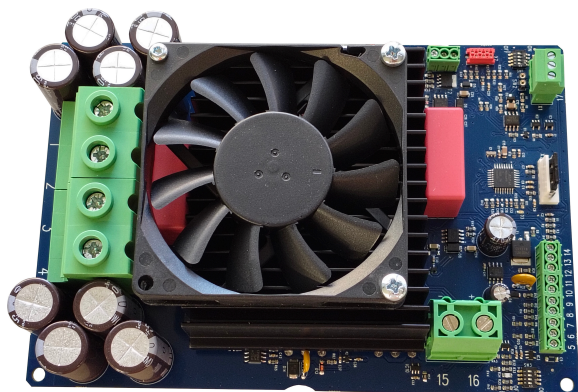# DC-MOTOR CONTROLLER
EM-362D 12-36V, 160A

FEATURES

- for motors up to 1.8kw@12V,
  2.5kW@24V and 3kW at 36V
- integrated fan.
- high current output
- brake load output
- current limit
- current limit for brake also
- zero-current limit
- speed setting/adjustment
- flexible control inputs
- impulse / continuous mode
- rail base mountable
- digital parameter setting
- D board ver. replaces earlier version EM-362
  + extended supply voltage range 12-36Vdc
  + added Rs-485 bus
  + D pcb v3 shutdown input added

APPLICATIONS

- vehicles
- winches
- steering prop

EM-362D is a full bridge DC-motor starter. It is designed to work with low voltage DC-motors (permanent magnet and brushed) in applications where a variety of special functions and settings are needed. Starter has adjustable acceleration and deceleration ramps, enabling the smooth starts and stops. Adjustable current limit protects the motor against overcurrent. Current limitation for braking is also available (regeneration I-limit). This driver is specifically designed for 12-36V applications, but it's still able to function when voltage is dropped down to 8V. The driver also has an integrated cooling fan, which improves cooling at continuous driving. This -D version has added Modbus Rs-485 control bus and the shutdown to minimize idle current consumption.

EM-362D has two selectable and settable speeds. This feature can be useful eg. in positioning applications. The FW and BW -inputs control the forward and backward runs. STOP input is used to stop the motor, but individual limit inputs are also available for FW and BW direction end stops, that will cause a motor shut-down. SPEED-2 input activates the presettable speed-2, but it can also be set for use as an analog speed control input (0-5V signal). FAULT terminal operates same time as an input and output. Fault line is internally pulled high (100kohm to Vsupply), but will be pulled down in overheat or conditionally also in current trip situation. If FAULT-line is pulled down externally it will cause a stop and disable a new start. For example it is possible to link FAULT pins of several units together and achieve a syncronous stop this way.

Driving can be done with two selectable control modes, continuous and impulse. In continuous mode the motor runs as long as the command is on. In impulse mode a short command starts the motor, and only a new impulse will change the status. Inputs are divided into two groups, command and limit -inputs. These groups can be individually set to work with NPN (connect to zero control) or PNP (positive voltage control) -logic. The parameters are set digitally with a handheld EM-236 interface unit. With this unit the same settings (adjustments) can also be easily copied to multiple devices. Operation of the controller and some of its functional values can also be monitored with EM-236 interface unit.

TECHNICAL DATA (prog. EM-362D v2.1 / pcb version 362D)

Supply voltage nom. 12-36Vdc (abs. limits 10-45V)
Shutdown voltage 7.5V (start up 9.5V)
Overvoltage limit adjustable 15-45V
Idle current typ 20mA or 1mA shutdown input conn. to gnd
Motor current max. cont. 160A (at 50℃ amb. temp.)
Motor current max. 30s. 200A (at 50℃ amb. temp.)
Motor current max peak 5s. 300A (a start)
  -Motor currents are about 30% lower with 16kHz pwm freq.
Braking load current (pin 16) max cont 50A peak 100A
Current limit adjustable 1-255A
NOTICE! current limit is 20% boosted during start ramp.
Over temp. limit 100℃
Start and stop ramp adjustable 0-5s
PWM frequency 2kHz / 16kHz
Speed input scale (speed-2) 0-4.5V = 0-100% pwm
I-lim input scale 0-5V = 0-250A
Input control logic: high =4-30V, low=0-1V
Control input impedances typ. 10kohm
Control input response time typ 5ms.
Fault out. NPN open coll. max 42V / 0.5A
Fault in. actives Uin < 1V (NPN with 100k pull up)
Fan-output switch on 55℃, off 50℃
Fan-output NPN 12V 100mA
Rs-485 bus, halfduplex, Modbus RTU, 9.6/19.2 kbps
Brake output NPN max. 50A
Motor and supply connectors 16mm²
Control connectors 1mm²
Dimensions 180x122x height 52
CE-tested for industrial environment (EMC)
Operating ambient temp (Ta) -40...60℃
Weight 630g

