MOTION TECHNOLOGIES
PTY LTD

TECHNICAL SPECIFICATIONS

ELECTROMEN DC BRUSH MOTOR SPEED CONTROLLERS

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EM-170 DC-MOTOR CONTROLLER 12-24V 1.5A

FEATURES:

- 4-quadrants
- controlled direction change
- brake
- adjustable current limit
- acceleration and deceleration ramp
- dip-switch settable
- EMC-tested

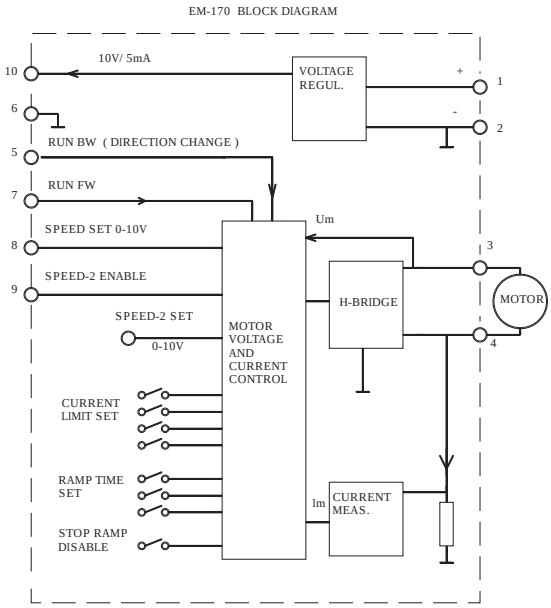
EM-170 motor controller is designed for small DC-motors. The controller operates in 4-quadrants, in other words it is possible to drive the motor in varible speed, change motor running direction and brake. The power stage operates with PWM-principle and has thus high efficiency.

Speed set value is given as analog voltage signal. Motor voltage is fed back to controller, so changes in operating voltage will not affect motor running speed.
10V regulated auxillary voltage can be used for speed set potentiometer reference voltage. 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	0-25V
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-170 BLOCK DIAGRAM



EM-170 OPERATING INSTRUCTIONS

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

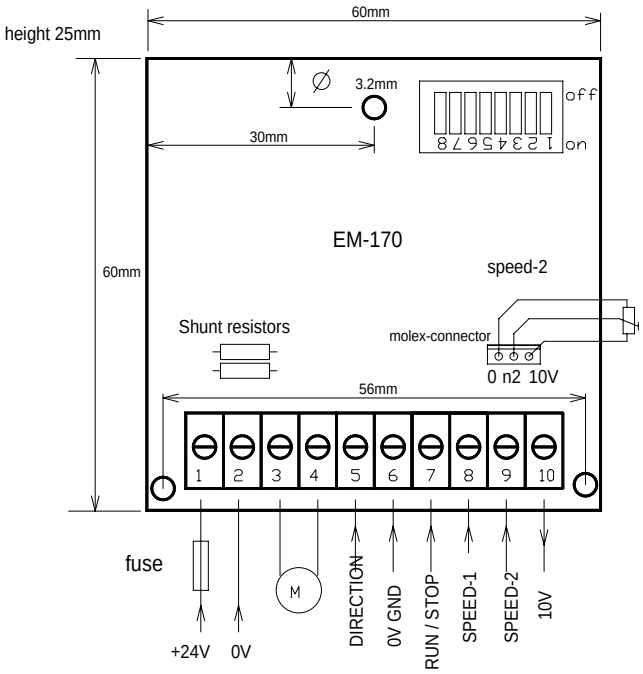
SETTINGS AND CONNECTING UNIT

Switch off power before connecting motor and power supply to EM-170. Prepare the control circuit. Set current limit and ramp time according to application.

Control input value 0-10V correspond to motor output 0-25V, so with a supply of 12V 0-5V will output 0-12.5V.
Speed-2 set value is connected to molex-connector. Scale is the same as with speed-1. 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.

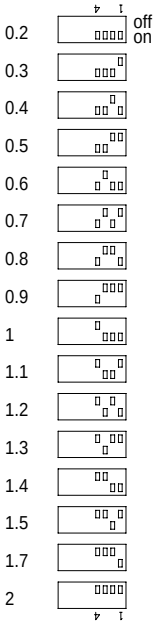
Control inputs can be used with switches, analog voltage or NPN outputs of a logic.
A voltage signal greater than 4V is logic 1, maximum input voltage 30V.
Forward input will start up the motor in forward direction.
Reverse input will start up the motor in reverse direction. When motor is already running 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).

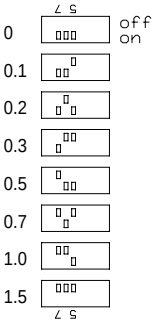


NOTE. With one shunt values will be halved.

current limit / A
dip-switches 1-4



ramp time / s
dip-switches 5-7

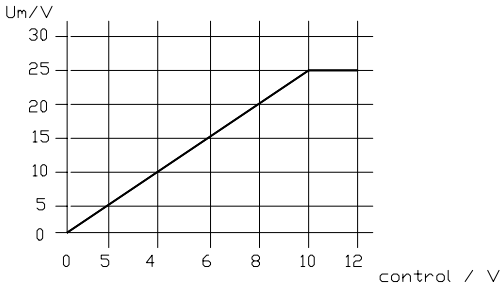


dip-switch 8

"off" = decel. ramp OFF

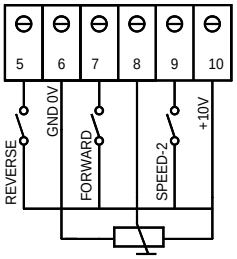
"on" = decel. ramp ON

control voltage / motor voltage



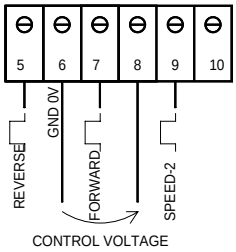
EXAMPLE 1

Speed set with potentiometer.
Speed-2 set with external trimmer.
Controls using switches.



EXAMPLE 2

Speed set with voltage 0-10V.
Speed-2 set with external trimmer.
Controls using 4-30Vdc signal.



EM-185A DC-MOTOR SPEED REGULATOR 12/24Vdc 3A

FEATURES:

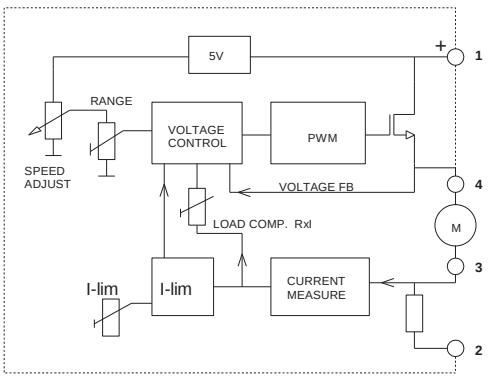
- **1-quadrant**
- **Panel mountable**
- **Small size**
- **Motor size 5-80W**
- **Good speed regulation**
- **Load comp. adjustable RxI**
- **Adjustable current limit**
- **EMC tested (CE marked)**
- **EM-185A replaces EM-185**
- **Changes in the wiring instruction**

EM-185A is a PWM-based DC-motor driver. The materials and features meet the industrial environment requirements. The device is CE marked and has been tested through EMC measurements required by industrial environment. Motor voltage is regulated against supply voltage changes, and there is also a load compensation (RxI) adjustment. Thanks to these features EM-185A offers good performance in motor speed control applications. The current limit and the rpm range are adjustable with trimmer potentiometers. EM-185A is easy to mount in a 10mm hole in an assembly panel.

TECHNICAL DATA

Supply voltage	12-24Vdc (10...35V)
Idle current max.	20mA
Motor current cont.	max 3A (Ta<50°C)
Motor current peak	max 6A (10s.)
Short circuit current	External Fuse
Current limit adj.	0.5-6A
PWM motor-frequency	25kHz
Motor and supply connectors	1.5mm
EMC	EN 50081-2
	EN 50082-2
Weight	75g
Operating temp (Ta)	0-60°C

EM-185A BLOCK DIAGRAM



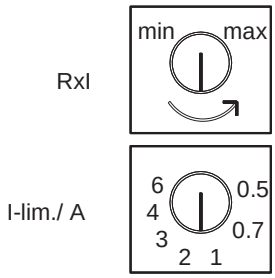
EM-185A OPERATING INSTRUCTIONS

Supply should be filtered 10-35Vdc,
max. ripple <20% on full load.

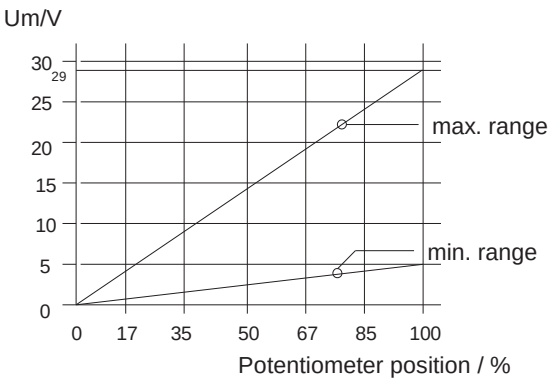
We recomended the use of fuse for supplyline.
Fuse max 6.3A

Current limit (I-lim) limits the motor current, in other words the motor torque. This adjustment is set according to the motor nominal current or within application.

RxI is always set to minimum in the beginning. After this set a motor rpm of 20-30%, slowly increase the compensation and try loading the motor simultaneously. When motor rpm is no longer affected by the loading, the compensation adjustment is in balance. If motor starts to twitch or accelerate when loading is applied, there is too much compensation.

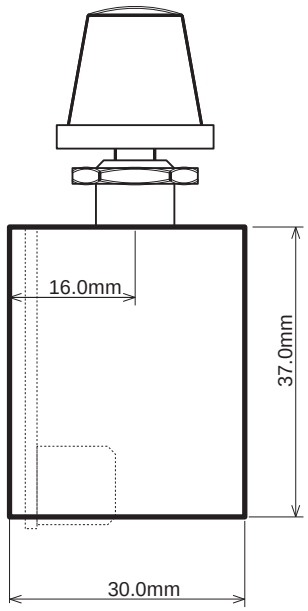


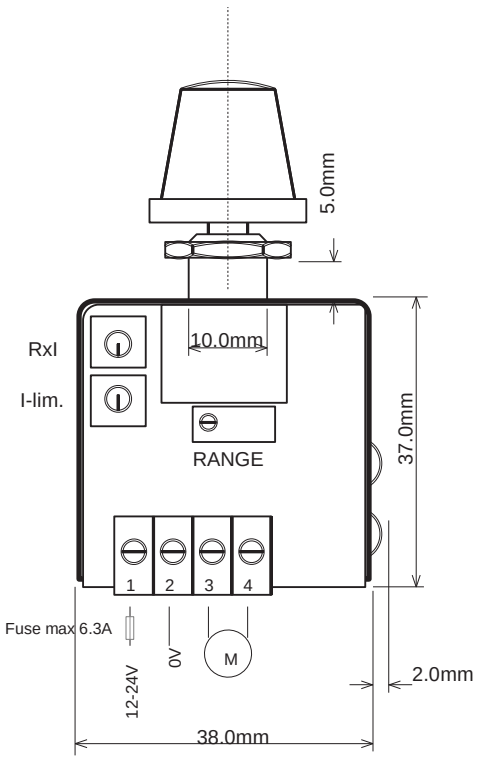
Potentiometer position / Motor voltage



Range is adjustable with range trim

0% = potentiomer full counter clockwise
100% = potentiometer full clockwise





EM-28 DC-MOTOR CONTROL UNIT 12-24V 3A

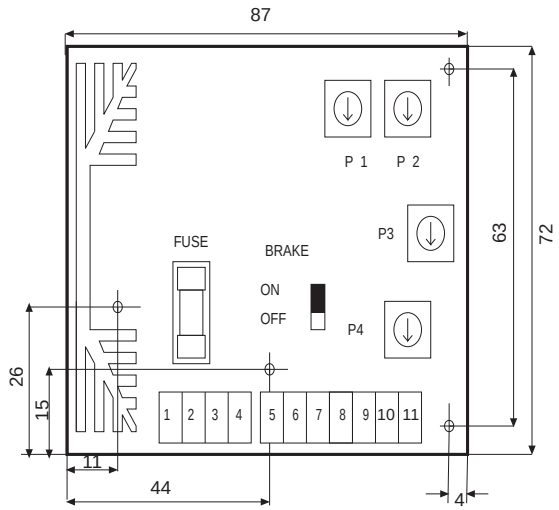
FEATURES:

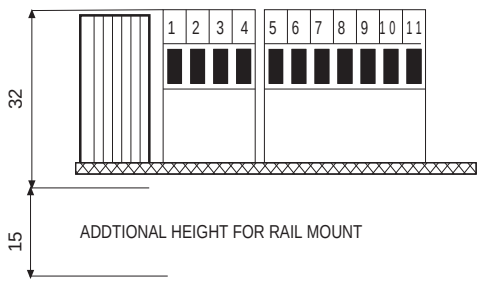
- **4-quadrative operation**
- **Continuous / 2-step speed control**
- **Adjustable current limit**
- **Logic inputs for presettable speed**
- **RI-adjust for load compensation**
- **Selectable rundown mode, braking / flywheeling**
- **High efficiency**
- **Din-rail mountable**

EM-28 is designed for modern automation systems. Controls can be performed easily with relay- or open collector -outputs. Analog controls work with positive voltage. Usable motor can be permanent magnet motor with brushes in power range of 5 ... 60 W. Due to the advanced pulse control (PWM) the unit operates with high efficiency, low temperature losses and provides a high starting torque.
Loading of the motor can be compensated with inbuilt RI-adjustment. The current, or in other words, the torque of the motor can be controlled with I-trim or with external control. The operation of the current limit is indicated with red led. The 2 preselectable rotating speeds can be adjusted with 2 control level trims P3 and P4. Alternatively P4 is the max.level adjustment when the analog control is used. In braking the unit leads the energy to the internal resistor of the motor. Braking can be disabled.

TECHNICAL DATA:

Supply voltage	12...32 Vdc
Max. load	3A (RMS) mom 6A (5s)
Operating frequency	approx. 30 kHz
Control pot.meter	1 ... 10 kohm
Recommended fuse	max. 5A, slow
Voltage loss /V	0.5+0.7*Im
Input impedances	> 10 kohm. Pins 6-10
Analog controls	
Pin 8 speed	0 ... 5 V => 0 ... 25 V
Pin 6 current	0 ... 5 V => 0 ... 6 A
Digital controls	
Pin 7,9,10	“on” < 2 V / closed
	“off” > 4 V / open
Operating temp.	0...50 °C
Dimensions	87*72*32 mm
Weight	about 200 g





EM-28 OPERATING AND CONNECTION INSTRUCTIONS

INTRODUCTION
Always disconnect supply before making connections. Operating voltage must be filtered DC-voltage with less than 25 % ripple at full load.

ADJUSTMENTS
Set all trims to the middle position. With analog control the maximum running speed is set with trim P4. When using the 2-step speed adjustment set the “fast” speed on (pin 9). Adjust the running speed to desired value with trim P4. Then change to the “slow” speed on (pin 10) and adjust the running speed to desired value with trim P3.

The current limit adjustment is linear between 0 ... 6 A. The set value can be approximately determined from the position of the trim. When more precise adjustment is needed a current meter must be connected to motor circuit. The operation of the current limit is indicated with red led light. During the load compensation adjustment (P1) the load of the motor should be adjusted while observing the speed changes of the motor running speed. The compensation can be increased to point where the motor starts to twitch. Twitching is a sign of over compensation. The compensation adjustment has a slight effect on the running speed settings.

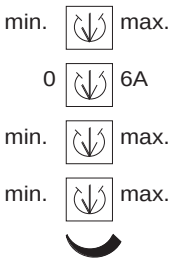
ADJUSTMENTS

P1 LOAD COMPENSATION

P2 CURRENT LIMIT (IF NO EXT. CONTROL)

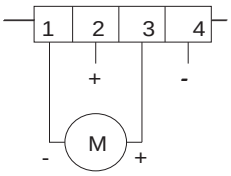
P3 PRESETTABLE SPEED “SLOW”

P4 PRESETTABLE SPEED “FAST”
OR MAX. LEVEL LIMIT



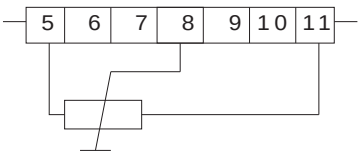
CONNECTIONS

1 MOTOR - (MINUS)
2 SUPPLY VOLTAGE 12 ... 32 V
3 MOTOR + (PLUS)
4 SUPPLY VOLTAGE (GND)
5 CONTROL VOLTAGE 0V (GND)
6 CURRENT LIMIT INPUT
7 DIRECTION CHANGE
8 SPEED CONTROL INPUT
9 SELECTION OF PRESET SPEED (FAST)
10 SELECTION OF PRESET SPEED (SLOW)
11 +5.5 V REFERENCE OUTPUT MAX. 50 mA



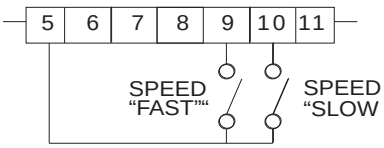
CONNECTION OF MOTOR
AND SUPPLY

SPEED ADJUSTMENT
WITH POTENTIOMETER



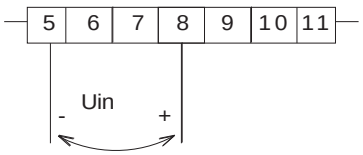
POT 1...10kohm
MAX. SET WITH TRIM P4

SELECTION OF PRESET SPEED
WITH SELECTION CONTACT



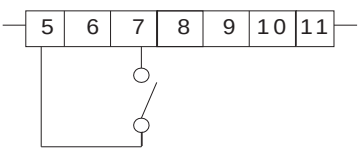
“FAST" IS SET WITH TRIM P4
“SLOW" IS SET WITH TRIM P3

SPEED ADJUSTMENT
WITH VOLTAGE SIGNAL



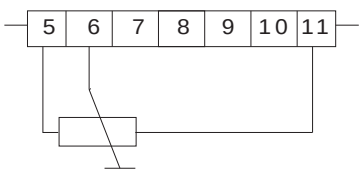
CONTROL 0 ... 5 V
MAX. SET WITH TRIM P4

DIRECTION SHIFT



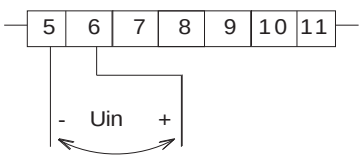
“FORWARD” OPEN OR VOLTAGE > 4 V
“RESVERSE” CLOSE OR VOLTAGE < 2 V

ADJUSTMENT OF TORQUE
(CURRENT) WITH POTENTIOMETER



POTENTIOMETER 1...10 kohm
TRIM P2 TO POSITION MIN

ADJUSTMENT OF TORQUE
WITH VOLTAGE SIGNAL



CONTROL 0...5 V
TRIM P2 TO POSITION MIN.

EM-67 DC-MOTOR CONTROLLER 24V 3A

FEATURES:

- **Direction change**
- **Braking**
- **Continuous / 2-step speed control**
- **Adjustable acceleration / braking ramp**
- **Adjustable current limit**
- **Adjustable load compensation**
- **Supply voltage variation compensated**
- **High efficiency**
- **Self recovery fuse**
- **Rail mountable**

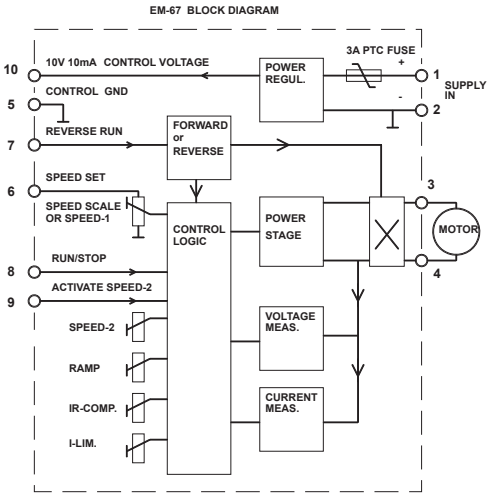
EM-67 DC-motor controller is designed for 24V permanent magnet motors with brushes in the power range of 5-70W (0,2-3A). Due to advanced PWM-controlling the unit runs with high efficiency and low thermal loss. The braking energy is fed to a power resistor.

The output voltage of the unit is regulated so that changes in supply voltage won't affect the motor speed. Additionally the unit has RI-compensation, that can be used to minimize motor speed changes in changing loading situations.
The required amount of RI-compensation depends on the motor used and is set with a trim. With this feature, a good motor speed versus control voltage ratio can be reached. Speed adjustment can be made with potentiometer or voltage signal. Alternatively the unit can also be used in two speed mode. In this case the speeds are set with trimmers on the card, and activation is done with switch or control voltage. The unit gives additional 10V for potentiometer and control switches.

Acceleration / braking ramp can be adjusted depending on the situation, this feature gives controlled and smooth direction change. Direction change can be controlled with either switch or control voltage.
The psupply inputos protected against overcurrent and reversed polarity using a self recovery fuse. EM-67 is EMC-tested and meets heavy industry standards.

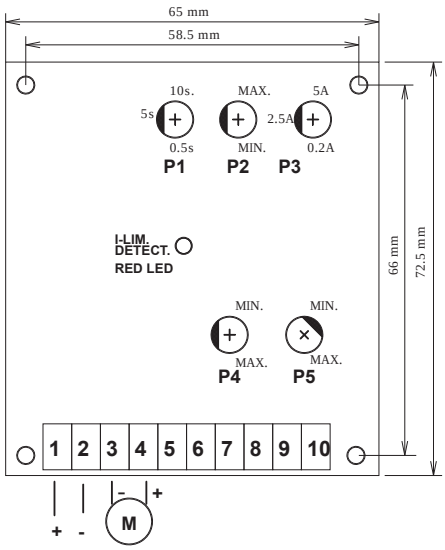
TECHNICAL DATA:

Supply	20...34 Vdc
Idle current	approx. 40mA
Control voltage	0...5V / 0...10V
Control current	3A rms / 5A mom
Control power	70W rms
Braking power	30W (1/10 duty cycle)
Voltage loss	1V @ Im=3A
Current limit	0.2...5A
Fuse	3A self recovery
Ramp	0.5...10s
Control potentiometer	1...10kohm
Digital control	"on" @ Uin=4...30V
	"off" @ Uin=0...1V or open
EMC-testing	EN 50081-2 & 50082-2
Dimensions	65x72x30mm
Weight	approx. 70g



EM-67 OPERATING AND CONNECTION INSTRUCTIONS

Supply voltage must be DC-voltage 20...34V (recommended 26...32V) with less than 20% ripple. At first set all trims to the middle position, except P5 in the minimum position.



1. Supply 20-34Vdc
2. Supply GND 0V
3. Motor (-)
4. Motor (+)
5. Control GND 0V
6. Speed control input
7. Direction change +run
8. Run / Stop.
9. Switch preset speed2
10. Additional voltage 10V 10mA

ADJUSTMENTS

P1 RAMP
Use trim to set acceleration and braking ramp. Adjustment range is 0.5...10s.

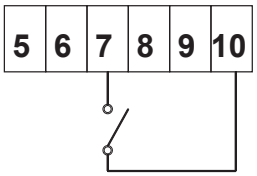
P2 SPEED SET FOR SPEED2
Use trim to change the preset value of speed2. Adjustment range is 0...100%.

P3 CURRENT LIMIT
Use trim to set the maximum current of the motor. A red light indicates the activation of the current limit. Adjustment range is 0.2...5A

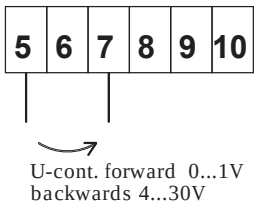
P4 CONTROL RANGE
Use trim to set the desired control range. The minimum range is 0...5V and maximum 0...50V. Also used for speed1 without potentiometer.

P5 LOAD COMPENSATION (RI)
Use trim to compensate the load affecting the motor speed. Compensation level can be increased until the motor starts to twitch. Set the initial value to the minimum.

Direction change can be added to following examples if needed. Note that direction change also starts the motor.

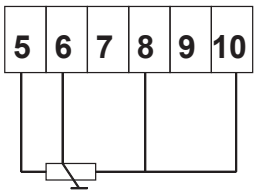


Direction change using control voltage. Can be used with other examples if needed.

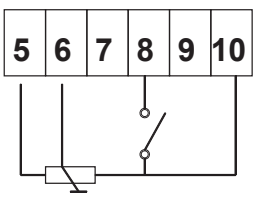


U-cont. forward 0...1V
backwards 4...30V

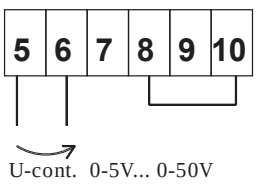
Speed set using potentiometer. Scale range with trim P4.



Speed set using potentiometer, activation using run/stop switch.

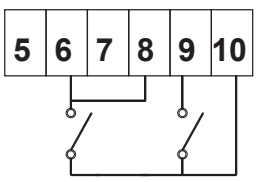


Speed set using voltage signal.



U-cont. 0-5V... 0-50V

Two speed mode.
Speeds are set using trims P2 (pin9) and P4 (pin6).
Activation using switches.



EM-75 DC-POWER CONTROLLER 12 - 30V 3A

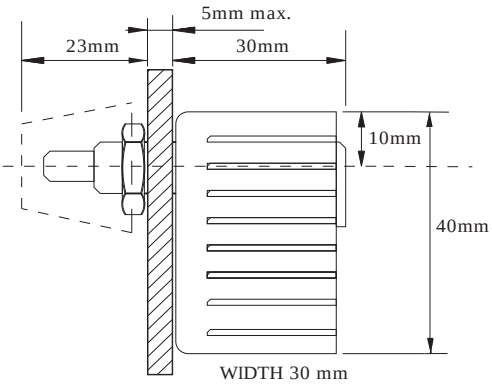
FEATURES:

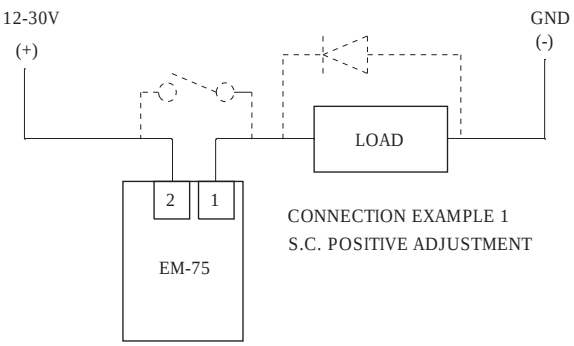
- Load regulated adjustments
- Adjustable base level
- Two wire connection
- Small size
- High efficiency > 90 %
- Wide power range 0.5 - 80 W
- EMC -tested (no radio frequency interference)
- Panel mountable

EM-75 is a low voltage DC-power control unit. Unit is connected in series with the load. Load can be any resistive load as light bulbs and resistors, with auxiliary diode even inductive loads as solenoids, valves and motors can be controlled as well. The power is adjusted with pulse ratio method (PWM) which permits high efficiency. The change of load does not have any effect on the adjustments. As an example, if part of the bulb load is turned off it does not effect the brightness of the rest of the light bulbs. This is supposing that the operating voltage does not change. The operating voltage can be DC-voltage or pulsating DC-voltage. The unit can be connected to + or to the - side of the load. The controller can be by-passed for light bulb tests. Power stage is protected against voltage surges, overloads and short circuits. Even the incorrect polarity does not damage the unit. EM-75 causes no interferance on the radio frequency.

