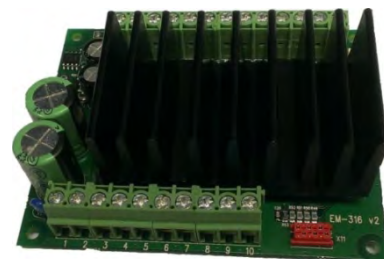
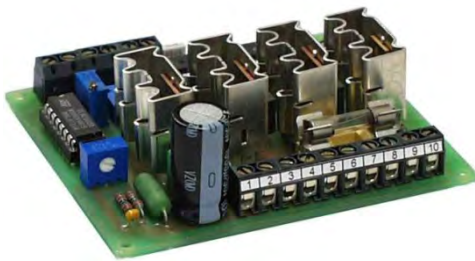




**MOTION TECHNOLOGIES
PTY LTD**

TECHNICAL SPECIFICATIONS

ELECTROMEN BRUSHLESS DC MOTOR SPEED CONTROLLERS



The full range of motor controllers available in this series:

Product files



Items under this category

AC motor controllers



Brushless DC motor controllers



DC motor controllers <10A



DC motor controllers >10A



Positioning controllers



Stepper motor controllers



Electromen Low Voltage Brushless Motor Controllers

Contents

Rated current Amps	Peak Current Amps (time)	Motor Volts dc	Model Number	Features Summary (refer to data sheet for full features list)	pdf Page
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5	8 (2s)	24 or 48	EM-206-48	1) 6)	10
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50	80 (5s)	12 or 24 or 48	EM-347B	2) 3) 4) 7) 8) 10) 11) 12) 14)	38
60		12 or 24 or 48	EM-347B-FAN		
Programming Interface Units (low cost)			EM-236A	stand alone	40
			EM-328 series		PC dongle
DIN rail base mount kits (low cost)			Part numbers to suit controller model, see data sheet		43

Notes:

All of above controllers are pcb board level only

All of above controllers include +5v supply for Hall sensor power

A full range of DIN rail mounting kits and enclosures are optional

Features Legend:

- 1) Trim pots + DIP switch setable
- 2) Software setable, needs low cost programming interface
- 3) Torque and/or speed commands
- 4) Modbus RS-485 comms optional
- 5) Positioning control with current limit and trip
- 6) ±10v command card option
- 7) Speed pulse output option
- 8) Symmetrical speed control optional, ±5v or ±10v
- 9) Regen braking option
- 10) Brake resistor output
- 11) Recommendations: 12v/800W, 24v/1200W, 48v/1600W
- 12) Stop Brake (winding short) and Stop Holding Current
(powered windings) are standard features
- 13) Safety switch function
- 14) open/closed loop modes

EM-240 BRUSHLESS DC-MOTOR CONTROLLER 12-24V 1.5A



FEATURES:

- Hall sensor supply and input
- Open or closed loop activity
- Controlled direction change
- Braking
- Settable current limit
- Settable start and stop ramp
- Dip-switch settable
- EMC tested

EM-240 controller is designed for small brushless DC-motors. The unit is suitable for three phase hall transducer brushless motors. There are two operating modes: in open loop operating mode the motor voltage is proportional to control value with the characteristics of a common DC-motor with brushes. In closed loop operation hall transducer signal is used to regulate motor speed. Through the feedback, a precise motor rpm in relation to control value can be achieved.

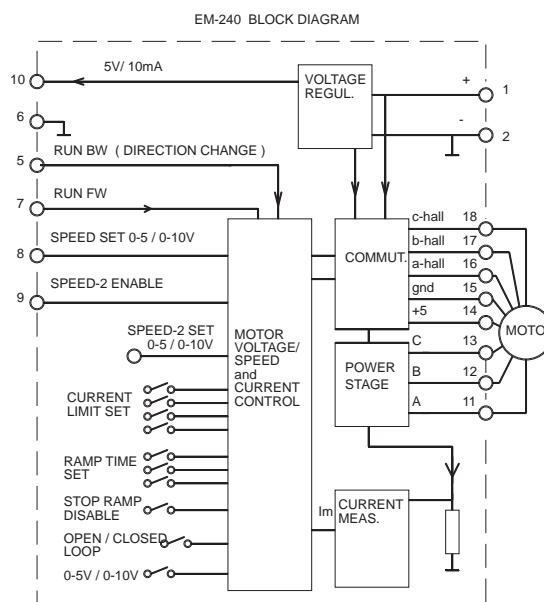
The motor operating speed and running direction can be adjusted and the motor may be braked in both operating modes. The power stage uses PWM principle and is highly efficient.

Speed control value is given as analog voltage signal. The auxiliary voltage signal is regulated and may be used as reference value for control potentiometer. The acceleration speed can be adjusted with acceleration and deceleration ramp. Deceleration ramp can also be bypassed when rapid braking is desired. Additionally the unit is equipped with speed2-feature, which can be activated individually. This is especially practical in positioning applications.

Current limit can be used to restrict motor torque and is dip-switch settable. Control inputs work with positive (NPN) logic. EM-170 is EMC-tested in accordance with industrial standards.

TECHNICAL DATA:

Supply	12-35V
Current cons.	max 2A
Idle current	20mA
Output voltage	0-32V
Motor rpm	max. 18000 rpm
Output current	1.5A continuous 2A (10s)
Current limit	0.2, 0.3, 0.4, 0.5, 0.6 0.7, 0.8, 0.9, 1, 1.1, 1.2 1.3, 1.4, 1.5, 1.7 and 2A
Ramp time	0, 0.1, 0.2, 0.3, 0.5 0.7, 1.0, 1.5s
Input control voltage	0-10V (Rin 100kohm)
ON/OFF control	0-1V ="off" 4-30V="on"
Input impedance	10kohm
Auxiliary voltage	10V (max. 5mA)
Operation freq.	16kHz
Operating temp.	0-60°C
EMC	EN-50081 and EN-50082-2
Measures	60x60x20mm
Weight	30g



EM-240 OPERATING INSTRUCTIONS

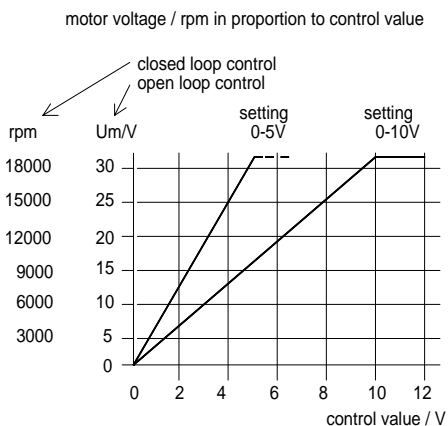
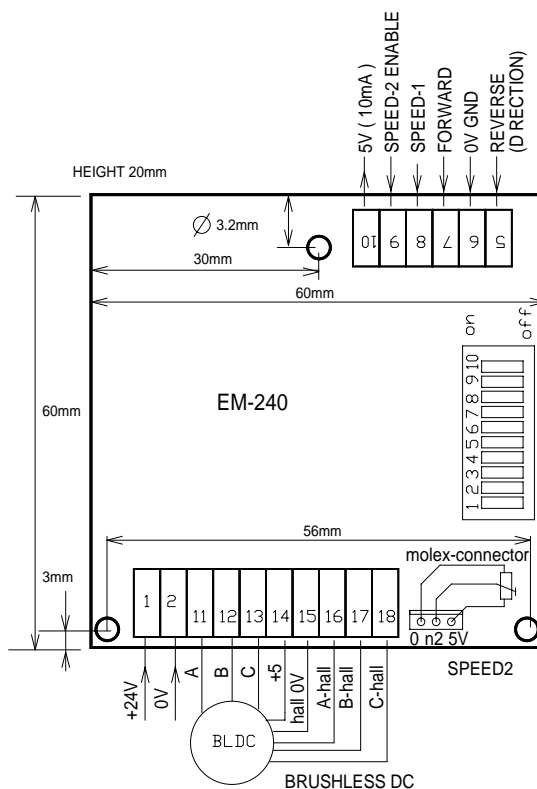
Supply filtered 12-35VDC with ripple < 20% with full load.
CAUTION ! reverse polarity can damage the unit
CAUTION ! no internal fuse

SETTINGS AND CONNECTING UNIT

Switch off power before connecting motor and power supply to EM-240. Prepare the control circuit. Set current limit and ramp time according to application.

In open loop mode motor rpm will drop when loaded (in relation to control voltage), whereas in closed loop mode the motor rpm will be constant (in relation to control voltage) unless the current limit is not exceeded. The control value relation to motor output voltage is illustrated in the chart below. Speed-2 control value is given via molex-connector, the scaling is same as in speed-1 input. If speed-2 feature is not required, this potentiometer can simply be left out. Recommended speed control potentiometer value is 2..50kohm for both speed-1 and speed-2.

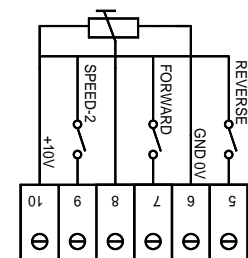
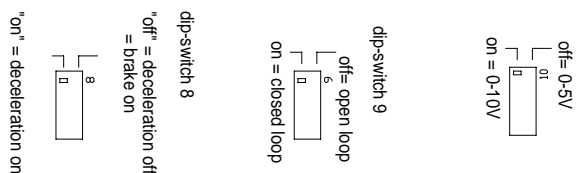
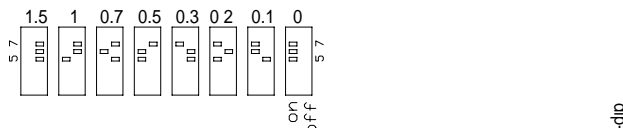
Control inputs can be used with switches, analog voltage or NPN outputs of a logic. A voltage signal greater than 4V is logic 1, maximum input voltage 30V. Forward input will start up the motor in forward direction. Reverse input will start up the motor in reverse direction. When motor is already running forward, direction will change. Speed-2 will set the running speed according to input signal in molex connector. Notice: Speed-2 input will start up the motor in forward direction even if no other inputs are activated. Control voltage and speed set value are in reference with 0V gnd potential (pin6).



current limit / A
dip-switches 1-4

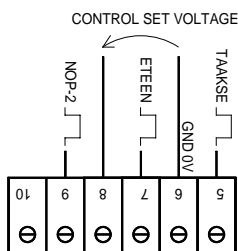


ramp time / s
dip-switches 5-7



EXAMPLE 1

Speed control with potentiometer.
 Speed-2 with external potentiometer.
 Control input with switches.



EXAMPLE 2

Speed control with voltage 0-5V or 0-10V.
 Speed-2 with external potentiometer.
 Control input with 4-30Vdc voltage.

EM-269A BRUSHLESS DC-MOTOR DRIVER 12-35V 2A



FEATURES

- Three phase output
- Speed adjustment
- Current limit and trip.
- Open/closed loop modes
- Settable Indication output
- Good efficiency
- Low EMC emissions
- DIN-rail mountable

GENERAL

EM-269A is brushless DC-motor driver for motors with hall sensor feedback. The unit has a mosfet power stage with good efficiency and it meets also today's EMC requirements. The unit has the basic digital command inputs like direction, start/stop, and analog input for speed control. Device has one NPN output for fault and overcurrent indication use. Indication output functions can be defined with parameter. The fault situations are also indicated with on-board LED.

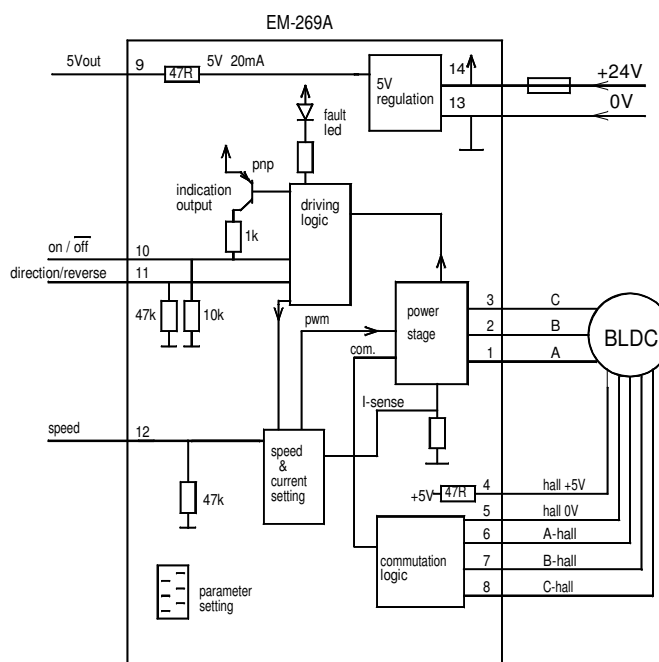
There are two control options for speed. Direct control (open loop) sets motor voltage in proportion to control voltage as with a standard DC-motor. Closed loop mode uses hall sensor feedback for speed control. This mode offers good speed regulation. Start and stop ramps are working in both mode. Speed adjust range, closed loop rpm range and ramps can be set with parameters. Analog input is filtered, so that also PWM signal of PLC can be used to control speed.

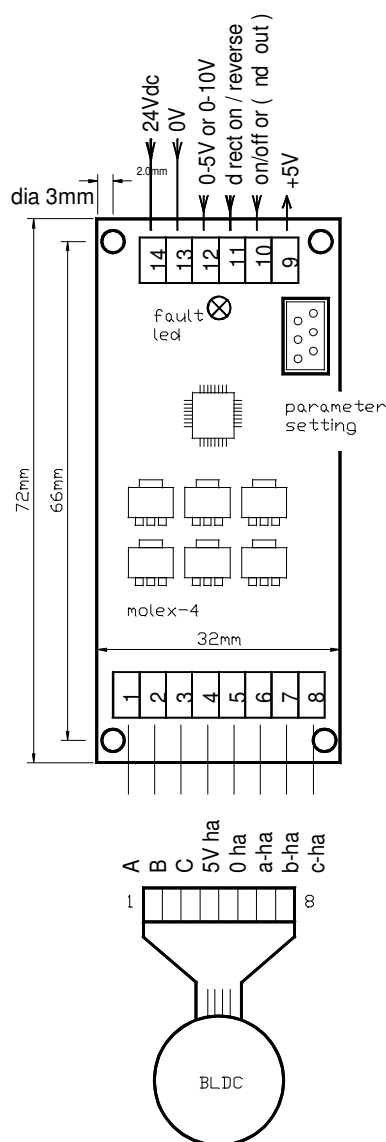
Parameter setting can be done digitally with EM-236 interface unit or with Emen-Tool lite PC-program and EM-268 adapter. There is also an option to use iPhone with Ementool-APP and EM-326 adapter. The parameter settings are stored into driver's nonvolatile memory. The parameter interfaces can be also used for motor current monitoring.

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

TECHNICAL DATA

Supply voltage 12-24V (11-35Vdc)
 Idle current typ. 30mA
 Max current 2A cont. (Tamb. 40 °C)
 Max current peak 3A (max 5s)
 PWM frequency typ. 16kHz
 Current limit setting 0.1-3A (step 0.1 A)
 Logic level of digital inputs
 0-1V or open = "off" / 4-30V = "on"
 Input impedance of logic inputs 10k
 Response time of digital inputs 2ms
 Analog input range 0-5V or 0-10V
 Input impedance of analog input 47k
 Speed input low pass filter fc. = 40Hz
 Speed input pwm freq. recom. > 300Hz
 NPN Indication output impedance 1kohm
 EMC measured for industrial and household env.
 PCB material flammability class UL94V-0
 Screw connectors, 1.5mm² (in standard version)
 Molex connector 2.5 pitch (option)
 Dimensions 72x32x18mm
 Din-rail option EM-KP72-42
 Metal-enclosure option EM-T15
 Weight 20g





EM-269A WIRING and INTRODUCTION

Supply: filtered 12-35VDC with ripple < 20% with full load.
CAUTION ! reverse polarity can damage the unit
CAUTION ! use an external fuse

Switch off power before connecting motor and power supply to EM-291A unit. Prepare the control circuit. Switch on the unit, connect the interface and set current limit and ramp time according to application. If motor will not start and takes a lot of current or run unsmooth, check the wiring of the motor and hall-sensors.

In open loop mode motor rpm will drop when loaded, The load compensation parameter can be used to reduce speed dropping in open loop mode.
 In Closed loop mode the feedback control try to keep speed a constant (in relation to control voltage) until the current limit is exceeded.

ON/OFF and REV.. inputs can be used with switches or NPN outputs of a logic. Voltage signal greater than 4V is logic "1", maximum input voltage is 30V. ON/OFF input will start up the motor to forward direction. REVERSE input will start up the motor to reverse direction. When motor is already running forward direction, a reverse command will change rotation of direction.
 If INDICATION output will be activated, then on/off input are not available, so driver is all time "on". but driver can be stopped with set speed input to zero.

On board fault led indicates overcurrent or current trip.

PARAMETERS SETTINGS (prog. 269A v1.2)

EM-269A parameters set with interface unit EM-236 or with Ementool-Lite and EM-268 or with Ementool-APP and EM-326 (default values in brackets)

- operating mode
0 = Open loop / 1 = Closed loop (0)
- rpm range in closed loop 1000-18000rpm / 1-18 (6)
- closed loop dynamic 1-5 (3)
higher value means slower dynamic.
- Input scale 0 =0-10V / 1= 0-5V
- load compensation (only open loop use) 0-50 (0)
- start ramp 0-8 / 0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.7, 1.0, 1.5s (4)
- stop ramp 0-8 / 0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.7, 1.0, 1.5s (4)
- current limit 0-3.0A / 0-30 (15)
- current trip delay 0= trip disabled
1-200 = 1-200ms delay(40)
- indication output function (1)
0 =not in use, 1=current trip, 2= current limit, 3= motor stopped

PARAMETERS DEFINITION

- Open loop or closed loop selection
- Closed loop RPM range can be defined with this parameter
1000 means that motor speed range is 0-1000rpm
- Closed loop dynamic set the closed loop control response
higher value means slower response
- Two selectable basic speed input scale ranges.
- Load compensation can be needed in open loop use. It gives additive torque at low rpm. The compensation value depends on motor. Right value can be found next way: Drive motor at low speed in open loop mode. Increase the compensation value for example 5 step at once and try to load motor. You can feel that the motor torque is increased. Notice too high compensation value will cause nervous behaviour of the motor. Keep the compensation value 0 at closed loop mode.
- & 7 acceleration and deceleration ramps. these parameters for smoothening the start stop situations. The start ramp also decreases start current spikes.
- Current limit parameter defines maximum value for current. Driver limits or trips if set value is exceeded. The current is in ratio for motor torque.
- This parameter sets reaction time for current trip.
Value 0 disabled current trip action, then current only will be limited to the value set with param 8. The values 1-200ms set how long time current limit has to been exceeded, until driver shut down motor.
- Disabling or selecting the indication output function.
Notice, that if setting something else than 0, then start/stop input pin is not in use, because out uses same terminal.

MONITOR VALUES

- trip status
0= no trip, 1= tripped for FW dir, 2=tripped for REV. dir.
- Speed input signal value
- Motor current 0-30 = 0-3.0A

OTHER.

An iPhone access code can be set when EmenTool-APP control is used. This code can be reset with simultaneous REV. and ON/OFF commands at the same time when power switch on.

EM-291A BRUSHLESS DC-MOTOR DRIVER 12-35V 4A



FEATURES

- Three phase output
- Speed adjustment
- Current limit and trip.
- Open/closed loop modes
- Settable Indication output
- Good efficiency
- Low EMC emissions
- DIN-rail mountable

GENERAL

EM-291A is brushless DC-motor driver for motors with hall sensor feedback. The unit has a mosfet power stage with good efficiency and it meets also today's EMC requirements. The unit has the basic digital command inputs like direction, start/stop, and analog input for speed control. Device has one NPN output for fault and overcurrent indication use. Indication output functions can be defined with parameter. The fault situations are also indicated with on-board LED.

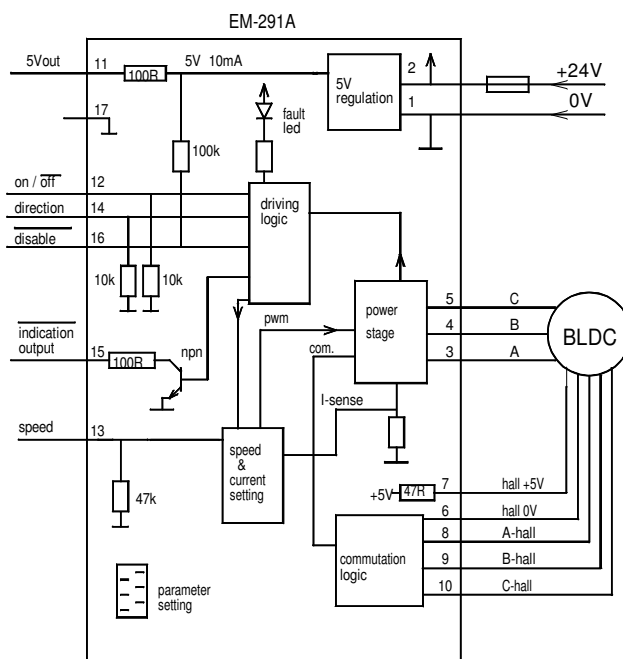
There are two control options for speed. Direct control (open loop) sets motor voltage in proportion to control voltage as with a standard DC-motor. Closed loop mode uses hall sensor feedback for speed control. This mode offers good speed regulation. Start and stop ramps are working in both mode. Speed adjust range, closed loop rpm range and ramps can be set with parameters. Analog input is filtered, so that also PWM signal of PLC can be used to control speed.

