip ind. to pin 16 & overcurr. ind. to pin 19  
1= No I trip indication to pin 16 and overcurr. to 19  
2= I-trip indication to pin 19  
3= Pin 19 reserved only for I-trip indication
- Pulse output for pin 19 0-5 ( 0 )  
0= pin 19 set with parameter 16  
1= 3pulse/round ( possible only when param 2 is 2,3 or 4 )  
2= 1pulse/round  
3= 1pulse/ 2round  
4= 1pulse/ 3round  
5= 1pulse/ 6round  
6= I-motor to freq. output -12...0...15A <=> 10...50...100Hz
- Brake out pin 21 0 or 20-75V / 20-75 ( 56 )  
0= brake out pin 21 is set to work like magn. brake cont. out  
15-65= Threshold level for pin 21 activation ( recom. max. 56V )

MONITOR VALUES

- Current 0-25A / 0-250
- Braking current 0-18A / 0-180
- Hall freq. 0-1000 / 0-1000Hz  
frequency of one hall sensor
- Operating voltage 0.07V / digit.
- PWM 0-100% / 0-255

TAKE IN USE

Operating voltage 20-56Vdc, ripple less than 20%.  
An external supply fuse is recommended ( 2-16A ).

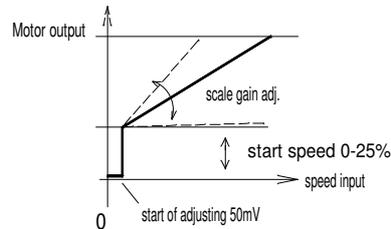
Pay attention when connecting motor wires, because there are a lot of combinations. If the motor takes much current or runs roughly, then change wiring.

Default settings are in brackets in parameter list.  
These are good start-up values.

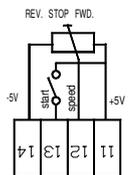
In example picture to the left, all inputs are connected.  
The device also works with less wiring. So only connect needed functions.

Overcurrent and fault outputs are NPN type and pull when activated. These can also connect to PNP input if using 2.2k external pull up resistor.

Speed adjusting input range can be set with parameters 6 and 7. See picture below.



If symmetrical control is needed ( $\pm 5V$  or  $\pm 10V$ ), then EM-A1 auxiliary card can be added into A1 slot.  
In symmetrical control the rotation direction is determined by polarity of the control signal and the middle point ( 0 ) is the same as STOP.  
The installing of EM-A1 modified inputs:  
SPEED input 0-5V / 0-10V turns  $\pm 5V$  or  $\pm 10V$  input.  
DIRECTION input turns -5V output. This voltage can be used for potentiometer, see drawing right.  
Instead of a potentiometer, a symmetrical voltage signal can also be used.



BRAKING

In some applications the load can generate energy back to drive when slowing down speed. In this case you need a braking resistor, which absorbs extra energy.  
NOTICE that parameter 18 has to be set about 10% higher than unloaded voltage of power supply.  
If using battery supply, then a braking resistor is not needed.  
NOTICE 2 do not set param. 18 higher than supply voltage max.

CONTROL INPUTS

Speed input is an analog control input for speed setting.  
Set signal can be between 0-5V and 0-10V.  
Speed scaling can be done with parameters 6 and 7.

Torque input is an analog input for current limit setting.  
0-5V signal to 0-25A current ( if parameter 12 is = 0 ).  
If parameter value is something else than zero, then current limit is = parameter value + analog input value.

Analog inputs above can also be controlled with PWM signal.  
Recommended PWM frequency is over 400Hz.

Start/stop input must be set "high" (>4V) to start motor.  
If this input is low or open, then the motor will not start.

Direction input is a digital input. It will change the rotation direction. It automatically uses stop/start ramps during change.

Speed-2 input is a digital input, which enables speed-2.  
Speed preset with parameter 13.

Stop/disable input is a digital input, which disables driver.  
Motor goes to freewheeling ( all poles floating ). This input can be set to work also as reset with parameters 14 and 15.  
This input has the highest priority.

INDICATIONS.

Fault led:  
Fast blinking = I-trip or overvoltage  
Random blinking = current limit  
Continuous = overtemp, disable input "on",

Fault output: ( Pin-16 PNP open collector output )  
Overtemperature, Overvoltage, Undervoltage.  
This indicates also I-Trip if parameter 16 is set to = 0

Overcurrent output : ( pin-19 PNP open collector out )  
This output indicates when current limit is exceeded.  
- if parameter 16 is set to =2 then it indicates also I-trip  
- if parameter 16 is set to =3 then it indicates only I-trip