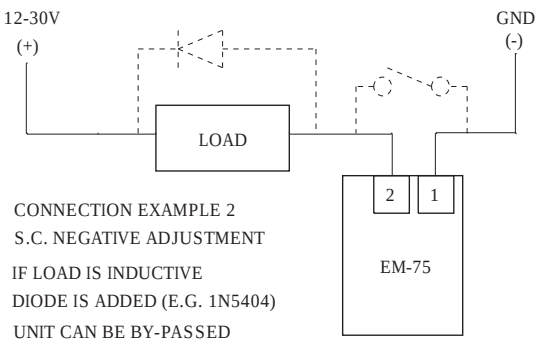
TECHNICAL DATA:

Supply	12...30 Vdc
Idle current	< 3 mA
Load capacity	3 A max.
Load	0.5 ... 80 W
Adjustment range	0 ... 98 %
Base level adjustment	0 ... 30 %
Operating frequency	approx. 250 Hz
Efficiency	> 90 %
Oper. ambient temp.	0...60 °C
Dimensions	40*30*30 mm
Weight	60 g





CONNECTION EXAMPLE 1
S.C. POSITIVE ADJUSTMENT



CONNECTION EXAMPLE 2
S.C. NEGATIVE ADJUSTMENT
IF LOAD IS INDUCTIVE
DIODE IS ADDED (E.G. 1N5404)
UNIT CAN BE BY-PASSED
WITH TEST SWITCH

EM-76 DC POWER CONTROLLER

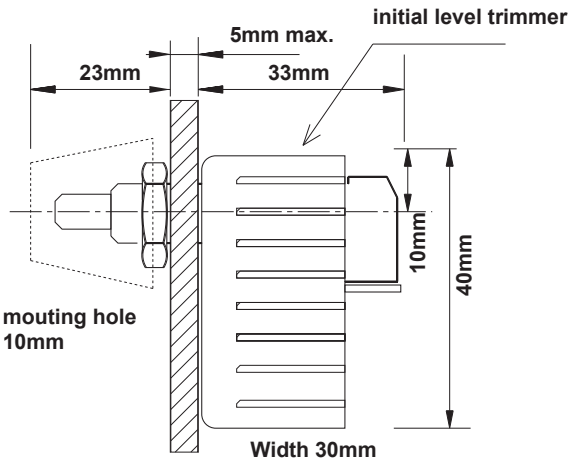
FEATURES:

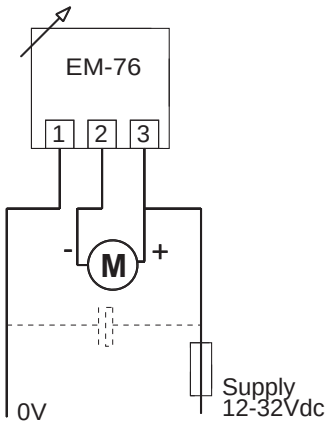
- **Panel mounted**
- **Adjustable initial level**
- **For inductive loads (motor / coils)**
- **Small size**
- **High efficiency >90%**
- **Power range 2-100 W**
- **EMC-tested (CE)**
- **Overload and short circuit protected**

The EM-76 is a panel mounted power controller for DC motors up to 100 Watts with a supply voltage of 12-24 Vdc. In order to achieve high efficiency the PWM principle is used. A suitable supply voltage is filtered DC and where the ripple is less than 20%. If the supply cable is longer than five meters a capacitor close to the regulator is recommended. The max. output power is dependent on the installation i.e. free air or enclosed resulting in amount of heat developed (There are examples in the tech specification). The power is adjusted by the potentiometer on the front, and the initial level set by the trimmer behind the panel. The device is installed through a 10 mm hole and held in place with a nut. The output is protected against spikes, overload and short circuit, it can also withstand reverse polarity as long as the recommended fuse is used. The EM-76 is EMC tested according to the industrial standards EN 50081-2 and EN 50082-2

TECHNICAL DATA

Supply voltage	12-32 Vdc
No load current	< 25m A
Fuse	< T6.3 A
Max output power	3.0 A (installed to plastic panel.)
	3.5 A (free air)
	4.0 A (installed to metal panel.)
Control range	0-99 % (of supply voltage)
Initial level	0-16 %
Output frequency	typ. 21 kHz
Efficiency	> 90 %
Ambient temperature	-10...50 °C
Dimensions (mm)	40 x 33 x 30
Weight	60 g





CONNECTION EXAMPLE

-Fuse should be chosen according to the application. Maximum value T6.3A
-If supply cables longer than 5 m the capacitor 220uF 35V close to controller is recommended.

EM-101 DC-MOTOR CONTROLLER 24V 3A 4-QUAD

FEATURES:

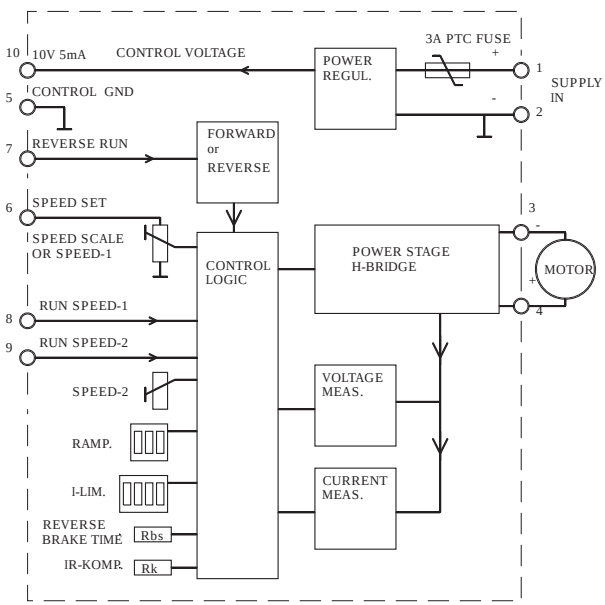
- 4-quadrant
- Protection with self recovering fuse
- Settable current limit
- Settable acceleration/brake ramp
- Load compensation
- Special braking options
- Supply voltage compensation
- Continuous / 2-step speed controlling
- Positive driving logic
- Mounting with DIN-rail or screws
- High efficiency

EM-101 is designed for modern automation systems. Controls can be performed easily with relay- or open collector-outputs. Analog controls work with positive voltage. Usable motor can be permanent magnet motor with brushes in power range of 5 ... 70 W. Due to the advanced pulse control (PWM) the unit operates with high efficiency, low temperature losses and provides a high starting torque.
Loading of the motor can be compensated with inbuilt RI-adjustment. The current, or in other words, the torque of the motor can be controlled with DIP-switch. The operation of the current limit is indicated with a red led.
There are a variety of braking options available in this device. For most effective braking “reverse braking”-mode can be used. In this mode reversed driving is used for braking, which effects extremely fast function. Additionally the card utilises short circuit braking which short circuits the motor circuit during the braking.
EM-101 also has inbuild settable time acceleration- and braking ramps.

TECHNICAL DATA EM-101

Supply voltage	20-34Vdc
Over voltage protection	36V
Idle current	app. 50mA
Control current	3A, mom. 4A
Control power	70W
Current limit	0,2...4.2A
Voltage loss	1V when Im=3A
Fuse	3A, self recovery
Ramp	0,5s...5s
Control voltage	0-5V, 0-10V
Control pot.meter	2...10kohm
Digital control	“on” when Uin 4-30V “off” when Uin=0-1V or NC
Dimensions	89x73x26
Weight	app. 70g

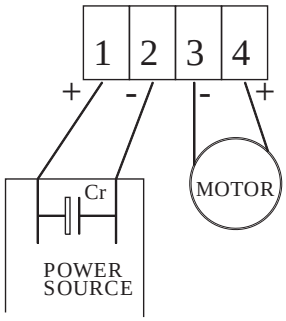
EM-101 BLOCK DIAGRAM

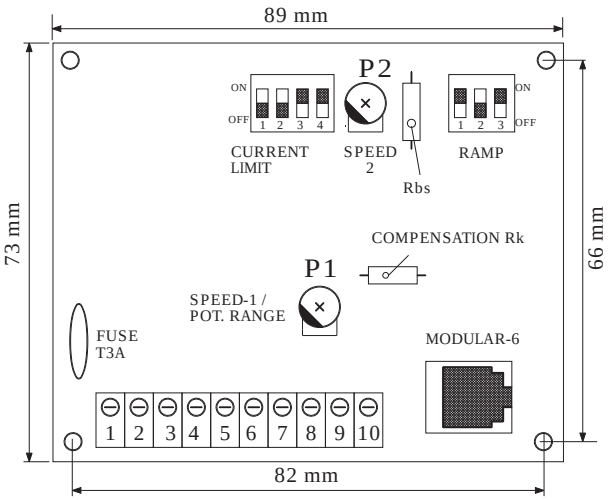


EM-101 INSTRUCTIONS

Supply voltage must be DC with ripple less than 20%. Supply voltage 20...34V (26...32V recommended). In the beginning set all trimmers in the middle position.

NOTE! When reversed braking is used the controller will take a very high current peak. Capacitor for the power supply should be at least 4700uF at 1A.

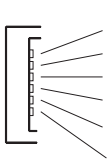




CONNECTORS:

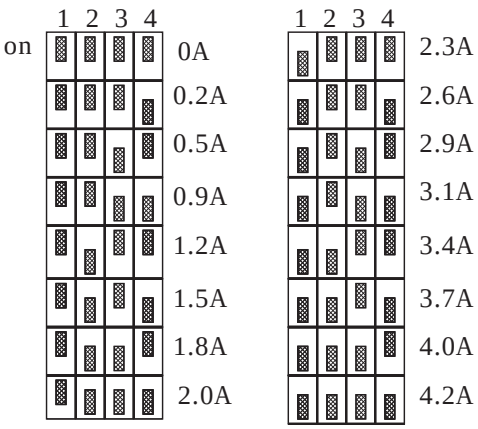
1. Supply voltage 20-34Vdc
2. Supply voltage GND 0V
3. Motor (-)
4. Motor (+)
5. Control GND
6. Controlling voltage
7. Reverse/driving direction
8. Run speed1 (potentiometer)
9. Run speed2
10. Helping voltage for potentiometer (10V, 5mA)

MODULAR-6 CONNECTOR



THE CURRENT LIMIT

Limitation of the current (torque)
Controlled with DIP-switches



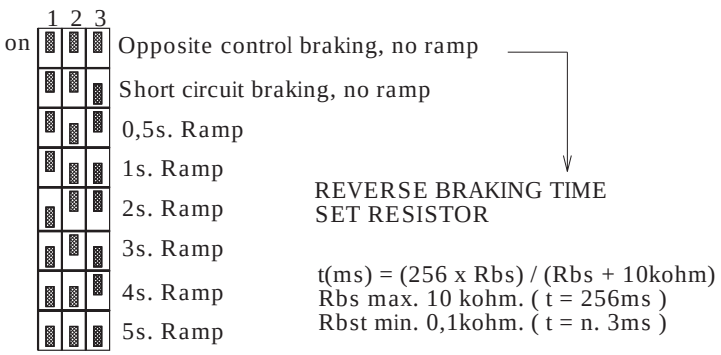
THE COMPENSATION

With compensation you can compensate the load effect to motor rpm. This feature increases controlling if current increases in the motor circuit. The need for compensation depends on application and motor. Typically small motors require more compensation than big ones. Over compensation occurs as twiching of the motor.

Example:
The smaller resistor the bigger compensation.
Typical settings: motor < 10W Rk= 50...500ohm
motor > 10W Rk= 200...2000ohm

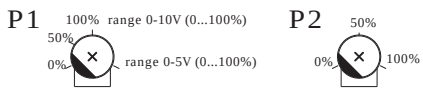
THE RAMP & BRAKING

In the map below the first two ramp settings are special braking options. The first position is so called reverse braking; the motor is controlled in opposite direction. Reverse braking time is set with resistor (rbs). The second position is so called short circuit braking where the motor circuit is short circuited during the braking. Other positions are for normal acceleration and braking settings which are set with DIP-switches.



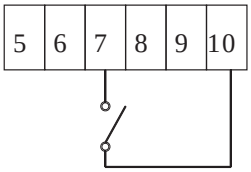
THE CONTROLLING

The max value of controlling voltage ranges 5...10V. The full range is thus maintained on 0...5V. The range can be set with trim P1. When driving with double speed controlling (run / set) the driving speed is set with trim P1 and the setting speed with trim P2.

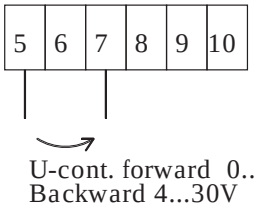


EM-101 CONNECTION EXAMPLES

Direction change
/reverse drive.

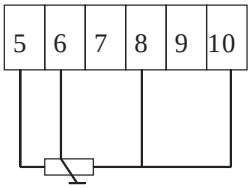


Direction change/reverse drive
with voltage.

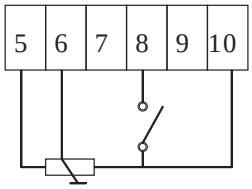


U-cont. forward 0...1V
Backward 4...30V

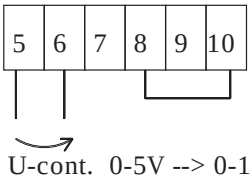
Speed adjustment with pot.meter.
Range scaling with trim P1.



Speed control with pot.meter,
activate with run speed1-
switch.

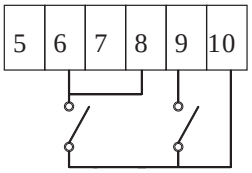


Speed control with voltage
signal.
Range scale with trim P1.

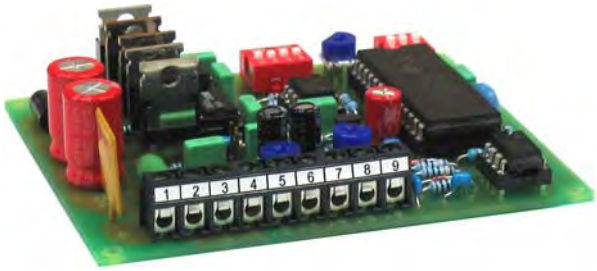


U-cont. 0-5V --> 0-10V

Double speed control.
Speeds set with trimmers
P2 (s2, pin9) and P1
(s1,pin6)
Activate with switches.



EM-101-BI MOTOR CONTROLLER 24V 4A 4-QUAD



FEATURES

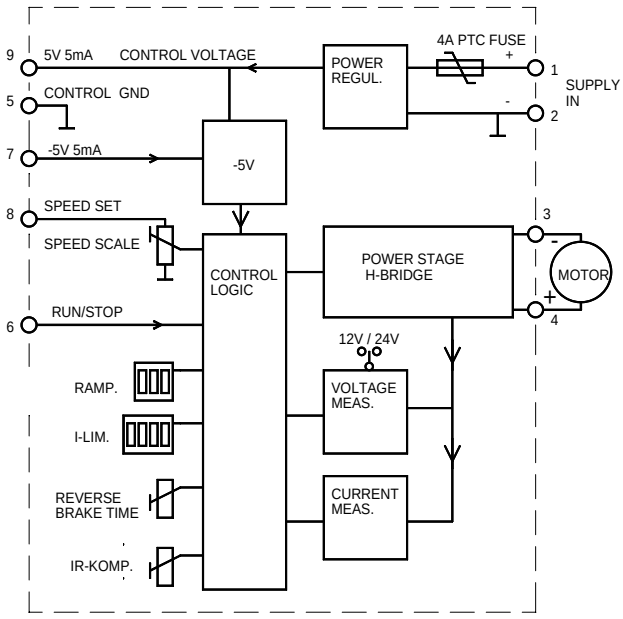
- 4 Quadrants
- Self recovery fuse
- Adjustable current limit
- Adjustable accel./braking ramp
- Load compensation
- Special braking options
- Supply voltage compensation
- Speed control ±10V (±5V)
- Positive control logic
- Mounting with DIN-rail or screws
- High efficiency

EM-101-BI is designed for modern automation systems. Controls can be performed easily with relay- or open collector outputs. Analog controls work with ±10V voltage. Usable motor can be permanent magnet motor with brushes in power range of 5...80 W. Due to the advanced pulse control (PWM) the unit operates with high efficiency, low temperature losses and provides a high starting torque.
Loading of the motor can be compensated with inbuilt RI-adjustment. The current, or in other words, the torque of the motor can be controlled with DIP-switch. The operation of the current limit is indicated with a red led.
There are a variety of braking options available in this device. For most effective braking “reverse braking”-mode can be used. In this mode reversed driving is used for braking, which effects extremely fast function. Additionally the card utilises short circuit braking which short circuits the motor circuit during the braking.
EM-101 also has inbuild settable time acceleration- and braking ramps.

TECHNICAL DATA

Supply	12-34Vdc
Over volt. protect.	36V
Idle current	approx. 50mA
Control current	4A continuous, 5A max.
Control power	80W continuous
Motor voltage	0-15V (12V range)
	0-29V (24V range)
Current limit	0.3...5A
Voltage loss	1V when Im=4A
Fuse	4A self recovery.
Ramp	0,5s...5s
Control voltage	-5...0...5V -->-10...0...10V
Control pot.	2...10kohm
Digital cont.	"on" when Uin 4 -30V
	"off" when Uin 0-1V or open
Dimensions	89x73x26mm
Weight	approx. 70g

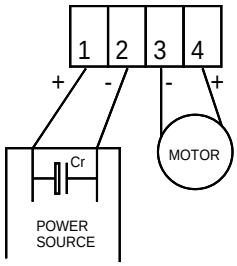
EM-101-BI BLOCK DIAGRAM

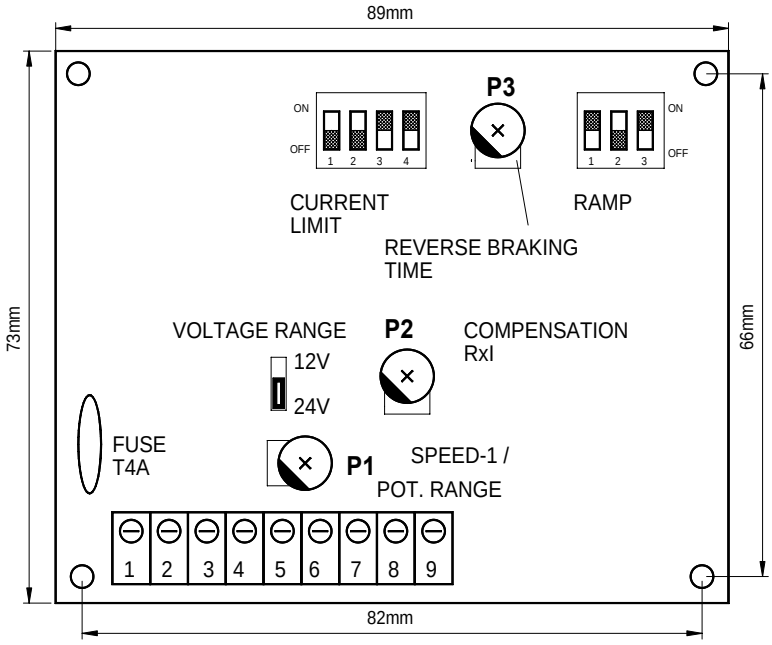


OPERATING INSTRUCTIONS EM-101-BI

Supply voltage must be DC with ripple less than 20%. Supply voltage 12...34V. In the beginning set all trimmers as shown in lay-out picture. Choose 12 / 24 according to the supply used.

NOTE! When reversed braking is used the controller will take a very high current peak. Capacitor for the power supply should be at least 4700uF at 1A.

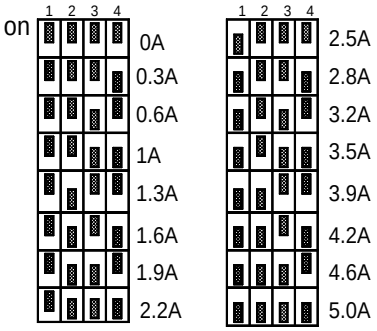




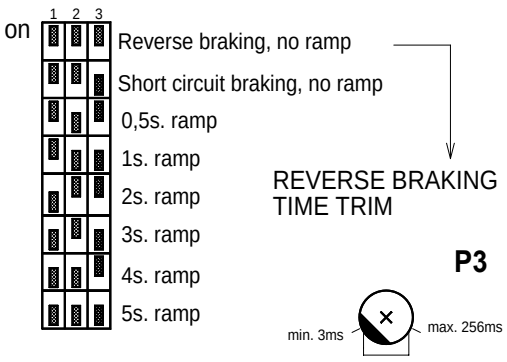
CONNECTORS

1. Supply 12-34Vdc
2. Supply GND 0V
3. Motor (-)
4. Motor (+)
5. Control GND 0V
6. Run / (Stop)
7. -5V Aux. voltage out (5mA)
8. Reference voltage in
9. +5 Reference out (5mA)

CURRENT LIMIT
Limitation of the current (torque)
Controlled with DIP-switches.

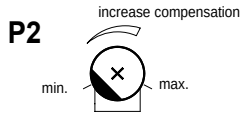


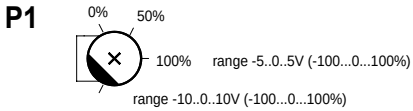
THE RAMP & BRAKING
In the map below the first two ramp settings are special braking options. The first position is so called reverse braking; the motor is controlled in opposite direction. Reverse braking time is set with trim P3. braking where the motor circuit is short circuited during the braking. Other positions are for normal acceleration and braking settings which are set with DIP-switches.



COMPENSATION
With compensation you can compensate the load effect to motor rpm. This feature increases controlling if current increases in the motor circuit. The need for compensation depends on application and motor. Typically small motors require more compensation than big ones. Over compensation occurs as twiching of the motor.

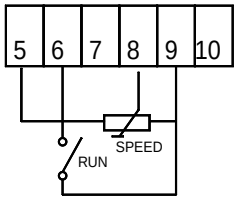
CONTROLLING
The max value of controlling voltage ranges ±(5...10V). The full range is thus maintained on 0...5V. The range can be set with trim P1.



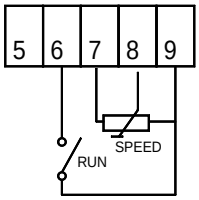


EM-101 CONNECTION EXAMPLES

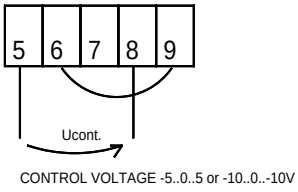
One direction drive.
Speed adjustment with potentiometer.



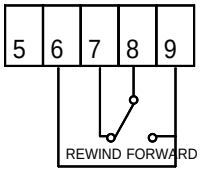
Two direction drive.
Speed and direction control with potentiometer.



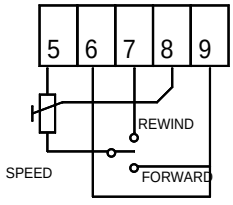
Two direction drive with voltage signal.
Run continuous on.



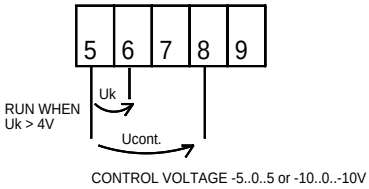
Two direction drive with switch.
Run continuous on.



Two direction drive with switch.
Speed with external potentiometer.
Run continuous on.



Two direction drive with voltage signal,
run with voltage control.



EM-174A DC-MOTOR DRIVER 12/24Vdc 8A

FEATURES:

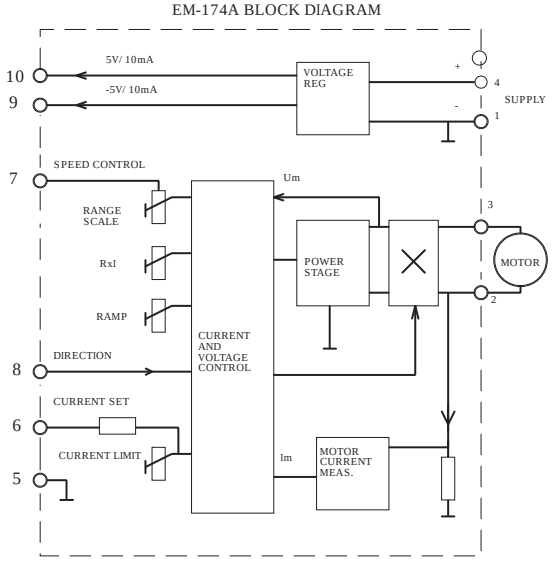
- Bidirectional
- No brake
- Controlled direction change
- ± 10 V or 0...10 V control
- Soft start ramp
- Adjustable current limit
- Load compensation
- High efficiency
- High peak loading
- Rail base fittable

EM-174A motor driver is designed for DC-motor speed control. The unit regulates motor voltage so non regulated supply voltage is well suited. A load affecting the motor rpm can be compensated with an adjustble load compensation (RxI). Potentiometer or direct voltage signal can be used to give the speed control value. Rotation direction changes when control value turns negative or if control signal is applied to direction input. The unit has reference positive and negative signal for potentiometer use, in other words potentiometer can also be used to drive both directions, motor stops at potentiometer middle position. Set value range can be scaled with range trim.
At direction change the controller waits for motor to stop before driving in opposite direction. This avoids current peaks at direction change. The current limit can be set with a trim or direct voltage signal to protect the motor and mechanics in jam situations. Startup speed can be limited with so called ramp, which slowly rises the motor voltage in a desired way. Ramp time is set with a trim.
EM-174A can be optimised for 12 or 24 V supply use.

TECHNICAL DATA

Supply	12-32 Vdc
Over voltage protection	40 V
Idle current	app. 30 mA
Driving current	8 A continuous (Ta<50°C) 12 A peak (50 / 50 %)
Motor voltage	0-15 (12 V setting) 0-29 (24 V setting)
Current limit	adj. 0-12 A
Cur. lim. volt. control	0-5 V (0-12 A)
Ramp time	adj. 0-3 s
Voltage loss	1 V (Im=8 A)
Operating frequency	25 kHz
Aux. voltages	-5 V and +5 V (10 mA)
Control pot.	1-50 kohm
Control volt. range	±5 V or ±10 V 0-5 V or 0-10 V
Direction change	“backwards” @ Uin = 4-30 V “forward” @ Uin = 0-1 V or open impedance 10 kohm
Operating temp (Ta)	-20...+70°C
Dimensions	(65x73x30) mm
Weight	approx. 80 g

EM-174A BLOCK DIAGRAM

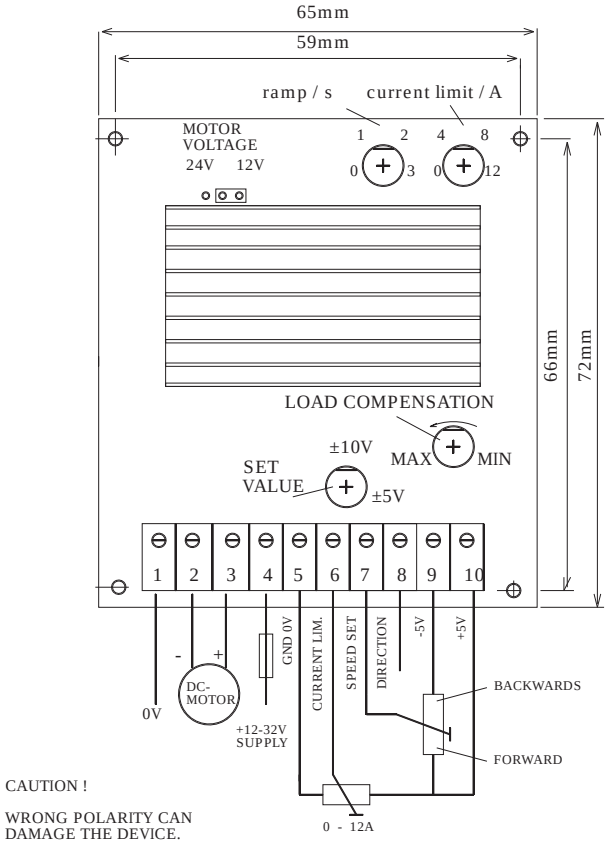


EM-174A OPERATING INSTRUCTIONS

Supply should be filtered 12-32Vdc,
max. ripple <30% on full load.
ATT. Wrong supply polarity can damage the driver.
ATT. Driver has no internal fuse.