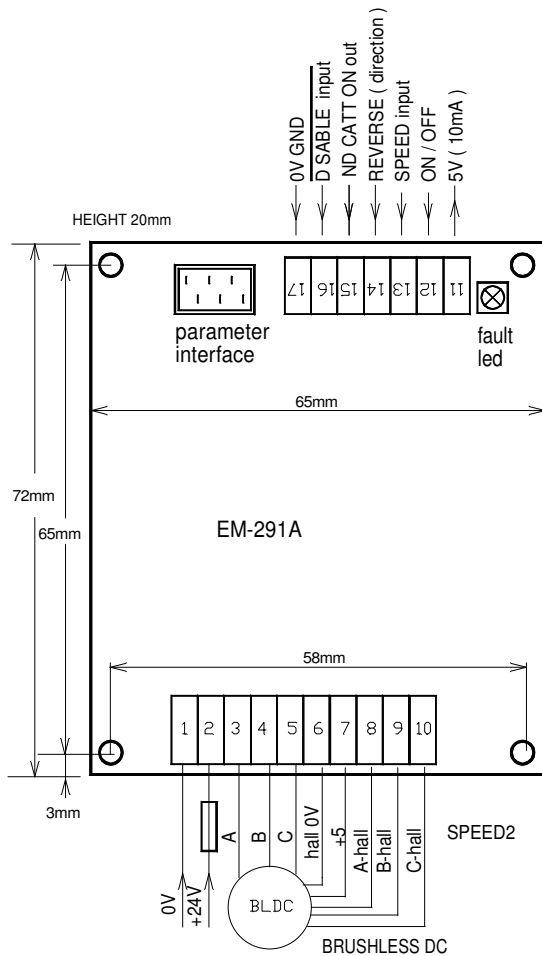
Parameter setting can be done digitally with EM-236 interface unit or with Emen-Tool lite PC-program and EM-268 adapter. There is also an option to use iPhone with Ementool-APP and EM-326 adapter. The Parameters setting are stored into driver's nonvolatile memory. The parameter interfaces can be also used for motor current monitoring.

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

TECHNICAL DATA

Supply voltage 12-24V (11-35Vdc)
 Idle current typ. 30mA
 Max current 4A cont. (Tamb. 40 °C)
 Max current peak 6A (max 5s)
 PWM frequency typ. 16kHz
 Current limit setting 0.1-6A (step 0.1 A)
 Logic level of digital inputs
 0-1V or open = "off" / 4-30V = "on"
 Logic level of disable input
 0-1V or open = disabled / 4-30V = on duty
 Input impedance of logic inputs 10k
 Response time of digital inputs 2ms
 Analog input range 0-5V or 0-10V
 Input impedance of analog input 47k
 Speed input low pass filter fc. = 40Hz
 Speed input pwm freq. recom. > 300Hz
 NPN Indication output impedance 100ohm
 EMC measured for industrial and household env.
 PCB material flammability class UL94V-0
 Screw connectors, max 2.5mm² cable
 Dimensions 72x65x20mm
 Din-rail option EM-KP72-65
 Metal-enclosure option EM-T17
 Weight 78g





EM-291A WIRING and INTRODUCTION

Supply: filtered 12-35VDC with ripple < 20% with full load.
CAUTION ! reverse polarity can damage the unit
CAUTION ! use an external fuse

Switch off power before connecting motor and power supply to EM-291A unit. Prepare the control circuit. Switch on the unit, connect the interface and set current limit and ramp time according to application. If motor will not start and takes a lot of current or run unsmooth, check the wiring of the motor and hall-sensors.

In open loop mode motor rpm will drop when loaded, The load compensation parameter can be used to reduce speed dropping in open loop mode. In Closed loop mode the feedback control try to keep speed a constant (in relation to control voltage) until the current limit is exceeded.

ON/OFF and REV.. inputs can be used with switches or NPN outputs of a logic. Voltage signal greater than 4V is logic "1", maximum input voltage is 30V. ON/OFF input will start up the motor to forward direction. REVERSE input will start up the motor to reverse direction. When motor is already running forward direction, a reverse command will change rotation of direction. The disable input releases power stage, so motor will run freely. When disable is removed the motor will start with ramp. Notice, the disable input works with negative logic.

On board fault led indicates overcurrent or current trip.

PARAMETERS SETTINGS (prog. 291A v1.2)

EM-291A parameters set with interface unit EM-236 or with Ementool-Lite and EM-268 or with Ementool-APP and EM-326 (default values in brackets)

- operating mode
0 = Open loop / 1 = Closed loop (0)
- rpm range in closed loop 1000-18000rpm / 1-18 (6)
- closed loop dynamic 1-5 (3)
higher value means slower dynamic.
- Input scale 0 =0-10V / 1= 0-5V
- load compensation (only open loop use) 0-50 (0)
- start ramp 0-8 / 0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.7, 1.0, 1.5s (4)
- stop ramp 0-8 / 0, 0.1, 0.2, 0.3, 0.4, 0.5, 0.7, 1.0, 1.5s (4)
- current limit 0-6A / 0-60 (15)
- current trip delay 0= trip disabled
1-200 = 1-200ms delay(40)
- indication output function (1)
0 =not in use, 1=current trip, 2= current limit, 3= motor stopped

PARAMETERS DEFINITION

- Open loop or closed loop selection
- Closed loop RPM range can be defined with this parameter
1000 means that motor speed range is 0-1000rpm
- Closed loop dynamic set the closed loop control response
higher value means slower response
- Two selectable basic speed input scale ranges.
- Load compensation can be needed in open loop use. It gives additive torque at low rpm. The compensation value depends on motor. Right value can be found next way: Drive motor at low speed in open loop mode. Increase the compensation value for example 5 step at once and try to load motor. You can feel that the motor torque is increased. Notice too high compensation value will cause nervous behaviour of the motor. Keep the compensation value 0 at closed loop mode.
- & 7 acceleration and deceleration ramps. these parameters for smoothening the start stop situations. The start ramp also decreases start current spikes.
- Current limit parameter defines maximum value for current. Driver limits or trips if set value is exceeded. The current is in ratio for motor torque.
- This parameter sets reaction time for current trip.
Value 0 disabled current trip action, then current only will be limited to the value set with param 8. The values 1-200ms set how long time current limit has to been exceeded, until driver shut down motor.
- Disabling or selecting the indication output function.

MONITOR VALUES

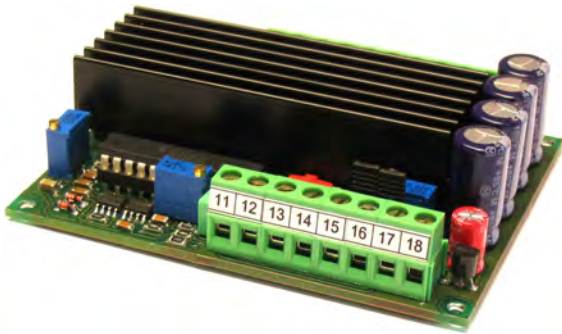
- trip status
0= no trip, 1= tripped for FW dir, 2=tripped for REV. dir.
- Speed input signal value
- Motor current 0-30 = 0-3.0A

OTHER.

An iPhone access code can be set when EmenTool-APP control is used. This code can be reset with simultaneous REV. and ON/OFF commands at the same time when power switch on.



EM-206-48 BRUSHLESS MOTOR CONTROLLER 80-) * V 5A



FEATURES:

- Three phase output
- Continuous speed adjustment
- Reversing
- Braking
- ±10V control option
- Hall sensor supply and input
- 60° or 120° commutation
- Settable / controllable current limit
- Fault output
- Open or closed loop activity
- High efficiency
- Rail base mountable

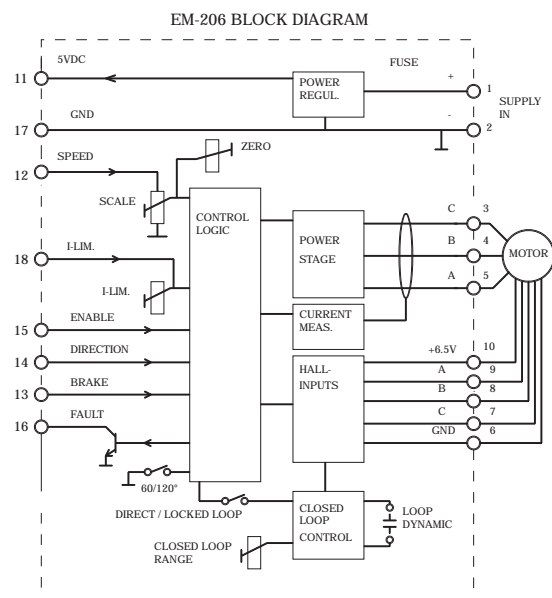
EM-206 is a DC-motor controller that is designed for brushless motors with hall sensor feedback. The unit has a mosfet-type high efficiency power stage. EM-206 can be connected to motors using 60° or 120° commutation. The unit is equipped with standard controls, such as speed, stop, reversing and braking. Mechanical installation can be done with screws or by using a rail mounting base.

There are two control options. Direct control (open loop) sets motor voltage in proportion to control voltage, as with a standard DC-motor. Frequency locked control (closed loop) uses hall sensor feedback for speed set besides commutation set. This way a precise speed control is attained. Closed loop response can be altered so that the adjustment remains stable in given application. Speed control signal can be scaled with trimmers.

Current limit restricts motor torque when motor current exceeds set value. Current limit can be set with a trimmer or with external signal. Fault output indicates the operation of the current limit. EM-206 is protected against surge voltage and overheating (excess load). The unit requires an external fuse. As an option, EM-A1 expansion card can be installed, this makes it possible to control EM-206 with ±10V signal.

TECHNICAL DATA:

Supply voltage	0...56 Vdc
Over voltage protect.	58Vdc
Idle current	approx. 50mA
Motor current	5A rms
	7A 50/50%
Current limit	0...8A
Current limit input	0-5V corresponds to 0-8A (input imp. 10k)
Thermal protection	120°C (heat sink)
Voltage loss	0.8V @ Im=5A
Control voltage	0-10V (0-5V adjustable)
Control potentiometer	2-10k
Control voltage output	5V (max 10mA)
Hall voltage output	6.5V
Digital control	"high" @ Uin=3...30V "low" @ Uin=0...1V or open
Control Input impedance	10k
Fault output	NPN open coll. 30V 10mA
Dimensions	89x73x25mm
Weight	approx. 130g



EM-206-48 OPERATING INSTRUCTIONS

Operating voltage G0-56V filtered, with less than 20% ripple.
An external supply fuse is recommended, suitable values 1-8A.

Speed control set with voltage or potentiometer. Range is adjustable with SCALE and ZERO trim.
The recommended pot. value is 2-10k, the control voltage signal should be 0-5V or 0-10V.

There is option for $\pm 10\text{V}$ control input if EM-A1 is assembled. Otherwise use two jumpers.
Speed input impedance of is 100kohm.

Speed control mode NORMAL or CLOSED LOOP is selected with SW1.

Normal speed control: Motor acts like a normal DC-motor without feedback.

Closed loop control: The control unit uses a hall sensor signal to regulate motor speed.

Accuracy of the motor rpm is typically $\pm 1\%$ in this mode.

The useable rpm range in closed loop mode is selected with "CLOSED LOOP RANGE" trimmer.

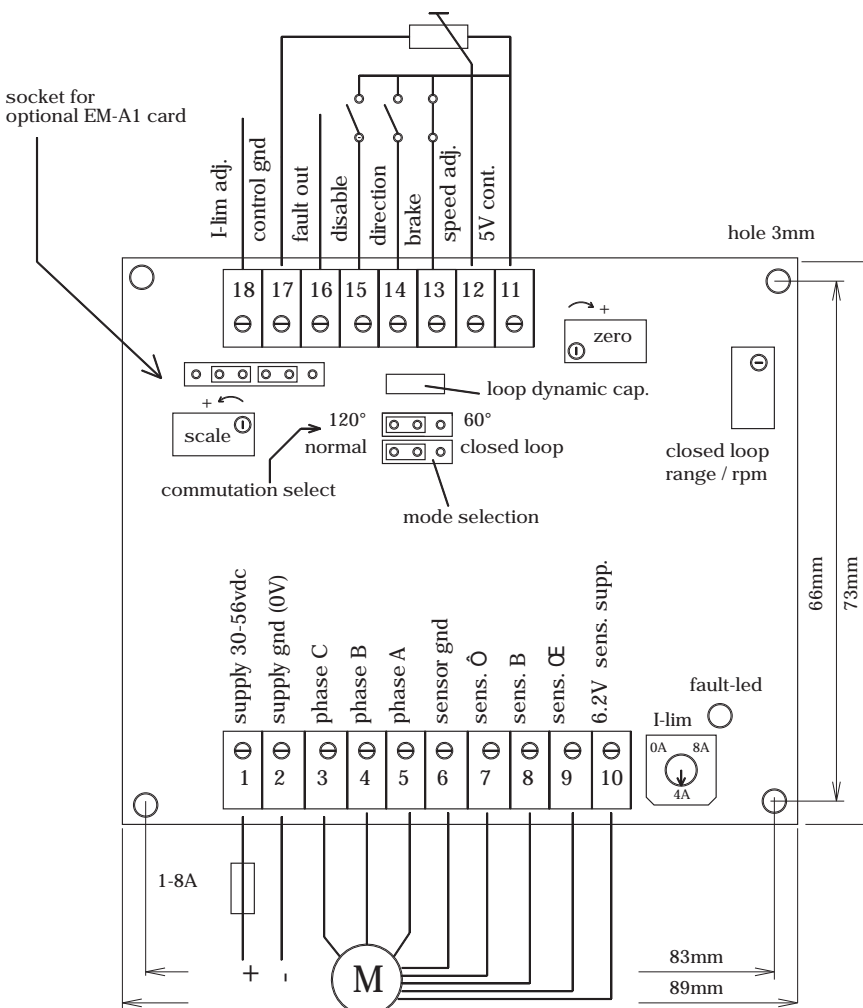
The loop dynamic behaviour can be changed with LOOP DYNAMIC

CAPASITOR. The capacitor is assembled to socket, and it is easily exchanged.

Recommended value is 47nF...1000nF.

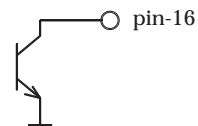
Current limit adjust (I-LIM) limits the motor current (torque). Normally current limit is set with I-lim trimmer.
If external I-lim control voltage is preferred, I-lim trim must be set to minimum, and control pin 18 connected to a potentiometer or a voltage signal of 0-5V (adj. range 0-8A). Input impedance of pin 18 is 10kohm.

Connection example:
control with pot. and switches



FAULT-output is pulled down and FAULT LED is lighted if at least one of the following conditions occurs:

- undervoltage
- current limit
- sensor fault
- disable input selected



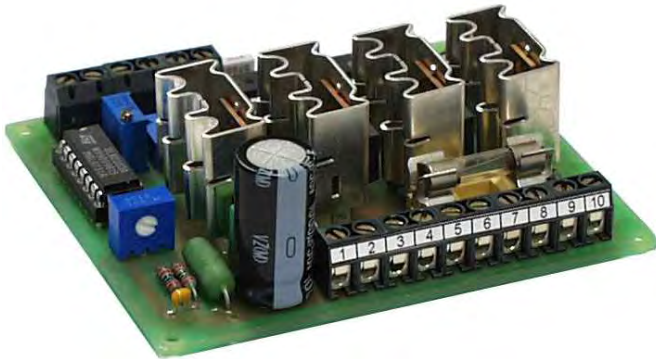
Brake input: Brakes if "low"; pin 13 connected to GND or open (brake has higher priority than disable). This function short-circuits motor wiring.

Direction in: "high" voltage 4-30V pin 14 for reverse

Disable in: "high" voltage 4-30V pin 15 disables output (motor freewheeling)



EM-106A BRUSHLESS DC-MOTOR CONTROL UNIT 12-24V 7A



FEATURES:

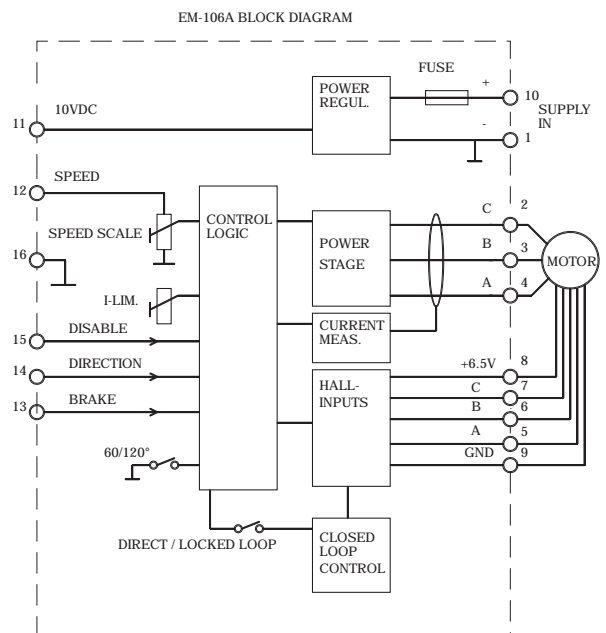
- Three phase output
- Direction change
- Hall-transducer supply and input
- Supports 60° and 120° commutating
- Adjustable current limit
- Direct or freq.locked driving
- High efficiency
- Inbuilt fuse
- Rail mounting base available
- Compatible with EM-106
- Improved current limit behavior

EM-106A controller is designed for brushless hall-feedback DC-motors. The device uses mosfet-type power stage with high efficiency. EM-106A can be connected to 60- or 120 degrees commutating motor. Standard driving includes speed adjustment, stopping, direction change and braking. The controller can be installed using screws or a standard rail mounting base.

There are two control modes: Within direct driving mode the motor voltage is set in proportion to the control voltage as with a normal DC-motor. Alternatively in frequency locked mode the controller uses the hall-transducer signal to speed adjustment besides commutating. This mode gives very precise speed referenced to the control voltage. As an additional feature the controller has an adjustment for loop response so that it provides as stable control as possible within all applications. Control input can be scaled with a trim. The current limit is set with a trim, it restricts driving when motor current exceeds the given value. The controller is protected against reversed input voltage polarity and fuse protected against over current.

TECHNICAL DATA:

Supply voltage	12...36 Vdc
Idle current	approx. 30 mA
Motor current	7 A cont. 10A 50/50%
Current limit	0-10 A adjustable
Voltage loss /V	0,8 V (Im=7 A)
Control voltage	0...10 V
Control pot.	2...10k
Control input	10 V max (20 mA)
Hall-input	6,5 V
Digital control	"on" at Uin 3...30 V "off" at Uin 0...1 V or open
Dimensions	87*73*35 mm
Weight	approx. 90 g
Operating temp.	0...50°C



EM-106A OPERATING INSTRUCTIONS

Operating voltage 12-36V filtered, less than 20% ripple.

Speed control set with voltage or potentiometer. Range is adjustable with SCALE and ZERO trim.
Speed control mode NORMAL or CLOSED LOOP is selected with SW1.

Normal speed control: Motor acts like normal DC-motor without feedback.

Closed loop control: The control unit uses a hall sensor signal to regulate motor speed.

Accuracy of motor rpm is typically $\pm 1\%$ in this mode.

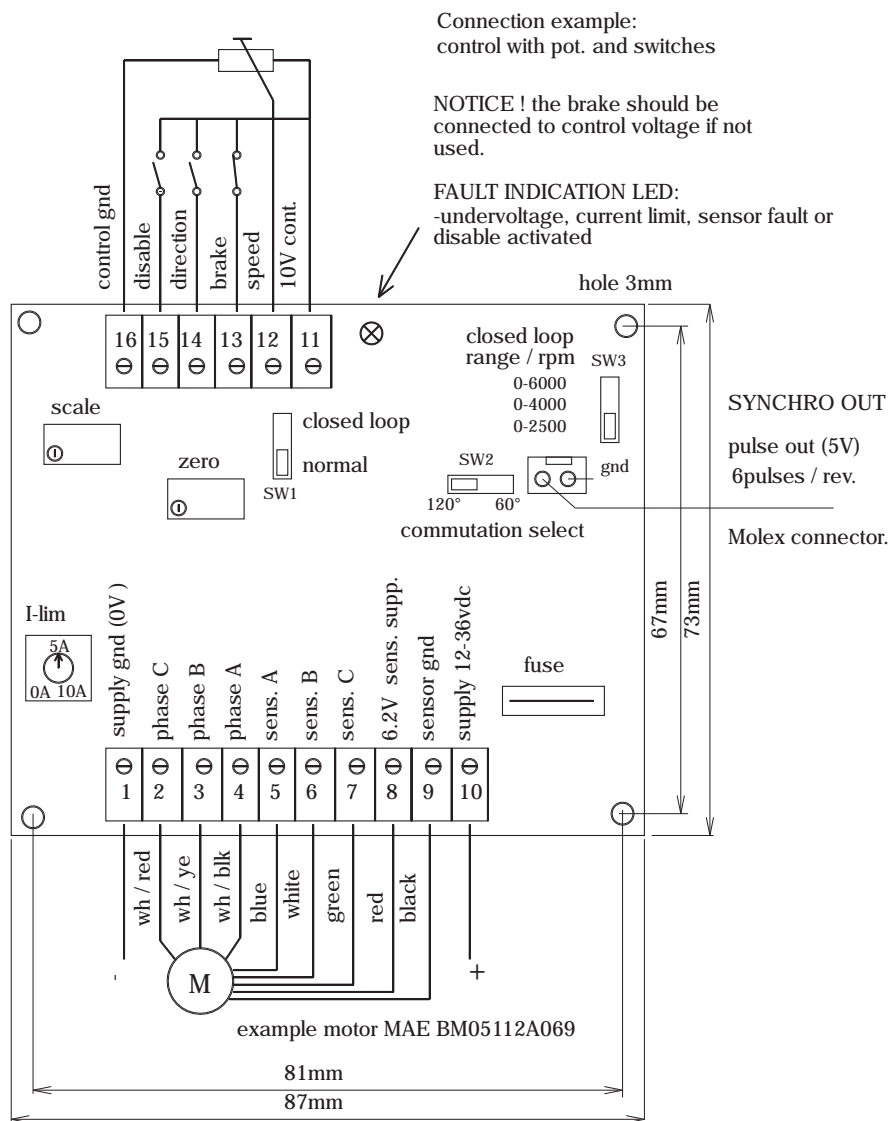
The desired rpm range in closed loop mode is selected with SW3.

Synchro control:

A SYNCHRO OUT feature can be used if phase locking loop (PLL) control (clock accuracy, frequency control) is needed. This control mode needs external PLL-unit.

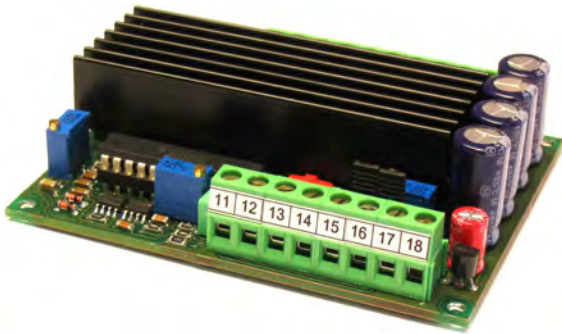
Current limit adjust (I-LIM) limits the motor current (torque).

