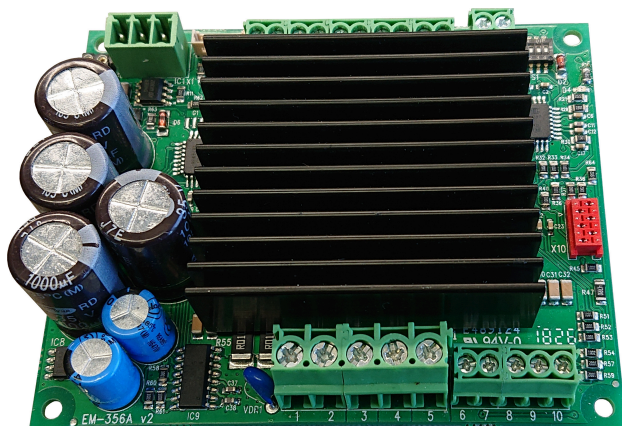# EM-356B BRUSHLESS DC-MOTOR DRIVER 12-48V 15A

FEATURES

- Only for motors with Hall sensors
- Speed and torque adjustment
- Open/closed loop modes
- Regenerative braking option
- Braking resistor output
- Fan control output
- For motors up to 100W @ 12V,
  and 200W@ 24V
- Current limit and trip
- Indication output option
- Good efficiency
- Low EMC emissions
- DIN-rail mountable

Firmvare v1.0 or later
- Rs-485 Modbus control option
Firmware v1.7 or later
- Added input functions, par. 11,13, 20
- Added power on mode, parameter 15
Firmvare v1.8
- par 20 added "inverted disable" option
- closed loop start up improved

GENERAL

EM-356B is brushless DC-motor driver with hall sensor feedback. The unit has a mosfet power stage with good efficiency and it meets also todays EMC requirements. The driver can be used with 120° commutation. This driver has true 4Q power stage, and it makes possible to use regenerative braking . In this braking method the supply voltage rises, this voltage rising can be controlled with braking resistor. If uses battery supply then the braking energy can be leaded back to battery and braking resistor will not needed.
The unit has the basic digital command inputs like direction, start/stop, disable, speed-2 activation and there is analog inputs for speed and current control. EM-356B has PNP output for fault indication use. Several input and output functions can be modified with parameters. Driver includes overvoltage, undervoltage and overtemperature protections. These fault situations are indicated with fault on-board LED and indication output. Optionally this device can be controlled with Rs-485 interface with modbus
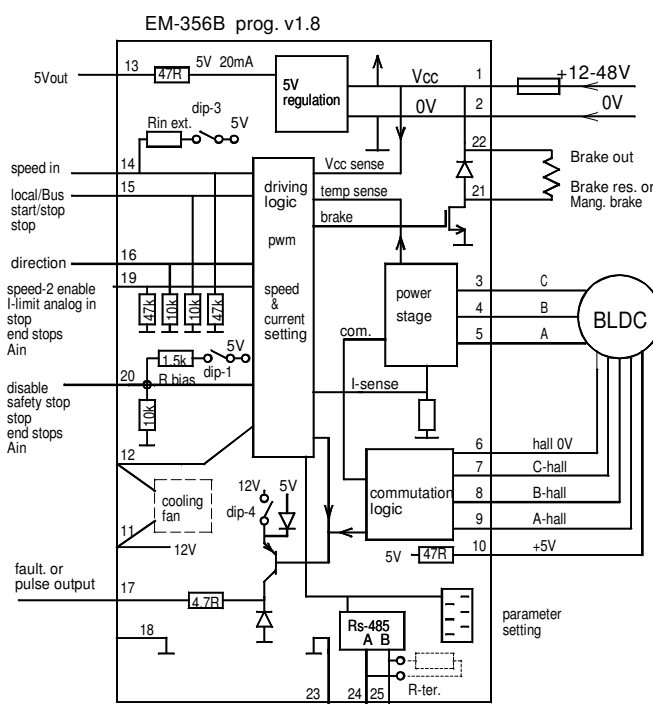
There are two control options for speed. Direct control (open loop) sets motor voltage in propotion to control voltage as with a standard DC-motor. Closed loop uses hall sensor feedback for speed control, this mode offers good speed regulation. Start and stop ramps work in both mode. Speed adjust range, closed loop rpm range and ramps can be set with parameter. Anolog input are filtered so that there can also use PWM signal for control speed and current.
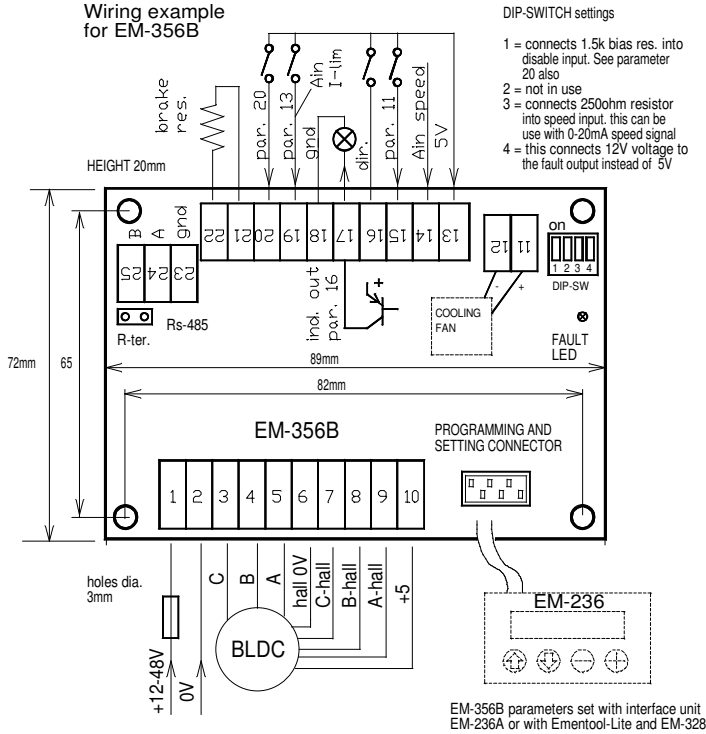
Setting can be done digitally with EM-236 interface unit or with Emen-Tool lite program installed in PC and EM-328 adapter cable. Parameters stored into nonvolatile memory of device. This interface unit can also be monitored the current and rpm of motor.