SETTINGS AND ADJUSTMENTS

Set all trims to center position. Choose motor voltage range: with <15 voltages choose 12 V and with greater voltages choose 24 V range.
Speed set value can be given with potentiometer or using a direct voltage signal 0-5 V ... 0-10 V.
Acceleration and deceleration ramp is set with trim. In 0-3 s time unit drives from zero to full speed or from full speed to zero.
Compensation adjustment: set motor on to a low rpm, add compensation until motor starts twiching and then reduce compensation until twitching ends. After this motor loading can be tested for steady motor run.
Current limit can be set to 0-12 A, current limit can also be set using direct 0-5 V voltage signal or potentiometer. If the external control is used, turn the inbuilt current limit trim to 0-position.



CAUTION !

WRONG POLARITY CAN DAMAGE THE DEVICE.

CHOOSE FUSE ACCORDING TO USE (1-16 A)

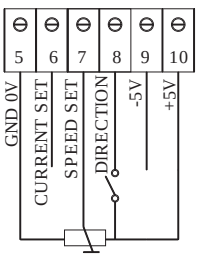
EXAMPLE 1 (BESIDE)

SPEED, DIRECTION AND CURRENT ARE SET WITH POTENTIOMETERS.

EXAMPLE 2

SPEED CONTROL WITH POTENTIOMETER.

DIRECTION CHANGE WITH SWITCH.



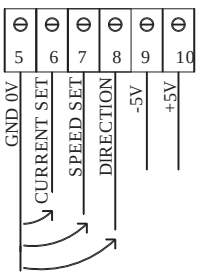
EXAMPLE 3

CONTROLS WITH VOLTAGES

ALL VOLTAGES WITH RESPECT TO GND (0 V)

CURRENT 0-5 V (0-12 A)
SPEED 0-5 V OR 0-10 V
±5 V OR ±10 V
DIRECTION 4-30 V = BACKWARDS

NOTICE!! IF CURRENT CONTROL IS USED, TURN CURRENT LIMIT TRIM TO MIN POSITION.



EM-12A PWM DC-MOTOR CONTROL UNIT 24V 8A 200W

FEATURES:

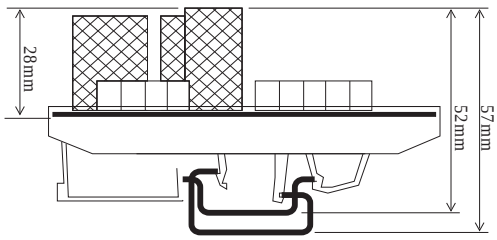
- Continuous power regulation and controlled direction change
- Adjustable current limit, acceleration ramp and max. power limit
- Load short circuit protected
- CB-mode for increased starting torque
- High efficiency, small size
- Controllable with potentiometer, switch or voltage signal
- Rail mounting base available

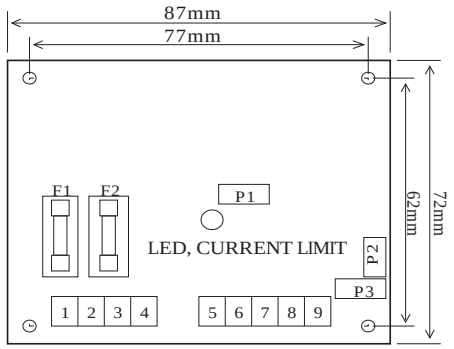
EM-12A DC-motor control unit is designed for use in industry and automation applications in power range of 0...200 W. With EM-12A DC-motor can be controlled easily and economically.
EM-12A includes many adjustments and various connection choices. Inbuilt protection features increase the reliability of use. CB-function (current boost) eliminates motor rushing if started with load.
EM-12A can be controlled continuously with one potentiometer forward/stop/reverse or the control can be divided to switch and potentiometer or just for switch. EM-12A can be controlled with ±10 V signal as well.

TECHNICAL DATA:

Operating voltage	18...30 Vdc
Idle current	50mA
Load capacity	8A (RMS) mom. 15A (5s)
Operating frequency	approx. 22 kHz
Control pot.meter	10k or 25k 0.25W lin.
Recommended fuses (F1,F2)	max. 8A, slow
Operating temp.	0...50 °C
Dimensions	87*72*28 mm

Adjustments:	
Acceleration ramp (0...100%)	0.5 ... 5 s
Current limit	0.5 ... 20 A
Max. power limit	0 ... 100 %





FUSES (8A, SLOW)
F1, SUPPLY
F2, MOTOR

ADJUSTMENTS
P1, CURRENT LIMIT
P2, ACCELERATION RAMP
P3, MAX. POWER LIMIT

EM-12A INSTRUCTIONS

CONNECTIONS

Connection choices are displayed in figures 2a, 2b, 2c and 2d. If the operating direction of the connected potentiometer is not as desired, the outer wires should be switched. If the rotating direction of the motor is not as wanted, the motor wires should be switched.
CAUTION. When the card is supplied from a transformer, capacitor should be added as shown in figures. With battery supply the capacitor is needed only if supply leads are extensive (over 5m).

INTRODUCTION

Adjust the max. power limit to 100 % (P3 clockwise), acceleration ramp to 5 s position (P2 counterclockwise) and the current limit to 20 A (P1 clockwise).

CONTROL LIMIT

Drive the motor full forward or full reverse. If the maximum running speed of the motor needs to be restricted, adjust P3 counter-clockwise until the running speed of the motor is acceptable.

ACCELERATION RAMP

With the preset ramp length of 5 s and maximum power, reversing the motor (full forward <=> full reverse) takes approximately 10 s. If the application can be stopped faster, the acceleration ramp can be set to shorter value by turning the P2 clockwise. DO NOT ADJUST THE RAMP TO SO SHORT VALUE THAT THE REVERSING OCCURS WHILE THE MOTOR IS STILL RUNNING.

CURRENT LIMIT

The purpose of the current limit is to protect the motor from overloading. Adjust the current limit so that the red led on the card is not lit during normal load conditions. NOTE: by adjusting the current limit too low, the torque of the motor is decreased. The operation of the current limit can be checked by overloading the motor.
CAUTION: Do not use the control card in applications with high inertia (eg. flywheel drive) or where the load rotates the motor (eg. automotive devices going downhill).

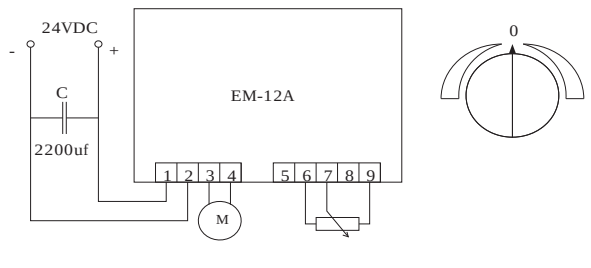


FIGURE 2a. POTENTIOMETER CONTROL. MIDDLE POSITION OF POTMETER FUNCTION STOP. CONTINUOS CONTROL IN BOTH DIRECTIONS

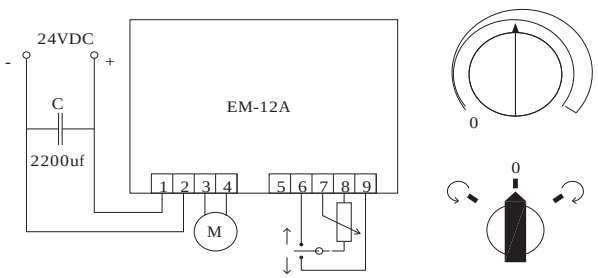


FIGURE 2b. SPEED CONTROL WITH POTMETER, DIRECTION WITH SWITCH. STOP FUNCTION IS ACHIEVED WITH THREE POSITION SWITCH.

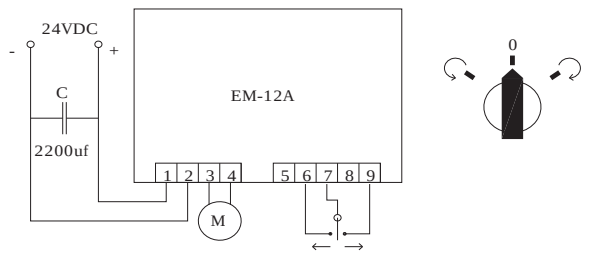


FIGURE 2c. CONTROL WITH SWITCH. FUNCTIONS FORWARD/STOP/REVERSE.

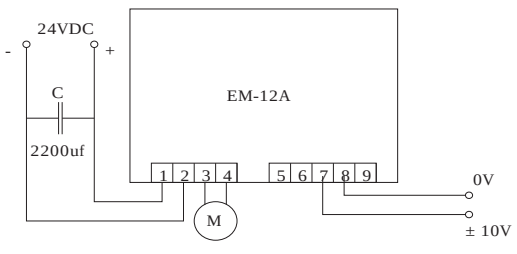
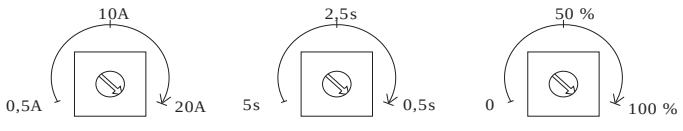


FIGURE 2d. VOLTAGE CONTROL. VOLTAGE SHOULD BE GALVANICALLY ISOLATED FROM DRIVER VOLTAGE.



P1 CURRENT LIMIT P2 ACCELERATION RAMP P3 MAX. POWER LIMIT

FIGURE 3. EM-12A ADJUSTMENTS.

EM-140A DC-MOTOR STARTER 12-24V 8A

FEATURES

- Controlled direction change
- Soft startup, ramp
- Trip or continuous current limit mode
- Settable current limit
- High efficiency
- High momentary load capasity
- Rail mounting base fittable
- Current limit indication
- Replaces models EM-140, EM-140-12 and EM-140ind

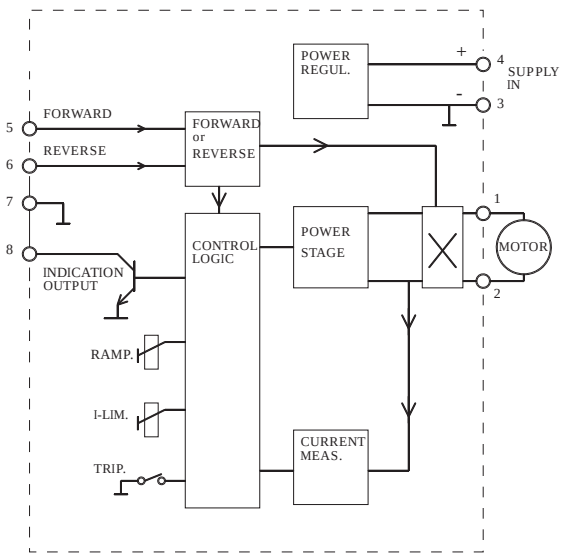
EM-140A DC-motor controller is designed for DC-motor on-off driving with direction change. The unit has an advanced current limit feature, that limits motor current in startup and jam-situation and in that way protects the motor and mechanics.

As the controller starts up in chosen direction, the startup speed can be limited with a so called ramp, thus full voltage isn't instantly lead to the motor but slowly risen through the ramp. The ramp time is set with a trim. When direction is changed the unit relay doesn't instantly change state but first drives control to zero and then waits for a while before driving in new direction. This feature protects the relay and the motor. The current limit works in two ways: the actual current limit is allways enabled and limits controlling if the current exceeds the preset value. Additionally a trip-feature is included, this will shut down control when the current limit is exceeded. After this the unit will startup only with reverse control, with double current limit for 0,3 s.

TECHNICAL DATA:

Supply	11...35 Vdc
Idle current	approx. 30mA
Control current	8A rms
	10A 50/50%
Current limit	1...10A
	2...20A @ startup
Indication output	NPN open collector
	50mA max
Current trip delay	approx. 2ms
Startup delay	10ms
Braking delay	5ms
Dir. change delay	approx. 200ms
Voltage loss	0,5V @ Im=8A
Operating frequency	500Hz
Ramp	0, 10, 20, 40, 80, 150ms
	0,25; 0,5; 1s
Digital control	“off” @ Uin=4...30V or open
	“on” @ Uin=0...1V
Dimensions	43x73x35mm
Weight	approx. 70g

EM-140A BLOCK DIAGRAM

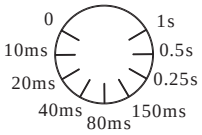


EM-140A OPERATING INSTRUCTIONS

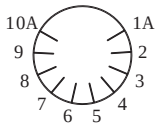
Supply voltage must be filtered 11-35 VDC with less than 30% rippel at full load. Caution! Wrong polarity can damage the unit.
Caution! The unit does not have a internal fuse.

Selecting the current limit; trip-jumper is
on = cut-off -mode
off = only current limit control

Choose startup speed (ramp)

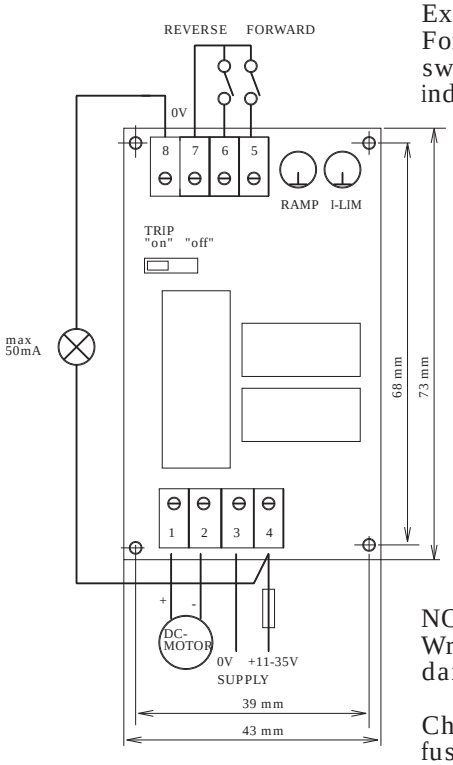


Choose current limit /A (I-lim)



Notice!
- Motor specs can affect the current limit value
- At startup the current limit value is double the value set

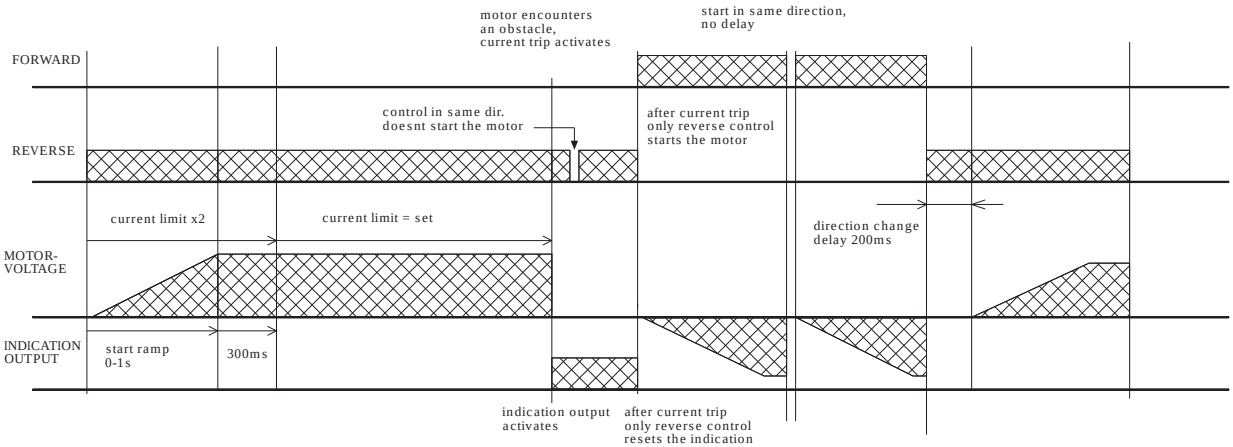
Example:
Forward / Reverse with switches, current limit indication with ext. lamp.



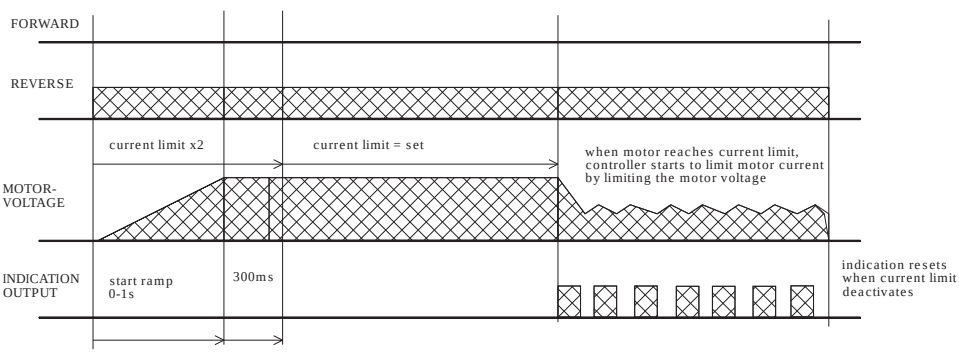
NOTICE!
Wrong polarity can damage the unit.

Choose a suitable fuse for the application.

EXAMPLE 1: (current-trip selected)



EXAMPLE 2: (continuous current limit selected)



EM-175 DC-MOTOR CONTROLLER 12/24Vdc 10A

FEATURES:

- Unidirectional
- 2-quadrant, drive and brake
- Dynamic and regenerative braking
- Smooth startup ramp
- Adjustable current limit
- Load compensation
- High efficiency
- High peak loading capacity
- Rail mountable

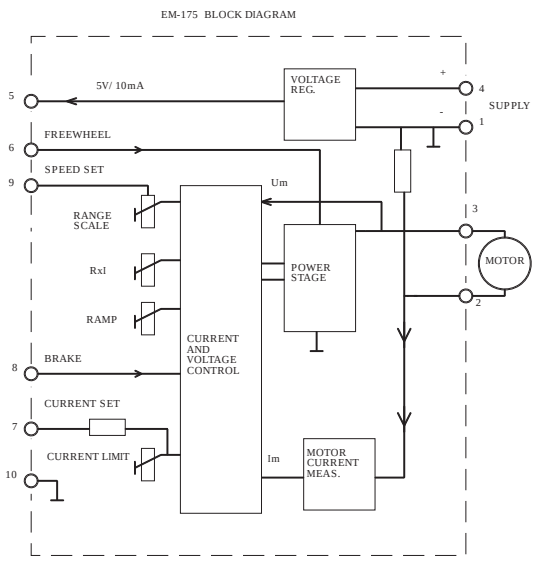
EM-175 motor driver is designed for DC-motor speed control. The unit regulates motor voltage so non regulated supply voltage is well suited. A load affecting the motor rpm can be compensated with an adjustble load compensation (RxI). Potentiometer or direct voltage signal can be used to give the speed control value. The current limit can be set with a trim or direct voltage signal to protect the motor and mechanics in jam situations.

Startup speed can be limited with so called ramp, which slowly rises the motor voltage in a desired way. Ramp time is set with a trim. The unit also features a brake input which can be used to rapidly brake motor (dynamic braking). There are two diffirent dynamic braking options available: in the first one even very short braking resets the set value and ramp time, that is after braking motor starts from zero rpm. The second braking method reduces ramp value during braking according to ramp time, in other words motor starts from ramp value after braking. When the unit is battery-operated, regenerative braking can be used. This method feeds the braking energy back to battery. Regenerative braking automatically activates when motor voltage exceeds set value, for example in a situation where set value is rapidly being reduced.

The freewheel command sets motor free from control. Freewheel overrides all other controls. EM-175 can be optimised for 12 or 24 V supply use.

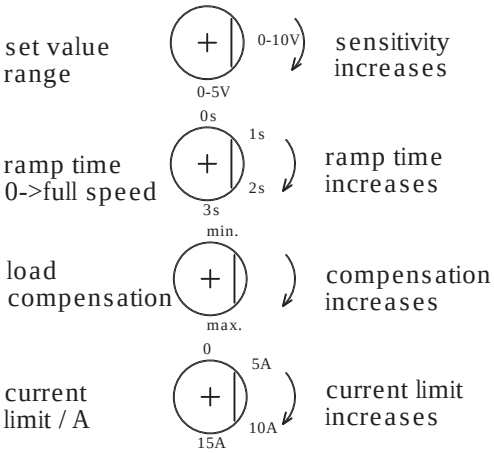
TECHNICAL DATA

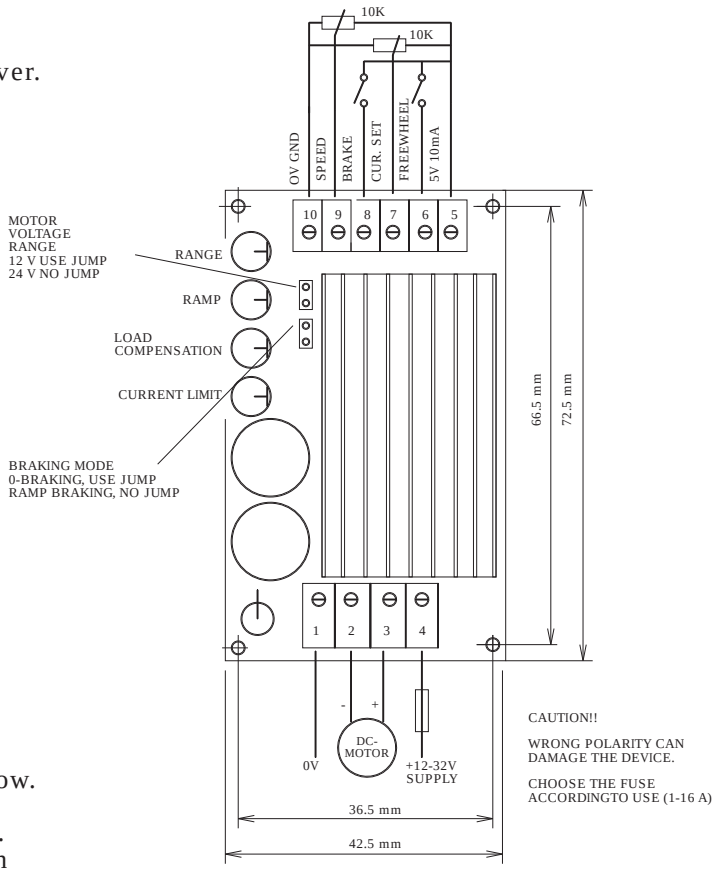
Supply	12-32Vdc
Overvoltage protection	40V
Idle current	approx. 20mA
Motor current	10A continuous (Ta<50°C)
	15A peak
Motor voltage	0-15V (12V setting)
	0-29V (24V setting)
Current limit	adj. 0...15A
Cur. lim. volt. contol	0...5V (0...15A)
Ramp time	adj. 0...3s
Voltage loss	1V (Im=10A)
Operating frequency	25kHz
Aux. voltage	5V 10mA
Control pot.	1-50kohm
Control volt. range	adj. 0-5V...0...10V
Digital inputs	"on" @ Uin 4 -30V
(brake and freewheel)	"off" @ Uin 0-1V or open
	impedance 10kohm
Operating temp	-20...+70
Dimensions	43x73x30mm
Weight	approx. 80g



EM-175 OPERATING INSTRUCTIONS

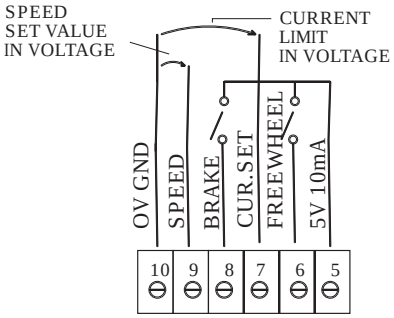
Supply should be filtered 12-32Vdc,
max. ripple <30% on full load.
ATT. Wrong supply polarity can damage the driver.
ATT. Driver has no internal fuse.



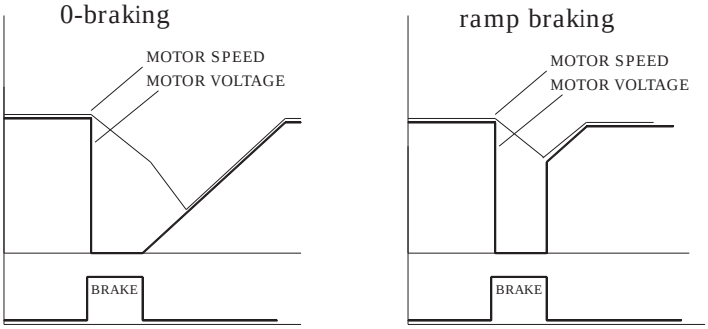


SETTINGS AND ADJUSTMENTS

Choose desired braking option, see picture below.
Potentiometer or direct voltage signal
0-5 V ... 0-10 V can be used to set speed value.
Acceleration and deceleration ramp are set with trims, 0-3 s, this is time from zero to full speed or from full speed to zero. Compensation adjustment: set motor on to a low rpm, add compensation until motor starts twiching and then reduce compensation until twitching ends. After this motor loading can be tested for steady motor run.
Current limit can be set to 0-12 A, current limit can also be set using direct 0-5 V voltage signal or potentiometer. If the external control is used, turn the inbuilt current limit trim to 0-position.



BRAKING OPTIONS



EM-176 DC-MOTOR CONTROLLER
12/24Vdc 10A

FEATURES:

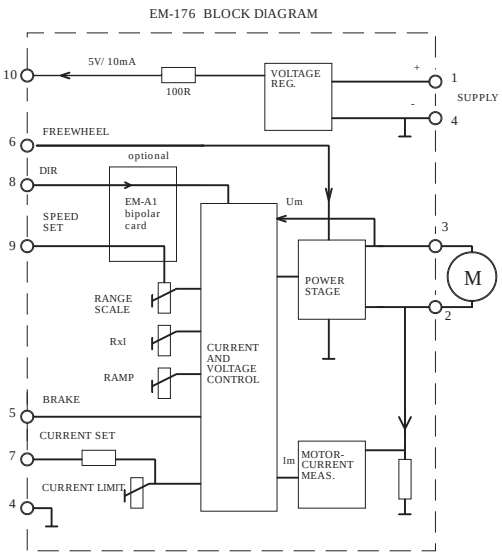
- 4 Quadrants
- Braking
- Freewheeling
- Reversal
- 0...10V control
- Optional ±10V control
- Soft start ramp
- Adjustable current limit
- Load compensation (RxI)
- High efficiency
- High peak loading capacity
- Rail mountable

EM-176 is designed for DC-motor speed control. The unit can be used with unregulated DC supply. Motor loading can be compensated with inbuilt RxI-type adjustment. EM-176 utilizes PWM driven H-bridge, thus achieves high efficiency and extensive controlling options. Speed control value can be set with voltage signal or with potentiometer, there is an auxiliary voltage signal output for potentiometer use. The scale trimmer can be used to scale set value to correspond better the motor rpm. An auxiliary card can be fitted into EM-176 for bipolar input controlling with voltage signal or potentiometer. The ramp feature is used to limit the motor start and brake speed, in other words soften the operation and prevent the occurrence of current spikes. The current limit limits motor torque that is current; this protects the motor and the mechanics. The unit has separate inputs for brake, freewheel and reverse. Brake short-circuits the motor poles and produces powerful braking. Freewheel detaches the power stage from the motor and leaves motor rotating freely. Reverse changes motor rotating direction, this is done using the set ramp times.
Brake and freewheel bypass the ramp feature.