Commutation phase of motor is selected with SW2.



EM-206 BRUSHLESS MOTOR CONTROLLER

12-36V 10A



FEATURES:

- Three phase output
- Continuous speed adjustment
- Reversing
- Braking
- $\pm 10V$ control option
- Hall sensor supply and input
- 60° or 120° commutation
- Settable / controllable current limit
- Fault output
- Open or closed loop activity
- High efficiency
- Rail base mountable

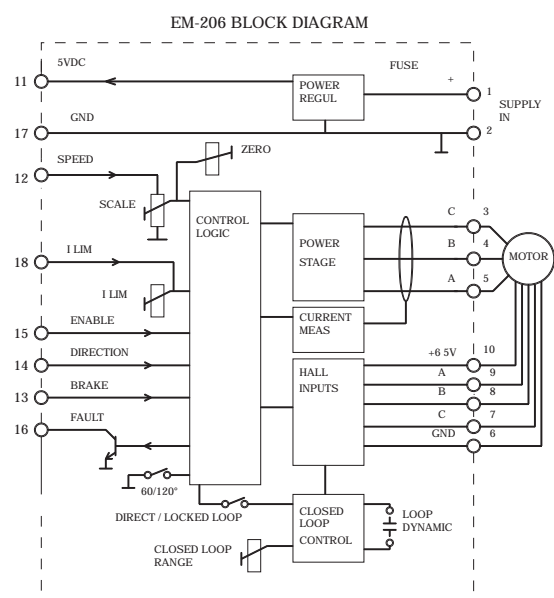
EM-206 is a DC-motor controller that is designed for brushless motors with hall sensor feedback. The unit has a mosfet-type high efficiency power stage. EM-206 can be connected to motors using 60° or 120° commutation. The unit is equipped with standard controls, such as speed, stop, reversing and braking. Mechanical installation can be done with screws or by using a rail mounting base.

There are two control options. Direct control (open loop) sets motor voltage in proportion to control voltage, as with a standard DC-motor. Frequency locked control (closed loop) uses hall sensor feedback for speed set besides commutation set. This way a precise speed control is attained. Closed loop response can be altered so that the adjustment remains stable in given application. Speed control signal can be scaled with trimmers.

Current limit restricts motor torque when motor current exceeds set value. Current limit can be set with a trimmer or with external signal. Fault output indicates the operation of the current limit. EM-206 is protected against surge voltage and overheating (excess load). The unit requires an external fuse. As an option, EM-A1 expansion card can be installed, this makes it possible to control EM-206 with $\pm 10V$ signal.

TECHNICAL DATA:

Supply voltage	12...36 Vdc
Over voltage protect.	39Vdc
Idle current	approx. 50mA
Motor current	10A rms
	15A 50/50%
Current limit	0...15A
Current limit input	0-5V corresponds to 0-15A (input imp. 10k)
Thermal protection	120°C (heat sink)
Voltage loss	0.8V @ $I_m=10A$
Control voltage	0-10V (0-5V adjustable)
Control potentiometer	2-10k
Control voltage output	5V (max 10mA)
Hall voltage output	6.5V
Digital control	"high" @ $U_{in}=3...30V$ "low" @ $U_{in}=0...1V$ or open
Control Input impedance	10k
Fault output	NPN open coll. 30V 10mA
Dimensions	89x73x25mm
Weight	approx. 130g



EM-206 OPERATING INSTRUCTIONS

Operating voltage 12-36V filtered, with less than 20% ripple.
An external supply fuse is recommended, suitable values 1-12A.

Speed control set with voltage or potentiometer. Range is adjustable with SCALE and ZERO trim.
The recommended pot. value is 2-10k, the control voltage signal should be 0-5V or 0-10V.

There is option for $\pm 10V$ control input if EM-A1 is assembled. Otherwise use two jumpers.
Speed input impedance of is 100kohm.

Speed control mode NORMAL or CLOSED LOOP is selected with SW1.

Normal speed control: Motor acts like a normal DC-motor without feedback.

Closed loop control: The control unit uses a hall sensor signal to regulate motor speed.

Accuracy of the motor rpm is typically $\pm 1\%$ in this mode.

The useable rpm range in closed loop mode is selected with "CLOSED LOOP RANGE" trimmer.

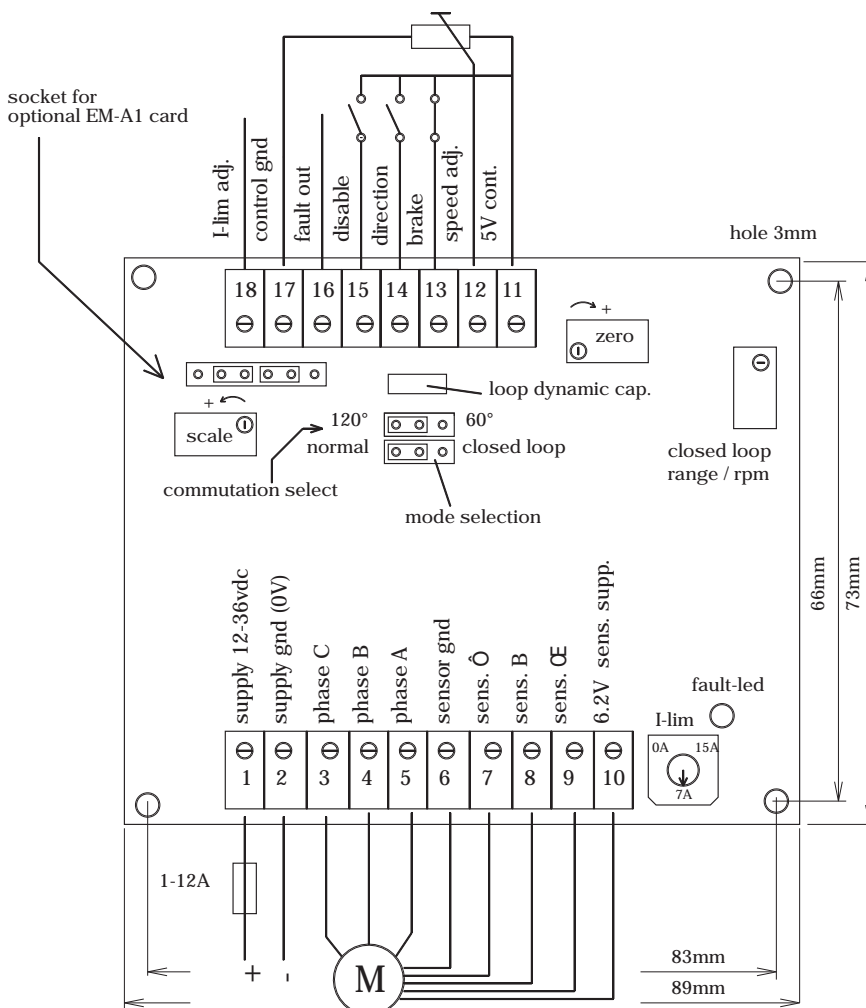
The loop dynamic behaviour can be changed with LOOP DYNAMIC CAPASITOR.

The capacitor is assembled to socket, and it is easily exchanged.

Recommended value is 47nF...1000nF.

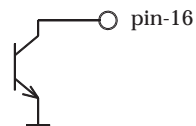
Current limit adjust (I-LIM) limits the motor current (torque). Normally current limit is set with I-lim trimmer.
If external I-lim control voltage is preferred, I-lim trim must be set to minimum, and control pin 18 connected to a potentiometer or a voltage signal of 0-5V (adj. range 0-15A). Input impedance of pin 18 is 10kohm.

Connection example:
control with pot. and switches



FAULT-output is pulled down and FAULT LED is lighted if at least one of the following conditions occurs:

- undervoltage
- current limit
- sensor fault
- disable input selected



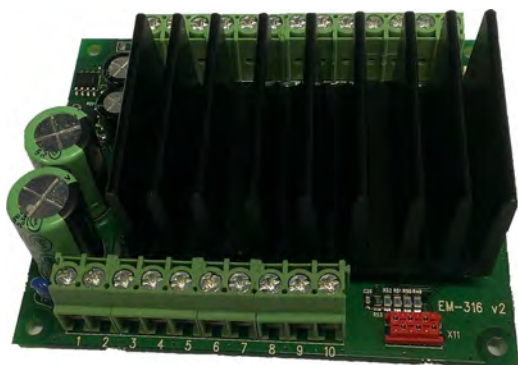
Brake input: Brakes if "low"; pin 13 connected to GND or open (brake has higher priority than disable). This function short-circuits motor wiring.

Direction in: "high" voltage 4-30V pin 14 for reverse

Disable in: "high" voltage 4-30V pin 15 disables output (motor freewheeling)



EM-316A BRUSHLESS DC-MOTOR DRIVER 12-35V 10A



FEATURES

- Three phase output
- Speed and torque adjustment
- Open/closed loop modes
- Dynamic braking
- Current limit and trip
- Fault and overcurrent outputs
- 60° / 120° commutation options
- Good efficiency
- Low EMC emissions
- DIN-rail mountable
- EM-316A is compatible with EM-316
- Added EM-A1 card slot for $\pm 10V$ control
- Rpm-pulse output option (prog v1.5)

GENERAL

EM-316A is brushless DC-motor driver with hall sensor feedback. The unit has a mosfet power stage with good efficiency and it meets also today's EMC requirements. The driver can be used with 120° or 60° commutation. The unit has the basic digital command inputs like direction, brake, start/stop, disable and there is analog inputs for speed and current control. One digitally presettable second speed (speed-2) is possible to activate with digital command input. EM-316 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 protections. 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.

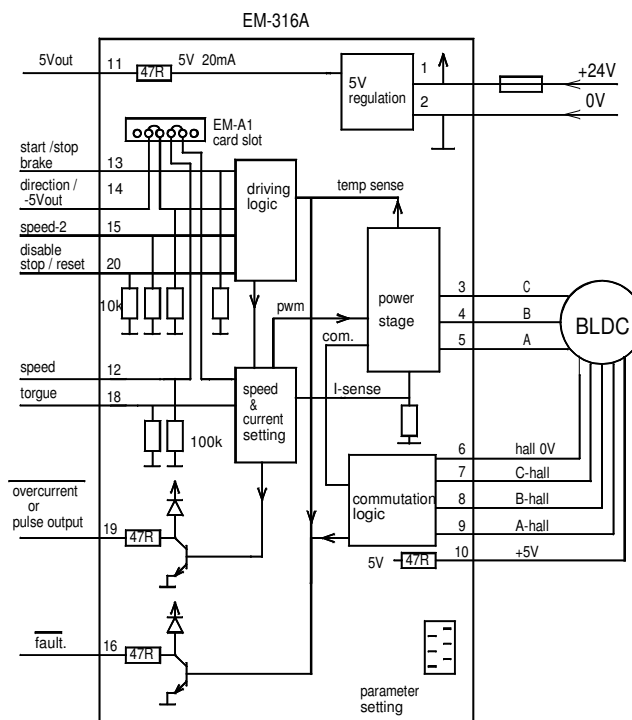
There are two control options for speed. Direct control (open loop) sets motor voltage in proportion to control voltage as with a standard DC-motor. Closed loop uses hall sensor feedback for speed control, this mode offers good speed regulation. Start and stop ramps work in both mode. Speed adjust range, closed loop rpm range and ramp can be set with parameter. Analog input are filtered so that there can also use PWM signal for control speed and current. EM-316A has added card slot for EM-A1 card, which make possible to use symmetric control -5..0..+5V (rev-stop-fwd) EM-A1 card generate also -5V auxiliary voltage for local potentiometer control

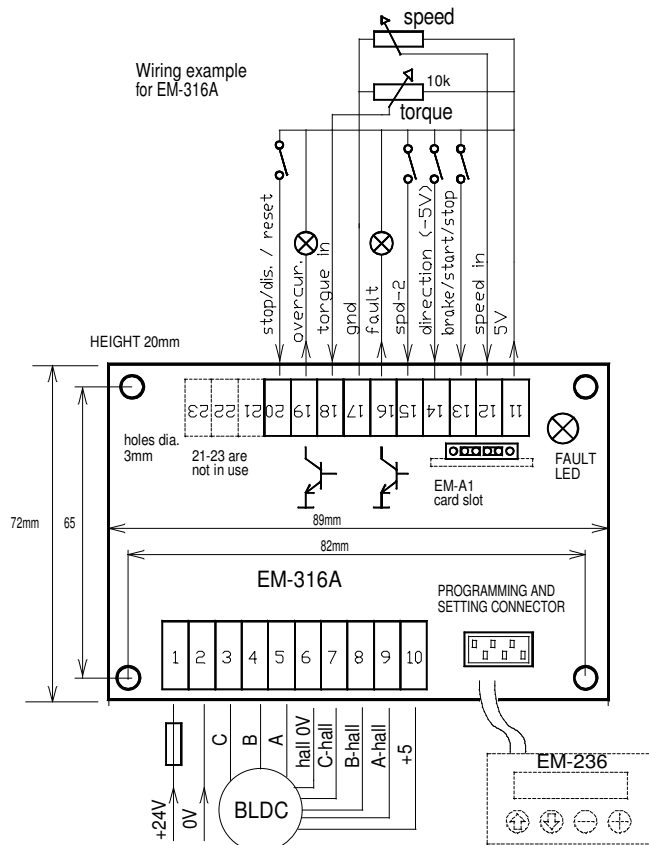
Setting can be done digitally with EM-236 interface unit or with Emen-Tool lite program installed in PC and EM-268 adapter cable. Parameters stored into nonvolatile memory of device. This interface unit can also be monitored the current and rpm of motor.

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
 Idle current typ. 30mA
 Max current 10A cont (Tamb. 40 °C)
 Max current peak 25A (max 2s)
 Pwm frequency typ. 16kHz
 Overtemperature Temp shut down 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
 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. 316 v1.5)

EM-316A parameters set with interface unit EM-236 or with Ementool-Lite and EM-268

1. mode: open loop =0 / closed loop=1 (0)
2. closed loop range 0-4 (3)
 - 0=3000rpm
 - 1=15000rpm
 - 2=9000rpm
 - 3=5000rpm
 - 4=3000rpm
3. start ramp 0-5s / 0-50 (1 s)
4. stop ramp 0-5s / 0-50 (1 s)
5. I-trip delay 1-255ms / 0-255 0=no trip (200ms)
6. scale start speed 0-25.5% / 0-255 (0)
7. scale gain 0-2.55 / 0-255 (200)
8. closed loop dynamic P-factor 1-200 (10)
9. closed loop dynamic I-factor 1-200 (10)
10. commutation angle 120°=0 / 60°=1 (0)
11. pin 13 input mode
 - 0 = brake
 - 1 = start / stop
 - 2 = start / brake
12. current limit 0-25A / 0.1-250 (4A)
 - 0 = current setting with pin 18
13. speed-2 value 0-100% / 0-100 (50)
14. I-trip reset mode (0)
 - 0 = only with disable pin
 - 1 = with speed input change 0 to up
 - 2 = with direction input
 - 10-200 = timer reset 1-20s. (0)
15. Over temp reset mode (0)
 - 0 = only with disable input
 - 1 = with speed input change 0 to up
 - 2 = 10-200 timer reset 1-20s.
16. I-trip indication (0)
 - 0 = I-trip indication to pin16
 - 1 = No I trip indication to pin 16 or 19
 - 2 = I-trip indication to pin 19
 - 3 = pin 19 reserved only for I-trip indication
17. pulse output for pin19 0-5 (0)
 - 0 = not in use = 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

MONITOR VALUES

1. current 0-25A / 0-250
2. hall rpm 0-1000 / 0-1000Hz

TAKE IN USE

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

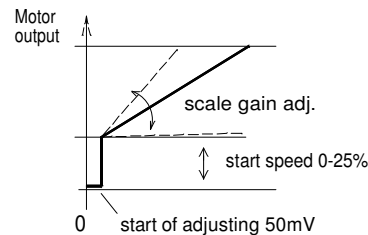
Be sharp when connect motor wires, because there is lot of combination. If motor takes much current or run roughly then change wiring.

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

In example picture beside there all input connected, but device work also with less wiring. So connect only needed functions.

Overcurrent and fault outputs are NPN type, and pull when activates, This could also connect to PNP input if uses 2.2k external pull up resistor

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



CONTROL INPUTS

> speed input

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.

EM-316A has optionally possibility to use symmetric control ($\pm 5V$ up to $\pm 10V$). This can be done with connecting the EM-A1 into card. Remove two jumper and put A1 card into slot. Then the direction input will give -5V (max. 5mA), and speed input is symmetric, referred to gnd (0V =stop). If local potentiometer is used, then connect potentiometer ends to +5V (pin 11) and -5V (pin 14) and the slide can connect to pin 12 . Use potentiometer which nominal value is 10-100k

Torque input is 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 then = parameter value + analog input value.

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

Brake input is a digital input. Normally this activates brake function. It means that motor poles shorted and speed set to zero. But this input can be set to work also as start/stop input. Input functions can be set with parameter 11.
In start/stop mode the start work with positive command.
NOTICE ! Current limit doesn't limit braking current, so it is not recommend to use this for long and high inertia braking.

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

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

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

INDICATIONS.

Fault led:

Fast blinking = I-trip

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

EM-346 BRUSHLESS DC-MOTOR DRIVER 12-35V 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

GENERAL

EM-346 is brushless DC-motor driver with hall sensor feedback. The unit has a mosfet power stage with good efficiency and it meets also today's 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, brake, start/stop, disable and there is 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 protections. 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.

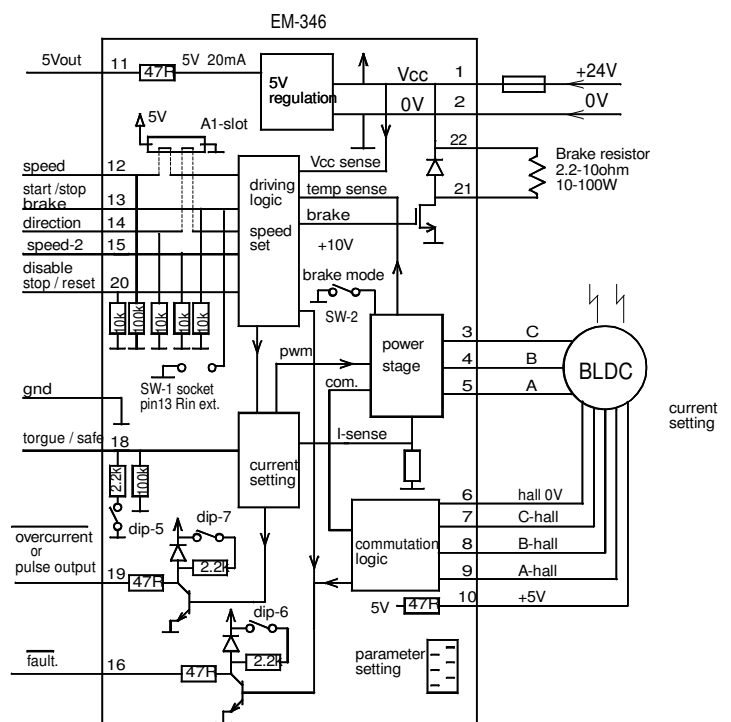
There are two control options for speed. Direct control (open loop) sets motor voltage in proportion to control voltage as with a standard DC-motor. Closed loop uses hall sensor feedback for speed control, this mode offers good speed regulation. Start and stop ramps work in both mode. Speed adjust range,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

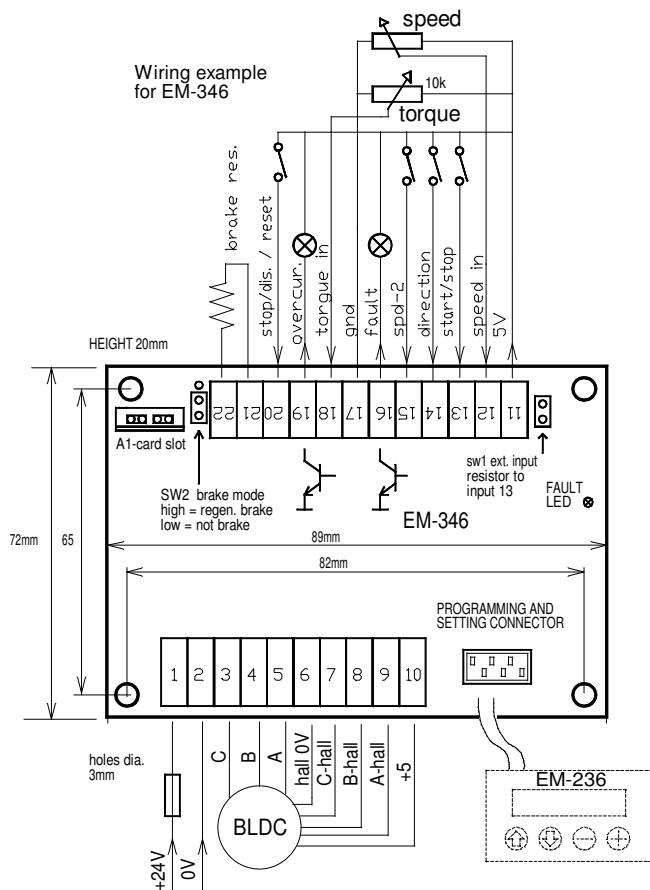
Setting can be done digitally with EM-236 interface unit or with Emen-Tool lite program installed in PC and EM-268 adapter cable. Parameters stored into nonvolatile memory of device. This interface unit can also be monitored the current and rpm of motor.