EM-362D BLOCK DIAGRAM
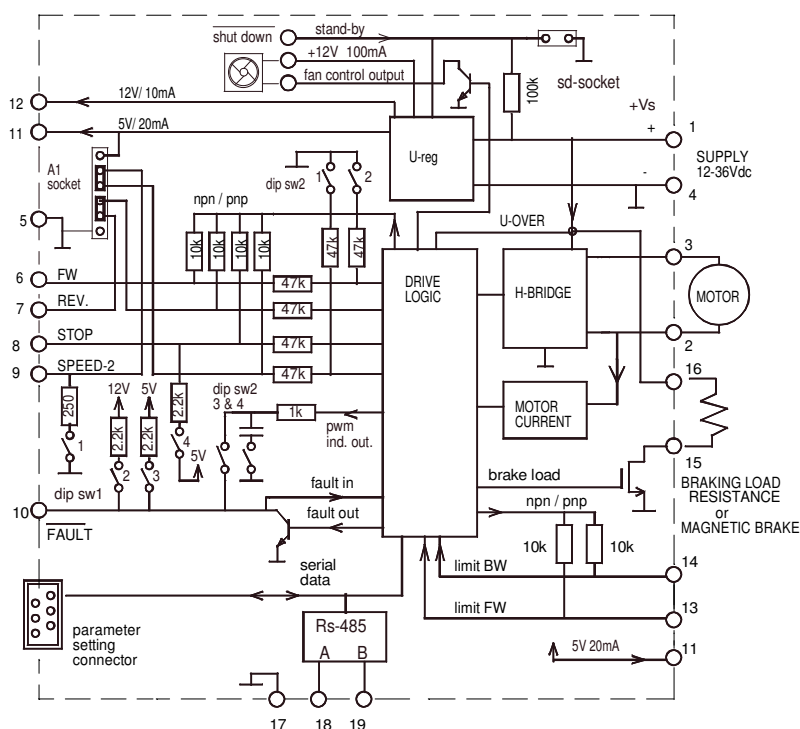
ELECTROMEN Oy   www.electromen.com

CONNECTIONS

Nominal supply voltage must be filtered DC of 12-36V,
and ripple should be less than 20% at full load.
Max supply voltage 45Vdc
CAUTION ! Wrong polarity can damage the unit.
CAUTION ! Unit doesn't have an internal fuse.
So if required, an external fuse should be added.
NOTICE ! thermal controlled FAN-out only in PCB
version -C v3 or later

ADJUSTMENT AND SETTINGS

Settings can be done with 2 interface device options.
1. EM-236 interface unit
2. EM-328 series interface units with EmenTool Lite
   PC-software (free download from our website)

SETTABLE PARAMETERS (EM-362D v2.1 defaults in brackets)

1 command mode: continuous = 0, impulse= 1 (0)
2 start condition combinations: 0-3 (1)
   0= start both direction after I-trip and Stop
   1= start only opposite direction after I-trip
   2= start only opposite direction after Stop
   3= start only opposite direction after I- and Stop
3 input logic combinations 0-7 PNP/NPN (0)
   PNP control with positive signal and input has pull down res.
   NPN control with negative signal and input has pull up res.
   N.C. = input resistor as above, but control signal is inverted
   0= cont. PNP, limits PNP   4=cont. PNP, limits PNP N.C.
   1= cont. NPN, limits PNP   5=cont. NPN, limits PNP N.C.
   2= cont. PNP, limits NPN   6=cont. PNP, limits NPN N.C.
   3= cont. NPN, limits NPN N.C.   7=cont. NPN, limits NPN
4 running speed-1: 0-100% / 0-100 (100)
   If analog speed input mode is select with parameter 5,
   then parameter 4 work analog input range adjust
5 control mode / running speed-2 preset 0-100% / 0-100 (50)
   0= Analog speed mode -1
      "speed 2-input" is used as analog 0-5V speed control input.
   1= Analog speed mode -2
      as above but FW direction is automatically "on" and
      BW input works as direction change input.
      FW input works as pause input
   2-100 = 2-speed mode (two digitally settable speed)
      speed-1 preset with param. 4 and speed-2 with param. 5)
6 current limit : FW   0-255A / 0-255 (30)
7 current limit : BW   0-255A / 0-255 (30)
   NOTICE! if both 6 & 7 is set = 0, then I-lim input is active
8 Trip combinations: 0-3 (1)
   0= no I-trip, no zero-current-trip
   1= only I-trip
   2= only zero-current-trip
   3= both I-trip and zero-current-trip
9 I-trip delay: 0-255ms / 0-255 (20)

10 Fault output combinations: 0-5 (1)
   0= I-trip and zero current won´t cause fault output signal
   1= only I-trip causes fault output signal
   2= only zero current causes fault output signal
   3= both I-trip and zero currenT causes fault output signal.
   4 = overcurrent indication
   5 = "run" indication = pull down when motor run

Limit inputs FW / BW

These inputs stop motor without ramp with dynamic
brake But in control mode "2-speed" dynamic brake
is enabled only when speed-2 is activated.
If motor has stopped with limit switch the dynamic
brake is at least 1s. active, also in case when
freewheel is selected.