TECHNICAL DATA:

Supply	12-35Vdc
Over voltage protection	39V
Idle current	appox. 30mA
Motor current	10A cont. (Ta<50°C)
	15A peak (20% on/ 80% off)
Motor voltage	0-29V (0-100%)
Current limit	adj. 0...15A
Current lim. volt. ctrl	0...5V (0...15A)
Ramp time	adj. 0...3s
Voltage loss	1.2V (Im=10A)
Operating freq.	25kHz
Aux. voltages	+5V 10mA (option -5V)
Set value range	0...5 or 0...10V
	(±5V or ±10V option)
Set value input imp.	100kohm (pin 7 and 9)
Control voltage	"on" when Uin 4 -30V
	"off" when Uin 0-1V or open
Control input imp.	10kohm (pin 5, 6 and 8)
Recom. control pot.	4.7...47k
Operating temp (Ta)	-20...+70
Measures	65x73x30mm
Weight	approx. 100g

EM-176 BLOCK DIAGRAM



EM-176 WIRING AND INSTALLATION

INSTALLATION EM-176

Supply voltage 12-35VDC, ripple <30% at full load.
CAUTION ! Wrong polarity may damage the device.
CAUTION ! The device is not equipped with an internal fuse.

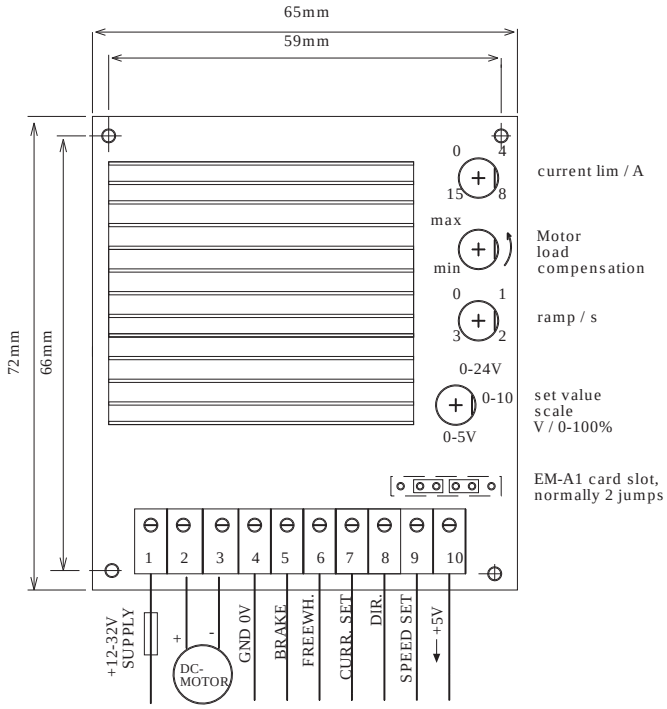
SETTINGS AND ADJUSTMENTS

Set trimmers in center position. Current limit can be set in the range of 0-15A. If an external voltage signal (0-5V) or potentiometer is used to set the current limit, set the inbuilt current limit trimmer to 0-position.

The compensation (RxI) is used as follows: first set the motor running slowly. Then increase compensation until the motor starts twitching. Now decrease compensation a little so that the twitching ends. Finally test the operation: when loading the motor, the rotation speed should almost remain constant.

The acceleration- and braking ramp are set with trimmers in the range of 0-3s (the time from zero to full speed or vice versa). The speed can be set with potentiometer or with 0-5V voltage signal. With the set value trimmer the set value range can be scaled to match the motor rotating speed range.

If the use of bipolar control signal is desired, an auxiliary card EM-A1 can be fitted onboard, which makes it possible to use either ±5V or ±10V control voltage signals. EM-A1 card also gives -5V auxiliary voltage into pin8; this enables potentiometer to be used to control both speed and direction (forward-stop-reverse).

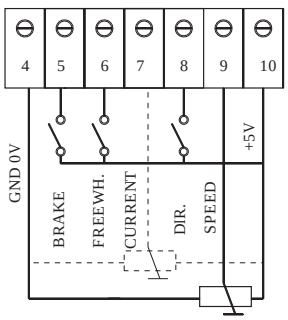


CAUTION !
Wrong polarity can damage the device.
Select a fuse (1-16A) in accordance with the application.

EXAMPLE 1

CONTROLLING WITH SWITCHES.
SPEED SET WITH POTENTIOMETER.
SPEED RANGE ADJUSTABLE WITH SPEED SET RANGE ADJUSTMENT.

CURRENT LIMIT CAN BE SET WITH INBUILT TRIMMER. IF EXTERNAL ADJUSTMENT IS USED, SET THE INBUILT CURRENT LIMIT TRIMMER TO MINIMUM.



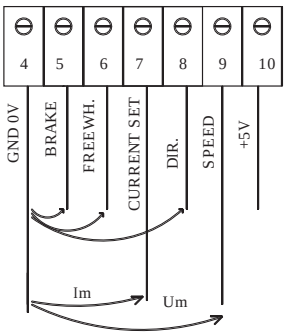
EXAMPLE 2

CONTROLLING WITH VOLTAGES.

CURRENT 0-5V CORRESPONDS TO 0-15A.
CURRENT LIMIT TRIMMER IS SET TO MIN.

SPEED 0-5V CORRESPONDS TO 0-100% SPEED. SCALE WITH TRIMMER.

DIRECTION, FREEWHEEL OR BRAKE 0-1V OR OPEN=OFF, 4-30V=ON.

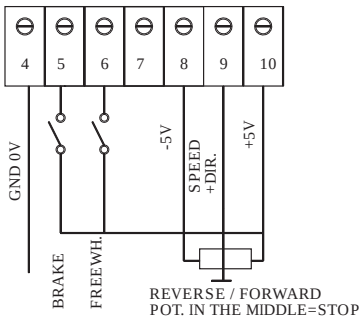


EXAMPLE 3 (OPTIONAL)

EM-A1 BIPOLAR-CARD INSTALLED.

CONTROLLING WITH POTENTIOMETER FORWARD/REVERSE OR WITH VOLTAGE SIGNAL (±5V OR LARGER BIPOLAR VOLTAGE). RANGE ADJUSTABLE WITH RANGE SCALE TRIMMER ADJUSTMENT.

OTHER CONTROLS AS IN PREVIOUS EXAMPLES.



EM-180 ON-OFF DC-MOTOR DRIVER 12/24Vdc 10A

FEATURES:

- Fast change of direction
- Soft start-up, acceleration ramp
- Settable current limit
- Trip or continuous current limit
- High efficiency
- Dynamic braking
- High momentary load capacity
- Rail base fittable
- Freewheel option
- Two control modes

EM-180 is developed for controlled ON-OFF driving and direction change of a DC-motor with brushes. Driver has advanced current limit features. It limits the motor current in start-up and jam-situations and that way protects the motor and mechanics from over torque. Driver has also an error output to indicate error / over current situations.

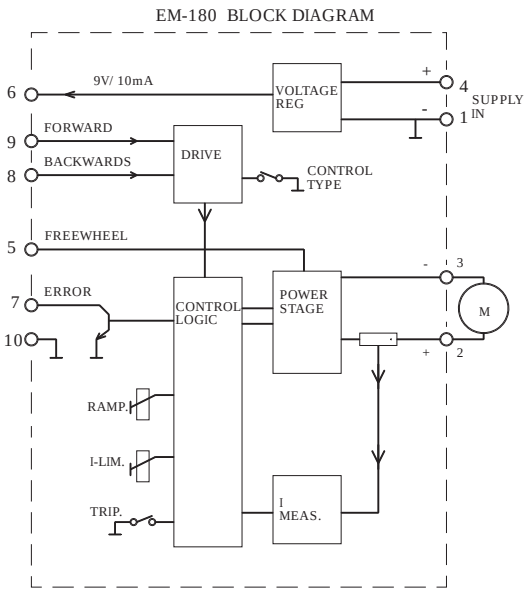
The acceleration ramp time for start-up is adjustable to suit each application. In other word the motor voltage is slowly rised to give a smooth start-up. As the control is set off, the motor is dynamically braked with so called short-circuit braking. The motor poles are connected together. The reverse and forward commands can be set with positive or negative control. The freewheel command sets motor run free. Freewheel overrides forward and backwards commands.

The current protection is double acting. First there is a continuous and adjustable current limit which decreases the motor voltage if the current exceeds the adjusted value. Second there is settable trip feature that cuts the motor voltage if the current limit value is exceeded (after trip delay 2ms). After trip the motor starts only to the opposite direction. Additionally the driver doubles the adjusted current value for 0.3 seconds in start-up to ensure sufficient power to overcome the start-up friction. Error output indicates the activation of the current limit.

TECHNICAL DATA

Supply	12-32Vdc
Over voltage protection	40V
Idle current	app. 30mA
Driving current	10A continuous 15A 50/50%
Current limit	1...15A 2...30A in start-up
Current trip delay	n. 2ms
Start delay	5ms
Stop delay	5ms
Direction change time	n. 20ms
Voltage loss	0.5V (Im=10A)
Operating frequency	500Hz
Ramp	0.10, 20, 40, 80 150ms 0.25, 0.5, 1s
Digital inputs	"off" @ Uin 4 -30V or open "on" @ Uin 0-1V
Error output	max 30V 50mA
Operating temp (Ta)	-20...+70ºC
Measures	43x73x35mm
Weight	app. 80g

EM-180 BLOCK DIAGRAM



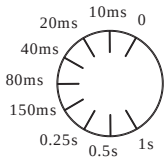
EM-180 OPERATING INSTRUCTIONS

Supply should be filtered 12-32Vdc,
max. ripple <30% on full load.
ATT. Wrong supply polarity can damage the driver.
ATT. Driver has no fuse in it.

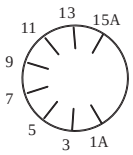
Choose the current limit mode: continuous/tripping
Trip jumper: on=tripping limit, off=continuous limit

Choose control mode (forward / backwards)
pos = PNP positive control
neg = NPN negative control

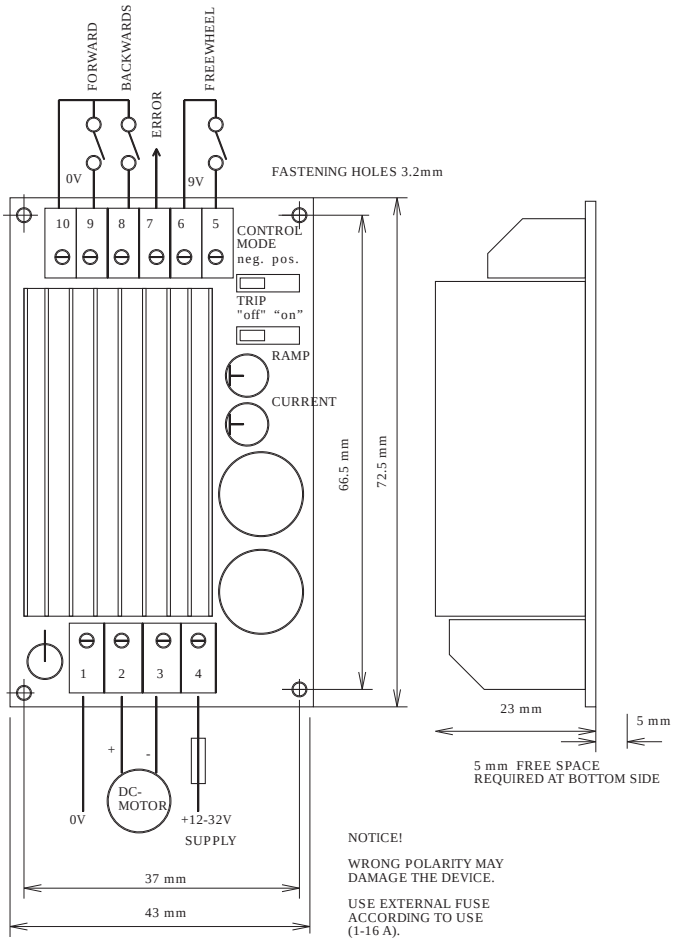
Choose the ramp time



Choose the current limit value / Amps.



ATTENTION
- The current limit values can be affected by the used motor.
- In start-up the current limit value is doubled (for 0.3s).

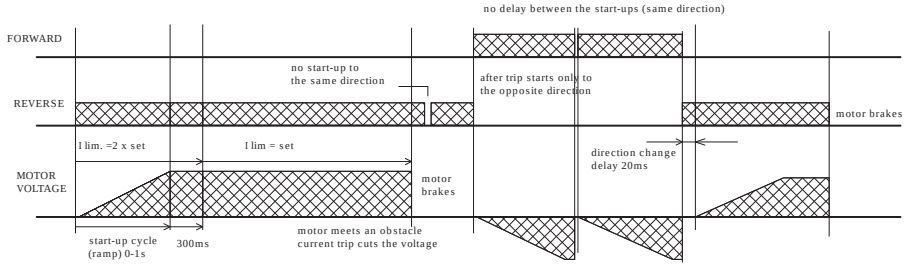


NOTICE!

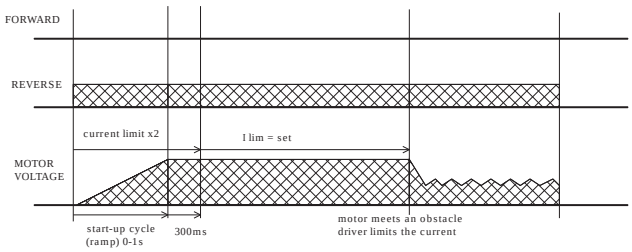
WRONG POLARITY MAY DAMAGE THE DEVICE.

USE EXTERNAL FUSE ACCORDING TO USE (1-16 A).

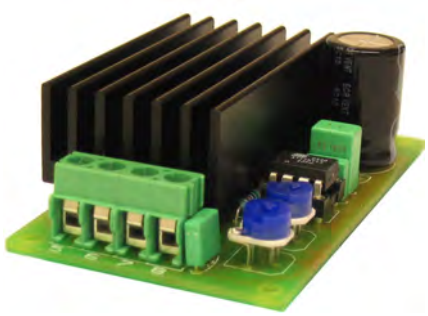
OPERATIONAL EXAMPLE: tripping current limit



OPERATION EXAMPLE: continuous current limit



EM-213 1-QUADRANT POWER CONTROLLER 12-24Vdc 10A

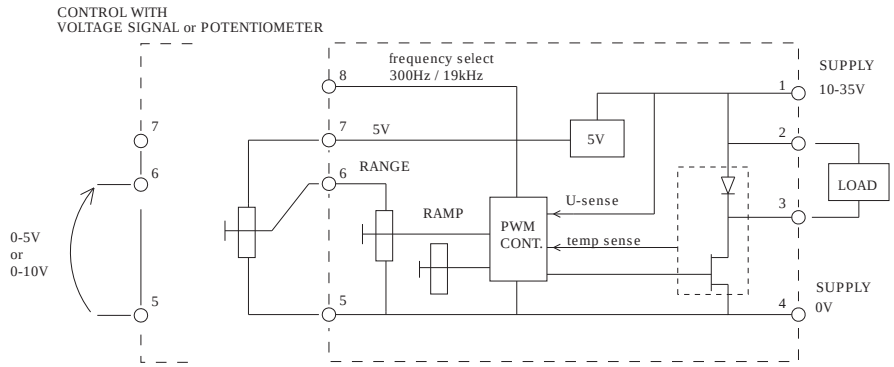


FEATURES:

- Low cost
- High efficiency
- Operating voltage compensated
- For resistive or inductive loads
- Applications: motor speed control, lamp dimmer
- Rail base fittable

EM-213 is a 1-quadrant power controller. The controller uses PWM principle with high efficiency. The PWM frequency can be set to high or low mode. High frequency is used with inductive (motor) load and low with resistive (lamp) load. The output of the device is compensated against power supply changes, so the device can be used succesfully with unregulated power supply. Output is overload (overheat) protected. The protection recovers by itself as temperature decreases. Control of device is done with analog voltage signal 0-5V or more, range of this signal is adjustable. EM-213 also includes a soft-start ramp with adjustable time.

EM-213 BLOCK DIAGRAM



TECHNICAL DATA

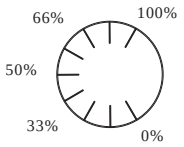
Supply voltage	10-35V
Motor current	cont. max 10A (Ta<50°C) peak max 15A (10s)
Voltage drop	0.4V at 10A
PWM frequency	300Hz or 19kHz
Soft-start time	0..4s adjustable
Control range	0-5V or more, adjustable
Control input imp.	100kohm
Connectors	1.5mm
EMC	EN-50081-2 & EN-50082-2 (industrial)
Temp. protection	110°C
Weight	70g
Operating temp (Ta)	-20...70°C

EM-213 OPERATING INSTRUCTIONS

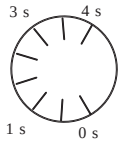
Supply should be filtered 10-35Vdc,
max. ripple <30% on full load.
ATT. Wrong supply polarity can damage the controller.
ATT. Driver has no fuse in it.

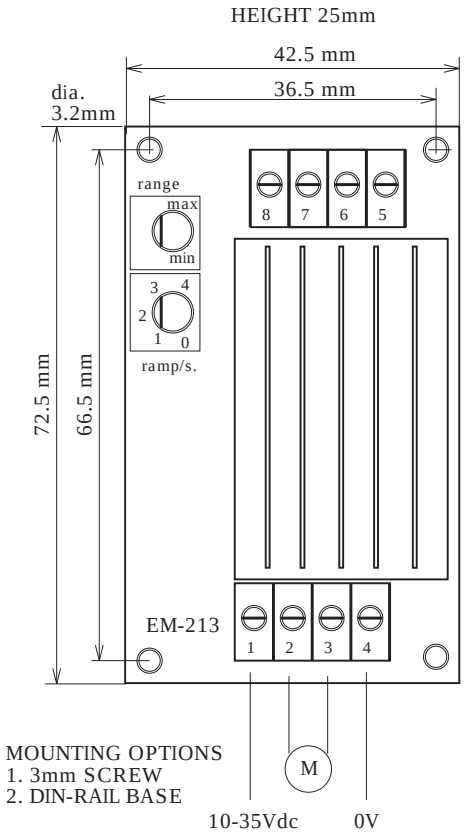
Choose the operating frequency with pin8,
0V..1V or open for 19 kHz , 2..5V for 300 Hz.

Choose the range



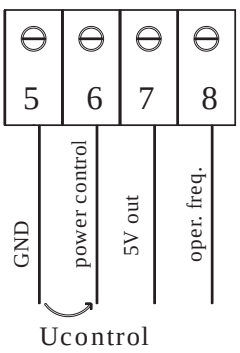
Choose the ramp time / s.





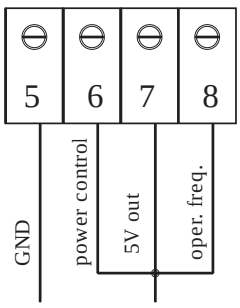
EXAMPLE 1 - MOTOR CONTROLLER

Speed is set with with external voltage signal to pin 6. Control range is set with range trim. Motor ramp is set with ramp trim. Pin8 is left open for 19 kHz operation frequency. Auxiliary 5V from pin7.



EXAMPLE 2 - LAMP DIMMER

Lamp brightness is set with with internal range trim.
Illumination ramp is set with ramp trim. Pin8 is connected to 5V for 300 Hz operation frequency.
Auxiliary 5V from pin7.



EM-241C-48V DC-MOTOR CONTROLLER 24-48V 10A

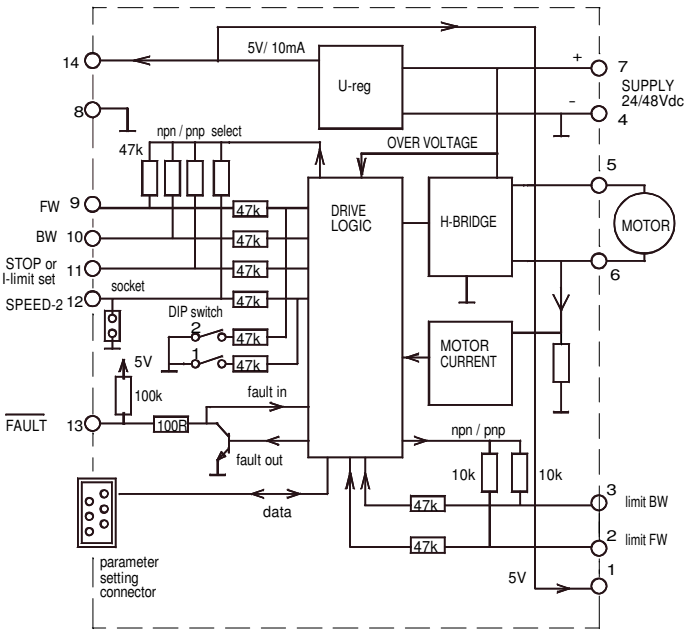
- small size
- high current output
- current limit
- zero current limit
- overvoltage brake
- speed setting
- flexible control inputs
- impulse / continuous mode
- rail base mountable
- digital parameter setting
- 48V version of EM-241C
- current limit setting input (new)
- freewheel options (new)
- 2 or 16kHz PWM freq. (new)

EM-241C-48V is a full bridge DC-motor starter for nominal voltage 24, 36 or 48V. It is designed to work with DC-motor in applications where some special functions are needed. Starter has adjustable acceleration and deceleration ramps, which make possible the smooth starts and stops. Adjustable current limit protects motor against overcurrent and it can also be used as an end-stop. This device has also two settable speeds, which are usefull in positioning applications. Control inputs FW and BW start the forward and backward run. STOP is for the motor soft shut-down but there are also available individual limit inputs for FW and BW directions. SPEED-2 input activates preset speed-2, but it can also be used as input for analog speed control signal 0-5V. STOP input can be set to work as current limit setting. FAULT terminal has at the same time input and output function, the pin is normally high, but is pulled down in overheat and conditionally also in current trip situation. If FAULT-line is pulled down externally it will cause a stop and prevent the new start. For example, it is possible to link fault pins of several units together and achieve a synchronous stop. C-version includes wo new parameter: freewheel options for realease the rotor of motor. and pwm frequency select, but notice, that in silence 16kHz pwm frequency. the output current is smaller!
There are two selectable control modes, continuous and impulse. In continuous mode the motor runs as long as the control is active. In impulse mode a short comand starts the motor, and only a new impulse will change the status. There is also few special settings start-kick and auto reverse. The card has selectable input logics. Inputs are divided in two groups, control and limit -inputs. Groups can be individually set for NPN or PNP logic.
For parameters setting there is next options: EM-236 interface unit, EM-268 with EmenTool-Lite PC-program and EM-326 with EmenTool-App application for smartphone

TECHNICAL DATA (prog ver. 241C-48 v1.0)

Supply voltage range nom. 24-48V / max. 20-60V
Overvoltage limit adjustable 15-60V
Start up voltage 14V, shutdown voltage 12V
Continuous current output when ambient temp is <50°C)
10A at 100% speed / 7A at 5-99% speed pwm=2kHz
7A at 100% speed / 4A at 5-99% speed pwm=16kHz
Peak (5s.) 25A at 2khz pwm and 20A at 16kHz pwm
Current limit adjustable 0.1-25A (at start max 30A)
Overheat limit 100°C
Start and stop ramp adjustable 0-5s
PWM frequency 2kHz / 16kHz
Speed input scale (speed-2) 0-5V = 0-100% pwm
I-limit input scale (stop input) 0-5V = 0-20A
Input control logic: high =4-30V, low=0-1V
Control input impedances typ. 47kohm
Limit FW / BW input imped. typ 10kohm
Control input response time typ 5ms.
Fault out. NPN open coll. max 30V / 50mA
Fault in actives Uin < 1V (NPN)
Motor and supply connectors 2.5mm
Control connectors 1mm
Dimensions 42x72x25mm
Dimensions in DIN-rail base 45x80x45mm
CE-tested for industrial environment (emc)
Operating temp (Ta) -40...60°C
Weight 75g

EM-241C-48V BLOCK DIAGRAM



CONNECTIONS

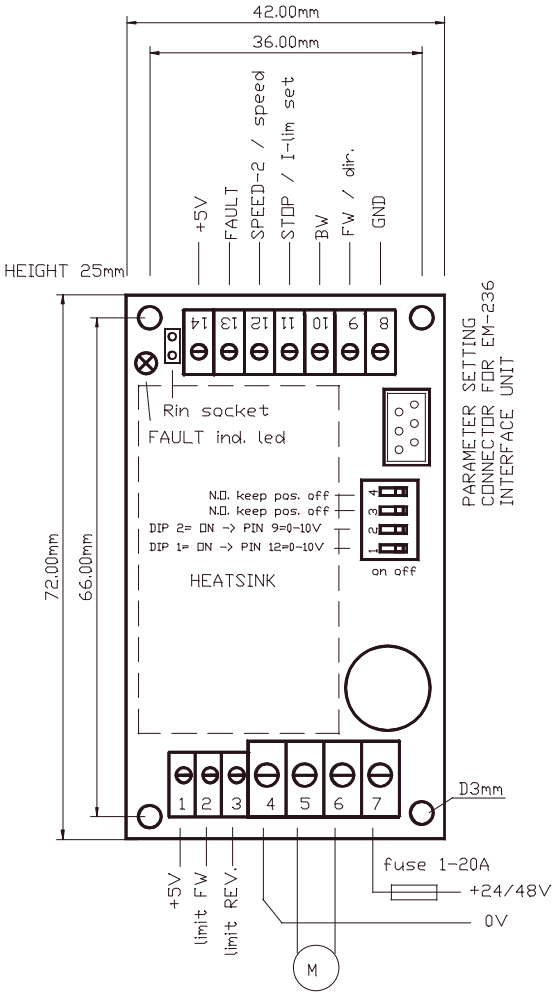
Supply voltage must be filtered DC of 10-35V,
and ripple should be less than 30% at full load.
CAUTION ! Wrong polarity can damage the unit.
CAUTION ! Unit doesn't have an internal fuse, so
an external fuse should be added if fuse required.

MONITORABLE VALUES

1/5 Motor current 0-20A (0-200)
2/5 PWM-level-% 0-100% (0-100)
3/5 hour counter (max.65535h)
4/5 start counter (max.65535)
5/5 carry counter for start counter

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. overvoltage	4 x blink -pause...
6. overheat	short blink- long pause...
7. timeout	3 x blink + long blink...
8. fault input	2 x short + 1x long blink...