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
 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 shut down 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
 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. 346 v1.0)

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

1. mode: open loop =0 / closed loop=1 (0)
2. closed loop range 0-4 (3)
0=3000rpm
1=1500rpm
2=9000rpm
3=5000rpm
4=3000rpm
3. start ramp 0-5s / 0-50 (1s)
4. stop ramp 0-5s / 0-50 (1s)
5. I-trip delay 1-255ms / 0-255 0=no trip (200ms)
6. scale start speed 0-25.5% / 0-255 (0)
7. scale gain 0-2.55 / 0-255 (200)
8. closed loop dynamic P-factor 1-200 (10)
9. closed loop dynamic I-factor 1-200 (10)
10. braking current limit 1-18A / 1-18 (18)
11. not in use this version 0-2
12. current limit 0-25A / 0.1-250 (40)
0= current setting with pin 18
13. speed-2 value 0-100% / 0-100 (50)
14. I-trip reset mode (0)
0= only with disable pin
1= with speed input change 0 to up
2= with direction input
10-200 = timer reset 1-20s. (0)
2= 10-200 timer reset 1-20s.
15. Over temp reset mode (0)
0= only with disable input
1= with speed input change 0 to up
2= 10-200 timer reset 1-20s.
16. I-trip indication (0)
0= I-trip indication to pin16
1= No I trip indication to pin 16 or 19
2= I-trip indication to pin 19
3= pin 19 reserved only for I-trip indication
17. pulse output for pin19 0-5 (0)
0= not in use = 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
18. brake res. treshold (=overtoltage) 15-50V / 15-50 (36)

MONITOR VALUES

1. current 0-25A / 0-250
2. braking current 0-18A / 0-180
3. hall rpm 0-1000 / 0-1000Hz

TAKE IN USE

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

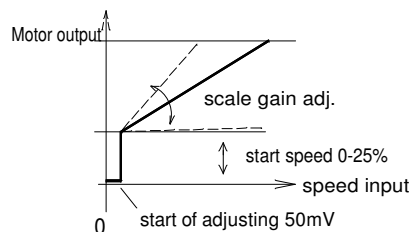
Be sharp when connect motor wires, because there is lot of combination. If motor takes much current or run roughly then change wiring.

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

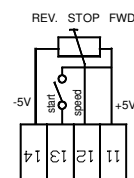
In example picture beside there all input connected, but device work also with less wiring. So connect only needed functions.

Overcurrent and fault outputs are NPN type, and pull when activates, This could also connect to PNP input if uses 2.2k external pull up resistor

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



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



BRAK NG

In some application the load can generates energy back to drive, when slowing down speed. In this case you need braking resistor, which absorbed extra energy.
NOTICE that the parameter 18 has to be set about 10% higher than unloaded voltage of power supply.
If using battery supply, then braking resistor would not needed.

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.

Torgue input is 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 then = parameter value + analog input value.

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

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

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

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

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

EM-346-48V BRUSHLESS DC-MOTOR DRIVER 24-48V 10A



FEATURES

- Three phase output
- Supply voltage nominally 24 up to 48V
- 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

GENERAL

EM-346-48V is brushless DC-motor driver with hall sensor feedback. The unit has a mosfet power stage with good efficiency and it meets also today's 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 be needed.

The unit has the basic digital command inputs like direction, brake, start/stop, disable and there is analog inputs for speed and current control. One digitally presettable 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 protections. 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.

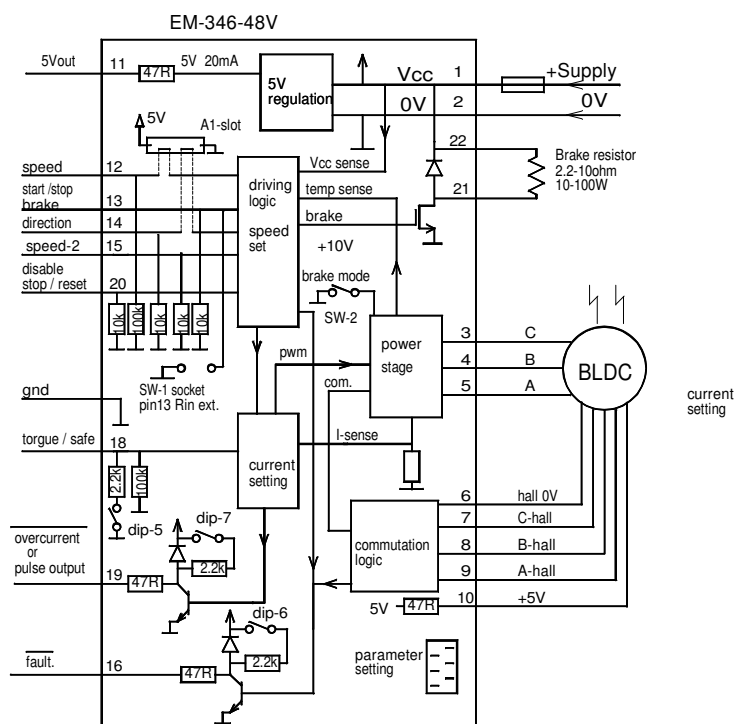
There are two control options for speed. Direct control (open loop) sets motor voltage in proportion to control voltage as with a standard DC-motor. Closed loop uses hall sensor feedback for speed control, this mode offers good speed regulation. Start and stop ramps work in both mode. Speed adjust range,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

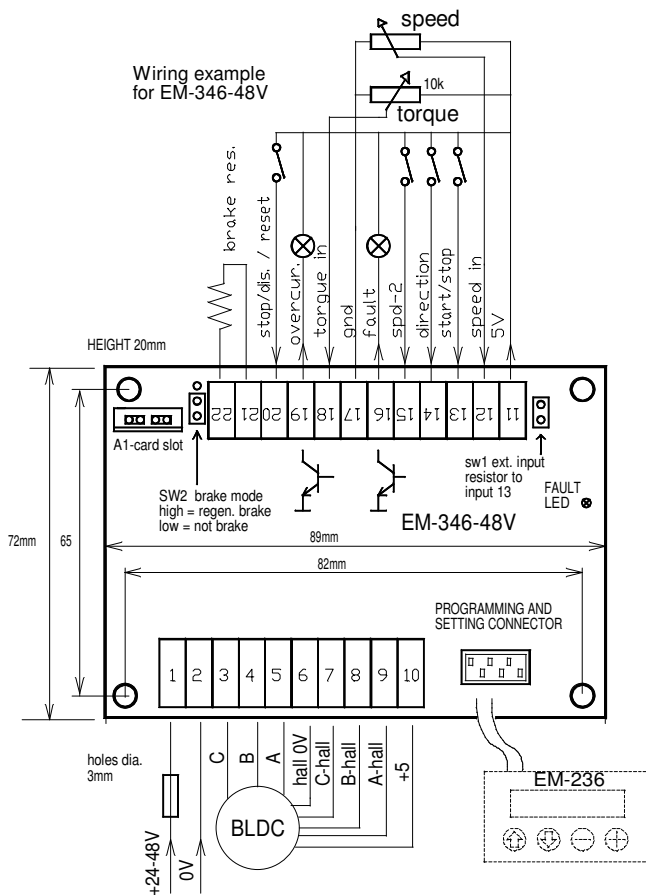
Setting can be done digitally with EM-236 interface unit or with Emen-Tool lite program installed in PC and EM-268 adapter cable. Parameters stored into nonvolatile memory of device. This interface unit can also be monitored the current and rpm of motor.

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

TECHNICAL DATA

Supply voltage 24-48V (20-56Vdc)
 Overvoltage shutdown adjustable
 Undervoltage shut down 18V
 Idle current typ. 30mA
 Max current 10A cont (Tamb. 40 °C)
 Max current peak 20A (max 2s)
 Max brake output current 10A
 Pwm frequency typ. 16kHz
 Overtemperature Temp shut down 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
 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. 346-48V v1.0)

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

1. mode: open loop =0 / closed loop=1 (0)
2. closed loop range 0-4 (3)
 - 0=3000rpm
 - 1=15000rpm
 - 2=9000rpm
 - 3=5000rpm
 - 4=3000rpm
3. start ramp 0-5s / 0-50 (1s)
4. stop ramp 0-5s / 0-50 (1s)
5. I-trip delay 1-255ms / 0-255 0=no trip (200ms)
6. scale start speed 0-25.5% / 0-255 (0)
7. scale gain 0-2.55 / 0-255 (200)
8. closed loop dynamic P-factor 1-200 (10)
9. closed loop dynamic I-factor 1-200 (10)
10. braking current limit 1-18A / 1-18 (18)
11. not in use this version 0-2
12. current limit 0-25A / 0.1-250 (40)
 - 0= current setting with pin 18
13. speed-2 value 0-100% / 0-100 (50)
14. I-trip reset mode (0)
 - 0= only with disable pin
 - 1= with speed input change 0 to up
 - 2= with direction input
 - 10-200 = timer reset 1-20s. (0)
15. Over temp reset mode (0)
 - 0= only with disable input
 - 1= with speed input change 0 to up
 - 2= 10-200 timer reset 1-20s.
16. I-trip indication (0)
 - 0 = I-trip indication to pin16
 - 1 = No I trip indication to pin 16 or 19
 - 2 = I-trip indication to pin 19
 - 3 = pin 19 reserved only for I-trip indication
17. pulse output for pin19 0-5 (0)
 - 0 = not in use = 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
18. brake res. treshold (=overvoltage) 20-75V / 20-75 (60)

MONITOR VALUES

1. current 0-25A / 0-250
2. braking current 0-18A / 0-180
3. hall rpm 0-1000 / 0-1000Hz

TAKE IN USE

Operating voltage 20-56Vdc ripple less than 20%
The peak voltages can be 60V.
An external supply fuse is recommended (2-16A)

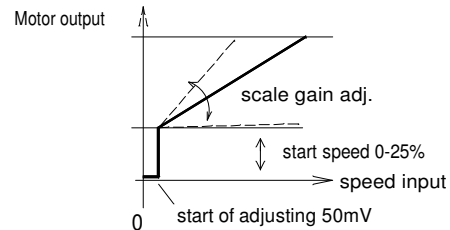
Be sharp when connect motor wires, because there is lot of combination. If motor takes much current or run roughly then change wiring.

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

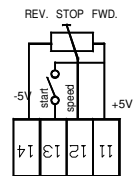
In example picture beside there all input connected, but device work also with less wiring. So connect only needed functions.

Overcurrent and fault outputs are NPN type, and pull when activates, This could also connect to PNP input if uses 2.2k external pull up resistor

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



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



BRAKING

In some application the load can generates energy back to drive, when slowing down speed. In this case you need braking resistor, which absorbed extra energy.
NOTICE that the parameter 18 has to be set about 10% higher than unloaded voltage of power supply.
If using battery supply, then braking resistor would not needed.

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.

Torque input is 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 then = parameter value + analog input value.

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

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

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

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

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

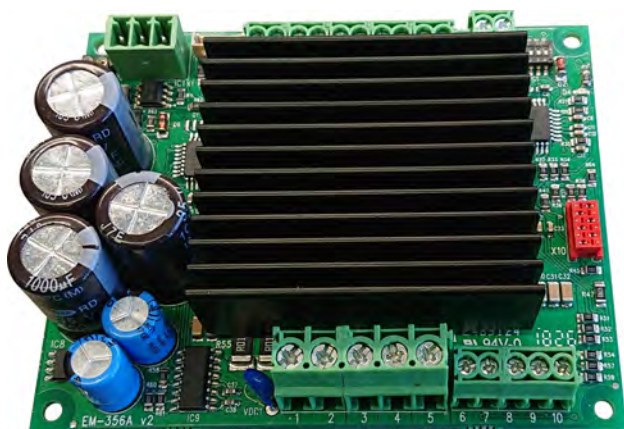
INDICATIONS.

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

EM-356B BRUSHLESS DC-MOTOR DRIVER 12-35V 15A (20A)



FEATURES

- For with Hall sensors
- Three phase output
- Speed and torque adjustment
- Open/closed loop modes
- Regenerative braking option
- True 4Q-power stage
- Braking resistor output
- Fan control output
- Output current 25A with fan
- Current limit and trip
- Fault output
- Rpm-pulse output option
- Good efficiency
- Low EMC emissions
- DIN-rail mountable

- Firmware - B v1.0 or later
- Rs-485 Modbus control option

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 today's 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 be 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-356A has PNP output for fault indication use. Some 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. Current limit situations can be reset with reset input, reset-timer or by setting analog speed control to value to 0.

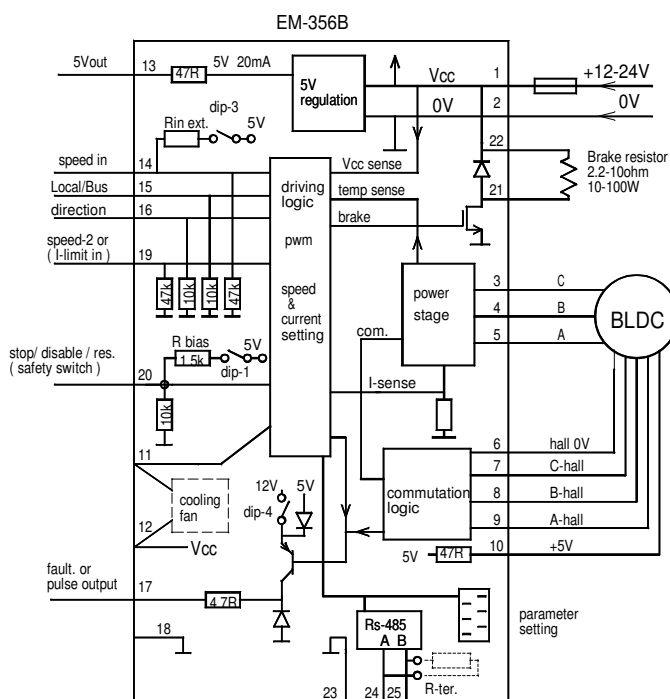
There are two control options for speed. Direct control (open loop) sets motor voltage in proportion to control voltage as with a standard DC-motor. Closed loop uses hall sensor feedback for speed control, this mode offers good speed regulation. Start and stop ramps work in both mode. Speed adjust range, closed loop rpm range and ramps can be set with parameter. Analog 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
 Idle current typ. 30mA
 Max current 15A cont. (Tamb. 40 °C)
 Max. current 20A cont. (with fan, Tamb. 40 °C)
 Max current peak 40A (max 2s)
 Max brake output current 10A
 Pwm frequency typ. 16kHz
 Overtemperature Temp shut down 90°C
 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
 Analog input range 0-5V up to 0-10V
 Input impedance of analog inputs 100k
 Input filter of analog input 100Hz
 Fault outputs NPN max 50mA
 Fan output NPN max. 100mA
 EMC measured for industrial and env.
 PCB material flammability class UL94V-0
 Dimensions 89x73x32mm (height 44mm with fan)
 Weight 150g and 200g with fan



TAKE IN USE

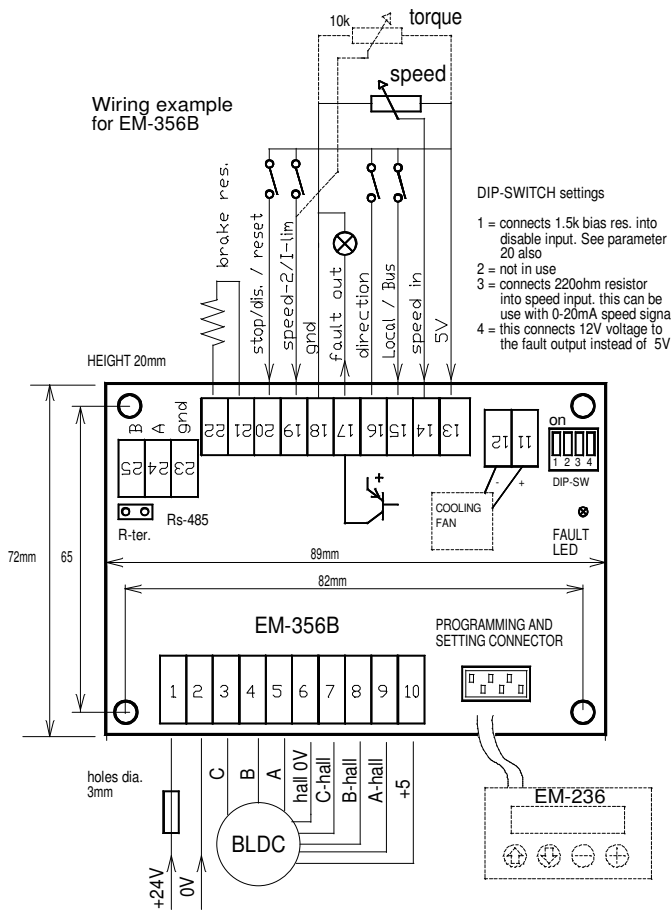
Operating voltage 12-35Vdc ripple less than 20%
An external supply fuse is recommended (2-40A)

Be sharp when connect motor wires, because there is lot of combination. If motor takes much current or run roughly then change wiring.

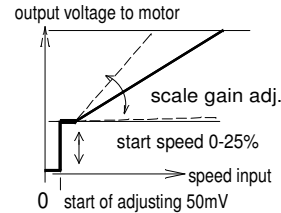
Default settings are in brackets in parameter list. This are good start-up values

In example picture beside there all input connected, but device work also with less wiring. So connect only needed functions.

Fault outputs are PNP type, and pull up when activates,



- DIP-SWITCH settings
- 1 = connects 1.5k bias res. into disable input. See parameter 20 also
 - 2 = not in use
 - 3 = connects 220ohm 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



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. If uses battery supply, then braking resistor would not needed.

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.

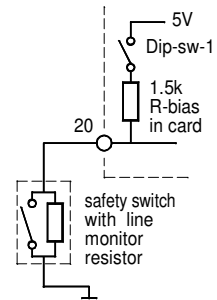
LOCAL/BUS This input can be used to select control source. Local control with card terminal or Buscontrol with Rs-485. This Input options can be set with parameter 11

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

SPEED-2 / I-LIMIT is a multifuntion input. Normally this input is a PNP digital input, which activate speed-2 presetting, which has been set with parameter 13. If parameter 12 is set = 0, then this input changes to analog input for current limit setting, 0-5V reponds lim. value 0-40A

DISABLE / SAFETY SWITCH input is a multifuntion input. Normally it works as a digital input, "high" will disable driver and motor goes to freewheeling (disables = all poles floating). This input has highest priority!

This input can be set to work as an safety switch input with line monitor. see picture beside. This option can be set with param. 20. Safety switch conneted GND to pin 20, and with dip-switch-1 will activate bias resistor for line monitoring.



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

Rs-485 port can be used to control device with Modbus protocol. This port has own guige 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 over voltage 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

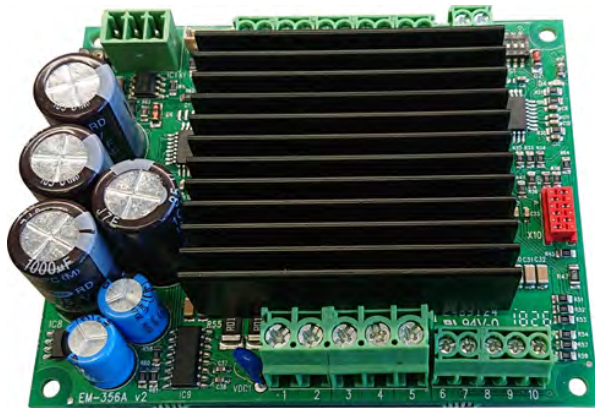
Fault output: (Pin-17 PNP open collector output)
Overtemperature, Overvoltage, Undervoltage.
This indicates also I-Trip if parameter 16 is set to = 0

SETTABLE PARAMETERS (prog. 356B v1.0)

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

1. mode: open loop =0 / closed loop=1 (0)
2. closed loop range 0-4 (3)
0=3000rpm
1=15000rpm
2=9000rpm
3=5000rpm
4=3000rpm
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=no trip, (200)
6. scale start speed 0-25.5% / 0-255 (0)
7. scale gain 0-2.55 / 0-255 (200)
8. closed loop dynamic P-factor 1-200 (10)
9. closed loop dynamic I-factor 1-200 (10)
10. regen. braking current limit 2-40A / 2-40 (25)
11. Local/Bus select 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 would work as start/stop
12. current limit 0 / 1-40A / 1-40 (20)
0= current setting with I-lim input pin 19
1-40 = current limit
13. speed-2 value 0-100% / 0-100 (90)
14. I-trip reset mode (0)
0= only with disable pin
1= disable or with speed input change 0 to up
10-200 = timer reset with 0.1s steps = 1-20s.
15. Over temp. reset mode (1)
0= only with disable input
1 = with speed input change 0 to up
10-200 = timer reset 0.1s steps = 1-20s.
16. Indications of fault output pin 17 (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
17. pulse output divider, 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)
don't set this higher than max supply (35V)
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. Disable / safety switch input options (0)
0 = disable (and reset)
1 = safety switch stop with wiring monitor (closing contact)
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)

EM-356A-SBL BRUSHLESS DC-MOTOR DRIVER 12-24V 15/20A POSITIONING and MODBUS



FEATURES

- Three phase output
- Speed and torque adjustment
- Rs-485 Modbus cont. option
- Servo amplifier for positioning
- Regenerative braking option
- Position counter 31bit
- True 4Q-power stage
- Braking resistor output
- Fan control output
- Output current 25A with fan
- Current limit and trip
- Good efficiency
- Low EMC emissions
- DIN-rail mountable

GENERAL

EM-356A-SBL is brushless DC-motor driver with hall sensor feedback. The unit has a mosfet power stage with good efficiency and it meets also today's 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 be needed. The unit has the basic digital command inputs like reset/homing, disable, local/bus and safety stop. There is analog input for position set. EM-356A-SBL has PNP output for fault indication use. Some input and output ports and functions can be set and change with parameters. Alternatively this driver can be also controlled via Rs-485 control bus with Modbus protocol. Driver includes overvoltage, undervoltage and overtemperature protections. These fault situations are indicated with fault on-board LED. Current limit situations can be reset with reset input, reset-timer or by setting analog speed control to value to 0.

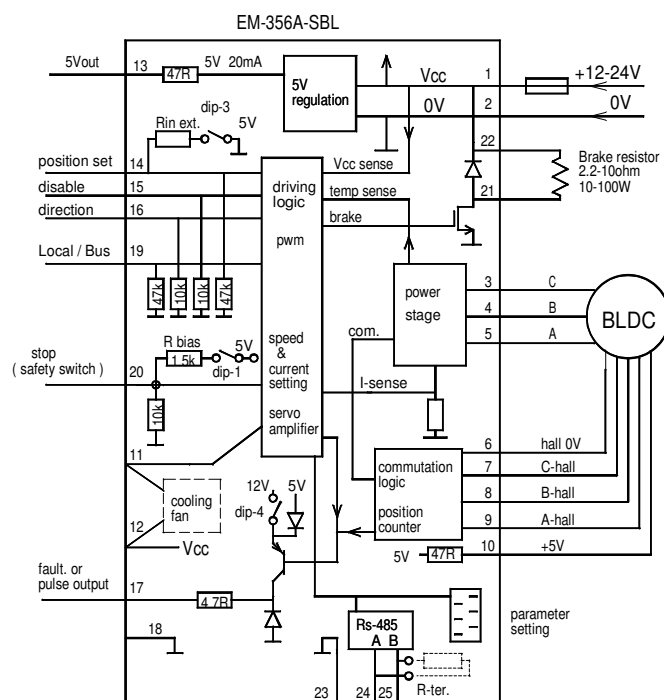
This version of EM-356 uses motor feedback pulses also for positioning, little like in servo system. The positioning resolution depends on the numbers of motor poles. for example 1-pole-pair motor 6-position in round and 7-pole-pair motor 42 position in round. and this round means motor shaft rounds, so with gearbox the resolution can be improved. Driver has own positioning amplifier and with this can be easily adjusted dynamic and accuracy of system. Driver has also RS-485 bus with Modbus control protocol, this make flexible use and control many driver in system.