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

TECHNICAL DATA

Supply voltage 12-24V (11-35Vdc)
Overvoltage shut down 40V
Undervoltage shutdown 10V, start up 11V
Idle current typ. 30mA
Max. current 15A cont. (Tamb. 25 ℃ / Vdc 24V)
 above Tamb. can be 50℃ ,when fan is used.
Max current peak 40A (max 2s)
Max brake output current 5A
Pwm frequency typ. 16kHz
Overtemperature Temp shut down 90℃
Current limit setting 1-40A (step 1A)
Current limit analog scale 0-5V = 0-40A
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
Speed input range 0-5V up to 0-10V
Input impedance of analog inputs 100k
Input filter of analog input 100Hz
indication output PNP 12V max 30mA
Fan output NPN max. 100mA (switch on at 55℃)
EMC measured for industrial enviroment
PCB material flammability class UL94V-0
Dimensions 89x73x32mm (height 44mm with fan)
Weight 150g and 200g with fan

EM-356B prog. v1.8

ELECTROMEN Oy

www.electromen.com

Wiring example for EM-356B

DIP-SWITCH settings

1 = connects 1.5k bias res. into disable input. See parameter 20 also
2 = not in use
3 = connects 250ohm resistor into speed input. this can be use with 0-20mA speed signal
4 = this connects 12V voltage to the fault output instead of 5V

HEIGHT 20mm

72mm 65

holes dia. 3mm

EM-356B

PROGRAMMING AND SETTING CONNECTOR

89mm
82mm

Rs-485
R-ter.

ind. out par. 16

COOLING FAN

FAULT LED

DIP-SW

1 2 3 4 5 6 7 8 9 10

C B A hall 0V C-hall B-hall A-hall +5

BLDC

+12-48V   0V

EM-236

EM-356B parameters set with interface unit EM-236A or with Ementool-Lite and EM-328

SETTABLE PARAMETERS   (prog. EM-356 v1.8)

1. mode: open loop =0 / closed loop=1/ closed loop "slow" =2 (0)
2. 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 ration
   of number of poles
3. start ramp 0-5s / 0-50   (10)
4. stop ramp 0-5s / 0-50   (5)
5. I-trip delay 0.01-2,5 / 0-255, 0=I-trip, disabled (200)
6. scale start speed 0-25.5% / 0-255 (0)
7. scale gain 0-2.55 / 0-255   (200)
8. Load compensation (RxI) adjut 1-200 (5)
   or in closed loop mode dynamic P-factor
9. closed loop dynamic I-factor 1-200 (10)