ADJUSTMENT AND SETTINGS (prog ver. EM-241C-48V v.1.0)

Settings can be done with three interface device options.
1. EM-236 interface unit
2. EM-268 interface unit 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 20pcs. (defaults in brackets)

1- command mode: 0,1 and 2 (0)
   0= continuos FW / REV
   1= impulse commands FW / REV. with stop
   2=impulse commands FW / REV without stop
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 0-3 PNP/NPN (0)
   0= command and limit inputs as PNP (positive)
   1= command inputs NPN, and limit inputs PNP
   2= command inputs PNP. and limit input NPN
   3= command and limit inputs NPN (negative)
4- running speed-1: 0-100% / 0-100 (100)
5- running speed-2: 0-100% / 0-100 (50)
   special parameter values of param. 5
   0= "speed 2-input" is used as analog 0-5V speed control input.
   1= FW direction is automatically "on" and FW input works as
      direction change input.
6- current limit FW: 0-25A / 0-250 (30)
7- current limit REV: 0-25A / 0-250 (30)
   notice! If both 6 & 7 is set = 0, then I-limit input is enabled, and
   works as current limit adjust input.
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: 0-3 (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.
11- overvoltage limit: 15-60V / 15-60 (55)
   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
   the power stageset to free-wheel state, and if voltage still rises
   then powerstages shorted to brake motor more
   In battery supply use the brake current is charging the battery
   and the voltage will not normally rice.
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%) Increase 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: 0-5s / 0-500 (100)
16- stop ramp: 0-5s / 0-500 (100)
17- start-kick 0-200ms / 0-200 (0)
   This gives full drive at start and I-lim is 30A
   The start kick length is 0-200ms.
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= no freewheel
   1= freewheel when stopped
   2= freewheel during stop ramp.
   3= freewheel during stop ramp and if stopped
20- Pwm frequency 1=2kHz / 2=16kHz

EM-239 PARALLEL DRIVER FOR TWO ACTUATORS or MOTORS
12/24Vdc 2x10A or 2x20Apeak

FEATURES (program version 1.4 or later)

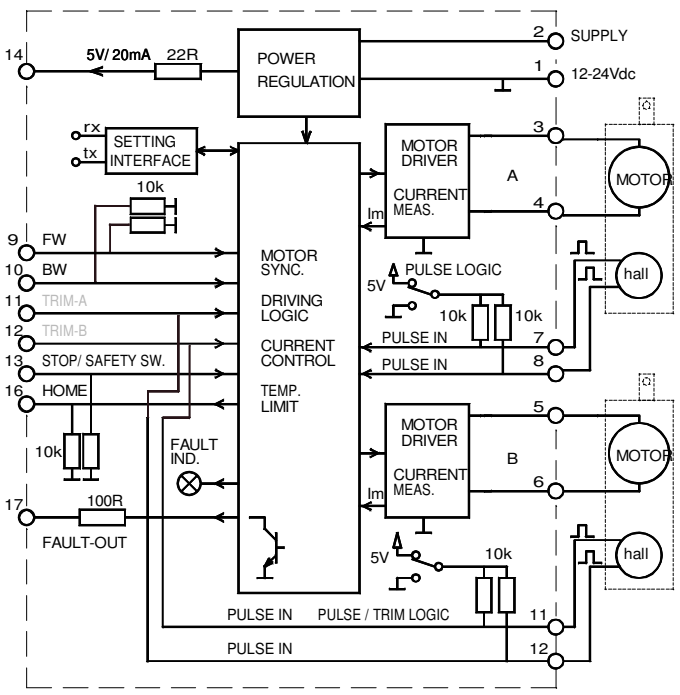
- **synchronized parallel driving**
- **operates with pulse feedback**
- **input for negative or positive pulses**
- **current and temperature limit**
- **settable drive speed**
- **acceleration and deceleration ramps**
- **different control modes**
- **wide range of parameters**
- **easy setting with serial interface**
- **good repeatability of settings**
- **autobalance feature**
- **one or double pulse mode**
- **safety reverse function (only prog. v2.4)**

EM-239 is designed for driving two actuators in parallel. The drive is done as synchronized according actuators pulse feedback signal. The synchronization is achieved by adjusting actuator speed during drive. If the adjustment can not compensate the unbalance between actuators, the motors will be stopped. This way the mechanical stress and breakage can be avoided. Additively the driver includes current limit and power stage temperature limit.
Driver works with actuators that can offer pulse feedback signal. Pulses can be derived from Hall-sensors, reed or other kind of switches. Driver can be set to read negative or positive pulses and also there can be selected two or one pulse line/motor mode.
Driver power stage operates with PWM (pulse width modulation), that enables the high efficiency and low losses of power stage.
The basic control is done with FORWARD-, BACKWARD- and STOP-commands. FORWARD and BACKWARD can be done in continuous or in impulse control mode. In continuous mode the drive is done as long the command is on. In impulse mode the command impulses start and stop the driving. For help in assembly and in other special situations, driver has TRIM-inputs for controlling both actuators individually. With these control inputs the user can override most of the limits of normal use and balance the actuators or restore the normal driving position after some unexpected occurrences like equipment failure or user in danger situation. HOME-command input is for driving the system in to its initial position. This driving is done with low speed and in to the end (in to the initial position). The counters are reset to zero. Wide range of parameters can be set to suit to different demands and different applications. In most cases the driver is ready to work with default parameters but some special features and behaviour can be accomplished with further parameter setting.
One new feature is SAFETY REVERSE function, which automatically reversing when motors meet obstacle and will be overloaded
The parameters are set with a handy interface unit EM-236. There is also possibility to use EmenTool Lite PC-sofware with EM-268 and EmenTool App with smartphones for parameter setting.

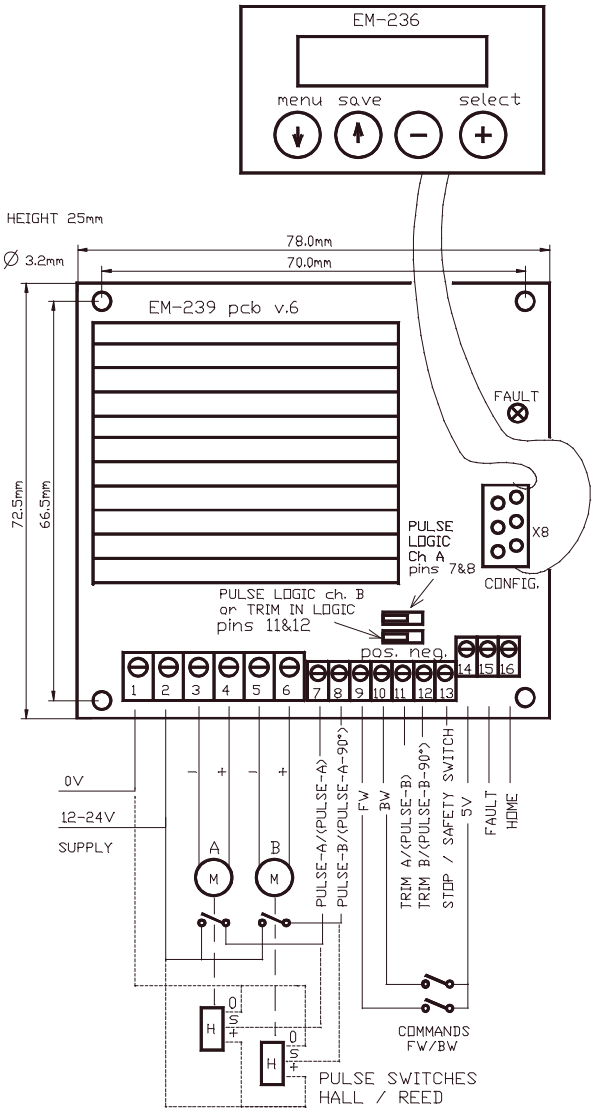
TECHNICAL DATA

Supply voltage 12- 35Vdc
Quiescent current 15mA
Motor output currents
2 x 10A cont. or 2 x 20A (at 25% duty)
PWM frequency 2kHz
Current limit 1-25A
Temp. limit 120℃ (pow.stage)
Ramp times 0 - 2s
Pulse input freq. max. 1kHz/ input ch
Pulse inputs pull- up/down 10kohm.
Control inputs 0-1V = OFF / 4-30V = ON
Input impedances 10kohm.
Fault-output active, pull down max. 50mA
Aux. voltage output 5V, max. 20mA
Measures 78 x 73 x 25mm
Operating temp. range -20 to 60℃
Weight of card 110g
CE Electromagnetic compatibility
EN-55022B and EN 61000-6-2/ -4-2...6

EM-239 BLOCK DIAGRAM (PCB. v.6)



EM-239 INSTRUCTION GUIDE
prog. version 2.4, pcb ver.6



INPUTS / OUTPUTS

PULSE A and B inputs are for incoming feedback pulselines. Parameter 13 enables also the use of two pulselines/motor. If chosen the input pin order is changed and TRIM-inputs are disabled. In board v.6 the input logic can be selected for all pulse inputs with pulse and trim in logic jumpers. pos.= PNP, neg.= NPN

FW & BW are command inputs forward / backward.

STOP input is for the use of external stop command (eg. end switches). Stop input trigs also safety reverse function, so this input can be used as SAFETY SWITCH input.

HOME input is for starting the "drive home" routine

TRIM inputs enable driving of only one motor for setting the balance of the system or an emergency over-riding of motors, one or both. Trim inputs are changed to Pulse B and pulse B-90° input, if double pulse mode is chosen (param.13).
In bord v.6 also the trim input logic can be changed with jumper to be positive= PNP or negative = NPN.

FAULT output is activated in the following situations:
- -difference limit exceeded
- -pulses have disappeared
- -too high temperature
- -current limit exceeded (if enabled)

Notice! fault output is pulled down on alarm.

Inputs, 4-30Vdc (as HIGH) signal levels
0-1V, (as LOW)

Output, NPN open collector max. 50mA

CONNECTION

Connect motors and supply as in picture. Supply voltage 12-35Vdc must be filtered, ripple less than 20% .
Pulse inputs can work with positive (PNP) or negative (NPN) pulses.
Selection is made with PULSE LOGIC selection switch.
Other inputs work only with positive commands.
NOTE. also TRIM-inputs work only with positive signal also in feedback use.

ADJUSTMENT AND SETTINGS (prog ver. EM-239 v2.4)

Settings can be done with three interface device options.
1. EM-236 interface unit
2. EM-268 interface unit 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.

parameter list with : quality (set range) -default

1 Running speed 40-100% (40-100) -100%
2 Home speed 20-60% (20-60) -60%
3 Start ramp 0-2s (0-20) -0,5s
4 Stop ramp 0-2s (0-20) -0s
5 Current limit 1-25A (10-250) -5A
6 Difference limit 3-50pulses (3-50) -10
7 Behaviour smo.-> aggr. (1-10) -5
8 I-trip indication disabled =0 enabled=1 -0
9 Start condition 0-3 -1
  0= starts both direction after I-trip or stop comm.
  1= starts only for opposite direction. after I-trip,
  2= starts only for opps. dir. after stop command.
  3= starts only for opps. dir. after I-trip or stop comm.
10 Control Mode 1-4 -1
  1=continuous (runs as long as command is active)
  2=impulse (short command starts run)
  3=impulse-2 (as par-2, but dir. change without stop)
  4=continuous + continuous home command
11 Safety reverse time 0-30 (0 or 0.1-3.0s) -0
  0= safety reverse disabled, 1-30= reverse time
12 Auto bal. trigger 0-255 / (0-255) 0=not in use -0
13 Double pulse mode 0=disable / 1= enabled -0
14 End limit FW 0-65535 / (0-65535) 0=disabled -0

PARAMETER DESCRIPTION

"Running speed" is the speed which is used in normal mode.

"Home speed" is the low speed used during home-routine.

"Start and stop ramps" define the acceleration and deceleration time to 0-100%-0 speed.

"Current limit" is limit value for current trip.
If current limit value is exceeded the motors will be stopped. During the period of start ramp + 1s the current limit is 1.5 times the current limit set value.

"Difference limit" is the value for largest allowable difference between A and B pulse counters. If this value is exceeded motors will be stopped.

"Adjust behaviour" defines how fast and intensively the driver will adjust the syncronisation between motors A and B. Smooth 1 --> Aggressive 10

"I-trip-indication"
FAULT output can be set to go ON also in current trip situation.

"Start condition" enables the device to re-start the motor to both or only to opposite direction after a trip or stop situation.

"Mode" sets the driver control mode.
In continuous mode the motor runs as long as command (fw or bw) is ON.
In impulse mode a short command starts the motor and the direction is changed with opposite command. Motor will stop only with stop command.
In impulse-2 mode motor starts with short (FW/BW) impulse. Following command stops the motor, and next command (FW/BW) starts the motor again. Of course in all modes the difference limit, current limit and STOP-command will stop the motors.

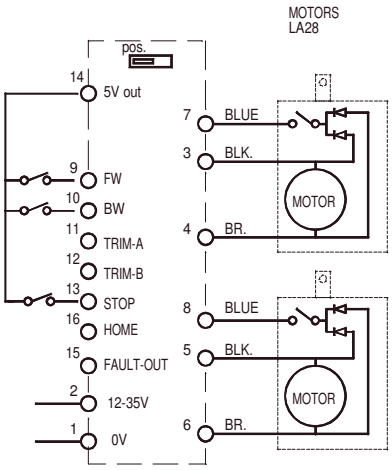
"Safety reverse" means automatic reverse run if device has stopped result of overload = I-trip. This function can be disabled or the reversing running time can be set with parameter. Also stop input trigs safety reverse function

" autobalance trigger " parameter value sets the starting point for auto balancing. Value is the number of pulses counted from mechanical home. The autobalance runs at home-speed which can be set with parameter 2.

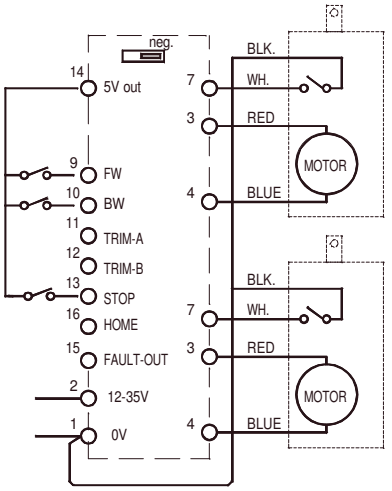
"double pulse mode" makes posible to use two pulse sensors for one motor and this way driver can always detect the right direction of the movement. This is recommended allways when double pulses are available. NOTICE. the TRIM function is not possible to use in double pulse mode. See example 4

"end limit fw" is a pulse counter "end stop" for FW direction. The position is determined in pulse edges from 1 to 32000. Value 0 means that end stop is not in use

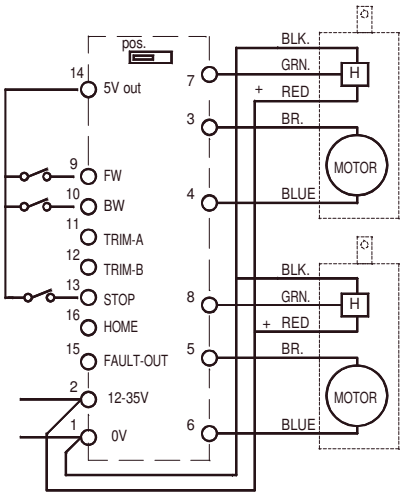
EXAMPLE 1.
3-WIRE MOTOR WITH REED SWITCH
PULSE SENSOR, PULSE LOGIC
LINK SHOULD BE IN POS. POSITION



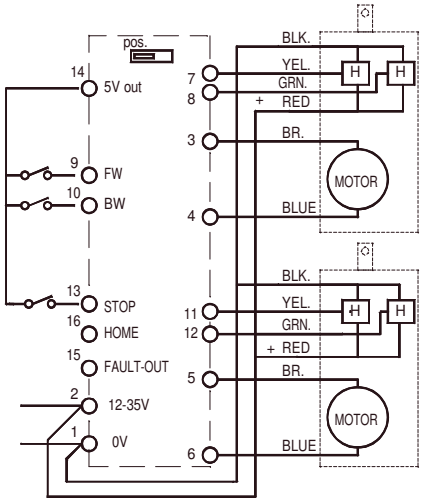
EXAMPLE 2.
4-WIRE MOTOR WITH REED-SWITCH
PULSE SENSOR, PULSE LOGIC
LINK SHOULD BE IN NEG. POSITION



EXAMPLE 3.
MOTOR WITH HALL PULSE-SENSOR ,
PULSE LOGIC LINK SHOULD BE IN
POS. POSITION



EXAMPLE 4.
MOTOR WITH HALL DOUBLE PULSE-SENSOR ,
PULSE LOGIC LINK SHOULD BE IN
POS. POSITION



DRIVE HOME ROUTINE (balancing)

Drive home routine is a calibration cycle for balancing the system. Home routine can be started by giving FW and BW commands at the same time for 3s or with incoming signal to HOME input. If "power-on home" parameter is enabled the home routine is started every time when power comes on. Drive home routine can be interrupted with new FW or BW command or signal to STOP input. When drive home routine starts, both motors start to run to same direction and will run until current limit stops the motor or pulses stop coming. During the drive home routine the fault led is blinking slowly. When blinking stops and both motors have stopped the device has reset the pulse counters. Now device is ready for use. If there is need to change the home drive direction, swap the motor wires. In double feedback pulse mode the hall signal wires should be swapped too (A to A-90 and B to B-90).

AUTO BALANCE (soft ending to home position)

Auto balance starts balancing ruotine before "real" home. The trigger point is set with parameter 12 . If auto balance is active it balances the system automatically in the end of stroke. This will prevent the possible pulse error cumulation. Auto balance works always to the home direction and with "home-speed" speed (parameter 2). The auto balance can be used also as soft ending to home position, because the motors will decrease speed to "home-speed" before reach mechanical end.

FAULT situations:

motor is jammed (current trip), pulses disappear or, pulse counter difference is too high (difference limit). The driver will stop the motors and FAULT output will be pulled down (also in I-trip if indication is enabled). When motor is re-started the FAULT output is reset. Faults are also indicated with fault LED as followes:

1 slow blink = position corrupted
2 blinks = current trip,
3 blinks = pulses disappeared,
4 blinks= difference limit,
5 blink = over temperature.

TRIM and override

TRIM input allowes the balance trimming and emergency use. When one of TRIM inputs is activated only the corresponding motor will run. During trim-run the balance adjust and pulse counters are disabled. If both TRIM inputs A and B are activated, it is possible to override motors and only the current limit is active.

MONITORING.

During the normal use it is possible to monitor the function of driver with EM-236. Select the monitor mode in EM-236 and you can check the following values:
- 1 current, motor A 10-200 = 1-20A
- 2 current, motor B 10-200 = 1-20A
- 3 pulse count / run cycle (only motor A)
- 4 pulse count difference
- 5 position counter A 0-65535
- 6 position counter B 0-65535

FEEDBACK PULSES

Pulse inputs can work with positive or negative feedback pulses. When pulse logic switch is in negative position, the inputs are internally pulled to 5V with 10kohm resistor. When positive logic is chosen the inputs are pulled to 0V correspondingly. The driver counts pulse edges so the counted value is double compared to the actual number of pulses.

EM-241A/B DC-MOTOR CONTROLLER 12-24V 15A

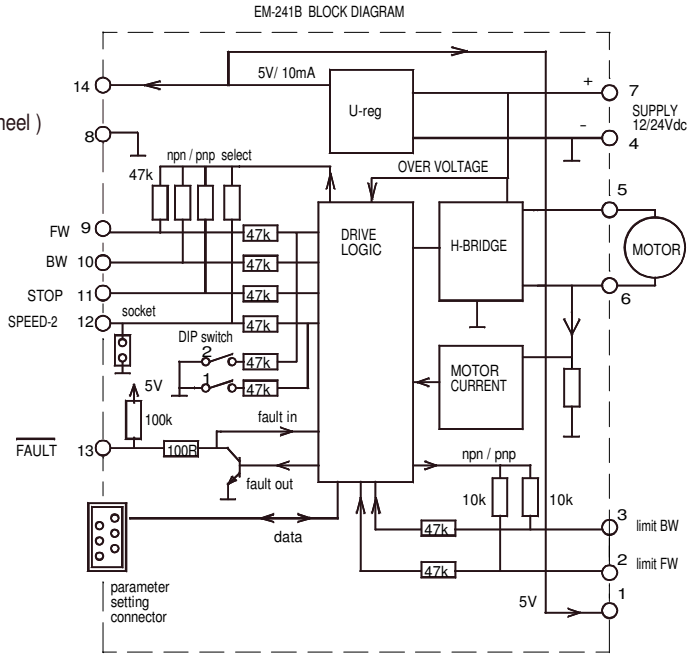
- small size
- high current output
- current limit
- zero current limit
- overvoltage brake
- speed setting
- flexible control inputs
- impulse / continuous mode
- rail base mountable
- dip switch only in PCB. version B
- A softwares compatible for B ver. PCB.
- digital parameter setting

EM-241 is a full bridge DC-motor starter. It is designed to work with DC-motor in applications where some special functions are needed. Starter has adjustable acceleration and deceleration ramps, which make possible the smooth starts and stops. Adjustable current limit protects motor against overcurrent and it can also be used as an end-stop. This device has also two settable speeds, which are usefull in positioning applications. Control inputs FW and BW start the forward and backward run. STOP is for the motor shut-down but there are also available individual limit inputs for FW and BW directions. SPEED-2 input activates preset speed-2, but it can also be used as input for analog speed control signal 0-5V. FAULT terminal has at the same time input and output function, the pin is normally high, but is pulled down in overheat and conditionally also in current trip situation. If FAULT-line is pulled down externally it will cause a stop and prevent the new start. For example, it is possible to link fault pins of several units together and achieve a syncronous stop.
There are two selectable control modes, continuous and impulse. In continuous mode the motor runs as long as the control is active. In impulse mode a short comand starts the motor, and only a new impulse will change the status. There is also few special settings start-kick and auto reverse. The card has selectable input logics. Inputs are divided in two groups, control and limit -inputs. Groups can be individually set for NPN or PNP logic. The parameters are set with EM-236 interface unit. Operation of the controller and some of its functional values can also be monitored with EM-236 interface unit.

TECHNICAL DATA (prog ver. 241A v1.5)

Supply voltage cont. max. 10-35V
Overvoltage limit adjustable 15-40V (connect motor to freewheel)
Overvoltage dynamic brake 40V (shorting motor poles)
Start up voltage 9V, shutdown voltage 8V
Motor current cont. max. 15A, peak max. 30A (Ta<50℃)
Current limit adjustable 0.1-20A (at start max 30A)
Overheat limit 100℃
Start and stop ramp adjustable 0-5s
PWM frequency 2kHz
Speed input scale (speed-2) 0-5V = 0-100% pwm
Input control logic: high =4-30V, low=0-1V
Control input impedances typ. 47kohm
Limit FW / BW input imped. typ 10kohm
Control input response time typ 5ms.
Fault out. NPN open coll. max 30V / 50mA
Fault in actives Uin < 1V (NPN)
Motor and supply connectors 2.5mm
Control connectors 1mm
Dimensions 42x72x25mm
Dimensions in DIN-rail base 45x80x45mm
CE-tested for industrial environment (emc)
Operating temp (Ta) -40...60℃
Weight 75g

EM-241B BLOCK DIAGRAM



CONNECTIONS

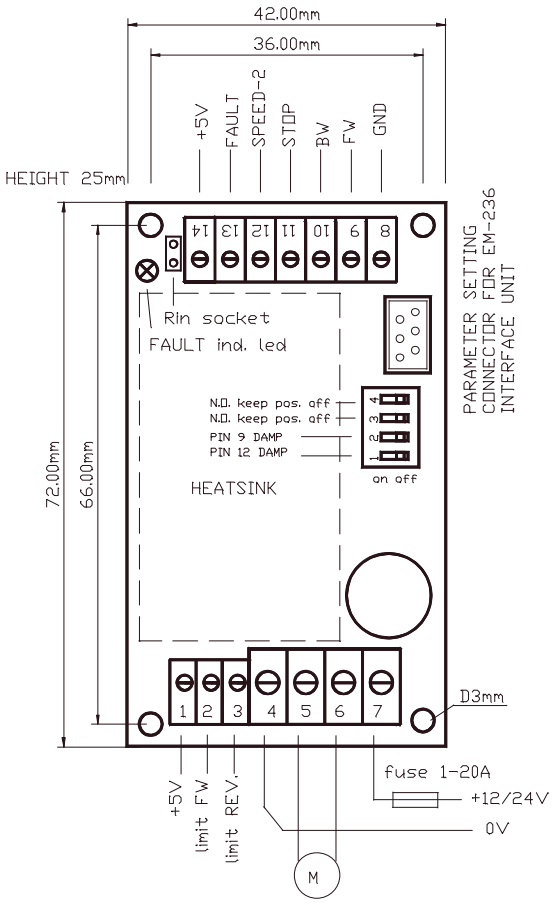
Supply voltage must be filtered DC of 10-35V,
and ripple should be less than 30% at full load.
CAUTION ! Wrong polarity can damage the unit.
CAUTION ! Unit doesn't have an internal fuse, so
an external fuse should be added if fuse required.

MONITORABLE VALUES

1/5 Motor current 0-20A (0-200)
2/5 PWM-level-% 0-100% (0-100)
3/5 hour counter (max.65535h)
4/5 start counter (max.65535)
5/5 carry counter for start counter

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. overvoltage	4 x blink -pause...
6. overheat	short blink- long pause...
7. timeout	3 x blink + long blink...
8. fault input	2 x short + 1x long blink...



ADJUSTMENT AND SETTINGS (prog ver. EM-241A v.1.5)

Adjusting and parameter setting of eg.
current limit value, ramp times and speed-2
value is done with the EM-236 interface unit.
With EM-236 the parameters and adjusted
values can also be copied to multible
devices accurately and reliably.

SETTABLE PARAMETERS 18pcs. (defaults in brackets)

1- command mode: 0,1 and 2 (0)
  0= continuos FW / REV
  1= impulse commands FW / REV. with stop
  2=impulse commands FW / REV without stop
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 0-3 PNP/NPN (0)
  0= command and limit inputs as PNP (positive)
  1= command inputs NPN, and limit inputs PNP
  2= command inputs PNP. and limit input NPN
  3= command and limit inputs NPN (negative)
4- running speed-1: 0-100% / 0-100 (100)
5- running speed-2: 0-100% / 0-100 (50)
  Note: If selected to 0 or 1 "speed2-input" is
  used as analog 0-5V speed control input, and
  when 1 is selected FW direction is automatically
  "on" and FWD input works as direction change
6- current limit FW: 0.1-20A / 1-200 (30)
7- current limit REV: 0.1-20A / 1-200 (30)
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: 0-3 (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.

