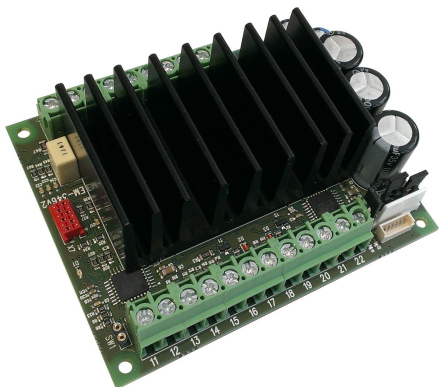


# EM-346A BRUSHLESS DC-MOTOR DRIVER 12-48V 10A



## 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)
- Firmware v2.5 add options magn. brake ( par. 18)
  - + param. 19 and 20 for TTL modbus ( Rx,Tx )
  - + param. 21 work only with PCB ver. 346A
- PCB ver -A has extended oper. voltage
- +added brake options dip-switch

## GENERAL

EM-346A 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.

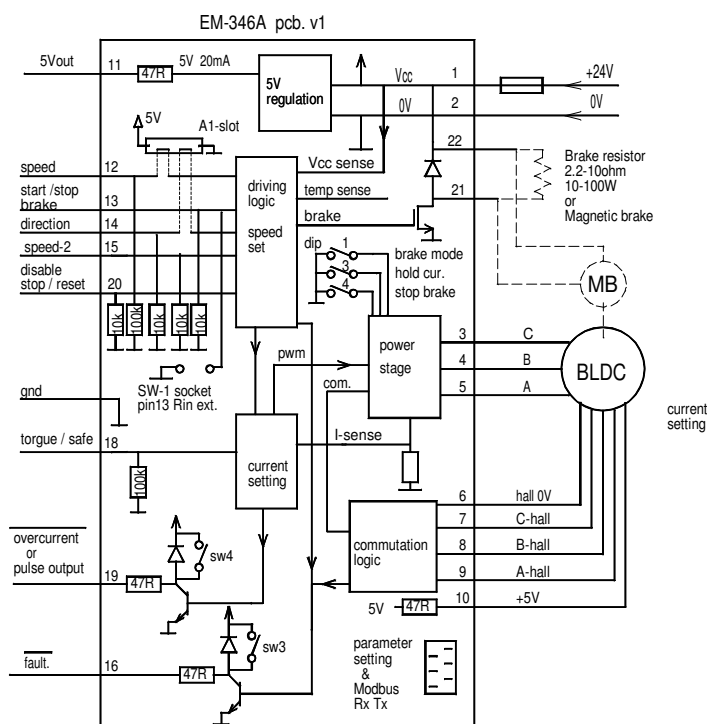
There are two control options for speed. Direct control ( open loop ) sets motor voltage in propotion to control voltage as with a standard DC-motor. Closed loop uses hall sensor feedback for speed control. This mode offers good speed regulation. Start and stop ramps work in both modes. Speed adjust 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.

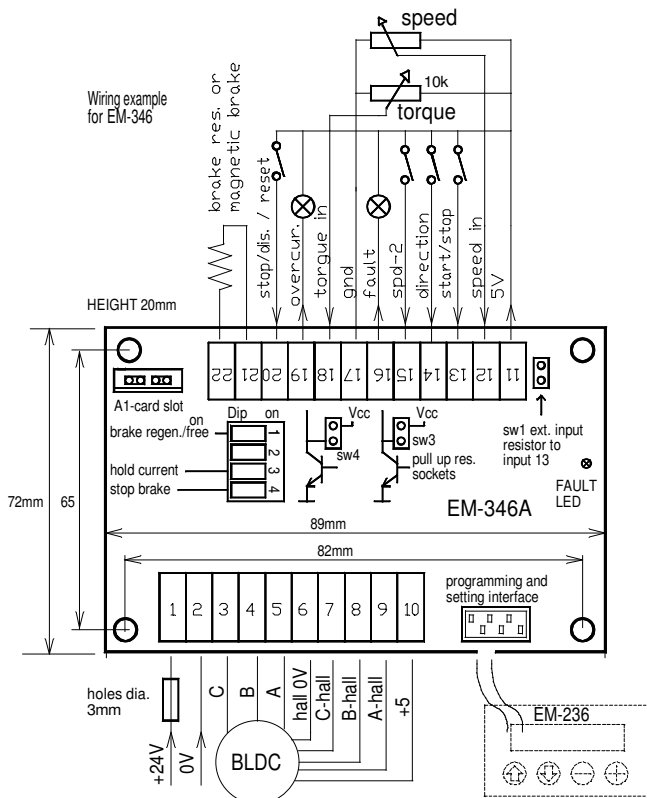
Settings can be done digitally with EM-236 interface unit or with Emen-Tool lite program installed in PC and EM-268 adapter cable. Parameters are stored into non-volatile memory of device. This interface unit can also monitor the current and rpm of motor.