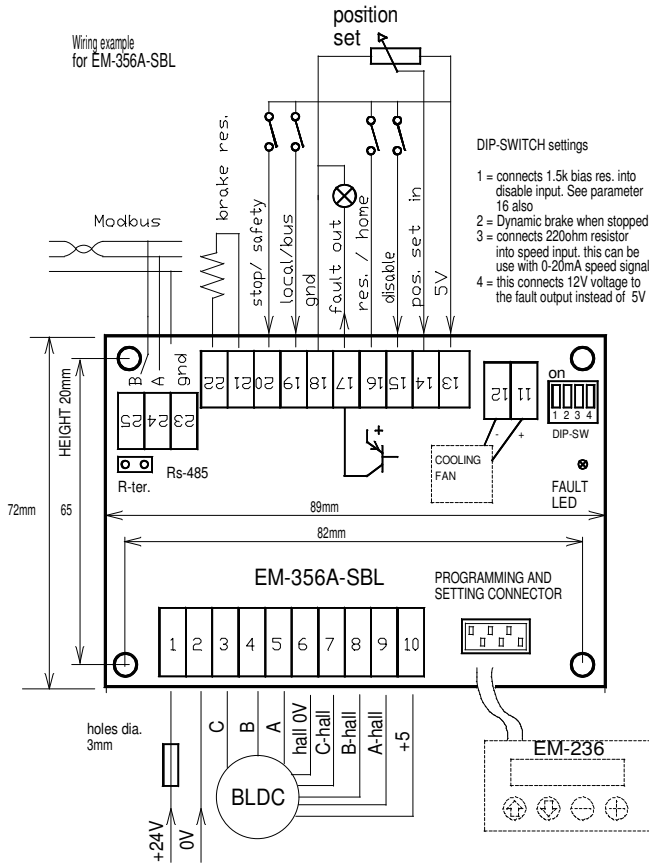
Setting can be done digitally with EM-236 interface unit or with Emen-Tool lite program installed in PC and EM-328 adapter cable. Parameters stored into nonvolatile memory of device. This interface unit can also be monitored the current and rpm of motor. Parameter setting and monitoring can be also done via Rs-485 bus.

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
 Idle current typ. 30mA
 Max current 15A cont. (Tamb. 40 °C)
 Max. current 20A cont. (with fan, Tamb. 40 °C)
 Max current peak 40A (max 2s)
 Max brake output current 10A
 Pwm frequency typ. 16kHz
 Overtemperature Temp shut down 90°C
 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
 Analog input range 0-5V up to 0-10V
 Analog input resolution 10bit. (1024 step)
 Position counter resolution 31b (2147 milj. steps)
 Input impedance of analog inputs 100k
 Input filter of analog input 100Hz
 Fault outputs NPN max 50mA
 Fan output NPN max. 100mA
 EMC measured for industrial and env.
 PCB material flammability class UL94V-0
 Dimensions 89x73x32mm (height 44mm with fan)
 Weight 150g and 200g with fan





CONNECTION ADVICE

Supply voltage should be in the limits of 10-35Vdc.
Ripple should be lower than 30% even with max. load.
NOTICES!

1. Wrong supply polarity can cause damage the device.
2. There is no inbuilt fuse in this device. Use an external fuse which is chosen according to your application.
3. that function and scale of some of the input and output terminals is depending on the selected parameter values and defined ranges.
Please, see the parameter list and explanations.
4. BLCD the right connecting is important, motor manufactures can be different marking method.
If motor takes lot of current or not at all, the try to change the order of hall- sensors (a, b, c)
5. If you start using with local control, then parameter 18=3 and link pin 19 to pin 13

CONTROL INPUTS AND OUTPUTS.

POSITION SET (Analog input)

This is analog input. for local mode position setting. This input range is basically 0-10V. But the input range can be adjusted with parameters 20 and 21 see more ANALOG INPUT RANGE section.

DISABLE

This terminal is PNP input, positive command disables device. This input has highest priority.

RES/ HOME /LEARN

At short command this input reset fault, and with longer 5s command this input starts HOME or LEARN routine. Input configured with parameter 15.

LOCAL / BUS (control select)

This input is normally for selecting several LOCAL or BUS control modes, this input can be config. with parameter 17 When input pin is open, then local mode is selected.

Rs-485 (modbus)

Standard half-duplex Rs-485 terminal incl. gnd, A and B The line terminal resistor 120R can be set to socket R-ter if needed.

BRAKE OUT

This NPN output can be used to control magnetic brake of motor or as a braking resistor in re-generation situation see. parameter 13

ADJUSTMENT AND SETTINGS

Settings can be done with three interface device options.

1. EM-236 interface unit
2. EM-328 series interface units with EmenTool Lite PC-software
3. EM-326 interface unit with EmenTool App smartphone application When using App you can set device-specific access code, which protects device against unauthorized smartphone connections. The access code can be reset with simultaneous FW and BW command, when power switch on.

SETTABLE PARAMETERS (prog. 356A-SBL v1.0)

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

1. Output voltage max. 10-50V / 10-50 (0)
values 0-9 = not in use
2. Overvoltage limit 15-60V / 15-60 (40)
Don't set this over max. supp. voltage
3. Start ramp 0-5s / 0-50 (10)
4. Stop ramp 0-5s / 0-50 (2)
5. I-trip delay 0.01-2.55s / 0-255 0=no trip (50)
6. Current limit FW 1-40A / 1-40 (5)
7. Current limit BW 1-40A / 1-40 (5)
8. Load compensation 0-255 (0)
9. Max. speed FW 0-100% (100)
10. Max. speed BW 0-100% (100)
11. Home speed 0-100 (50)
12. Reset option 0-1 (1)
0 = only with reset input,
1 = also with opposite direction
13. brake output mode and braking mode 0-3 (0)
0 = overvoltage activates output and brk. mode is "regenerative"
1 = overvoltage activates output and brk. mode is "freewheel"
2 = output active when "run" and braking mode is "regenerative"
3 = output active when "run" and braking mode is "freewheel"
14. Fault output options (pin 17)
0 = over temp, I-trip.
1 = over temp, overvoltage and I-trip
2 = over temp, overvoltage, I-trip and overcurrent
3 = continuous light when "positioned" and blinking if fault
4 = fault output same function as on board ind. led
15. Res/home input config. (pin 16) (0)
0 = 5s. command starts homing.
1 = 5s command starts learning
16. stop/safety input config. (pin 15) (0)
0 = digital stop input
1 = safety switch input with line monitor
17. Positioning counting direction 0 or 1 (0)
18. Control options and Local / Bus selection (3)
0 = fw-bw switch mode, pin 19 select Local mode
1 = fw-bw switch mode, automatic return to bus with 1s delay
2 = fw-bw switch mode, Return to Bus control with Bus command.
3 = Analog in mode, pin 19 select Local mode
4 = Analog in mode, Pin 14 voltage changes activates local cont. Return to Bus control with Bus command.
5 = Back up switch mode, pin 19 select Local mode
6 = Back up switch mode, automatic return to bus, with 1s delay
7 = Bus control only
19. not in use
20. Baud rate 0...5
0 = 9600, even, 1 stop
1 = 9600, odd, 1 stop
2 = 9600, none, 2 stop
3 = 19200, even, 1 stop
4 = 19200, odd, 1 stop
5 = 19200, none, 2 stop
21. Modbus Address 1...247 (1)
22. Input range min. Ain 0-10V / 0-1000 (0)
23. Input range max. Ain 0-10V / 0-1000 (1000)
24. Bw end limit 0-10000 pulse from home / 0-10000
25. Fw end limit 0-10000 pulses from max. of range / 0-10000
26. Braking area 1-1023 pulses / 1-1023 (200)
27. Dead zone 2-100 pulses / 2-100 (25)
28. Range at pulses 0-65535 (5000)
29. Range factor 1=65535 / 0-32767 pulses (0)

MONITOR VALUES

1. current 0.1A / digit
2. pwm 0-255
3. position 0-65535 pulses
4. position factor 1=65535 pulses
5. operation voltage 0.1V digit

INDICATIONS.

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

Fault output: (Pin-17 PNP open collector output)
This indication output is configured with param. 14

TAKING IN TO USE

The setting of the controller is done with parameters, and the parameters can be set and edited with Interface devices EM-236 or EM328 Unit. In the beginning set the two first parameters according to the application. Check also that current limit parameter are suitable for your application.

OVERVOLTAGE (brake output threshold)

Set parameter 2 at least 10% higher as voltage of supply. If supply voltage rises over overvoltage limit (set with param. 2) then the brake output pin 21 activates. and if brake resistor is connected then it will absorb braking energy. If supply voltage rises 3V over overvoltage limit, then driver will be disabled.

POSITION FEEDBACK (feedback pulse inputs)

This driver uses hall-sensor of motor also for positioning. For example 1-pole-pair motor gives 6-position/round, and 7-pole motor give 7 times more 42-position/round.

FULL RANGE

Full range is the full mechanical movement of the linear of positioning system. At first it is always needed to determine the full range before it is possible to drive the system correctly. The full range can be determine with LEARN routine or If this is already known it can be set direct to parameter 28 and 29 (Full range). The position counter is 31bit and that's why the parameter has split to "ones" and " 16bit factor"

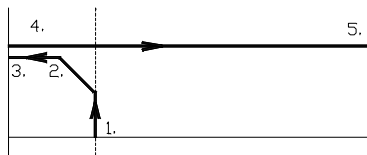
HOMING (absolute position matching of position counter)

The position feedback is received as pulses so the driver can not know the absolute position before pulse counter is reset in some known position. Homing routine will drive the motor to mechanical end of bw direction and then the position counter is reset.

LEARNING (absolute position match and measuring of full range)

Learning is a extended routine of homing. It is for finding the full range for system and also match the absolute position. Homing or learning is selected with parameter 15

home pos. "HOMING" cycles 1 to 3 position full
counter "LEARNING" cycles 1 to 6 range
= 0



1. start homing or learning by giving a long 5s command to RES/ HOME/ LEARN input (pin 16)
Notice, that parameter 15 should be 1 to enable learn
2. motor starts to run "home" direction with home speed
Home direction is same as "bw" direction
3. current limit stops the motor when the end is reached and position counter will be reset .
This is also the end of HOMING cycle
4. motor starts to "fw" direction and makes a full stroke.
During stroke the pulse counter measures the range.
5. motor reaches the mechanical end of fw direction and current limit stops the motor.
6. Device stores full range value and it is ready for use
7. After successfully learning we recommended to return parameter 15 to value 0 (home)

TROUBLES ON HOMING OR LEARNING

Motor will not run at all in homing or learning.

- hall pulses has wrong phasing, try to change to hall sensor wiring
- system is stuck
- current limit is too low for system

Motor run only about 0.5 sec, and ind. led blinking
-counting direction is wrong, change parameter 17

LOCAL / BUS (control mode select)

This driver can be used with local control inputs or with Rs-485 Bus. The Bus control offer more options than local input and for bus control has own special instructions. "Modbus register definitions for EM-356A-SBL" Device is set for bus mode as a default. (see param. 18)
If you want to start with Local control , then set pin 19 "on"

CONTROL OPTIONS

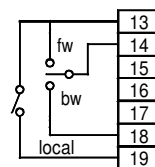
Device has several control option. The main select is Local or Bus control. As a default device is in Bus control mode, The Bus is Rs-485 Modbus RTU. and it has separate instructions "Modbus register definitions for EM-356A-SBL".

The parameter 18 defines how the device can change to Local control mode, which means that control inputs of card is enabled. Local mode with fw-bw switch can be set pin 19 "on", or direct with fw-bw switch. Return to Bus control with pin 19 "off", or automatically or with Bus command.

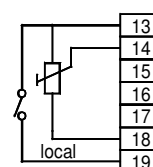
Local mode with potentiometer can be activated with with pin 19 or with 5% voltage change of potentiometer. Return to bus mode with pin 19 to "off" or with Bus command.
In the back up switch mode the switch has high priority and it bypass positioning servo and end limit.

Below two basic wiring for Local control

FW-BW SWITCH MODE



ANALOG IN MODE



LOAD COMPENSATION (torque at low speed)

Load compensation (par.8) when set to right value, will ensure the needed force to start driving and to taking the load in to the right position. With high load and too low load compensation value, the motor dont have force enough to reach the right position. Start testing with zero value and increase value untill motor behaves unstable and twitching. Thumb rule in this point is to decrease the value with 25%.

CURRENT LIMIT and I-TRIP (torque limit and shutdown)

Current limits should be set according to the motor nominal max. current or according to the required current of the application. these set with parameter 6 and 7
Current I-trip (overcurrent shutdown) delay can be adjusted with parameter 5. Notice if this parameter is set = 0 then shutdown is disabled but current limit still works

INDICATIONS

Fault situations are indicated with coded blinking of the red LED. and fault code number is also read from monitor value.

Fault output (pin.17). indicated fault situations also. This output pull up in fault situation as, overtemp, I-trip, pulse lost etc. see parameter 14

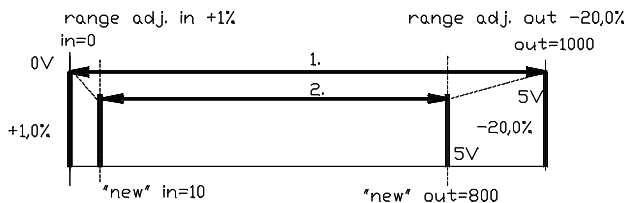
RESETTING OF FAULTS

The faults can reset with short command with RES./ HOME / LEARN input. I-trip and pulse lost faults reset also automatically if gives new position set which starts run to opposite direction.
Faults can be reset also via bus, if bus mode is selected.

ANALOG INPUT RANGE ADJUST

This driver analog position set input is 10b (1023 step), and with analog input cannot reach same accuracy as with bus control. The input range is 0-10V, but this range can be compressed with parameter 20 and 21. for example. Input signal is 0.4 - 5.0V, then set parameter 20 = 40 and 21 = 500. This input can work also as 0-4-20mA input, dip-switch 3 can be connected 220ohm input resistor, then parameter values are correspondingly 20= 88 and 21= 440

Example of RANGE ADJUST for analog input



1. Original learnt range = mechanical full range
Is in this example = 1000 count.
Control signal is 0-5.0V (param. 22=0 and 23=500)
2. Desired mechanical range compression
bw end limit = +1 % set parameter 23 = 10
fw end limit = - 20% set parameter 24 = 200
"New" stroke of actuator is compressed to:
positioning set value 0V = 10
positioning set value 5V = 800

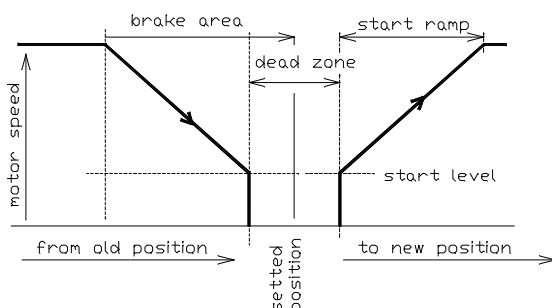
POSITIONING DYNAMIC

Dead zone (par.27) is to determine the accuracy of positioning. This parameter has the major effect to positioning accuracy. The smaller value means theoretically better accuracy, but on the other hand too small value affect unstability in positioning. The right value will be find with testing. Notice! that mechanical slack and stiffness could be reason to increase dead zone.

Braking area (par. 26) is used to optimize the time needed for positioning. Too high value slows down too early, and too low value will cause an fast position passing and needs a corrective return driving.

Start and stop ramp (par. 3& 4) are to smoothen the direction change. Often suitable value for stop ramp is half of start ramp. Too long stop ramp can make the direction change too time consuming and too short can cause mechanical stress and non desired agressivity.

POSITIONING WINDOW



ACCURACY

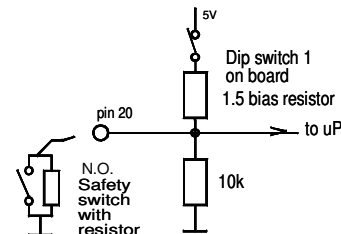
Position counter is 31bit, which is over 2000 million steps, so device can be reached exelent accuracy and big range. But of course the resolution depends on of feedback pulse source. For example 1-pole-pair motor gives 6-position/round, and 7-pole motor gives 42-pos./round. Theoretical positioning accuracy could be 1-2 feedback pulse step.

In some application the mechanic itself will reduce the accuracy, for example stiffness and slack. The parameters 8, 26 and 27 are important to optimize accuracy of system.

Notice! if position set gives with analog input then the resolution is only 10b theoretically and in practice 0.2% (1/500)
The high accuracy is possible only with bus control.

SAFETY SWITCH INPUT (stop input with monitoring)

The stop input can be used as safety switch input with monitor. Safety switch has usually monitoring resistor, which has used to monitoring the condition of safety switch wires. This input has possibility to monitoring this line when "safety switch" option has selected with parameter 16 . R-bias enabled with dip-sw 1 Recommended safety switch resistor 1-2.2kohm
If line fault detected, then the device gives "line fault" warning
The acceptable voltage value is between 1.6...3.5V
This input is enabled also in BUS control mode.



EM-366 BRUSHLESS DC-MOTOR DRIVER 12-48V 30/25A

14.02.2020 366br14

FEATURES

- For BLDC motor with Hall sensor
- Three phase output
- Speed and torque adjustment
- Open/closed loop modes
- Regenerative braking option
- True 4Q-power stage
- Braking resistor output
- Fan control output
- Current limit and trip
- Fault
- Rpm-pulse output option
- Good efficiency
- Low EMC emissions
- DIN-rail mountable

Firmware 1.4v or later
- Rs-485 Modbus control option



GENERAL

EM-366 is brushless DC-motor driver with hall sensor feedback. The unit has a mosfet power stage with good efficiency and also with industrial 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, disable, speed-2 activation and there is analog inputs for speed. Alternatively method to control device is a Rs-485 bus with Modbus protocol. In this way can be easily controlled several units. and current control. EM-366 has PNP output for fault indication use. Some 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. Current limit situations can be reset with reset input, reset-timer or by setting analog speed control to value to 0.

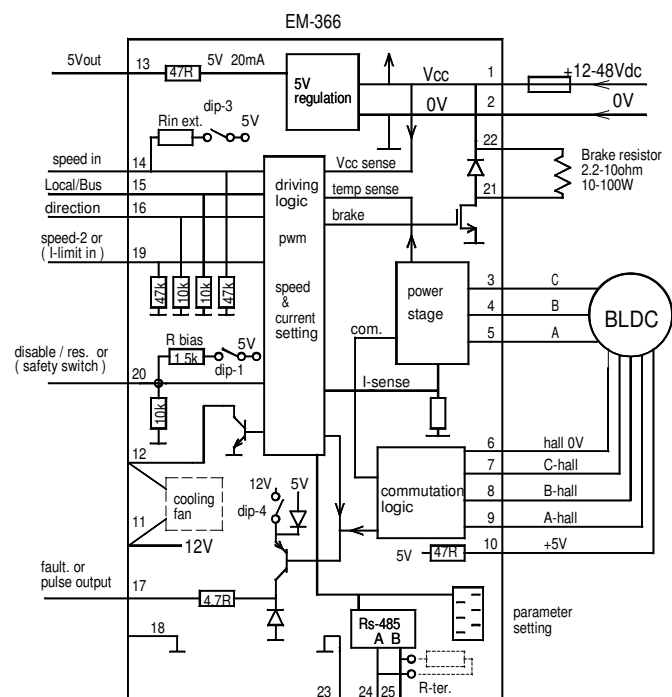
There are two control options for speed. Direct control (open loop) sets motor voltage in proportion to control voltage as with a standard DC-motor. Closed loop uses hall sensor feedback for speed control, this mode offers good speed regulation. Start and stop ramps work in both mode. Speed adjust range, closed loop rpm range and ramps can be set with parameter. Analog 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 12-48Vdc (11-58Vdc)
Overvoltage shut down 60V
Idle current typ. 30mA
Max current 30A cont. (@ 24Vdc, Tamb. 40 °C)
Max. current 25A cont. (@ 48Vdc, Tamb. 40 °C)
Max current peak 60A (max 2s)
Max brake output current 10A
Pwm frequency typ. 16kHz
Overtemperature Temp shut down 90 °C
Current limit setting 1-60A (step 1A)
Current limit analog scale 0-5V = 0-60A
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
Fault outputs NPN max 50mA (5V / 12V)
Fan output NPN max. 100mA (12V)
Fan output "on" > 55 °C / "off" < 50 °C
EMC measured for industrial and env.
PCB material flammability class UL94V-0
Dimensions 108x91x37mm
Weight 270g



TAKE IN USE

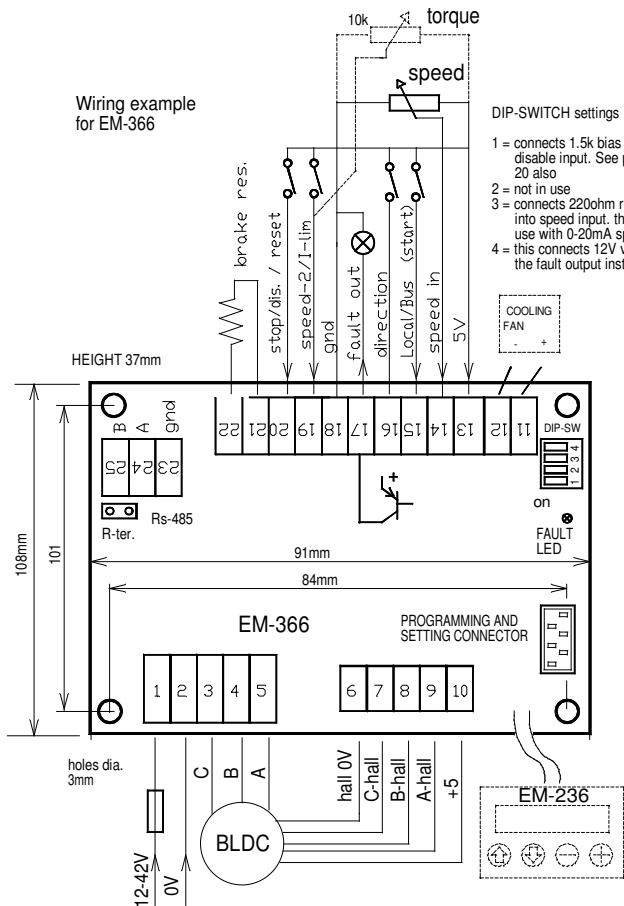
Operating voltage 12-48Vdc ripple less than 20%
An external supply fuse is recommended (2-50A)

Be sharp when connect motor wires, because there is lot of combination. If motor takes much current or run roughly then change wiring.