11- overvoltage limit: 15-40V / 15-40 (35)
  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
  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 rice.
  There is also 40V fixed dynamic brake point = motor pole shorted
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%) Increase compensation
  with small steps until motor start behaviour unstable,
  t hen 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: 0-5s / 0-500 (100)
16- stop ramp: 0-5s / 0-500 (100)
17- start-kick 0-200ms / 0-200 (0)
  This gives full drive at start and I-lim is 30A
  The start kick length is 0-200ms.
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

EM-241-C DC-MOTOR CONTROLLER 12-24V 15A

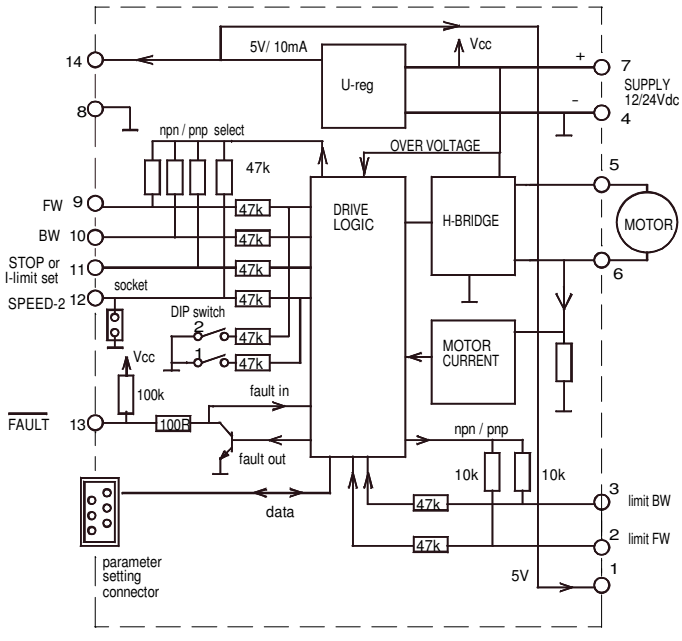
- small size
- high current output
- current limit
- zero current limit
- overvoltage brake
- speed setting
- flexible control inputs
- impulse / continuous mode
- rail base mountable
- digital parameter setting
- C-version replaces A and B versions
- C-firmware can be loadad B ver. card
- C.version available with molex connector
- current limit setting input (new)
- freewheel options (new)
- 2 or 16kHz PWM freq. (new)

EM-241C is a full bridge DC-motor starter. It is designed to work with DC-motor in applications where some special functions are needed. Starter has adjustable acceleration and deceleration ramps, which make possible the smooth starts and stops. Adjustable current limit protects motor against overcurrent and it can also be used as an end-stop. This device has also two settable speeds, which are usefull in positioning applications. Control inputs FW and BW start the forward and backward run. STOP is for the motor shut-down but there are also available individual limit inputs for FW and BW directions. SPEED-2 input activates preset speed-2, but it can also be used as input for analog speed control signal 0-5V. STOP input can be set to work as current limit setting. FAULT terminal has at the same time input and output function, the pin is normally high, but is pulled down in overheat and conditionally also in current trip situation. If FAULT-line is pulled down externally it will cause a stop and prevent thenew start. For example, it is possible to link fault pins of several units together and achieve a synchronous stop. C-version includes wo new parameter: freewheel options for realease the rotor of motor. and pwm frequency select, but notice, that in silence 16kHz pwm frequency. the output current is smaller!
There are two selectable control modes, continuous and impulse. In continuous mode the motor runs as long as the control is active. In impulse mode a short comand starts the motor, and only a new impulse will change the status. There is also few special settings start-kick and auto reverse. The card has selectable input logics. Inputs are divided in two groups, control and limit -inputs. Groups can be individually set for NPN or PNP logic.
For parameters setting there is next options: EM-236 interface unit, EM-268 with EmenTool-Lite PC-program and EM-326 with EmenTool-App application for smartphone

TECHNICAL DATA (prog ver. 241Cv1.4)

Supply voltage cont. max. 10-35V
Overvoltage limit adjustable 15-40V
Start up voltage 9V, shutdown voltage 8V
Continuous current output when ambient temp is <50°C)
15A at 100% speed / 10A at 5-99% speed pwm=2kHz
10A at 100% speed / 5A at 5-99% speed pwm=16kHz
Peak (5s.) 30A at 2khz pwm and 25A at 16kHz pwm
Current limit adjustable 0.1-25A (at start max 30A)
NOTICE! during start ramp current limit is 50% boosted
Overheat limit 100°C
Start and stop ramp adjustable 0-5s
PWM frequency 2kHz / 16kHz
Speed input scale (speed-2) 0-5V = 0-100% pwm
I-limit input scale (stop input) 0-5V = 0-20A
Input control logic: high =4-30V, low=0-1V
Control input impedances typ. 47kohm
Limit FW / BW input imped. typ 10kohm
Control input response time typ 5ms.
Fault out. NPN open coll. max 30V / 50mA
Fault in actives Uin < 1V (NPN)
Motor and supply connectors 2.5mm
Control connectors 1mm
Molex connector option KK 508 / KK 6410 (see page 2)
Dimensions 42x72x25mm
Dimensions in DIN-rail base 45x80x45mm
CE-tested for industrial environment (emc)
Operating temp (Ta) -40...60°C
Weight 75g

EM-241C BLOCK DIAGRAM



CONNECTIONS

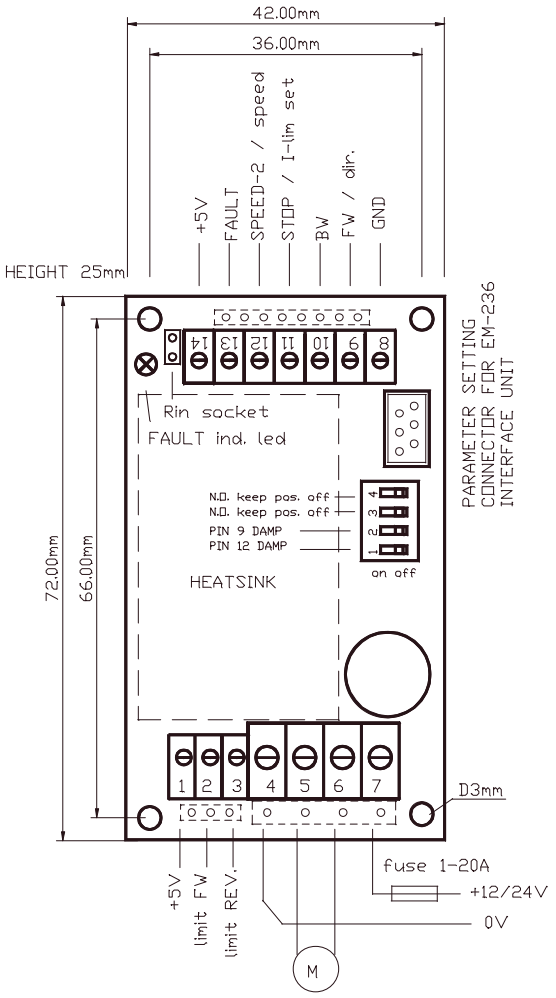
Supply voltage must be filtered DC of 10-35V,
and ripple should be less than 30% at full load.
CAUTION ! Wrong polarity can damage the unit.
CAUTION ! Unit doesn't have an internal fuse, so
an external fuse should be added if fuse required.

MONITORABLE VALUES

1/5 Motor current 0-2.0A (0-200)
2/5 PWM-level-% 0-100% (0-100)
3/5 hour counter (max.65535h)
4/5 start counter (max.65535)
5/5 carry counter for start counter

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. overvoltage	4 x blink -pause...
6. overheat	short blink- long pause...
7. timeout	3 x blink + long blink...
8. fault input	2 x short + 1x long blink...



Molex connector options with dashed line
3-pin molex 22-27-2031
4-pin molex 10-08-5041
7-pin molex 22-27-2071

ADJUSTMENT AND SETTINGS (prog ver. EM-241C v.1.4)

Settings can be done with three interface device options.
1. EM-236 interface unit
2. EM-268 interface unit 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.

PARAMETERS 20pcs. (defaults in brackets)

1- command mode: 0,1 and 2 (0)
   0= continuos FW / REV
   1= impulse commands FW / REV. with stop
   2=impulse commands FW / REV without stop
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 (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 logic 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 N.C. 6=cont. PNP, limits NPN
   3= cont. NPN, limits NPN N.C. 7=cont. NPN, limits NPN
4- running speed-1: 0-100% / 0-100 (100)
5- running speed-2: 0-100% / 0-100 (50)
   special parameter values of param. 5
   0= "speed 2-input" is used as analog 0-5V speed control input.
   1= FW direction is automatically "on" and FW input works as
      direction change input.
6- current limit FW: 0-25A / 0-250 (30)
7- current limit REV: 0-25A / 0-250 (30)
   notice! If both 6 & 7 is set = 0, then I-limit input is enabled, and
   works as current limit adjust input.
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

11- overvoltage limit: 15-40V / 15-40 (35)
   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
   the power stageset to free-wheel state, and if voltage still rises
   then powerstages shorted to brake motor more
   In battery supply use the brake current is charging the battery
   and the voltage will not normally rice.
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%) Increase 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: 0-5s / 0-500 (100)
16- stop ramp: 0-5s / 0-500 (100)
17- start-kick 0-200ms / 0-200 (0)
   This gives full drive at start and I-lim is 30A
   The start kick length is 0-200ms.
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 0-5 (0)
   0= freewheeling when overvoltage
   1= freewheeling when overv. or stopped
   2= freewheeling when overv, or stop ramp
   3= freewheeling when overv. or stopped or stop ramp
   4= freewheeling only when stopped
   5= freewheelin disabled
20- Pwm frequency 1=2kHz / 2=16kHz

EM-241C-JS1 DC-MOTOR CONTROLLER 12-24V 15A

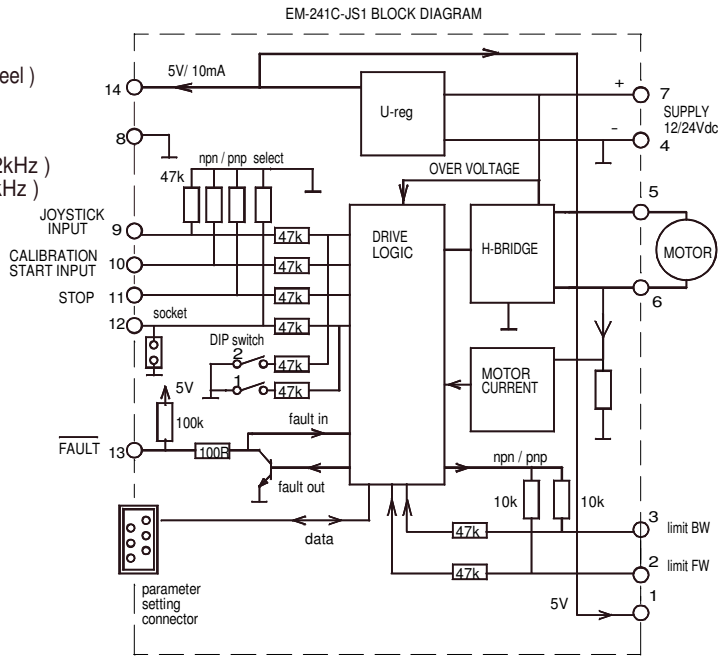
- JS1 is specially for joystick use
- three point calibration
- small size
- high current output
- current limit
- overvoltage brake
- 2 or 16kHz pwm frequency
- motors up to 200W
- own speed ranges for FW and REV.
- rail base mountable
- digital parameter setting
- JS1 program can be update also for standard EM-241 board

EM-241C-JS1 is a full bridge DC-motor starter. It is designed to joystick controlled DC-motor applications. Drievr has adjustable acceleration and deceleration ramps, which make possible the smooth starts and stops. Adjustable current limit protects motor against overcurrent and it can also be used as an end-stop. This device has also two settable speeds, separate speed ranges for forward and reverse direction. Control input is specially designed for joystick control. The joystick range calibration is done automatically, when calibration function is activated. Calibration detects forward, reverse and midpoint positions. FAULT terminal has at the same time input and output function, the pin is normally high, but is pulled down in overheat and conditionally also in current trip situation.
If FAULT-line is pulled down externally it will cause a stop and prevent the new start. For example, it is possible to link fault pins of several units together and achieve a syncronous stop.
There is also special settings as start-kick which could be used if there is danger of stuck. Limit input can be individually set for NPN or PNP logic.
The parameters settings can be done with various EM- interface units. Operation of the controller and some of its functional values can also be monitored with interface units.

TECHNICAL DATA (prog ver. 241C-JS1 v1.0)

Supply voltage cont. max. 10-35V
Overvoltage limit adjustable 15-40V (connect motor to freewheel)
Overvoltage dynamic brake 40V (shorting motor poles)
Start up voltage 9V, shutdown voltage 8V
Continuous current output when ambient temp. is < 50°C
15A at 100% speed / 10A at 5-99% speed (pwm freq. 2kHz)
10A at 100%speed / 5A at 5-99% speed (pwm freg 16kHz)
Peak current (5s.) 30A at 2kHz / 25A at 16khz
Current limit adjustable 0.1-25A (at start max. 30A)
Overheat limit 100°C
Start and stop ramp adjustable 0-5s
PWM frequency 2kHz / 16kHz (selectable)
Joystick input scale 0-5V or 0-10V (if dip 2 = ON)
Input control logic: high =4-30V, low=0-1V
Control input impedances typ. 47kohm
Limit FW / BW input imped. typ 10kohm
Control input response time typ 5ms.
Fault out. NPN open coll. max 30V / 50mA
Fault in actives Uin < 1V (NPN)
Motor and supply connectors 2.5mm
Control connectors 1mm
Dimensions 42x72x25mm
Dimensions in DIN-rail base 45x80x45mm
CE-tested for industrial environment (emc)
Operating temp (Ta) -40...60°C
Weight 75g

EM-241C-JS1 BLOCK DIAGRAM



CONNECTIONS

Supply voltage must be filtered DC of 10-35V,
and ripple should be less than 30% at full load.
CAUTION ! Wrong polarity can damage the unit.
CAUTION ! Unit doesn't have an internal fuse, so
an external fuse should be added if fuse required.

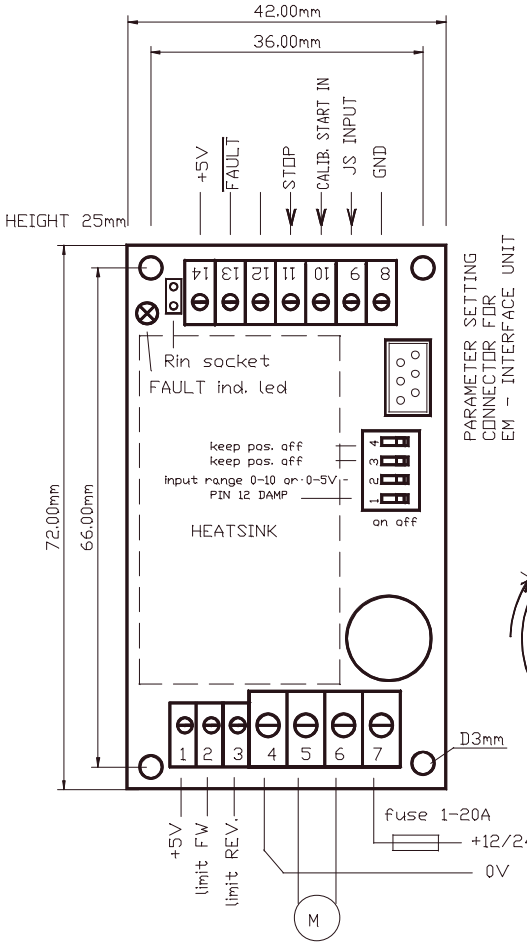
MONITORABLE VALUES

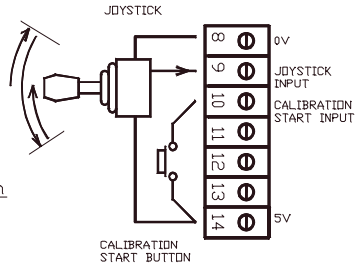
1/6 Motor current 0-20A (0-200)
2/6 PWM-level-% 0-100% (0-100)
3/6 hour counter (max.65535h)
4/6 start counter (max.65535)
5/6 carry counter for start counter
6/6 joystick position 0-1024

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. overvoltage	4 x blink -pause...
6. overheat	short blink- long pause...
7. timeout	3 x blink + long blink...
8. fault input	2 x short + 1x long blink...

Special codes for calibration mode
solid light = calibration can be done
blink light = calibration is done





ADJUSTMENT AND SETTINGS (prog ver. EM-241C-JS1 v1.0)

Adjusting and parameter setting of eg.
current limit value, ramp times and speed-2
value can be done with various EM-interface units
EM-236 is basic parameter setting device.
EM-268 and EM- 328 are USB-serial converters,
which makes possible to set parameters also
with computer where is installed EmenTool Lite
program. EM-326 is Bluetooth -dongle which can
be used in smart devices with EmenTool App.

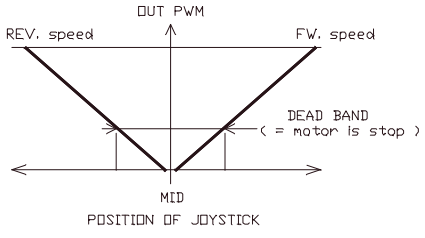
SETTABLE PARAMETERS 20pcs. (defaults in brackets)

1- not in use
2- not in use
3- input logic for limit inputs 1 or 2 PNP/NPN (1)
1= limit inputs PNP 2= limit input NPN
4- max. speed FW. 0-100% / 0-100 (100)
5- max. speed REV. 0-100% / 0-100 (100)
6- current limit FW. 0.1-20A / 1-200 (30)
7- current limit REV. 0.1-20A / 1-200 (30)
8- current trip 0= disabled, 1= enabled : (1)
9- not in use
10- Fault output combinations: 0-2 (0)
0= overtemp, current trip. overvoltage
1= as above + calibration indication
2= current limit indication
NOTICE ! fault input is disabled in setting 2
11- overvoltage limit: 15-40V / 15-40 (35)
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
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.
There is also 40V fixed dynamic brake point = motor pole shorted
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%) Increase 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: 0-5s / 0-500 (50)
16- stop ramp: 0-5s / 0-500 (20)
17- start-kick 0-200ms / 0-200 (0)
This gives full drive at start and I-lim is 30A
The start kick length is 0-200ms.
18- Dead band wide 0-50% / 0-50 (5)
19- Freewheel options 0-3 (0)
0= no freewheel
1= freewheel when stopped
2= freewheel during stop ramp.
3= freewheel during stop ramp and if stopped
20- Pwm frequency 1=2kHz / 2=16kHz

JOYSTICK CALIBRATION

Give about 3s. control signal to CALIB
input. when Fault-led of device will be lit:
-push joystick full forward, then
-pull joystick full reverse, then
-release joystick to mid position, then
-wait until led start to blink = calibration done

NOTICE ! calibration above defines joystick
full fw, full rev. and mid point positions.
But the max. speed can be set with
parameters 4 and 5



EM-241B-PLI DC-MOTOR CONTROLLER 12-24V 15A

This is modified version from EM-241B
Pulse counter block is added. This block
can be used for end limit use.

- **small size**
- **high current output**
- **2ch pulse counter inputs**
- **Pulse counter limits.**
- **current limit**
- **zero current limit**
- **overvoltage brake**
- **speed setting**
- **PWM 2 or 16 kHz**
- **flexible control inputs**
- **impulse / continuous mode**
- **rail base mountable**
- **dip switch only in PCB. version B**
- **A softwares compatible for B ver. PCB.**
- **digital parameter setting**

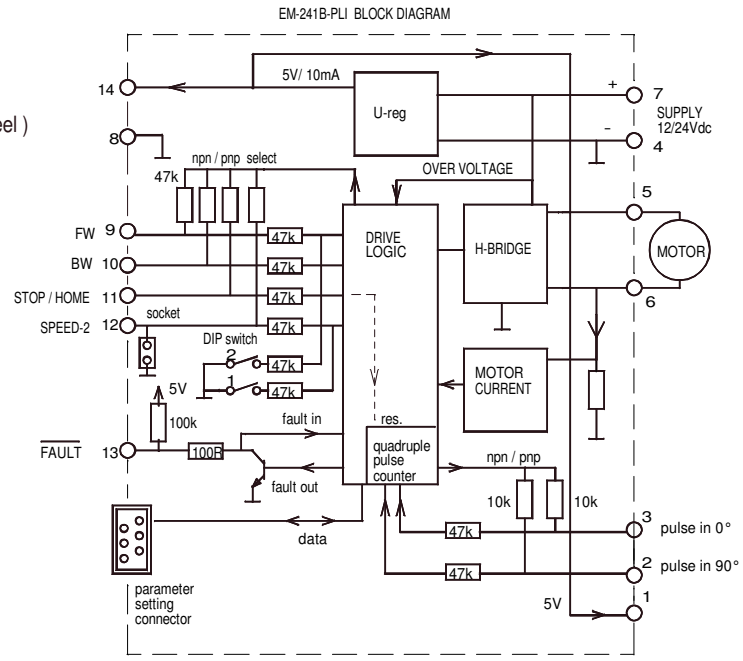
EM-241 is a full bridge DC-motor starter. It is designed to work with DC-motor in applications where some special functions are needed. Starter has adjustable acceleration and deceleration ramps, which make possible the smooth starts and stops. Adjustable current limit protects motor against overcurrent and it can also be used as an end-stop. This device has also two settable speeds, which are usefull in positioning applications. Control inputs FW and BW start the forward and backward run. STOP is for the motor shut-down. In -PLI version there are also PULSE COUNTER which can be used for end limit use. This counter value keep in memory of card also when power is turned off. SPEED-2 input activates preset speed-2, but it can also be used as input for analog speed control signal 0-5V. FAULT terminal has at the same time input and output function, the pin is normally high, but is pulled down in overheat and conditionally also in current trip situation. If FAULT-line is pulled down externally it will cause a stop and prevent the new start. For example, it is possible to link fault pins of several units together and achieve a syncronous stop.

There are two selectable control modes, continuous and impulse. In continuous mode the motor runs as long as the control is active. In impulse mode a short comand starts the motor, and only a new impulse will change the status. There is also few special settings start-kick and auto reverse. The card has selectable input logics. Inputs are divided in two groups, control and limit -inputs. Groups can be individually set for NPN or PNP logic. The parameters are set with EM-236 interface unit. Operation of the controller and some of its functional values can also be monitored with EM-236 interface unit.

TECHNICAL DATA

Supply voltage cont. max. 10-35V
Overvoltage limit adjustable 15-40V (connect motor to freewheel)
Overvoltage dynamic brake 40V (shorting motor poles)
Start up voltage 9V, shutdown voltage 8V
Motor current cont. max. 15A, peak max. 30A (Ta<50℃)
Current limit adjustable 0.1-20A (at start max 30A)
Overheat limit 100℃
Start and stop ramp adjustable 0-5s
PWM frequency 2kHz
Speed input scale (speed-2) 0-5V = 0-100% pwm
Input control logic: high =4-30V, low=0-1V
Control input impedances typ. 47kohm
Pulse input imped. typ 10kohm
Pulse input freq max. 400Hz
Control input response time typ 5ms.
Fault out. NPN open coll. max 30V / 50mA
Fault in actives Uin < 1V (NPN)
Motor and supply connectors 2.5mm
Control connectors 1mm
Dimensions 42x72x25mm
Dimensions in DIN-rail base 45x80x45mm
CE-tested for industrial environment (emc)
Operating temp (Ta) -40...60℃
Weight 75g

EM-241B-PLI BLOCK DIAGRAM



CONNECTIONS

Supply voltage must be filtered DC of 10-35V,
and ripple should be less than 30% at full load.
CAUTION ! Wrong polarity can damage the unit.
CAUTION ! Unit doesn't have an internal fuse, so
an external fuse should be added if fuse required.

MONITORABLE VALUES

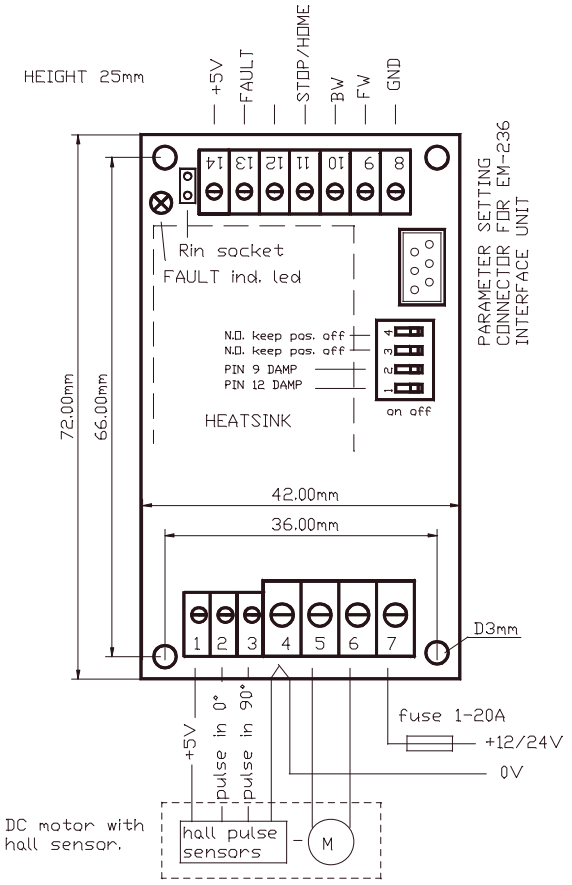
1/6 Motor current 0-20A (0-200)
2/6 PWM-level-% 0-100% (0-100)
3/6 hour counter (max.65535h)
4/6 start counter (max.65535)
5/6 carry counter for start counter
6/6 pulse counter value 0-65000

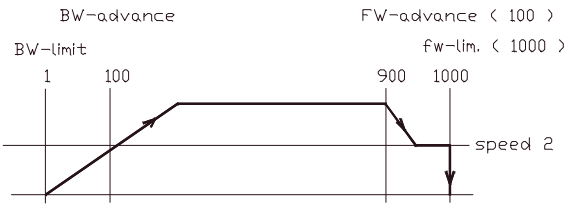
FAULT-LED signal codes

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. overvoltage	4 x blink -pause...
6. overheat	short blink- long pause...
7. timeout	3 x blink + long blink...
8. fault input	2 x short + 1x long blink...

HOME RUN = PULSE COUNTER RESET

Pulse counter have to reset to calibrate position. Calibration can be done by start HOME RUN. Then driver start to run BW direction at speed-2. In this running mode limits are not active, so motor run as long as HOME RUN is active. When HOME RUN stops the counter will reset also.
HOME RUN can be started with different way: long push same time with FW and BW commands or with STOP / HOME command or with BW commands. See parameter 21.





Example of function of limit. (with default values)
In limit advance point changes speed to the speed-2
In limit point the driver brakes motor to stop

ADJUSTMENT AND SETTINGS (prog ver. EM-241B PLI v1.2)

Adjusting and parameter setting of eg.
current limit value, ramp times and speed-2
value is done with the EM-236 interface unit.
With EM-236 the parameters and adjusted
values can also be copied to multible
devices accurately and reliably.

SETTABLE PARAMETERS 21pcs. (defaults in brackets)

1- command mode: 0,1 and 2 (0)
  0= continuos FW / REV
  1= impulse commands FW / REV. with stop
  2=impulse commands FW / REV without stop
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 0-3 PNP/NPN (0)
  0= command and pulse inputs as PNP (positive)
  1= command inputs NPN, and pulse inputs PNP
  2= command inputs PNP. and pulse input NPN
  3= command and pulse inputs NPN (negative)
4- running speed-1: 0-100% / 0-100 (100)
5- running speed-2: 0-100% / 0-100 (50)
  Note: If selected to 0 or 1 "speed2-input" is
  used as analog 0-5V speed control input, and
  when 1 is selected FW direction is automatically
  "on" and FWD input works as direction change
6- current limit FW: 0.1-20A / 1-200 (30)
7- current limit REV: 0.1-20A / 1-200 (30)
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: 0-3 (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.