FAULT in/out

This NPN input pull down when fault. Combination
can be selected with parameter 10.
If this input is pulled down with externally,
then it would disabled motor as long as pulled down.

SHUTDOWN input.

If this pin pull down then the idle current reduced
to 1mA. driver is disabled as long as this input is
pulled down. This input cannot use as emergency
input.

11 overvoltage limit: 15-65V / 15-65 (40) ! Not set higher than 45
   Overvoltage can be caused by load driving the motor or
   when braking the speed down but supply can not accept
   the current back from driver. Exceeding the limit will cause
   first the brake load switch on and if voltage still rise 10% as
   limit value the power stage set to free-wheel state.
   With a direct battery supply the brake current is charging the
   battery and the voltage will not normally rise.
12 load compensation: 0-255 / 0-255 (0)
   Load compensation (RxI) improves low speed and start
   torgue, but too high compensation achieve unstable running.
   Run motor at low speed (30%) Increace compensation
   with small steps until motor start behaviour unstable,
   then decrease value about 10%
13 timeout: 0-255s. / 0-255 (0=not in use) (0)
14 reset for start and hour-counter 0/1 (0)
    selecting 1 and push save = reset counters
15 start ramp: 0.05-5s / 5-500 (100)
16 stop ramp: 0.05-5s / 5-500 (100)
17 start kick 0-200ms / 0-200 (100)
   gives short 0-200ms full drive pulse for start
18- I-trip auto reversing 0-5s / 0-500 (0)
   Change automatically run direction when I-trip occurs
   the revesing time will select with this parameter
19- Freewheel options 0-3 (0)
   0= freewheeling when overvoltage
   1= freewheeling when overv. or stopped
   2= freewheeling when overv. or during stop ramp
   3= freewheeling when overv. or when stopped or during stop ramp
20- Pwm frequency 1=2kHz / 2=16kHz (1)
21- Current limit in braking 5-200A / 5-200 (50)
22- Pin-15 (brake load) options 0-2 (0)
   0= regen. braking = switch on when overvoltage exceed
   1= running indication = switch on pin-16 when motor run
   2 =as above but also stop input switch on pin-16
23 Serial port configuration, 1-8   (1)
   speed, parity, and number of stop bits
   1 =9600bps 8N1   5 =19200bps 8N1
   2 =9600bps 8N2   6 =19200bps 8N2
   3 =9600bps 8E1   7 =19200bps 8E1
   4 =9600bps 8O1   8 =19200bps 8O1
24 Modbus address 1-247 (1)

SPEED-2 input

This input activates speed-2 when 2-speed
mode is selected. In analog speed modes
this input work as speed set input

SERIAL PORT (red micromatch connector)

This is normally for parameter settings and
monitoring with Ementool program or
EM-interface units.
But there is also availability for open protol
control (Modbus)
This option has own instruction guide.

Rs-485 (Bus)

This port can be used with Modbus protocol
This option has own instruction guide.

FAULT-LED signal codes

1. power on	one blink
2. current on limit	led is lit
3. current trip	fast blinking...
4. zero-cur trip	long blink- short pause...
5. over voltage	4 x blink -pause...
6. over heat	short blink- long pause...
7. time-out	3 x blink + long blink...
8. fault input	2 x short + 1x long blink...

MONITORABLE VALUES

1 Motor current 0-255A (0-255)
2 PWM-level-% 0-100% (0-100)
3 hour counter (max.65535h)
4 start counter (max.65535)
5 carry counter for start counter
6 Braking current 0-200A (0-200)

HEIGHT 60mm

180
172
dia 4mm

SUPPLY
12-36V

FUSE

1 +Vs
2
3
4
M
0V

122
114

serial port:
parameter setting
connector for EM-236
or EM-328 interface units

shutdown out 12V Fan output

sd-socket

on rx

B
A Rs-485
GND

19
18
17

Attenuation for pin 9 = speed input range "off" =0-5V & "on" =0-10V
Attenuation for pin 6 optional analog input 0-10V if 2="on"
Analog 0-5V output option for pin 10 if 3 & 4 are "on"
NOTICE! standard prog. will not support dip-2 switches -2 -3 and -4

1
2
3
4
dip-2

Optional EM-A1 card socket
EM-AThis can be enable symmetric
±5V or ±10V control signal

Notice !
When installed EM-A1 card then
also set parameter 5=1

FAULT
LED

The input functions in brackets
can be activated with param. 5
0 = speed input
1 = speed input +dir + pause.

I -lim input activates to set
param 6&7= 0

14 limit BW
13 limit FW
12 +12V
11 +5V
10 FAULT
9   SPEED-2 (speed input)
8   STOP (I-lim input)
7   run REV. (dir.)
6   run FW (pause)
5   GND

BRAKE LOAD OUT

+Vs

stop input 22k bias (safety)
22kohm pull up to fault out
22kohm pull up to fault out
speed-2 input 25kohm

dip-1 on

1
2
3
4

15 16

External braking resistor 0.5 -10R
setting with par. 11 and 22. or
Magnetic brake, setting with par. 22