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

In example picture beside there all input connected, but device work also with less wiring. So connect only needed functions.

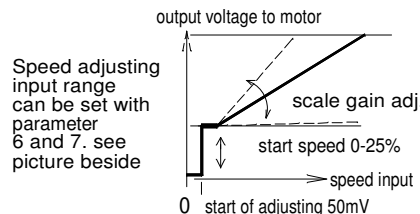
Fault outputs are PNP type, and pull up when activates,



SETTABLE PARAMETERS (prog. 366 v1.4)

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

1. mode: open loop =0 / closed loop=1 (0)
2. closed loop range 0-4 (3)
 - 0=30000rpm
 - 1=15000rpm
 - 2=9000rpm
 - 3=5000rpm
 - 4=3000rpm
3. start ramp 0-5s / 0-50 (1s)
4. stop ramp 0-5s / 0-50 (1s)
5. I-trip delay 1-255ms / 0-255 0=no trip (200ms)
6. scale start speed 0-25.5% / 0-255 (0)
7. scale gain 0-2.55 / 0-255 (200)
8. closed loop dynamic P-factor 1-200 (10)
or open loop mode Rxl load compensation
9. closed loop dynamic I-factor 1-200 (10)
10. regen. braking current limit 2-60A / 2-60 (25)
11. Local/Bus select 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 mode only / pin 15 as start
12. current limit 0 / 1-60A / 1-60 (20)
 - 0= current setting with I-lim input pin 19
 - 1-60 = current limit
13. speed-2 value 0-100% / 0-100 (50)
14. I-trip reset mode (0)
 - 0= only with disable pin
 - 1= disable or with speed input change 0 to up
 - 10-200 = timer reset with 0.1s steps = 1-20s.
15. Over temp. reset mode (0)
 - 0= only with disable input
 - 1 = with speed input change 0 to up
 - 10-200 = timer reset 0.1s steps = 1-20s.
16. Indications of fault output pin 17 (0)
 - 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
17. pulse output divider, 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 (50)
19. brake output mode and braking mode 0-3 (1)
 - 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. Disable / safety switch input options
 - 0 = disable (and reset)
 - 1 = safety switch stop with wiring monitor (closing contact)
21. 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
22. Modbus Address 1...247 (1)



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. If uses battery supply, then braking resistor would not needed.

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.

LOCAL/BUS This input can be used to select control source Local control with card terminal or Bus control with Rs-485 This Input options can be set with parameter 11 This input works also as start/stop input if param 11 = 3

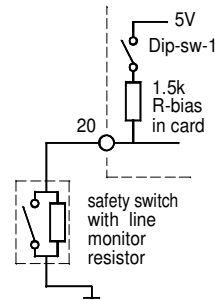
DIRECTION input is a digital input. It changes the rotation direction. It uses automatically stop/start ramps during change.

SPEED-2 / I-LIMIT is a multifuntion input. Normally this input is a PNP digital input, which activate speed-2 presetting, which has been set with parameter 13. If parameter 12 is set = 0, then this input changes to analog input for current limit setting, 0-5V reponds lim. value 0-60A If parameter 12 is set =1, then input work as stop input

DISABLE / SAFETY SWITCH

input is a multifuntion input. Normally it works as an digital input, "high" will disable driver and motor goes to freewheeling (disables = all poles floating). This input has highest priority !

This input can be set to work as an safety switch input with line monitor . see picture beside This option can be set with param. 20. Safety switch conneted GND to pin 20, and with dip-switch-1 will activate bias resistor for line monitoring.



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

FAN output pin 12 pull down if temp exceed 55 °C

Rs-485 port can be used to control device with Modbus protocol This port has own guige sheet " Modbus register definitions for EM-366"

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 over voltage 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

EM-151B BRUSHLESS DC MOTOR DRIVER

12-24V 25A



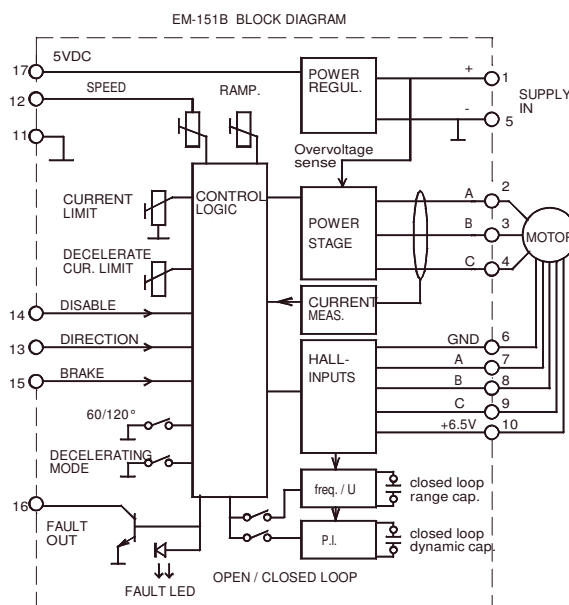
FEATURES

- Three phase output
- Open or Closed loop speed cont.
- Controlled direction change
- Dynamic or Regenerative braking
- 60° or 120° commutation
- ±10V control option
- Fault output
- High efficiency
- Thermal protection
- Rail base mountable

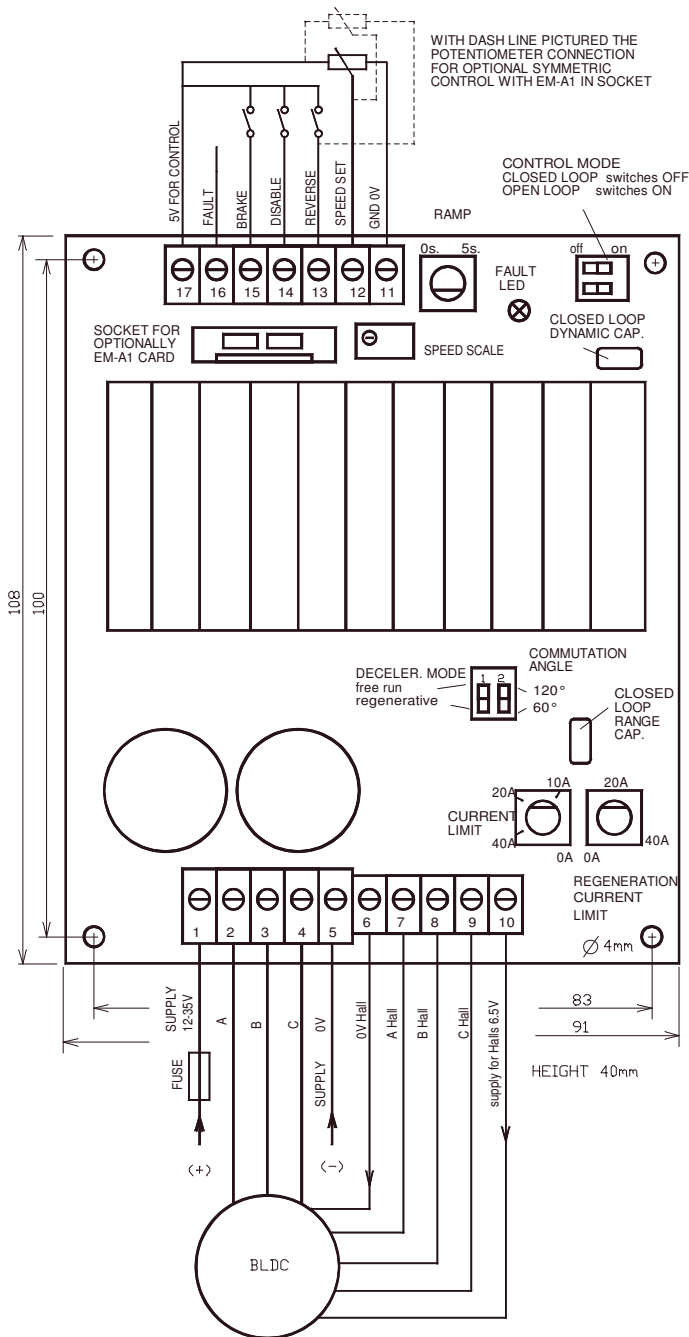
EM-151B is a DC-motor driver for brushless dc-motor with hall-sensors. The commutation angle can be 60 or 120 deg. It has two modes for speed control. In open loop mode driver works like normal dc-motor speed controller. In closed loop mode the hall pulses are used as speed feedback. Closed loop mode offers a high accuracy in speed control. The speed control input signal can be scaled with zero and range trims. Card includes also an acceleration and deceleration ramp adjustment for smooth starts and stops. The ramp is used also in direction change, that way it can be done controlled and smoothly. Current limit is also adjustable with trimmer. Regenerative braking can be used when power is supplied from a battery. In this case the current limit adjustment works also in braking. In overcurrent the driver activates the fault output.

TECHNICAL DATA

Supply voltage 12-32Vdc (11-35Vcd)
 Undervoltage cut out 11V
 Overvoltage cut out 38V
 Motor current cont. max 20A (Ta<40°C)
 Motor current peak max 40A (5s.)
 Temperature limit 100°C (heatsink)
 Current limit adjust 0-40A
 Decelerating cur. limit adj. 0-40A
 Speed set signal 0-5V...0-30V
 Speed set input impedance 100kohm
 Ramp time 0.1s-5s. (adjustable)
 PWM motor-frequency 18kHz
 Digital control "on" 4-30V, "off" 0-1V or open
 Control input impedances typ. 10kohm
 Fault out. NPN open coll. max 30V / 10mA
 Motor and supply connectors 4mm2
 Control connectors 1.5mm2
 Dimensions 108x91x40mm
 Weight 230g
 Recommended operating temp (Ta) -30...60°C



INSTRUCTION GUIDE EM-151B



Operating voltage 12-32Vdc filtered dc, ripple less than 20% . Use suitable external fuse for application, but less than 40A The wrong polarity connection can damage the device. Be carefull also with the motor hall sensor connection.

Speed can be controlled with a potentiometer or voltage signal from 0-5V to 0-30V. The speed set input signal can be adjusted with speed scale trimmer. Speed set signal can also be eg. 24V PWM from PLC as long as the frequency is higher than 1kHz. Optionally it is possible to have zero symmetric voltage control, using EM-A1option card. When EM-A1 is plugged in to its socket, the direction input (pin 13) changes to -5V output for potentiometer. In symmetrical control the motor is stopped when potentiometer is in the middle position. An outside speed set voltage signal can be from ±5 to ±30V. The RAMP adjustment can be used to smoothen the acceleration and deleration. Ramp time is adjustable from 0.1 to 5s. (0-100% / 100%-0 speed).

Speed CONTROL MODE can be selected to be an open or closed loop mode. The selection is made with two dip switches. In open loop mode the motor is driven like normal DC-motor. In closed loop mode the driver uses the Hall-pulses as speed feed-back. The closed loop speed range can be changed with CLOSED LOOP RANGE CAP. Smaller capacitor will offer higher speed range and the fine adjustment is made with SPEED SCALE trimmer. The factory preset value is 4.7nF which gives range up to about 6000rpm. Size of this capacitor is inversely proportional to the speed range. The dynamic behaviour of closed loop control can be tuned with CLOSED LOOP DYNAMIC CAP. For smaller speeds should be used a higher capacitor value. Factory preset value for this is 330nF. On lower speed application this capacitor should be bigger, and on higher speed it should be smaller.

The digital control input works with positive commands (PNP) The control voltage can be from 5V up to 30V. DIR. command is used to change the rotation direction of the motor. Dir will utilize automatically deceleration and acceleration ramps. BRAKE command shorts the motor poles and gives a strong dynamic brake effect. DISABLE command releases motor poles(freewheeling). This command has the highest priority.

The right COMMUTATION ANGLE can be selected to be 60° or 120°. Selection is made with dip switch.

The DECELERATE MODE can be set to be regenerative or freewheeling. In regenerative mode the motor generates current back to the supply as the motor is decelerating. This mode is usefull only when the supply is from a battery that can accept this energy back. Also a braking load can be used. CAUTION ! If normal power supply is used with regenerative braking the voltage could rise up to 40V which can damage the power supply. In freewheeling mode energy is not returned to supply, but of course the deceleration is also weak. NOTICE ! The digital BRAKE command shorts the motor poles and does not regenerate energy (so called dynamic braking).

The CURRENT LIMIT limits the motor current. Exceeding this limit is indicated with FAULT LED and FAULT output. The DECELERATION CURRENT LIMIT limits the current during the deceleration if regenerative mode is selected. NOTICE ! The deceleration current limit does not work with digital brake command.



ADJUSTMENT AND SETTINGS

Settings can be done with three interface device options.

1. EM-236 interface unit
2. EM-328 series interface units with EmenTool Lite PC-software
3. EM-326 interface unit with EmenTool App smartphone application When using App you can set device-specific access code, which protects device against unauthorized smartphone connections. The access code can be reset with simultaneous FW and BW comand, when power switch on.

SETTABLE PARAMETERS (prog. 366-SBL v1.0)

EM-366-SBL parameters set with interface unit EM-236A or with Ementool-Lite and EM-328

1. Output voltage max. 10-50V / 10-50 (0)
values 0-9 = not in use
2. Overvoltage limit 15-60V / 15-60 (40)
Don't set this over max. supp. voltage
3. Start ramp 0-5s / 0-50 (10)
4. Stop ramp 0-5s / 0-50 (2)
5. I-trip delay 0.01-2.55s / 0-255 0=no trip (50)
6. Current limit FW 1-60A / 1-60 (5)
7. Current limit BW 1-60A / 1-60 (5)
8. Load compensation 0-255 (0)
9. Max. speed FW 0-100% (100)
10. Max. speed BW 0-100% (100)
11. Home speed 0-100 (50)
12. Reset option 0-1 (1)
0 = only with reset input,
1 = also with opposite direction
13. brake output mode and braking mode 0-3 (0)
0 = overvoltage activates output and brk. mode is "regenerative"
1 = overvoltage activates output and brk. mode is "freewheel"
2 = output active when "run" and braking mode is "regenerative"
3 = output active when "run" and braking mode is "freewheel"
14. Fault output options (pin 17)
0 = over temp, I-trip.
1 = over temp, overvoltage and I-trip
2 = over temp, overvoltage, I-trip and overcurrent
3 = continuous light when "positioned" and blinking if fault
4 = fault output same funtion as on board ind. led
15. Res/home input config. (pin 16) (0)
0= 5s. command starts homing.
1= 5s command starts learning
16. stop/safety input config. (pin 15) (0)
0= digital stop input
1= safety switch input with line monitor
17. Positioning counting direction 0 or 1 (0)
18. Control options and Local / Bus selection (3)
0= fw-bw switch mode, pin 19 select Local mode
1= fw-bw switch mode, automatic return to bus with 1s delay
2= fw-bw switch mode, Return to Bus control with Bus command.
3= Analog in mode, pin 19 select Local mode
4= Analog in mode, Pin 14 voltage changes activates local cont.
Return to Bus control with Bus command.
5= Back up switch mode, pin 19 select Local mode
6= Back up switch mode, automatic return to bus, with 1s delay
7= Bus control only
- 19 not in use
20. Baud rate 0...5
0= 9600, even, 1 stop
1= 9600, odd, 1 stop
2= 9600, none, 2 stop
3= 19200, even, 1 stop
4= 19200, odd, 1 stop
5= 19200, none, 2 stop
21. Modbus Address 1...247 (1)
22. Input range min. Ain 0-10V / 0-1000 (0)
23. Input range max. Ain 0-10V / 0-1000 (1000)
24. Bw end limit 0-10000 pulse from home / 0-10000
25. Fw end limit 0-10000 pulses from max. of range / 0-10000
26. Braking area 1-1023 pulses / 1-1023 (200)
27. Dead zone 2-100 pulses / 2-100 (25)
28. Range at pulses 0-65535 (5000)
29. Range factor 1=65535 / 0-32767 pulses (0)

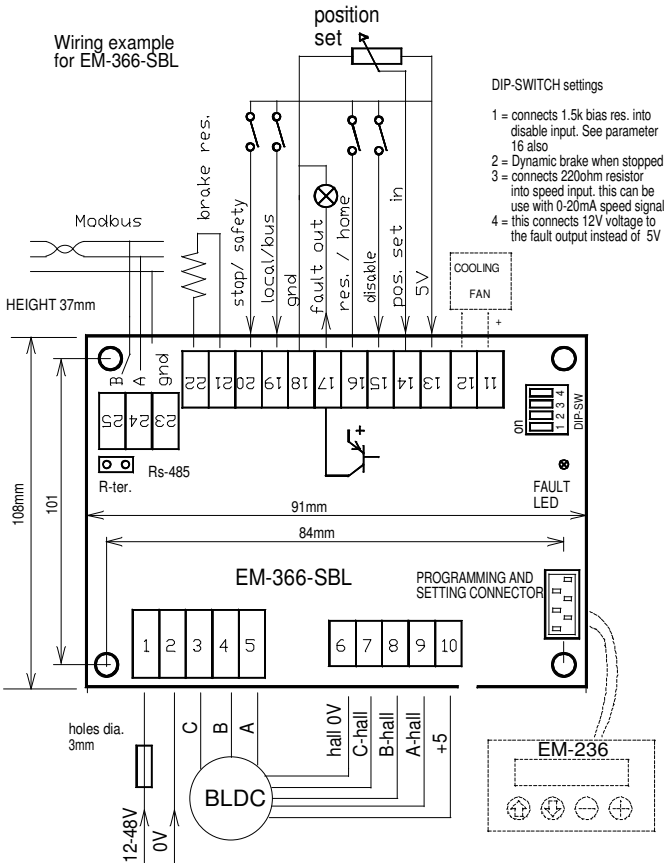
MONITOR VALUES

1. current 1A / digit
2. pwm 0-255
3. position 0-65535 pulses
4. position factor 1=65535 pulses
5. operation voltage 0.1V digit

INDICATIONS.

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

Fault output: (Pin-17 PNP open collector output)
This indication output is configured with param. 14



CONNECTION ADVICE

Recommended supply voltage range is 12-48Vdc. Ripple should be lower than 30% even with max. load.

NOTICES !

1. Wrong supply polarity can cause damage the device.
2. There is no inbuilt fuse in this device. Use an external fuse which is chosen according to your application.
3. that function and scale of some of the input and output terminals is depending on the selected parameter values and defined ranges. Please, see the parameter list and explanations.
4. BLCD the right connecting is important, motor manufactures can be different marking method. If motor takes lot of current or not at all, the try to change the order of hall- sensors (a, b, c)
5. If you start using with local control, then parameter 18=3 and link pin 19 to pin 13

CONTROL INPUTS AND OUTPUTS.

POSITION SET (Analog input)

This is analog input. for local mode position setting. This input range is basically 0-10V. But the input range can be adjusted with parameters 20 and 21 see more ANALOG INPUT RANGE section.

DISABLE

This terminal is PNP input, positive command disables device. This input has highest priority.

RES/ HOME /LEARN

At short command this input reset fault, and with longer 5s command this input starts HOME or LEARN routine. Input configured with parameter 15.

LOCAL / BUS (control select)

This input is normally for selecting several LOCAL or BUS control modes, this input can be config. with parameter 17 When input pin is open, then local mode is selected.

Rs-485 (modbus)

Standard half-duplex Rs-485 terminal incl. gnd, A and B The line termin resistor 120R can be set to socket R-ter if needed.

BRAKE OUT

This NPN output can be used to control magnetic brake of motor or as a braking resistor in re-generation situation see. parameter 13

TAKING IN TO USE

The setting of the controller is done with parameters, and the parameters can be set and edited with Interface devices EM-236 or EM328 Unit. In the beginning set the two first parameters according to the application. Check also that current limit parameter are suitable for your application.

OVERVOLTAGE (brake output threshold)

Set parameter 2 at least 10% higher as voltage of supply. If supply voltage rises over overvoltage limit (set with param. 2) then the brake output pin 21 activates. and if brake resistor is connected then it will absorb braking energy. If supply voltage rises 3V over overvoltage limit, then driver will be disabled.

POSITION FEEDBACK (feedback pulse inputs)

This driver uses hall-sensor of motor also for positioning. For example 1-pole-pair motor gives 6-position/round, and 7-pole motor give 7 times more 42-position/round.

FULL RANGE

Full range is the full mechanical movement of the linear of positioning system. At first it is always needed to determine the full range before it is possible to drive the system correctly. The full range can be determined with LEARN routine or if this is already known it can be set direct to parameter 28 and 29 (Full range). The position counter is 31bit and that's why the parameter has split to "ones" and " 16bit factor"

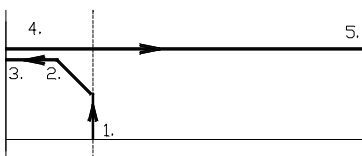
HOMING (absolute position matching of position counter)

The position feedback is received as pulses so the driver can not know the absolute position before pulse counter is reset in some known position. Homing routine will drive the motor to mechanical end of bw direction and then the position counter is reset.

LEARNING (absolute position match and measuring of full range)

Learning is an extended routine of homing. It is for finding the full range for system and also match the absolute position. Homing or learning is selected with parameter 15

home pos. "HOMING" cycles 1 to 3 position full
counter = 0 "LEARNING" cycles 1 to 6 range



1. start homing or learning by giving a long 5s command to RES/ HOME/ LEARN input (pin 16)
2. motor starts to run "home" direction with home speed
Home direction is same as "bw" direction
3. current limit stops the motor when the end is reached and position counter will be reset .
This is also the end of HOMING cycle
4. motor starts to "fw" direction and makes a full stroke. During stroke the pulse counter measures the range.
5. motor reaches the mechanical end of fw direction and current limit stops the motor.
6. Device stores full range value and it is ready for use
7. After successfully learning we recommended to return parameter 15 to value 0 (home)

TROUBLES ON HOMING OR LEARNING

Motor will not run at all in homing or learning.