11- overvoltage limit: 15-40V / 15-40 (35)
  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
  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 rice.
  There is also 40V fixed dynamic brake point = motor pole shorted
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%) Increase compensation
  with small steps until motor start behaviour unstable,
  t hen 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: 0-5s / 0-500 (100)
16- stop ramp: 0-5s / 0-500 (100)
17- start-kick 0-200ms / 0-200 (0)
  This gives full drive at start and I-lim is 30A
  The start kick length is 0-200ms.
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 BW counter limit 0-65000 count / 0-65000 (1)
  Value 0 = limit is disabled
20 FW counter limit 0-65000 count / 0-65000 (1000)
  Value 0 = limit is disabled
21 BW-limit advance 0-50000count / 0-50000 (100)
22 FW-limit advance 0-50000count / 0-50000 (100)
23 HOME RUN start cond. (=pulse counter reset) 0-2 (0)
  0 = simultaneous FW & BW command 5sec. push
  1 = also stop input long push 5s. starts HOME RUN
  2 = also new 5s. BW command starts HOME RUN
    if motor has stopped on limit or if I-trip occurs.
24 PWM-frequency 1=2kHz / 2=16kHz

NOTICE.
Pulse counter should count down when motor run to BW direction or
in HOME RUN. Counter value can be monitored with monitor value 6.
IF NOT. then you have to interchange pulse input wires 2<->3 or
interchange motor wires 5<->6.

If pulses counter did not count. then check parameter 3 settings
(pulse input PNP or NPN)

Max input pulse frequency is 400Hz max.
For example: 3000rpm x 4pulses/round = 200Hz

EM-285 DC-MOTOR SPEED REGULATOR 12 / 24V 20A

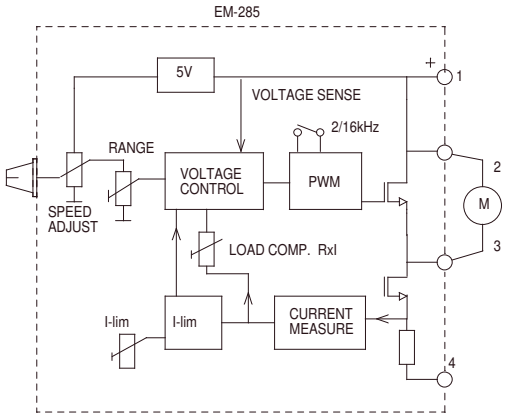
FEATURES

- **Speed cont. to 1-direction**
- **Panel mountable**
- **Small size**
- **Motor size 30-200W**
- **Good speed regulation**
- **Load comp. adjustable RxI**
- **Adjustable current limit**
- **Overheating protection**
- **EMC tested.**

EM-285 is a PWM-based DC-motor driver. The materials and features meet the industrial standards. Motor voltage is regulated against supply voltage changes, and there is also a load compensation adjustment (RxI), which enables steady speed during motor loading. Because of these features EM-285 can offer a good DC-motor speed regulation. In the power line of EM-285 there is an overvoltage limit, which trips the power stage in case the voltage would try to rise too high. This is possible in deceleration situation (emf voltage generation in braking). If potentiometer is turned on zero-position, the driver will make a shorting on motor wires for 5s. This creates a powerfull braking (dynamic brake) which can be used to stop or lower the motor speed fast. The current limit and potentiometer range can be adjusted with on-board trimmer potentiometer. The device is EMC measured and meets industrial requirements in typical installation. EM-285 is easy to mount to a D10mm hole in the assembly panel. The power stage is not short circuit protected, so it is recommended to use an external fuse in application supply wiring.

TECHNICAL DATA

Supply voltage 10-35Vdc
Overvoltage shut down 38V
Undervoltage shut down 10V
Start up voltage 11V
Idle current typ. 20mA
Motor current cont. max 20A (Ta<50℃)
Motor current peak max 30A (10s.)
Power losses 5W (at 20A and 16kHz)
Power losses 4W (at 20A and 2kHz)
Current limit adj. 1-30A
PWM frequency 2kHz or 16kHz
Temperature limit 90℃
Motor and supply connectors 2.5mm
EMC EN 50081-2 & EN 50082-2
Weight 85g
Operating temp (Ta) -20...60℃



EM-285 WIRING and INSTALLATION

Recommended supply voltage 12-32Vdc filtered DC
Ripple should be less than 20% at max. power.
At high power use the supply wires should be as short as possible. The use of external fuse is recommended.
ATT. Wrong supply polarity can damage device.
ATT. Driver has no inbuilt fuse.

Select operation frequency. At 2kHz there are lower power losses and lower EMC emission level, but some cases there can occur audiable noise.

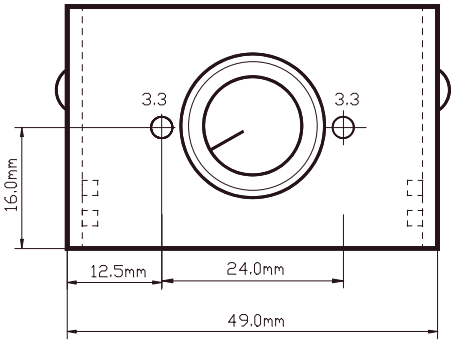
Range trim is used to scale the usable speed adjust range. See diagram below.

Current limit (I-lim) limits the motor current, in other words the motor torgue. This adjustment should be used to set the limit to suitable level according to the application.

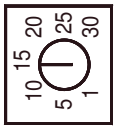
This device can be installed using one 10mm diameter hole. If the enviroment has high vibration level, the fastening can be secured with two external 3mm screws.

The body of this device can warm up, specially when continuos current is higher than 15A. Take this account when installing device in to plastic enclosure. In high power application the metal box is recommended.
Metal box also offers a better EMC properties and cooling.
The body temperature rise from ambient at 20A current is 45℃ at pwm-freq. of 16kHz and 35℃ at pwm-freq of 2kHz

Load compensation (RxI) should be set to minimum in beginning. Next set the a motor rpm 20-30%. and slowly increase compensation and simultanously try loading the motor. If motor rpm is no affected by loading the compensation adjustment is in optimum. But if motor starts to twitch or running turns nervous the adjustment is overcompensating.

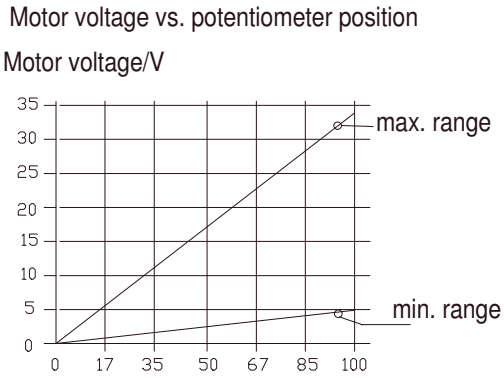


RxI compensation adjustment



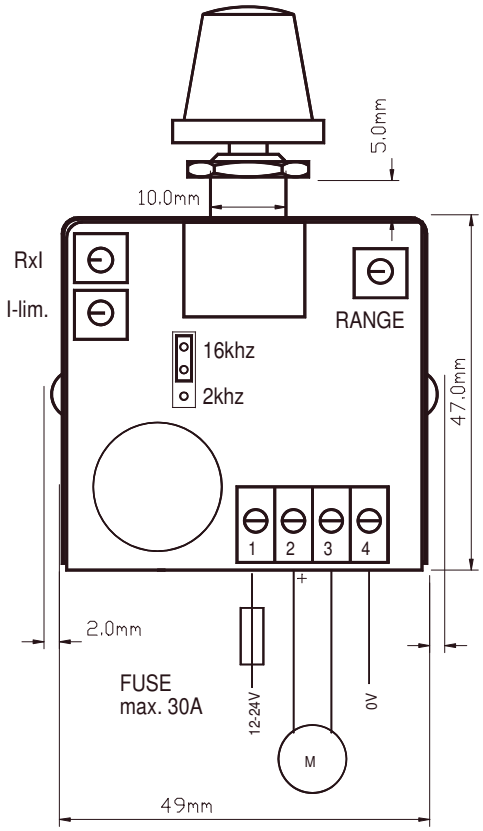
I-lim./ A current limit

Motor voltage vs. potentiometer position



Range is adjustable with inbuilt range trim

0% = potentiometer full counter clockwise
100% = potentiometer full clockwise



EM-115 DC-MOTOR CONTROL UNIT 12-36V 25A 4-QUAD.

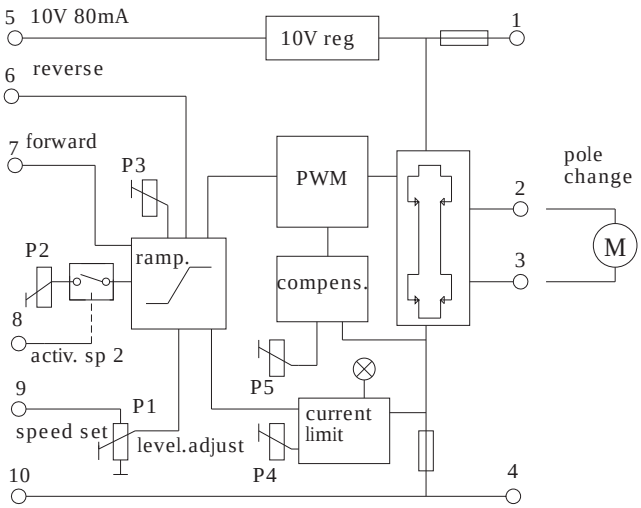
FEATURES:

- Small size
- Four quadrant drive
- High efficiency >92%
- Motor range 50-500W
- Rail mounting base fittable
- Adjustable current limit
- Adjustable ramp

EM-115 motor control unit is designed for big permanent magnet DC-motors. The power control is done with PWM method (Pulse Width Modulation). This facilitates high efficiency and small temperature losses. Thanks to a high switching frequency the unit operates quietly. A battery or a filtered DC-supply will do as a power source.
The maximum output given by the unit depends on the installation. When operating at maximum power output sufficient air ventilation has to be taken care of. The unit operates in 4-quadrants so it drives and brakes in both directions. The braking is done with regenerative way feeding braking energy back to power supply. When a battery is not used as a power source the braking energy will be fed to the internal resistance of the motor. The motor rpm can be set either with potentiometer, trim or external voltage signal. The output acceleration ramp and current limit are set with trims, the current limit is indicated with a red LED. A load affecting the motor rpm can be eliminated with a compensation trim. The power stage is protected against voltage peaks, overload and temporary shortcuts. Even the incorrect polarity does not damage the unit as long as a fuse of recommended value is used.

TECHNICAL DATA:

Supply voltage	12...36 Vdc
Idle current	< 50mA
Recommended fuse	5-30A
Control potentiometer	1k..50k
Load capacity	25A RMS
	50A mom. (5s)
Motor voltage	0-30V
Control voltage range	from 0-5V to 0-10V
Voltage loss /V	<1V when Im=25A
Current limit	4..50A
Operating frequency	approx. 21kHz
Ramp time	0.3..10s
On / Off control	>4V “on”
	<1V “off”
Input impedance	pins 6,7 and 8 = 10kohm
	pin 9 = 100kohm
Efficiency	>92%
Operating temp.	-10..50 °C
Dimensions	107*107*45 mm
Weight	approx. 270 g



EM-115 OPERATING AND CONNECTING INSTRUCTIONS

IMPORTANT!

Check polarity before connecting!
Use filtered 12-36VDC (ripple <20%)
as operating voltage.

When motor current constantly exceeds 20A,
proper air ventilation must be taken care of.
Ambient temperature should not be over 50°C.

CONTROLS

P1-maximum level.
Use to set maximum level. This is also
the speed set for speed-1 in 2-step speed mode.

P2-speed-2
When using 2-step speed mode use P2 to
set speed-2.

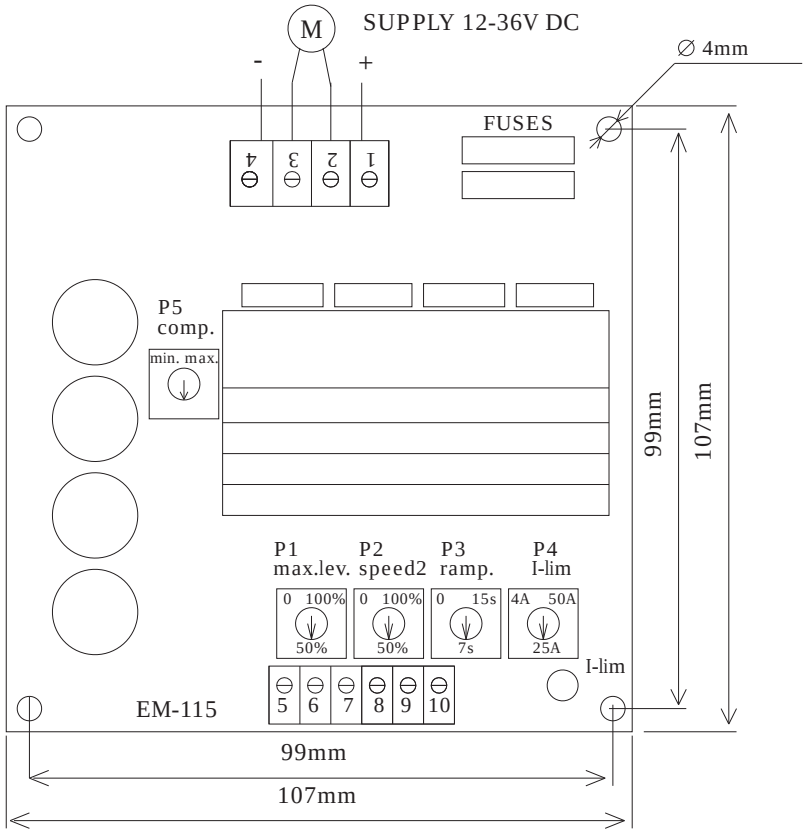
P3-acceleration / braking ramp
Use ramp adj. to obtain smooth
starting and running. The right value
can be found just by testing the set.

P4-current limit
The operation of the current limit is indicated
by a red LED next to the trim. Use it to set the
desired maximum current to the motor, in other
words max. torque.

P5-compensation
Use this trim to compensate the load affecting
the motor rpm. Set the motor rpm to approx.
50%, adjust ccw until the motor starts to twitch,
then adjust carefully backwards till the twitching ends.

FUSE

The fuse type is ATO 5-30A, according to
the application.

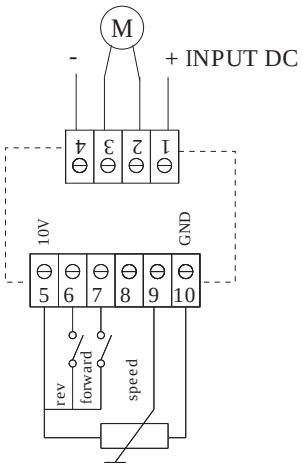


TERMINALS

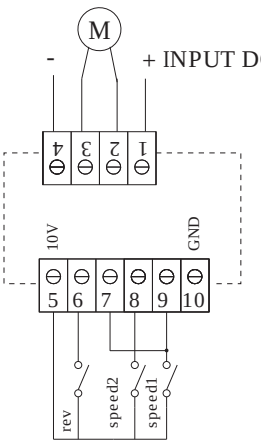
1. Supply voltage 12-36V
2. Motor out +
3. Motor out -
4. Supply voltage 0V gnd

5. Control voltage approx. 10V 80mA
6. Reverse (master)
7. Forward
8. Speed-2 activation
9. Control input (U / pot.)
10. Signal 0V gnd

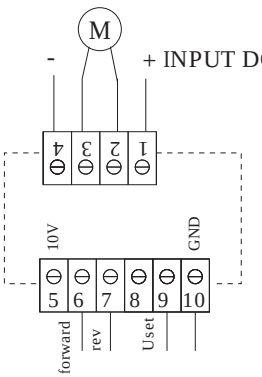
Continuous rpm control,
set with pot.meter, adjust
range with P1.
Switch to forward.
Switch to change direction.



2-step speed mode
(run / positioning)
P1-speed1, P2-speed2
Activation with speed1
& speed2.



Continuous rpm control,
set with voltage, adjust
range with trim P1.
Reverse and forward with
TTL, CMOS or 0-24V signal.



Forward, OFF 0-1V, ON 4-30V
Reverse, OFF 0-1V, ON 4-30V
Speed (Uset) 0-5V to 0-10V = 0-100%

EM-115-48 DC-MOTOR CONTROL UNIT 20-60V 25A 4-QUAD.

FEATURES:

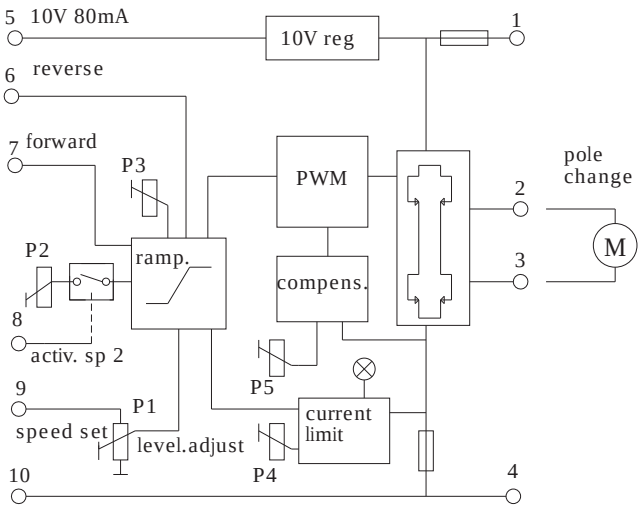
- Small size
- Four quadrant drive
- High efficiency >92%
- Motor range 50-500W
- Rail mounting base fittable
- Adjustable current limit
- Adjustable ramp

Notice: With this higher voltage version it is more important to use motor in accordance to the recommend motor power range (<500W).

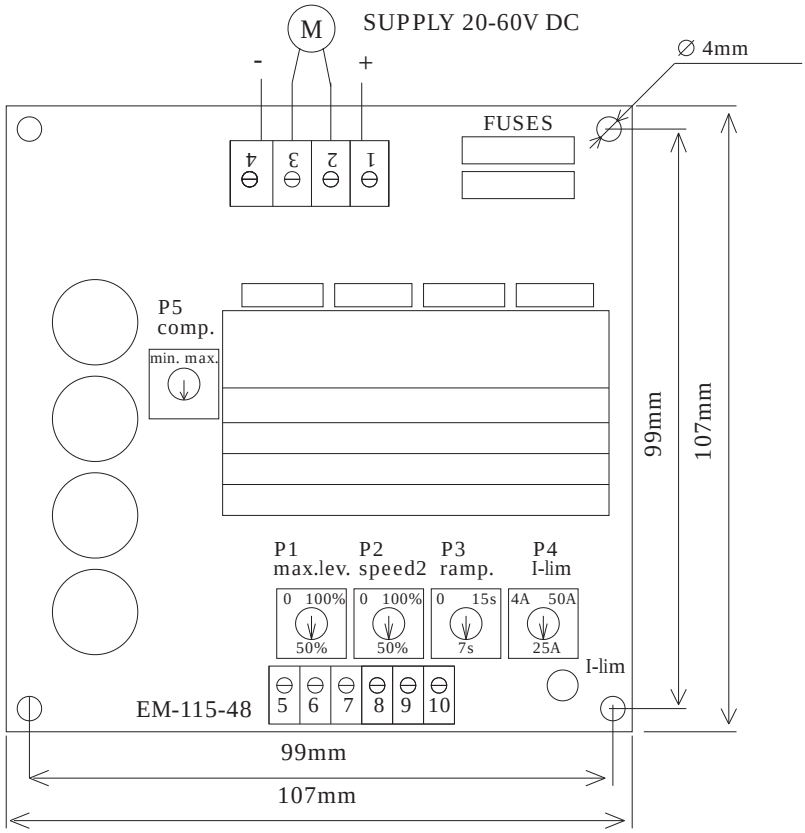
EM-115-48 motor control unit is designed for big permanent magnet DC-motors. The power control is done with PWM method (Pulse Width Modulation). This facilitates high efficiency and small temperature losses. Thanks to a high switching frequency the unit operates quietly. A battery or a filtered DC-supply will do as a power source.
The maximum output given by the unit depends on the installation. When operating at maximum power output sufficient air ventilation has to be taken care of. The unit operates in 4-quadrants so it drives and brakes in both directions. The braking is done with regenerative way feeding braking energy back to power supply. When a battery is not used as a power source the braking energy will be fed to the internal resistance of the motor. The motor rpm can be set either with potentiometer, trim or external voltage signal. The output acceleration ramp and current limit are set with trims, the current limit is indicated with a red LED. A load affecting the motor rpm can be eliminated with a compensation trim. The power stage is protected against voltage peaks, overload and temporary shortcuts. Even the incorrect polarity does not damage the unit as long as a fuse of recommended value is used.

TECHNICAL DATA:

Supply voltage	20...60 Vdc
Idle current	< 50mA
Recommended fuse	5-30A
Control potentiometer	1k..50k
Load capacity	25A RMS
	50A mom. (5s)
Motor voltage	0-58V
Control voltage range	from 0-5V to 0-10V
Voltage loss /V	<0.5V when Im=30A
Current limit	4..50A
Operating frequency	approx. 21kHz
Ramp time	0.3..10s
On / Off control	>4V “on”
	<1V “off”
Input impedance	pins 6,7 and 8 = 10kohm
	pin 9 = 100kohm
Efficiency	>92%
Operating temp.	-10..50 °C
Dimensions	107*107*45 mm
Weight	approx. 270 g



EM-115-48 OPERATING AND CONNECTING INSTRUCTIONS



IMPORTANT!

Check polarity before connecting!
Use filtered 20-60VDC (ripple <20%)
as operating voltage.

When motor current constantly exceeds 10A,
proper air ventilation must be taken care of.
Ambient temperature should not be over 50°C.

CONTROLS

P1-maximum level.
Use to set maximum level. This is also
the speed set for speed-1 in 2-step speed mode.

P2-speed-2
When using 2-step speed mode use P2 to
set speed-2.

P3-acceleration / braking ramp
Use ramp adj. to obtain smooth
starting and running. The right value
can be found just by testing the set.

P4-current limit
The operation of the current limit is indicated
by a red LED next to the trim. Use it to set the
desired maximum current to the motor, in other
words max. torque.

P5-compensation
Use this trim to compensate the load affecting
the motor rpm. Set the motor rpm to approx.
50%, adjust ccw until the motor starts to twitch,
then adjust carefully backwards till the twitching ends.

FUSE

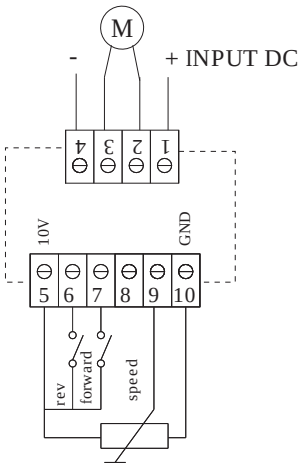
The fuse type is ATO 5-30A, according to
the application.

TERMINALS

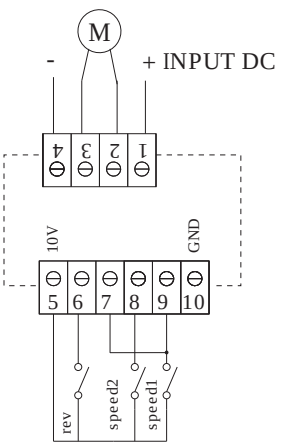
1. Supply voltage 20-60V
2. Motor out +
3. Motor out -
4. Supply voltage 0V gnd

5. Control voltage approx. 10V 80mA
6. Reverse (master)
7. Forward
8. Speed-2 activation
9. Control input (U / pot.)
10. Signal 0V gnd

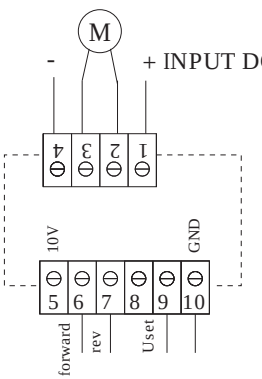
Continuous rpm control,
set with pot.meter, adjust
range with P1.
Switch to forward.
Switch to change direction.



2-step speed mode
(run / positioning)
P1-speed1, P2-speed2
Activation with speed1
& speed2.



Continuous rpm control,
set with voltage, adjust
range with trim P1.
Reverse and forward with
TTL, CMOS or 0-24V signal.



Forward, OFF 0-1V, ON 4-30V
Reverse, OFF 0-1V, ON 4-30V
Speed (Uset) 0-5V to 0-10V = 0-100%

EM-243A DC-MOTOR CONTROLLER 12-42V 50A

FEATURES

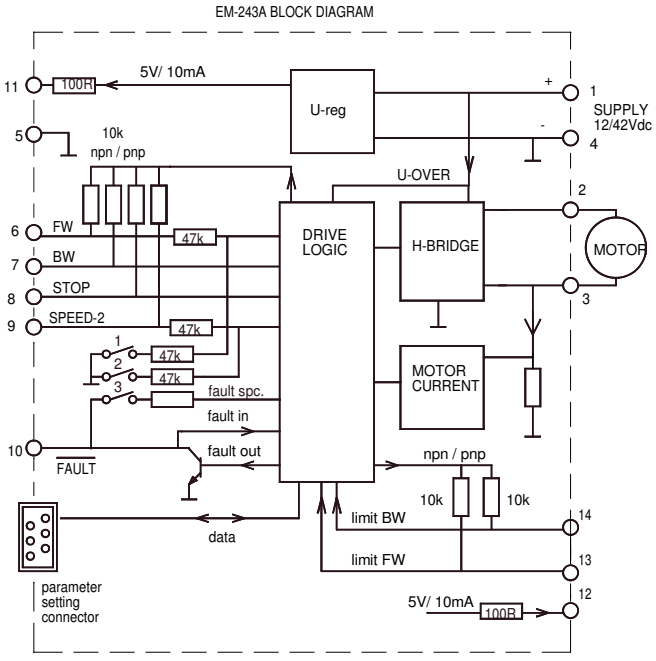
- small size
- high current output
- current limit
- zero current limit
- speed setting
- flexible control inputs
- impulse / continuous mode
- rail base mountable
- digital parameter setting
- A-vers. compatible with older version
  +higher supply voltage area
  +higher fault output current.
  +input damping with dip-switch

EM-243A is a full bridge DC-motor starter. It is designed to work with DC-motor in applications where some special functions are needed. Starter has adjustable acceleration and deceleration ramps, which make possible the smooth starts and stops. Adjustable current limit protects motor against overcurrent and it can also be used as an end-stop. This device has also two settable speeds, which are usefull in positioning applications. Control inputs FW and BW start the forward and backward run. STOP is for the motor shut-down but there are also available individual limit inputs for FW and BW directions. SPEED-2 input activates preset speed-2, but it can also be used as input for analog speed control signal 0-5V. FAULT terminal has at the same time input and output function, the pin is normally high, but is pulled down in overheat and conditionally also in current trip situation. If FAULT-line is pulled down externally it will cause a stop and prevent the new start. For example, it is possible to link fault pins of several units together and achieve a syncronous stop.
There are 2 selectable control modes, contionuous and impulse. In continuous mode the motor runs as long as the control is active. In impulse mode a short comand starts the motor, and only a new impulse will change the status. The card has selectable input logics. Inputs are divided in two groups, control and limit -inputs. Groups can be individually set for NPN or PNP logic. The parameters are set with EM-236 interface unit. Operation of the controller and some of its functional values can also be monitored with EM-236 interface unit.