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

## TECHNICAL DATA

Supply voltage 12-48V ( 11-56Vdc )  
 Overvoltage shud. max. 65V (adj. with par 18)  
 Idle current typ. 30mA  
 Max current 10A 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





### SETTABLE PARAMETERS (prog. EM-346A v2.5)

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=1500rpm, 1=750rpm, 2=500rpm 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 Rxl 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, 1, 2 or 15-65V / 15-65 (55)
  - 0= magn. brake out, 1= magn brake out "slow", 2= magn. brake out "fast"
  - 15-65= Threshold level for pin 21 activation (brake res. out)
- Baud rate 0...5 (0)
  - 0= 9600, even, 1 stop, 3= 19200, even, 1 stop
  - 1= 9600, odd, 1 stop 4= 19200, odd, 1 stop
  - 2= 9600, none, 2 stop 5= 19200, none, 2 stop
- Modbus Address 1...247 (1)
- Hold current 0-50 / 0=disable / 1-50 hold pwm (0)
  - Notice! hold current activation need also dip-3 = "on"

### TAKE IN USE

Operating voltage 12-35Vdc, ripple less than 20%.  
An external supply fuse is recommended ( 2-16A ).

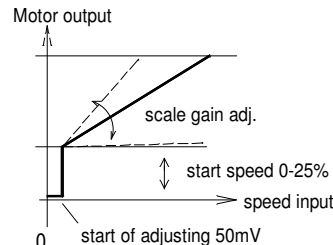
Pay attention when connecting motor wires, because there are a lot of combinations. If the motor takes much current or runs roughly, then change wiring.

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.

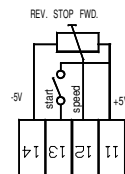
Speed adjusting input range can be set with parameters 6 and 7. See picture below.



### A1-CARD

If symmetrical control is needed ( $\pm 5V$  or  $\pm 10V$ ), then an EM-A1 auxiliary card can be added into A1 slot. In symmetrical control the rotation direction determined by the polarity of the control signal and the middle point ( 0 ) is same as STOP. The installing of EM-A1 modified SPEED and DIR. inputs

### EM-A1 option



### REGENERATION BRAKE

Driver can be set regenerative or non-regenerative mode with Dip-1. In regen. mode the driver feeds energy back to battery eg. when slowing down. But if uses standard power supply it cannot absorb energy and then must use braking resistor to absorb braking energy. The braking resistor activation level set with parameter 18, recommended set value is 10% over unloaded supply voltage. Notice also that in high inertia system not adjust stop ramp too small to avoid too high braking current.

### SPECIAL STOP MODES

The -A pcb. version card has added also two extra brake feature. With dip-3 can be set "hold current". This feature will activate when motor is stopped. This hold current increases "hold" torque in stop situation. The hold current set with param. 21 With dip-4 can set "stop brake" feature it connects motor wires together in stop situation and this way increases hold torque at stop situation.

### MAGNETIC BRAKE

If motor has integrated magnetic brake the driver can be set to control this brake unit. The brake unit normally energized ( released) when motor start to run. This mode set with parameter 18 options 0-2. Notice the regen. braking resistor option cannot use same time with magn. brake, then if needed use the external brake res. eg. EM-A23

### 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.

### LED INDICATIONS

### CONTROL OUTPUTS

Fault output: ( Pin-16 NPN open collector output ) this activates with general fault, Overtemperature, Overvoltage, Undervoltage. but this output can also indicates I-Trip if parameter 16 is set to = 0

Overcurrent output : (pin-19 NPN open collector output ) This output indicates when current limit is exceeded. but this output can be set also indicate I-trip situation or work as rpm pulse output. This output set with parameter 17

Brake output is NPN open collector output, pin-21  
See chapters BRAKE and MAGNETIC brake above

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

### 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