- hall pulses has wrong phasing, try to change to hall sensor wiring
- system is stuck
- current limit is too low for system

Motor run only about 0.5 sec, and ind. led blinking
-counting direction is wrong, change parameter 17

LOCAL / BUS (control mode select)

This driver can be used with local control inputs or with Rs-485 Bus. The Bus control offer more options than local input and for bus control has own instructions. "Modbus register definitions for EM-366-SBL" Device is set for bus mode as a default. (see param. 18)
If you want to start with Local control , then set pin 19 "on"

CONTROL OPTIONS

Device has several control option. The main select is Local or Bus control. As a default device is in Bus control mode, The Bus is Rs-485 Modbus RTU. and it has separate instructions "Modbus register definitions for EM-366-SBL".

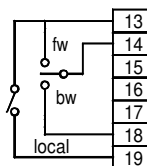
The parameter 18 defines how the device can change to Local control mode, which means that control inputs of card is enabled. Local mode with fw-bw switch can be set pin 19 "on" , or direct with fw-bw switch. Return to Bus control with pin 19 "off", or automatically or with Bus command.

Local mode with potentiometer can be activated with with pin 19 or with 5% voltage change of potentiometer. Return to bus mode with pin 19 to "off" or with Bus command.

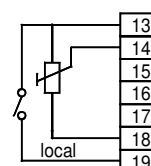
In the back up switch mode the switch has high priority and it bypass positioning servo and end limit.

Below two basic wiring for Local control

FW-BW SWITCH MODE



ANALOG IN MODE



LOAD COMPENSATION (torque at low speed)

Load compensation (par.8) when set to right value, will ensure the needed force to start driving and to taking the load in to the right position. With high load and too low load compensation value, the motor don't have force enough to reach the right position. Start testing with zero value and increase value until motor behaves unstable and twitching. Thumb rule in this point is to decrease the value with 25%.

CURRENT LIMIT and I-TRIP (torque limit and shutdown)

Current limits should be set according to the motor nominal max. current or according to the required current of the application. these set with parameter 6 and 7
Current I-trip (overcurrent shutdown) delay can be adjusted with parameter 5. Notice if this parameter is set = 0 then shutdown is disabled but current limit still works

INDICATIONS

Fault situations are indicated with coded blinking of the red LED. and fault code number is also read from monitor value.

Fault output (pin.17). indicated fault situations also. This output pull up in fault situation as, overtemp, I-trip, pulse lost etc. see parameter 14

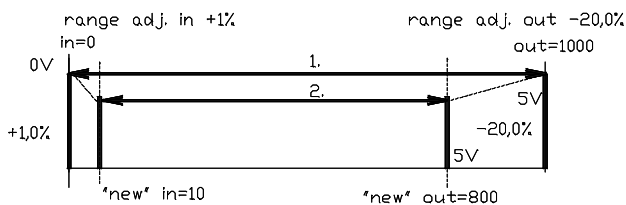
RESETTING OF FAULTS

The faults can reset with short command with RES./ HOME / LEARN input. I-trip and pulse lost faults reset also automatically if gives new position set which starts run to opposite direction.
Faults can be reset also via bus, if bus mode is selected.

ANALOG INPUT RANGE ADJUST

This driver analog position set input is 10b (1023 step), and with analog input cannot reach same accuracy as with bus control. The input range is 0-10V, but this range can be compressed with parameter 20 and 21. for example. Input signal is 0.4 - 5.0V, then set parameter 20 = 40 and 21 = 500. This input can work also as 0-4-20mA input, dip-switch 3 can be connected 220ohm input resistor, then parameter values are correspondingly 20= 88 and 21= 440

Example of RANGE ADJUST for analog input



1. Original learnt range = mechanical full range
Is in this example = 1000 count.
Control signal is 0-5.0V (param. 22=0 and 23=500)
2. Desired mechanical range compression
bw end limit = +1% set parameter 23 = 10
fw end limit = -20% set parameter 24 = 200
"New" stroke of actuator is compressed to:
positioning set value 0V = 10
positioning set value 5V = 800

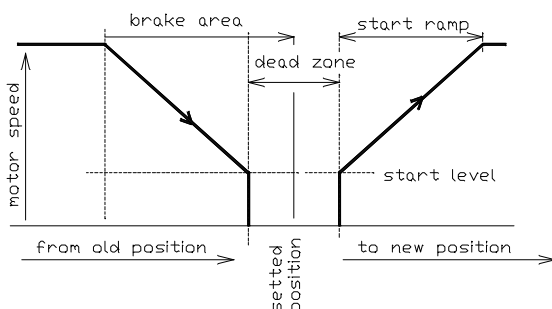
POSITIONING DYNAMIC

Dead zone (par.27) is to determine the accuracy of positioning. This parameter has the major effect to positioning accuracy. The smaller value means theoretically better accuracy, but on the other hand too small value affect unstability in positioning. The right value will be find with testing, Notice! that mechanical slack and stiffness could be reason to increase dead zone.

Braking area (par. 26) is used to optimize the time needed for positioning. Too high value slows down too early, and too low value will cause an fast position passing and needs a corrective return driving.

Start and stop ramp (par. 3& 4) are to smoothen the direction change. Often suitable value for stop ramp is half of start ramp. Too long stop ramp can make the direction change too time consuming and too short can cause mechanical stress and non desired aggressivity.

POSITIONING WINDOW



ACCURACY

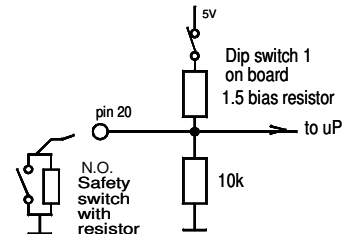
Position counter is 31bit, which is over 2000 million steps, so device can be reached exelent accuracy and big range. But of course the resolution depends on of feedback pulse source. For example 1-pole-pair motor gives 6-position/round, and 7-pole motor gives 42-pos./round. Theoretical positioning accuracy could be 1-2 feedback pulse step.

In some application the mechanic itself will reduce the accuracy, for example stiffness and slack. The parameters 8, 26 and 27 are important to optimize accuracy of system.

Notice! if position set gives with analog input then the resolution is only 10b theoretically and in practice 0.2% (1/500)
The high accuracy is possible only with bus control.

SAFETY SWITCH INPUT (stop input with monitoring)

The stop input can be used as safety switch input with monitor. Safety switch has usually monitoring resistor, which has used to monitoring the condition of safety switch wires. This input has possibility to monitoring this line when "safety switch" option has selected with parameter 16 . R-bias enabled with dip-sw 1
Recommended safety switch resistor 1-2.2kohm
If line fault detected, then the device gives "line fault" warning
The acceptable voltage value is between 1.6...3.5V
This input is enabled also in BUS control mode.



EM-347A BRUSHLESS DC-MOTOR DRIVER 12-36V 50A

EM-347A-fan 12-36V 60A



FEATURES

- To the motors with HALL sensors
- Three phase output
- Speed and torque adjustment
- Open/closed loop modes
- Dynamic braking
- Control output for cooling fan.
- True 4Q-power stage
- Braking resistor output
- Selectable brake mode
- 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
- A-version has 25% improved output current
- A-version available with integrated fan
- Firmware v1.4 extended operating options

GENERAL

EM-347A 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, but voltage rising can be controlled with a braking resistor. If using battery supply, then the braking energy can be lead back into the battery and a braking resistor will not be needed. The unit has 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-347-48V 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.

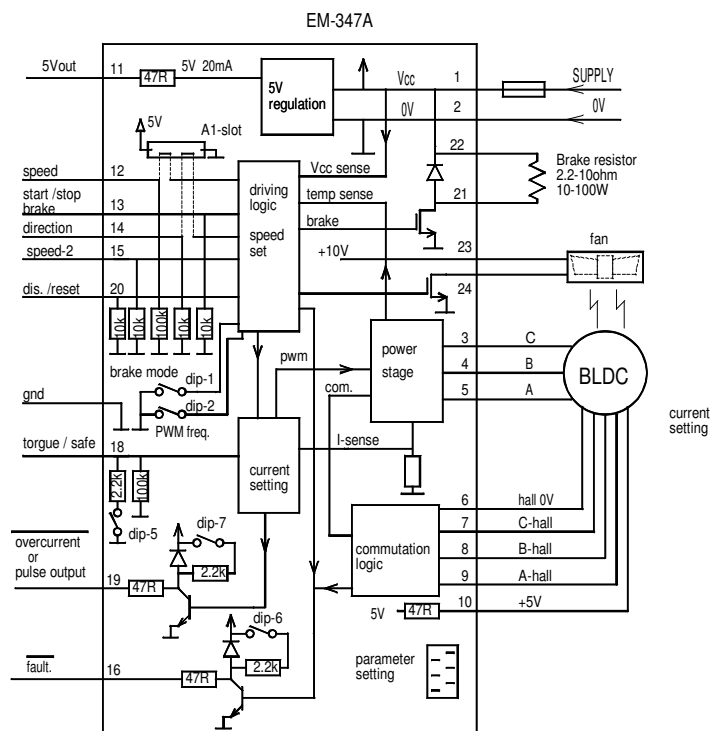
There are two control options for speed. Direct control (open loop) sets motor voltage in propotion to control voltage as with a standard DC-motor. Closed loop uses hall sensor feedback for speed control. This mode offers good speed regulation. Start and stop ramps work in both modes. Speed adjust range,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

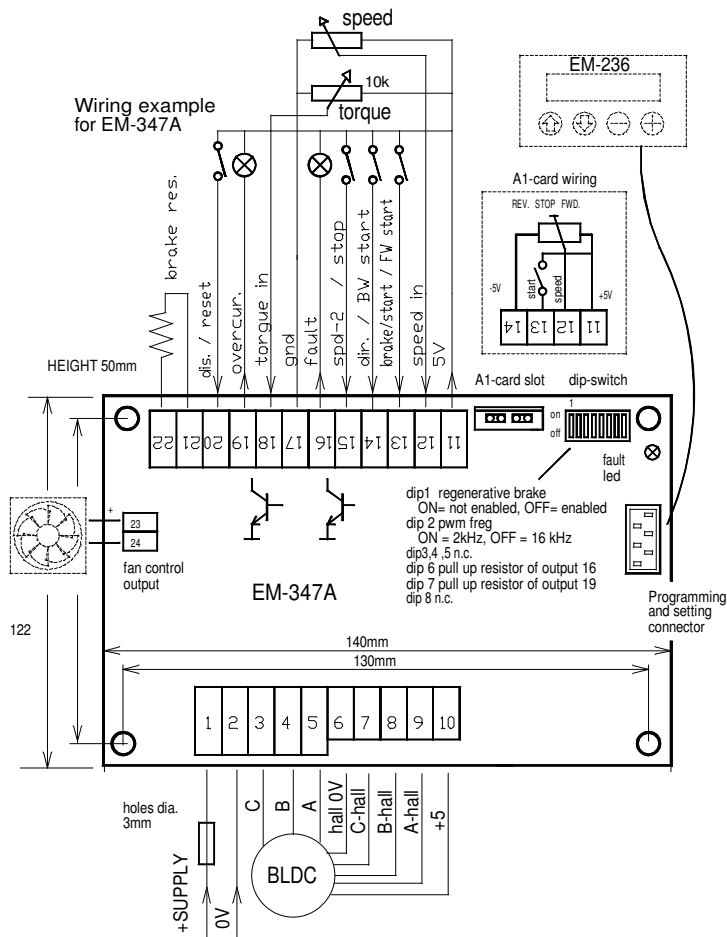
Settings can be done digitally with EM-236 interface unit or with Emen-Tool lite program installed in PC and EM-268 adapter cable. Parameters are stored into non-volatile memory of device. This interface unit can also monitor the current and rpm of motor. If necessary, the device also has an optional cooling fan available, which can be controlled with its designated output. This output switches on fan, when temperature rises over 65 deg.

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

TECHNICAL DATA

Supply voltage 12-36V (11-42Vdc)
 Overvoltage limit 15-65V (adjustable)
 Idle current typ. 30mA
 Max current 50A cont (Tamb. 50 °C)
 Max current 65A cont. with fan cooling
 Max current peak 100A (max. 5s)
 Max brake output (pin-21) current 25A
 Brake resistor recom.value 1-10ohm
 Pwm frequency typ. 16kHz
 Overtemperature shut down 90°C
 Fan output switch on > 65°C
 Current limit setting 1-100A (step 1 A)
 Current limit analog scale 0-5V = 0-100A
 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
 Overcur. and fault outputs NPN max 50mA
 Output for fan cooling 12V max. 100mA
 EMC measured for industrial environment
 PCB material flammability class UL94V-0
 Dimensions 140x122x50mm
 Weight 650g





SETTABLE PARAMETERS (prog. 347 v1.4)

EM-347 parameters are set with interface unit EM-236 or with Ementool-Lite and EM-268.

1. Mode: 0-2 (0)
0= open loop
1= closed loop
2= closed loop " high inertia "
2. Closed loop range 0-4 (3)
0=3000rpm 2=9000rpm 4=3000rpm
1=15000rpm 3=5000rpm
3. Start ramp 0-5s / 0-50 (1s)
4. Stop ramp 0-5s / 0-50 (1s)
5. I-trip delay 0.01-2.5s / 0-255 0=no trip (0.2s)
6. Scale start speed 0-25.5% / 0-255 (0)
7. Scale gain 0-2.55 / 0-255 (200)
8. Closed loop dynamic P-factor 1-200 (10)
9. Closed loop dynamic I-factor 1-200 (10)
10. Braking current limit 10-50A / 10-50 (50)
11. Operating modes: 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)
12. Current limit 0-100A / 1-100 (40)
0= Current setting with pin 18
13. Speed-2 input mode 0-100 (50)
0= stop input with rising edge (with ramp)
1= brake input with rising edge (without ramp)
10-100 = speed-2 preset value
14. I-trip (overcurrent shut down) reset options (0)
0= Only with disable pin
1= With speed input change 0 to up
2= With direction input
10-200 = Timer reset 1-20s. (0)
15. 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.
16. I-trip and overcurrent indication (0)
0= I-trip indication to pin16
1= No I trip indication to pin 16 or 19
2= I-trip indication to pin 19
3= Pin 19 reserved only for I-trip indication
4= Overcurrent indication to pin 16
17. Pulse output for pin19 0-5 (0)
0= Not in use = 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
18. Brake res. treshold (=overvoltage) 15-65V / 15-65 (60)

MONITOR VALUES

1. Current 0-250A / 0-250
2. Braking current 0-250A / 0-250
3. Hall freq. 0-1000Hz / 0-1000
4. Operating voltage 0-75V / 0-750

TAKE IN USE

Nominal supply voltage is 12-36Vdc, ripple repetitive peak max.63V.
An external supply fuse is recommended (10-75A).

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

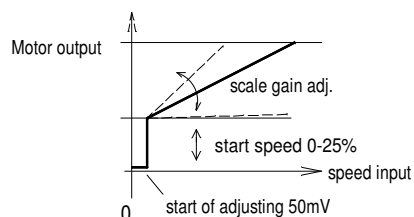
Default settings are in brackets in the parameter list. These are good start-up values.

Current limit has two mode, I-trip means overcurrent shutdown and the motor shutdown when current limit is exceeded or optionally continuous current limitation mode, when current is only limited, this last mode I-trip is disabled with parameter 5

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

In high power applications, a DC-fan can be installed into driver to improve cooling. Driver has its own connector for fan. This output offers regulated DC- voltage (12V). This output will activate when driver temperature exceeds 65°C.

Speed adjusting input range can be set with parameters 6 and 7. See picture below. In closed loop mode the speed range setting done with parameter-2. These rpm range values are calculated for 2-pole motor, for example 8-pole motor the rpm ranges are 4-time smaller.



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 inputs:
SPEED input 0-5V / 0-10V changes to $\pm 5V$ or $\pm 10V$ input. DIRECTION input changes to -5V output. This voltage can be used for potentiometer, see drawing. Instead of a potentiometer, a symmetrical voltage signal can also be used.

STOP and BRAKE

Driver has two options a brake motor. First option uses stop ramp and regenerate energy back to driver during slowing down. In this mode the regenerating energy has to lead battery or braking resistor. If there is battery power supply then energy goes automatically back to the battery. But in power supply use there has to use braking resistor, its output is activated when voltage exceeds value which has set with parameter-18, recommended set value is 10% over unloaded supply voltage. The second option is dynamic brake which means that stop ramp by-passed and motor poles shorted, this offer quick stop, but current can be rise very high in braking, so this is NOT RECOMMENDED for braking in cases where motor has high inertia! Braking options can be selected with parameter 11 and 13

CONTROL INPUTS and OUTPUTS

Speed input is an analog control input for speed setting.
Signal can be set 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 0-100A current (if parameter 12 is =0).
If parameter value is something else than zero, then current limit is = analog input value.

Start/stop input can be used start and stop and brake motor
Parameter 11 can be set different start and stop options
Stop means that motor stops with stop ramp.
Brake means that motor stops quickly with dynamic brake
This input can be set work also as FW-start.
Input functions can be set with parameter 11.

Direction input is a digital input. It will change the rotation direction. It uses stop/start ramps during change.
This input can set also as BW-start input, see param. 11

Speed-2 input is a digital input that activates speed-2.
Speed-2 input can be used also as stop in this input function can be set with parameter 13

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

INDICATIONS LED and OUTPUTS

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

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 out)
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

EM-347B and EM-347B-fan BRUSHLESS (BLDC) MOTOR DRIVER 12-48V 50A



GENERAL

EM-347B 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, but voltage rising can be controlled with a braking resistor. If using battery supply, then the braking energy can be lead back into the battery and a braking resistor will not be needed. The unit has basic digital command inputs like direction, brake, start/stop, disable and there are analog inputs for speed and current control. One digitally presettable second speed (speed-2) is possible to activate with digital command input. EM-347-48V 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 proportion 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. If necessary, the device also has an optional cooling fan available, which can be controlled with its designated output. This output switches on fan, when temperature rises over 65 deg.

This B-version has added shutdown control input to put driver to low pow consumption mode and also there is added Rs-485 port for Modbus communication. B-version has also few new stop braking option. In "stop brake" mode the all motor wire shorted in stop situation and it gives better hold torque as usually. The another special stop mode is "hold current" this generates very strong hold torque.

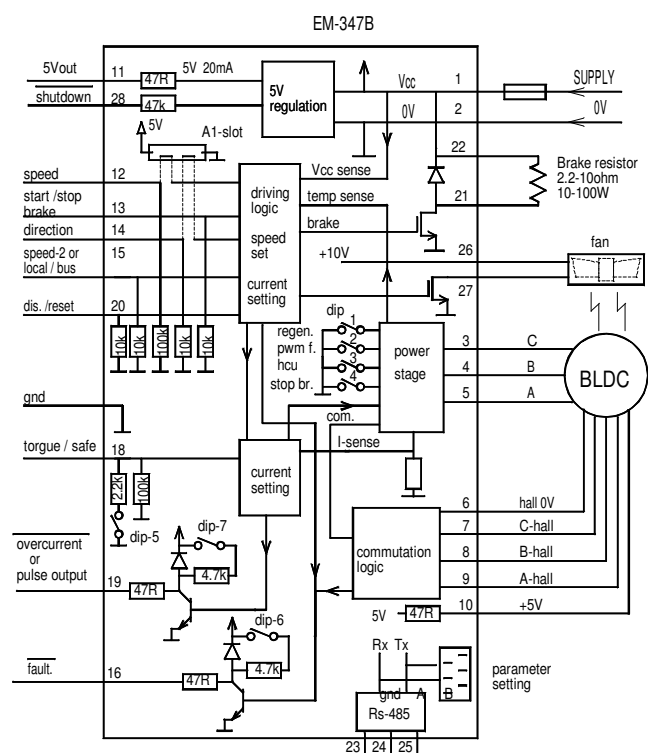
The device can be installed in DIN-rail base and some enclosure options are also available.

TECHNICAL DATA

Supply voltage 12-48V (11-60Vdc)
 Overvoltage limit 15-65V (adjustable)
 Idle current typ. 30mA
 Idle current, shutdown=gnd 0.2mA
 Max. current 50A cont (Tamb. 50 °C)
 Max. current 60A cont. with fan cooling
 Max. current peak 80A (max. 5s)
 Max. brake output (pin-21) current 20A
 Brake resistor recom.value 1.5-10ohm
 Pwm frequency typ. 16kHz
 Overtemperature shut down 90°C
 Fan output switch on > 65°C
 Current limit setting 1-100A (step 1 A)
 Current limit analog scale 0-5V = 0-100A
 Logic level of digital inputs
 "off" = 0-1V or open / "on"= 4-30V
 Input impedance of logic inputs 10k
 Shutdown input open or gnd (gnd= low idle)
 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
 Rs-485 9600 / 19200baud Modbus RTU
 Overcur. and fault outputs NPN max 50mA/60V
 Output for fan cooling 12V max. 100mA
 EMC measured for industrial environment
 PCB material flammability class UL94V-0
 Dimensions 140x122x43mm (56mm with fan)
 Weight 520g / with fan 550 g

FEATURES

- To the motors with HALL sensors
- motors 12V recom. up to 800W
- motors 24V recom. up to 1200W
- motors 48V recom. up to 1600W
- Three phase output
- Speed and torque adjustment
- Open/closed loop modes
- Dynamic braking
- Control output for cooling fan.
- True 4Q-power stage
- Braking resistor output
- Selectable brake mode
- 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
- B-board has extended voltage range
- B-board has shutdown input for idle reduction
- B-board replaced earlier A-versions (all voltage)
- B-board has Rs-485 port (Modbus RTU)
- B-board support B version firmwares
- B-version HW and SW offer special stop modes
- B-version board v3 support hold current option



TAKE IN USE

Nominal supply voltage is 24-48Vdc, ripple repetitive peak max.63V. An external supply fuse is recommended (10-60A).

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

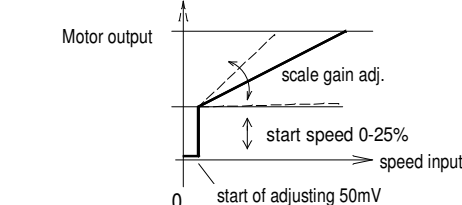
Default settings are in brackets in the parameter list. These are good start-up values.