10. regen. braking current limit 2-40A / 2-40 (25)
11. Input PIN 15 options (0)
    0 = open or "low" = Local / "high" = Bus
    1 = open or "low" = Bus / "high" = Local
    2 = local/Bus control selection with Bus only
    3= local only and pin 15 as start/stop
    4= local only and pin 15 as stop input
    5= local only and pins 15 and 16 impulse input
    6 = local only and pin 15 as end stop BW
12. current limit 0 / 1-40A / 1-40 (20)
13. Input PIN 19 options 0-100 / 0-100 (50)
    0= input is I-lim analog input 0-5V
    1= stop input
    2= end stop FW
    3 = end stop BW
    4 = analog input
    10-100 = speed-2 enable and par. = speed-2
14. I-trip reset mode   (0)
    0= only with disable in pin
    1= disable in and start/stop in or dir. in or speed in change 0 to up
    10-200 = timer reset with 0.1s steps = 1-20s.
15 Start up mode when power on & over temp. reset options (1)
    0= ready to run when power on & over temp. reset disable input
    1 = ready to run when power on & over temp. res. with speed 0 to up
    2 = disabled when power on & over temp. res. with speed 0 to up
    10-200 = ready to run when power on & over temp. reset with timer
             reset time 0.1s steps = 1-20s.
16 PIN 17 output function (1)
    0 = overtemp. and overvoltage
    1 = overtemp, overvoltage, and I-trip
    2 = overtemp, overvoltage, I-trip and overcurrent
    3 = reserved for pulse output use, see param 17
    4 = same as the LED on circuit board
17 pulse output divider 1-20, enabled only if param. 16=3 (1)
    1 = 1pulse/round
    2 = 1pulse/ 2round...
    ...
    20= 1pulse/ 20round
18. brake res. threshold (=overvoltage) 15-60V / 15-60 (35)
19. brake output mode and braking mode 0-3   (0)
    0 = output active if param. 18 value exceed and brk. mode "regenerative"
    1= output active if param 18 value exceed and brk. mode "freewheel"
    2= output active when "run" and braking mode "regenerative"
    3= output active when "run" and braking mode "freewheel"
20. Input pin 20 options (0)
    0 = disable (and reset)
    1 = safety switch stop with wiring monitor (closing contact)
    2 = stop input
    3 = end stop FW
    4 = end stop BW
    5 = Analog input
    6 = inverted disable (disabled when "low")
21. Baud rate 0...5 (3)
    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
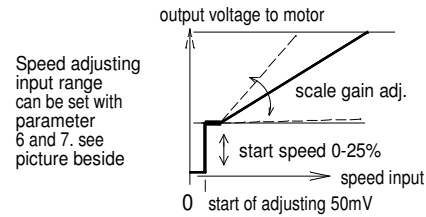22. Modbus Address 1...247 (1)

TAKE IN USE

Nominal operating voltage 12-24Vdc ripple less than 20%
An external supply fuse is recommended (2-40A)

Be sharp when connect motor wires, because there
is lot of combinations. If motor takes much current or
run roughly then change order of hall-sensor and try again

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

When power turn on the device can be ready to run or disabled
In ready to run mode driver starts directly if speed is set .
In disable mode speed must be set to 0 before start is possible.
See parameter 15

In example picture beside there all input connected,
but device work also with less wiring, you can start only
with speed signal (par. = 0). More wiring option on
application sheet.

Speed adjusting input range can be set with parameter 6 and 7. see picture beside

output voltage to motor

scale gain adj.

start speed 0-25%

speed input

0   start of adjusting 50mV

In some application load can be generated energy
back to drive, when slowing down speed. Then there
needed braking resistor, which absorbed extra energy.
NOTICE that the parameter 18 has to be set about 10%
higher than unloaded voltage of power supply.
In the battery powered application the resistor not need,
because the battery absorb the regenerated energy.

CONTROL INPUTS

SPEED input is a analog control input for speed setting.
Set signal can be between 0-5V and 0-10V
Speed scaling can be made with parameter 6 and 7.

PIN 15 can be used to select control source LOCAL / BUS
Local control with card terminal or Buscontrol with Rs-485
This Input has also another options which can be set with parameter 11

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

INPUT PIN 19 is a multifunction input it can be set with 13.
This can be worked as analog CURRENT LIMIT input, SPEED-2 activation
input or different type of STOP inputs

INPUT PIN 20 is a multifunction input,
it can be set with par. 20 This input
can be worked as SAFETY SWITCH
input, DISABLE input or different type
of STOP inputs

SAFETY SWITCH option including also
line monitor for safety switch. If the
line resistance is too high the device
gives warning

5V
Dip-sw-1
1.5k
R-bias
in card
20
safety switch
with line
monitor
resistor
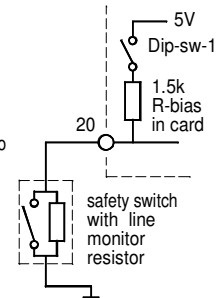
OUTPUTS

FAULT / PULSE OUT This output modes can be set with
parameter 16. There is some options when output will be activate.
The special mode is pulse output, in this case output gives out
rpm-pulses which can scaled with parameter 17

BRAKE output can used to control magnetic brake of motor or
switch a braking resistor in regenerative braking. the mode
can be set with parameter 19
Recommend brake resistor , Wirewound 10-50W
Resistance 4.7R at 12V, 10R at 24V and 22R at 48V

Rs-485 port can be used to control device with Modbus protocol
This port has own guide sheet " Modbus register definitions for EM-356A"

MONITOR VALUES

1. current 1A / digit
2. braking current 1A / digit
3. hall sensor freq. 0-255Hz
4. operation voltage 0.1V / digit
5. pwm 0-255   (255 = 100%)

INDICATIONS.

Continuous light: Over. temp. or overvoltage or disable
Fast blinking : current limit exceeded
Short blinks: shutted down by overcurrent (I-trip)
Long blinks: safety switch wire fault
Slow blinking: shutted down by safety switch

Fault output: (Pin-17 PNP open collector output)
Overtemperature, Overvoltage, Undervoltage.
This indicates also I-Trip if parameter 16 is set to = 0