Current limit has two mode, I-trip means overcurrent shutdown and the motor shutdown when current limit is exceeded or optionally continuous current limitation mode, when current is only limited, this last mode I-trip is disabled with parameter 5

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

In high power applications, a DC-fan can be installed into driver to improve cooling. Driver has its own connector for fan. This output offers regulated DC- voltage (12V). This output will activate when driver temperature exceeds 65°C.

Speed adjusting input range can be set with parameters 6 and 7. See picture below. In closed loop mode the speed range setting done with parameter-2. These rpm range values are calculated for 2-pole motor, for example 8-pole motor the rpm ranges are 4-time smaller.



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 inputs: SPEED input 0-5V / 0-10V changes to $\pm 5V$ or $\pm 10V$ input. DIRECTION input changes to -5V output. This voltage can be used for potentiometer, see drawing. Instead of a potentiometer, a symmetrical voltage signal can also be used.

STOP and BRAKE

Driver has two options a brake motor. First option uses stop ramp and regenerate energy back to driver during slowing down. In this mode the regenerating energy has to lead battery or braking resistor. If there is battery power supply then energy goes automatically back to the battery. But in power supply use there has to use braking resistor, its output is activated when voltage exceeds value which has set with parameter-18, recommended set value is 10% over unloaded supply voltage. The second option is dynamic brake which means that stop ramp by-passed and motor poles shorted, this offer quick stop, but current can be rise very high in braking, so this is NOT RECOMMENDED for braking in cases where motor has high inertia! Braking options can be selected with parameter 11 and 13

CONTROL INPUTS

Speed input is an analog control input for speed setting. Signal can be set 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 0-100A current. This input can be set to work as analog input when parameter 12 is set = 0

Start/stop input can be used start and stop and brake motor. Parameter 11 can be set different start and stop options. Stop means that motor stops with stop ramp. Brake means that motor stops quickly with dynamic brake. This input can be set work also as FW-start. Input functions can be set with parameter 11.

Direction input is a digital input. It will change the rotation direction. It uses stop/start ramps during change. This input can set also as BW-start input, see param. 11

Speed-2 input is a digital input that activates speed-2. Speed-2 input can be used also as stop in. Speed-2 input can be used also as LOCAL/BUS mode nput this input function can be set with parameter 13

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

Rs-485 communication port for Modbus RTU. This feature has own "Modbus register definition" guide. Modbus can be activated with set parameter 13 = 2

Shutdown in shut off the control voltage of device and it also reduce the idle current consumption. If this pin pull to ground (gnd) then device is disabled

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 ouput can be set also indicate I-trip situation or work as rpm pulse output. This output set with parameter 17

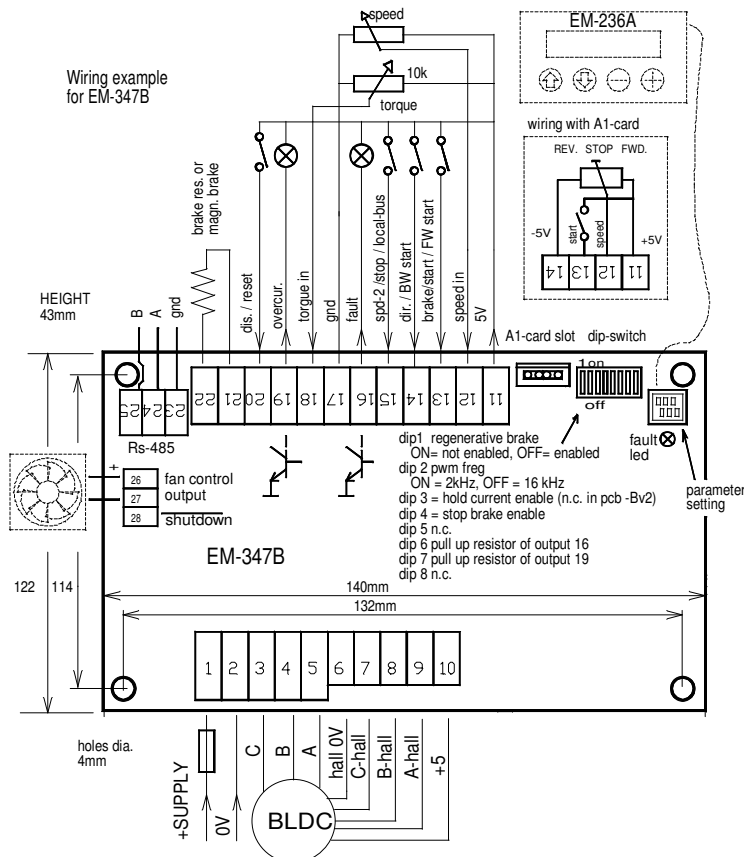
Brake output is NPN open collector output, pin-21 This can be used to control magnetic brake or brake resistor. This set with param 18.

MONITOR VALUES

1. Current 0-250A / 0-250
2. Braking current 0-250A / 0-250
3. Hall freq. 0-1000Hz / 0-1000
4. Operating voltage 0-75V / 0-750
5. PWM 0-100% / 0-255

LED INDICATIONS

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



SETTABLE PARAMETERS (prog. EM-347B v1.2)

EM-347 parameters are set with interface unit EM-236 or with Ementool-Lite and EM-268.

1. Mode: 0-2 (0)
0= open loop
1= closed loop
2= closed loop " high inertia "
2. Closed loop range 0-4 (3)
0=3000rpm 2=9000rpm 4=3000rpm
1=15000rpm 3=5000rpm
3. Start ramp 0-5s / 0-50 (1s)
4. Stop ramp 0-5s / 0-50 (1s)
5. I-trip delay 0.01-2.5s / 0-255 0=no trip (0.2s)
6. Scale start speed 0-25.5% / 0-255 (0)
7. Scale gain 0-2.55 / 0-255 (200)
8. Closed loop dynamic P-factor 1-200 (6)
or Rxl compensation in open open loop
9. Closed loop dynamic I-factor 1-200 (10)
10. Braking current limit 10-50A / 10-50 (50)
11. 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)
12. Current limit 0-100A / 1-100 (40)
0= Current setting with pin 18
13. 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= Local / Bus selection (if open then Modbus selected)
10-100 = speed-2 preset value
101-150 = enables and set hold current (also dip 3 must set "on")
14. 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)
15. 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.
16. 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
17. 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 -40...0...50A <=> 10...50...100Hz
18. Brake out pin 21 0 or 15-65V / 15-65 (55)
0= brake out pin 21 is set to work like magn. brake cont. out
15-65= Threshold level for pin 21 activation
19. 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
20. Modbus Address 1...247 (1)

EM-236A INTERFACE UNIT



FEATURES

- * **Accurate and easy adjustment**
- * **Good adjustment repeatability**
- * **Saves space in products**
- * **Gives economical advance**
- * **Enables dynamic monitoring**
- * **Easy to use**
- * **Smaller and lighter than EM-236**
- * **Replaces previous EM-236**

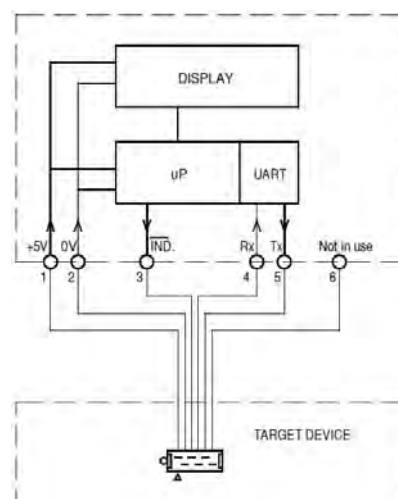
EM-236A Interface unit is made for adjusting and copying adjustments of Electromen driver devices and for monitoring dynamic values during drive. EM-236A enables the searching of the right settings and adjustments for the application, and after that these settings can be reliably loaded to other units. EM-236A is handy in instrumentation and also a simple tool in production.

The use in short:

After the driver unit is powered the cable from EM-236A with red "Micro Match" connector is connected to the driver unit, (Notice the hole in board for polarity tab). The display of interface unit wakes up and after some announcements it is ready to load up parameters from the target driver (Load&Edit), if there is need to edit, the values can be changed with + and - buttons. Then the parameters can be saved with 2 seconds push of the "2sec. save" button. If the operation of the driver is OK. the red connector can be connected to the next driver and with a push of "Copy to device" button the same parameters are loaded to the next unit and to as many units as the user desires.

TECHNICAL DATA:

Supply:	3-6V / 30mA
Baud rate:	9600b/s \pm 10%
Display:	2x16digits, LCD
Memory:	5 slots, each can store one set of parameters.
Lead length:	23cm
Measures:	70x50x20mm
Weight:	52g



FUNCTIONS OF EM-236A

Load & Edit

This will pick up the parameters from the driver unit. Parameters will be displayed and you can scroll and edit those with EM-236A. After editing a value, it will blink three times before it is valid. NOTE. Edited parameter list is only in RAM until you save. After saving (pressing 2sec save button) new edited parameters will be sent to driver unit and stocked in to selected memory slots of the EM-236A Interface unit.

Copy to device

This command will send the parameter list in to the driver unit.

Monitor values

This will enable user to monitor some dynamic values during the use of the driver. Monitorable values can be scrolled with arrow -buttons.

Memory

*** Show selected**

From here you can see the parameter list which is stored in the slot which is selected at the time. First you get a message, which slot is selected and for what product the parameters are. Then you are displayed the parameters, which you can scroll trough, but not edit until those are saved.

*** Select slot**

Here you choose which one of the 5 memory slots is active. When you save, copy, or go to "Show selected", the operation is referred to the slot you have chosen here.

SAVING

1. In "Load & Edit" press "2sec save" -button. The displayed parameters (edited or not) will be sent to the driver device and saved to the interface units active slot.
2. "Copy to device" will send the parameters that are in the interface units active slot to the driver device.
3. In all other situations, pressing "2sec save" -button will send the parameters from active slot to driver unit.

NOTE: If you by mistake leave from the "Load & Edit" window with out saving the edited parameters. The edits will stay there if you dont do any saving or copying, or you dont un plug the supply.

To save edited parameters you have to go back to "Load & Edit" and push "2sec save" button. Then the edited parameters are saved to active slot and sent to the driver device.

START UP

Interface unit is started up by connecting it to a powered driver unit.

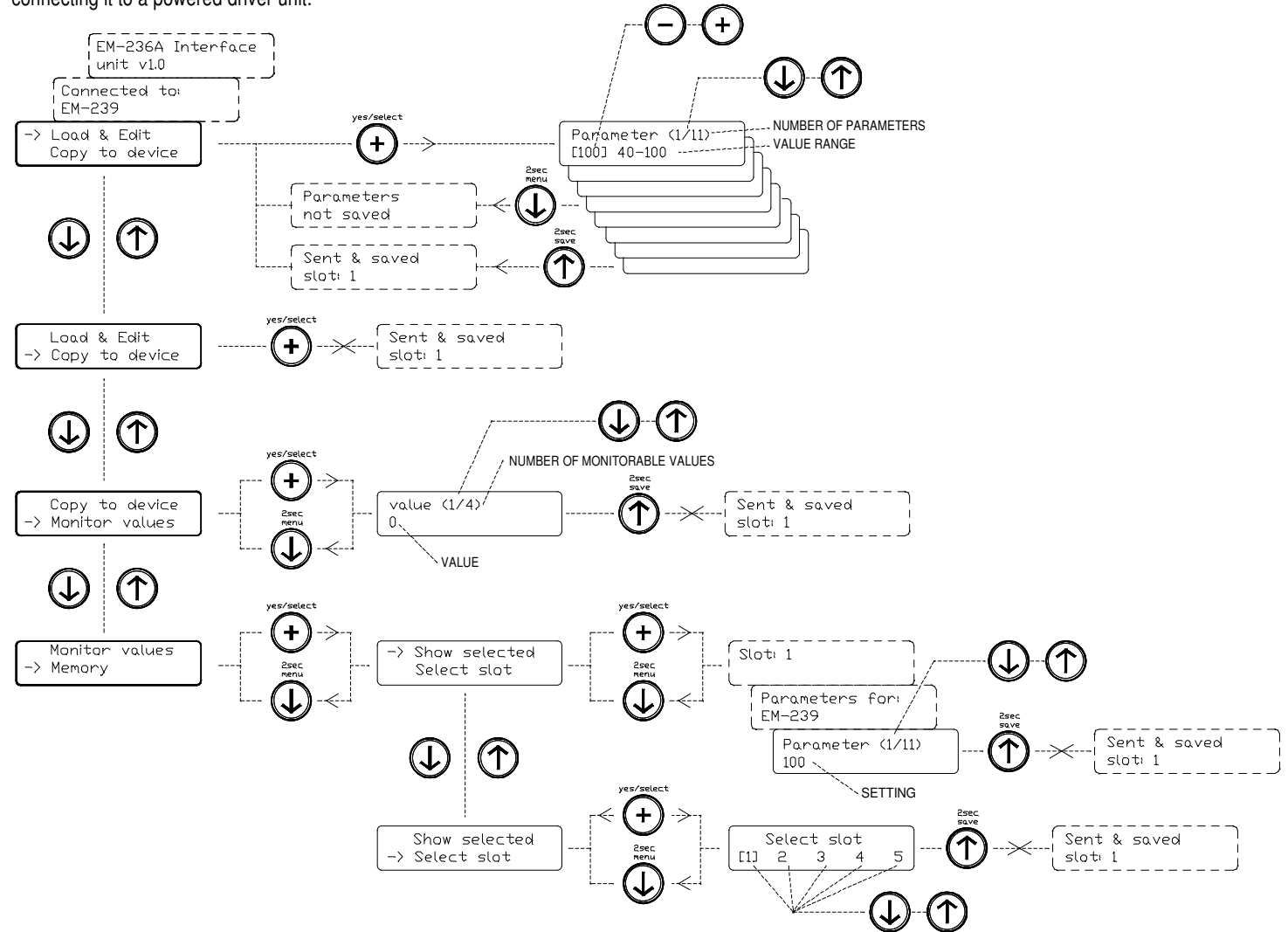


Fig.1. The menu map of EM-236A Interface Unit.

Note. This unit is for parameter setting of various products, but in examples we have used the code EM-239 for target device.

EM-328 INTERFACE UNIT SERIES "dongle" for EmenTool Lite



EM-328
"basic"

EM-328-ISO
isolated for
industrial use

EM-328A
"low cost"

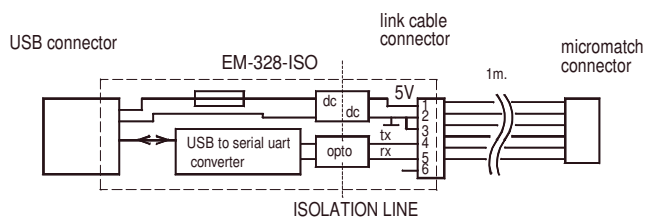
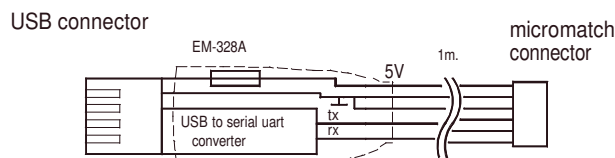
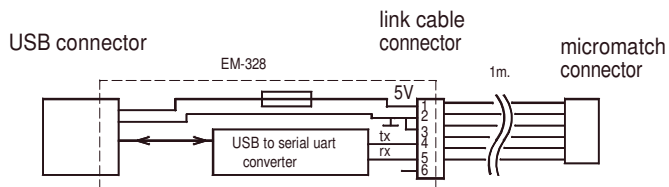
FEATURES

- USB to serial converter
- EmenTool Lite compatible
- Three different choices
- Power supply to the target device
- Galvanic isolation version (-ISO)
- Low cost version (A)
- Replaces earlier dongle EM-268
- Link cable length 1m
- Replaceable link cable (not in -A)

TEHNICAL DATA

Operating voltage 5V from USB socket
 Max. output current to 100mA
 Compatible up to USB 3.0
 Isolation 500V (only in -ISO version)

The EM-328 interface unit series is designed to convert USB port signal to serial port of EM-devices. EM-328 series has been designed to be used with EmenTool Lite PC program, which can be downloaded free from Electromen website. (www.electromen.com -> download area -> software). This device can be used to supply 5V voltage to the target device. There are three option available. The standard version is EM-328 and it is basic converter. EM-328 series replaces earlier dongle device, which type is EM-268. EM-328-ISO is an isolated version, this has isolated signal and power supply path. This version is recommended to use in industrial environment with a lot of interference. EM-328A is so called low cost version, this one has same electrical features as the basic version, but has been made mechanically more economical.



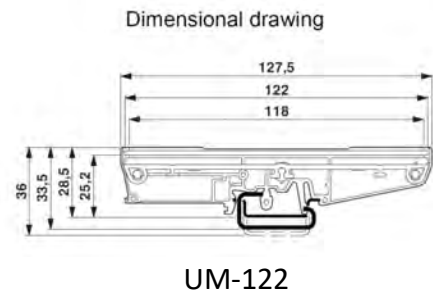
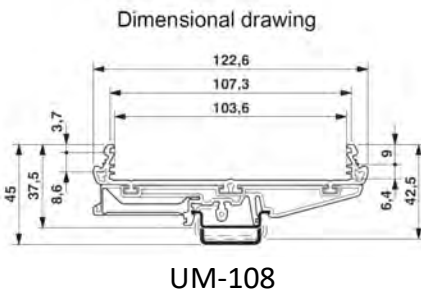
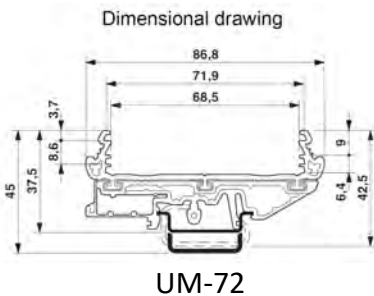
DIN RAIL BASES to suit EM controllers



FEATURES

- Right size for each product
- Fits to 35mm DIN-rail and C-rail
- Fast installation to rail
- Easy access to adjustments
- Easy access to connectors
- Widths 72mm, 108mm and 122mm

Electromen keeps also a stock of ready made rail bases for DC-motor drivers, controllers and speed regulators. Most of the Electromen stock products which don't have their own housing has been designed to fit into a rail housing. With the rail base these products can be installed into control cabinets or wall enclosures that are commonly used in industry and process automation.



ITEM NUMBER	CARD DIMENSIONS	APPLICABILITY						
		EM-203	EM-323					
EM-KP72-20	72x20	EM-203	EM-323					
EM-KP72-32	72x32	EM-165	EM-165PF	EM-269	EM-324			
EM-KP72-42,5	72x42.5	EM-124	EM-140A	EM-159	EM-175	EM-180	EM-213	EM-241
		EM-295	EM-341	EM-348				
EM-KP72-65	72x65	EM-67	EM-121	EM-143S	EM-172	EM-174A	EM-176	EM-291A
		EM-300	EM-296	EM-318				
EM-KP72-78	72x78	EM-239	EM-339					
EM-KP72-87,5	72x87.5	EM-12A	EM-28	EM-101	EM-101-BI	EM-106	EM-160	EM-206
		EM-314	EM-316	EM-346	EM-356A			
EM-KP72-110	72x110	EM-243	EM-M40					
EM-KP72-142	72x142	EM-337						
EM-KP107-54	107x54	EM-312						
EM-KP107-91	107x91	EM-151b	EM-366					
EM-KP107-107	107x107	EM-115						
EM-KP122-140	122x140	EM-347						
EM-KP122-180	122x180	EM-282	EM-362	EM-367				

Right base for the product



Motion Technologies LV Brushless DC Motor Controllers

High performance series (summary).....see full data sheet at http://www.motiontech.com.au/product_cat/speed-controllers/

Model number	Nbr axis Channels	Volts DC Supply	Cont. Amps/Ch	Peak Amps/Ch	Sensorless FOC	Cooling	Frame	Analogue Inputs	Digital Inputs	G.P. Outputs	Pulse Inputs	Dimensions, mm			
MTS1330	1	30	20	30	No	Conduction plate	Open	6	6	2 @ 1.5A	4	70x70x27			
MTS2330S			40	60	Yes			8	10	4 @ 1.5A	8	123x83x25			
MTM1330			50	100	150		No	Heatsink extrusion	IP51	4	6	2 @ 1.5A	5	140x113x29	
MTM1330A										4	6	2 @ 1.5A	5	140x113x29	
MTH1630			60	50	100		150	No	Heatsink extrusion	IP51	11	19	8 @ 1.0A	6	228x140x40
MTH1650											11	19	8 @ 1.0A	6	228x140x40
MTS1360		72		20	30	No	Heatsink extrusion	Open	6	6	2 @ 1.5A	4	70x70x27		
MTS2360S									8	10	4 @ 1.5A	6	140x140x25		
MTF2360S				80	80	120	Yes	Conduction plate	IP51	8	10	4 @ 1.5A	6	140x140x25	
MTF2360AS										8	10	4 @ 1.5A	6	140x140x25	
MTM1660			100	100	150	No	Heatsink extrusion	IP51	4	6	2 @ 1.5A	5	140x113x29		
MTM1660A									4	6	2 @ 1.5A	5	140x113x29		
MTH1660		96	300	500	Yes	Heatsink extrusion	IP51	11	19	8 @ 1.0A	6	228x140x40			
MTRG1860								8	10	6 @ 1.0A	8	190x200x58			
MTH1672			100	100	150	No	Conduction plate	Open	11	19	8 @ 1.0A	6	228x140x40		
MTRG1872									8	10	6 @ 1.0A	8	190x200x58		
MTH1696			200	200	300	Yes	Conduction plate	Open	11	19	8 @ 1.0A	6	228x140x40		
MTRG1896									8	10	6 @ 1.0A	8	140x200x58		
MTS2330		2	30	20	30	No	Heatsink extrusion	Enclosed IP51	11	19	8 @ 1.0A	4	228x140x40		
MTH2330														50	75
MTS2360			60	20	30	Yes	Conduction plate	IP51	8	10	4 @ 1.5A	6	140x140x25		
MTF2360														40	60
MTF2360A			72	50	75	No	Heatsink extrusion	IP51	11	19	8 @ 1.0A	4	228x140x40		
MTH2360														40	60
MTH2372	96		50	75	No	Heatsink extrusion	IP51	11	19	8 @ 1.0A	4	228x140x40			
MTH2396													40	60	Yes

Other Motion Tech Products



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