TECHNICAL DATA

Supply voltage nominal 12-42V, limits 10-55V
Start up voltage 9V, shutdown voltage 8V
Idle current typ 15mA
Motor current max. continous 50A (at 25°C amb temp), 40A (at 60° amb temp) and peak 100A (5s)
Current limit adjustable 1-100A (at start 1.5 times)
Overheat limit 100°C
Start and stop ramp adjustable 0-5s
PWM frequency 2kHz
Speed input scale (speed-2) 0-5 or 0-10V= 0-100% pwm
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. 50V / 1A
Fault in actives Uin < 1V (NPN)
Motor and supply connectors 2.5mm
Control connectors 1mm
Dimensions 107x72x40mm
Dimensions in DIN-rail base 110x80x55mm
CE-tested for industrial environment (EMC)
Operating ambient temp (Ta) -40...60°C
Weight 190g

EM-243A BLOCK DIAGRAM



CONNECTIONS

Supply voltage recomendation is 12-42VDC
and ripple should be less than 30% at full load.
Supply voltage limit is 55Vdc
CAUTION ! Wrong polarity can damage the unit.
CAUTION ! Unit doesn't have an internal fuse, so
an external fuse should be added if fuse required.

MONITORABLE VALUES

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

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. overvoltage	4 x blink -pause...
6. overheat	short blink- long pause...
7. timeout	3 x blink + long blink...
8. fault input	2 x short + 1x long blink...

ADJUSTMENT AND SETTINGS

Adjusting and parameter setting of eg.
current limit value, ramp times and speed-2
value is done with the EM-236 interface unit.
With EM-236 the parameters and adjusted
values can also be copied to multible
devices accurately and reliably.

DIP SWITCHES

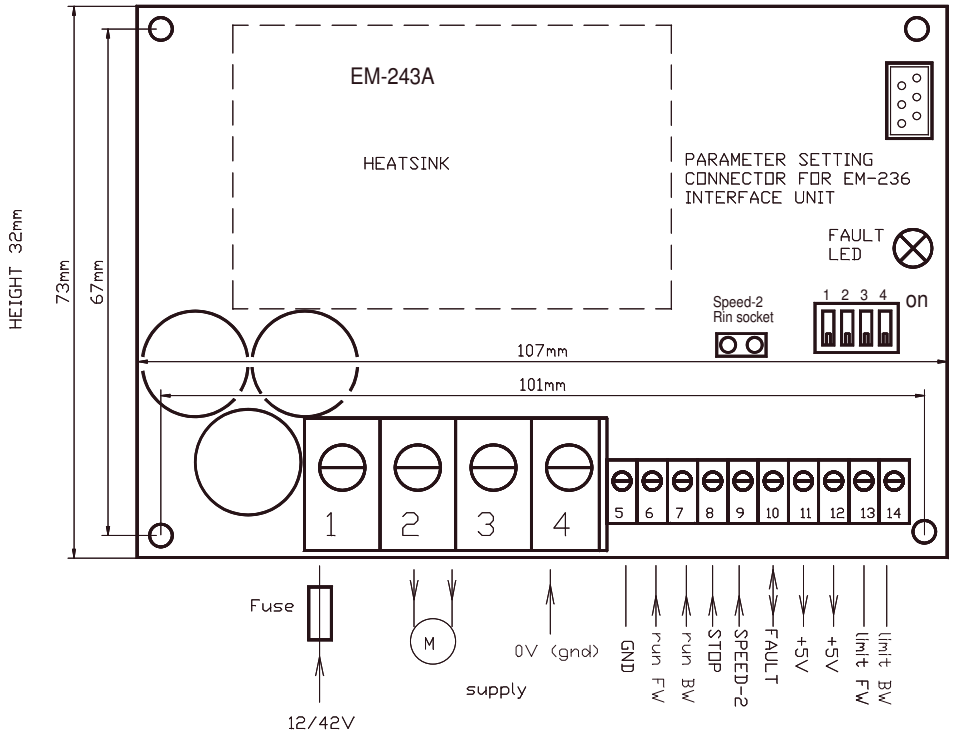
A-version has a dip swithes, When switch are
in OFF position the card will be compatible with
earlier version.

Dip-1 ON pos. damping FWD input
Dip-2 ON pos. damping Speed-2 input with 2
Dip-3 ON pos. special Fault output select
Dip-4 ON pos. special clock

SETTABLE PARAMETERS
prog. 243A v1.0 (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 0-3 PNP/NPN (0)
0= command and limit inputs as PNP (positive)
1= command inputs NPN, and limit inputs PNP
2= command inputs PNP. and limit input NPN
3= command and limit inputs NPN (negative)
4 running speed-1: 0-100% / 0-100 (100)
5 running speed-2: 0-100% / 0-100 (50)
Note: If selected to 0 "speed2-input" is
used as analog 0-5V speed control input.
6 current limit FW: 1-100A / 1-100 (10)
7 current limit REV: 1-100A / 1-100 (10)
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: 0-3 (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.

11 overvoltage limit: 15-60V / 15-60 (55)
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
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 rice.
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: 0-5s / 0-500 (100)
16 stop ramp: 0-5s / 0-500 (100)
17 start kick 0-200ms / 0-200 (0)
gives short 0-200ms full drive pulse for start



EM-243C-JS1 DC-MOTOR CONTROLLER 12-42V 50A

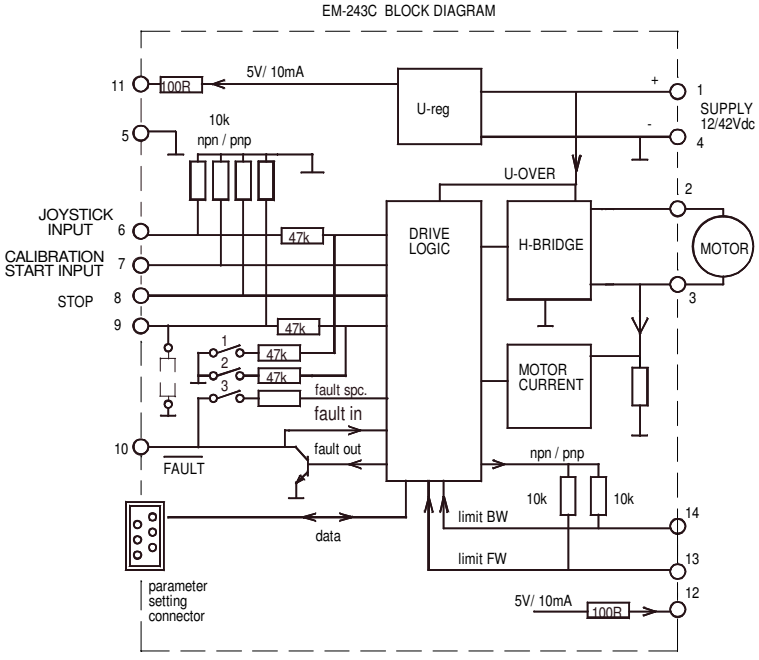
- **JS1 is specially for joystick use**
- **three point calibration**
- **compact size**
- **for motor up to 500W**
- **high current output**
- **current limit**
- **overvoltage brake**
- **own speed ranges for FW and REV.**
- **rail base mountable**
- **digital parameter setting**
- **JS1 program can be update also for standard EM-243A or 243C boards**

EM-243C-JS1 is a full bridge DC-motor starter. It is designed for joystick controlled DC-motor applications. The driver has adjustable acceleration and deceleration ramps, which enable the smooth starts and stops. Adjustable current limit protects the motor against overcurrent and it can also be used as an end-stop. This device has also two settable speeds, separate speed ranges for forward and reverse direction. Control input is specially designed for joystick control. The joystick range calibration is done automatically, when calibration function is activated. Calibration detects forward, reverse and midpoint positions. FAULT terminal has simultaneously both input and output functions, the pin is normally high, but is pulled down in overheat and conditionally also in current trip situation.
If FAULT-line is pulled down externally it will cause a stop and prevent it from starting again. For example, it is possible to link fault pins of several units together and achieve a syncronous stop.
There are also special settings as start-kick which can be used in case the device is in danger of being jammed.
Limit input can be individually set for NPN or PNP logic.
The parameter's settings can be done with various EM- interface units. Operation of the controller and some of its functional values can also be monitored with interface units.

TECHNICAL DATA

Supply voltage nominal 12-42V, limits 10-55V
Start up voltage 9V, shutdown voltage 8V
Idle current typ 15mA
Motor current max. with 2kHz pwm
100% pwm 50A ,
20-99pwm% 35A and peak 100A (5s)
Motor current max. with 16kHz pwm
100% pwm 40A ,
20-99pwm% 20A and peak 60A (5s)
Current limit adjustable 1-100A
Notice! current limit is increased 50% at start
Overheat limit 100°C
Start and stop ramp adjustable 0-5s
PWM frequency 2kHz or 16kHz (selectable)
joystick input scale 0-5 or 0-10V (if dip 1 is ON)
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. 50V / 1A
Fault in actives Uin < 1V (NPN)
Motor and supply connectors 4mm
Control connectors 1mm
Dimensions 107x72x40mm
Dimensions in DIN-rail base 110x80x55mm
CE-tested for industrial environment (EMC)
Operating ambient temp (Ta) -40...60°C
Weight 190g

EM-243C BLOCK DIAGRAM



CONNECTIONS

Supply voltage recomendation is 12-42VDC
and ripple should be less than 30% at full load.
Supply voltage limit is 55Vdc
CAUTION ! Wrong polarity can damage the unit.
CAUTION ! Unit doesn't have an internal fuse, so
an external fuse should be added if fuse required.

MONITORABLE VALUES

1/6 Motor current 0-20A (0-200)
2/6 PWM-level-% 0-100% (0-100)
3/6 hour counter (max.65535h)
4/6 start counter (max.65535)
5/6 carry counter for start counter
6/6 joystick position 0-1024

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. overvoltage	4 x blink -pause...
6. overheat	short blink- long pause...
7. timeout	3 x blink + long blink...
8. fault input	2 x short + 1x long blink...

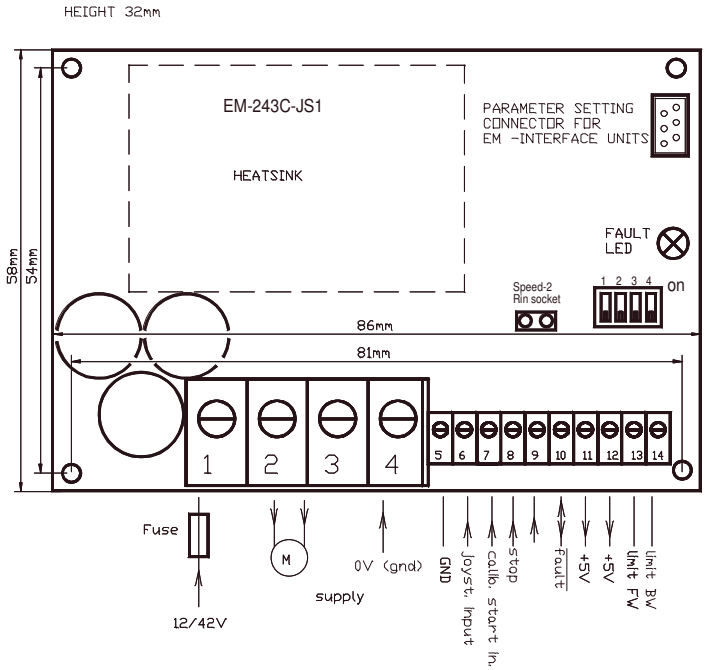
Special codes for calibration mode
solid light = calibration can be done
blink light = calibration is done

ADJUST AND SETTINGS (prog ver. EM-243C-JS1 v1.1)

Adjusting and parameter setting of eg.
current limit value, ramp times and speed-2
value can be done with various EM-interface units
EM-236 is basic parameter setting device.
EM-268 and EM- 328 are USB-serial converters,
which makes it possible to set parameters also
with computer where is installed EmenTool Lite
program. EM-326 is Bluetooth -dongle which can
be used in smart devices with the EmenTool App.

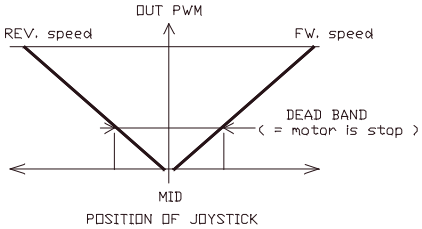
DIP SWITCHES

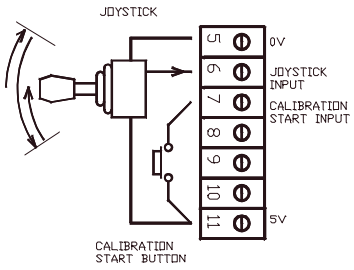
Dip-1 Damping pin 6 if set ON (joystick input)
Dip-2 Damping pin 9 if set ON
Dip-3 NOT in use keep always OFF
Dip-4 NOT in use keep always OFF



SETTABLE PARAMETERS 20pcs. (defaults in brackets)

1- not in use
2- not in use
3- input logic for limit inputs 1 or 4 PNP/NPN (1)
1= limit inputs PNP 2= limit input NPN
3= limit inputs PNP N.C. 4=limits inputs NPN N.C
(N.C.= normally closed = open circuits stops.)
4- max. speed FW. 0-100% / 0-100 (100)
5- max. speed REV. 0-100% / 0-100 (100)
6- current limit FW. 1-100A / 1-100 (30)
7- current limit REV. 1-100A / 1-100 (30)
8- current trip 0= disabled, 1= enabled : (1)
9- not in use
10- Fault output combinations: 0-2 (0)
0= overtemp, current trip. overvoltage
1= as above + calibration indication
2= current limit indication
NOTICE ! fault input is disabled in setting 2
11- overvoltage limit: 15-60V / 15-60 (55)
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
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.
There is also 60V fixed dynamic brake point = motor pole shorted
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%) Increase compensation
with small steps until motor start behaviour becomes 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: 0-5s / 0-500 (50)
16- stop ramp: 0-5s / 0-500 (20)
17- start-kick 0-200ms / 0-200 (0)
This gives full drive at start and I-lim is 30A
The start kick length is 0-200ms.
18- Dead band wide 0-50% / 0-50 (5)
19- Freewheel options 0-3 (0)
0= no freewheel
1= freewheel when stopped
2= freewheel during stop ramp.
3= freewheel during stop ramp and if stopped
20- Pwm frequency 1=2kHz / 2=16kHz (1)



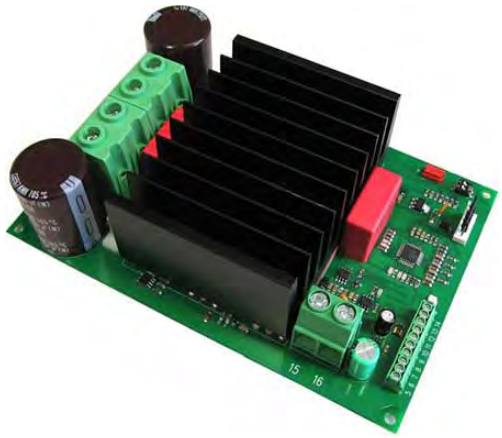


JOYSTICK CALIBRATION

Give about 3s. control signal to CALIB
input. when Fault-led of device will be lit:
-push joystick full forward, then
-pull joystick full reverse, then
-release joystick to mid position, then
-wait until led starts to blink = calibration done

NOTICE ! calibration above defines joystick
full fw, full rev. and mid point positions.
But the max. speed can be set with
parameters 4 and 5

DC-MOTOR CONTROLLER
EM-282C-48V 24-48Vdc 80A



FEATURES

- high current output
- brake load output
- suitable for 48V battery supply
- 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
- C versions program
  - + 2/16kHz pwm freq. options
  - + freewheel options
  - + autoreverse option
  - + running indication options
  - + expanded input logic options
  - + thermal cont. Fan-output (pcb v.3)

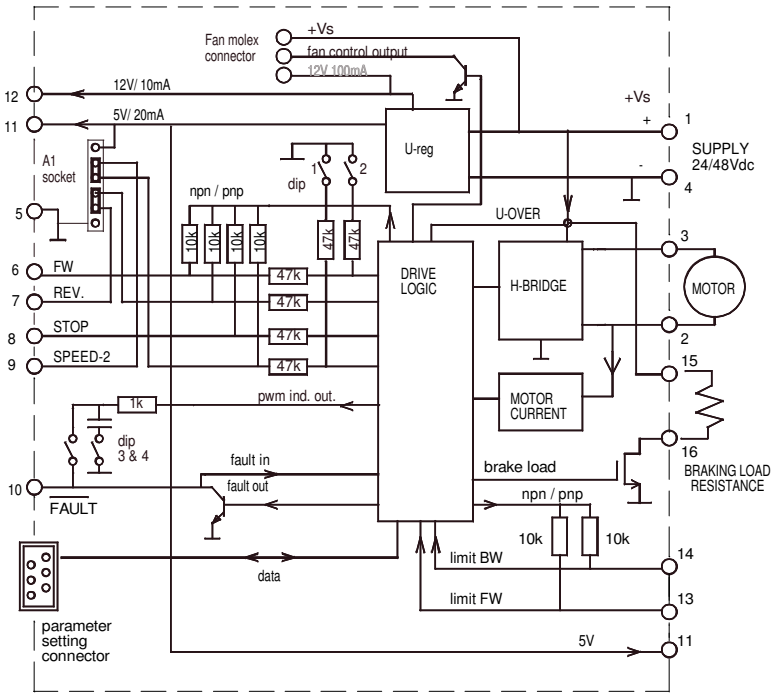
EM-282 is a full bridge DC-motor starter. It is designed to work with DC-motor (permanent magnet and brushed) in applications where a variety of special functions and settings are needed. Starter has an adjustable acceleration and deceleration ramps enabling the smooth starts and stops. Adjustable current limit protects motor against overcurrent. Current limitation for braking is also available (regeneration). EM-282 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 run. STOP input is to stop the motor but there are also available individual limit inputs 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 this way a syncronous stop.

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 in to 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 hand held EM-236 interface unit. With this unit the same settings (adjustments) can also be easily copied to an other or to multible devices. Operation of the controller and some of its functional values can also be monitored with EM-236 interface unit.

TECHNICAL DATA (prog. EM-282-48V prog v1.4 and pcb v.3 or later)

Supply voltage nom. 24-48Vdc (abs. limits 20-60V)
Shutdown voltage 20V
Overvoltage limit adjustable 20-65V
Idle current typ 20mA
Motor current max. continuous 80A (at 25°C amb. temp)
70A (at 50° amb temp) and peak 160A (5s)
Motor currents are about 20% lower if pwm frequency is 16kHz
Braking load current (pin 16) max cont 30A peak 100A
Current limit adjustable 1-200A
NOTICE current limit is 20% boosted during start ramp
Over temp. limit 100°C
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 = 0-200A
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°C, off 50°C (only pcb v.3 of later)
Fan-output NPN max 40V 100mA
12V Fan (+) max 100mA
Motor and supply connectors 16mm²
Control connectors 1mm²
Dimensions 180x122x60mm
CE-tested for industrial environment (EMC)
Operating ambient temp (Ta) -40...60°C
Weight 750g

EM-282 BLOCK DIAGRAM (board ver. v.3)



CONNECTIONS

Supply voltage must be filtered DC of 24-60V,
and ripple should be less than 20% at full load.
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 ver3 or more

ADJUSTMENT AND SETTINGS (prog. EM-282C v.1.3)
Settings can be done with 3 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. If 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 (EM-282C v1.4 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 N.C. 6=cont. PNP, limits NPN
3= cont. NPN, limits NPN N.C. 7=cont. NPN, limits NPN
4 running speed-1: 0-100% / 0-100 (100)
5 running speed-2: 0-100% / 0-100 (50)
Note: If selected to 0 "speed-2 input" is used as analog 0-5V speed control input.
Note2: If selected to 1 "speed-2 input" is used as analog 0-5V speed control input, and run start automatically and REV. input changes direction
6 current limit : FW 0-200A / 0-200 (30)
7 current limit : BW 0-200A / 0-200 (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

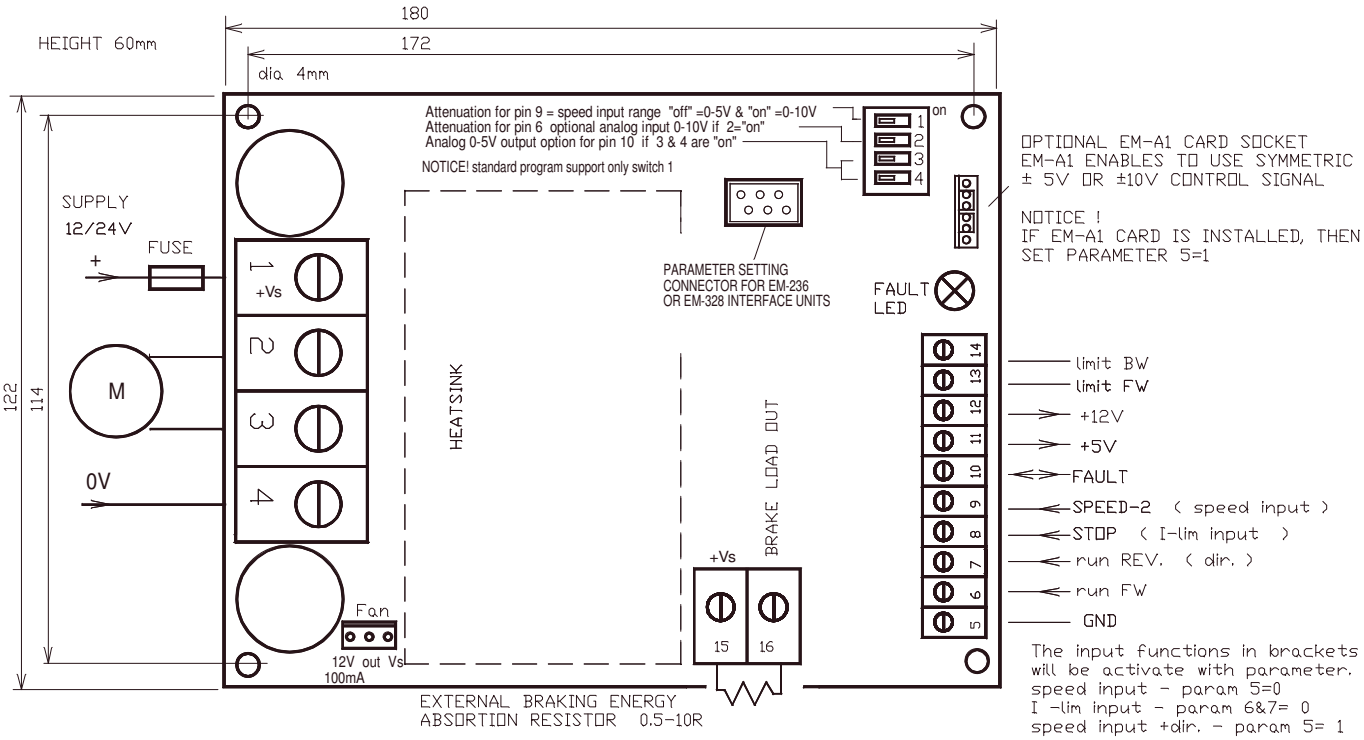
FAULT-LED signal codes

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...

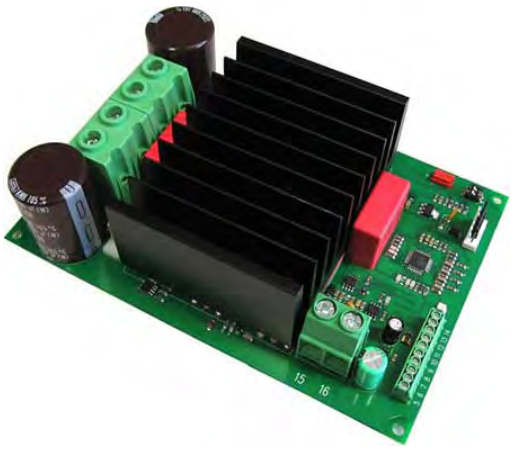
MONITORABLE VALUES (EM-236 / EmenTool)

1 Motor current 0-200A (0-200)
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)

11 overvoltage limit: 20-65V / 20-65 (60)
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 switc 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: 0.2-5s / 0-500 (100)
16 stop ramp: 0.2-5s / 0-500 (100)
17 start kick 0-200ms / 0-200 (0)
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 0-5 (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
4= freewheeling when stopped
5 =freewheeling disabled
20- Pwm frequency 1=2kHz / 2=16kHz
21- Current limit in braking 5-200A / 5-200 (50)
22- Pin-16 (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



DC-MOTOR CONTROLLER
EM-282C 12-42V 100A



FEATURES

- 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
- C versions program
  - + 2/16kHz pwm freq. options
  - + freewheel options
  - + autoreverse option
  - + running indication options
  - + expanded input logic options
  - + thermal cont. Fan-output (pcb v.3)

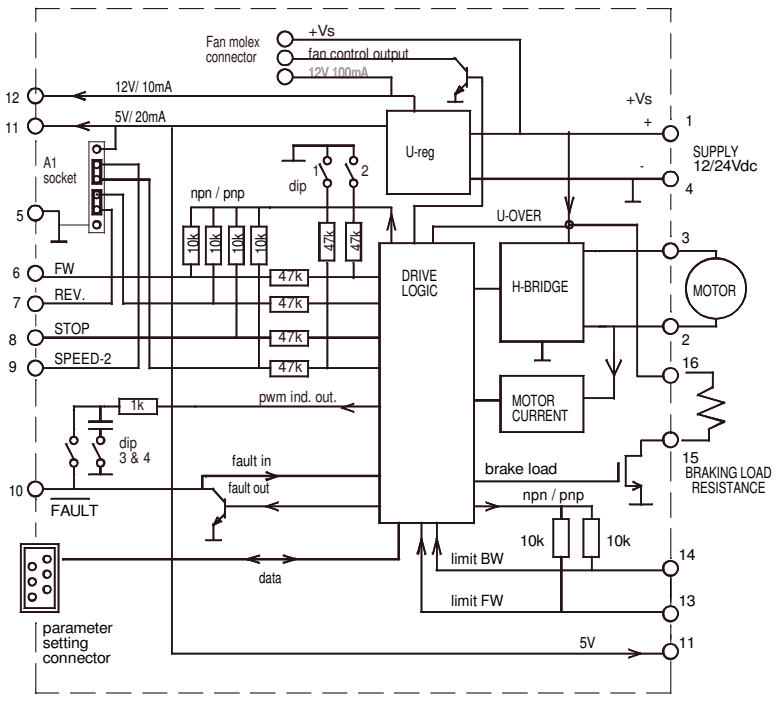
EM-282 is a full bridge DC-motor starter. It is designed to work with DC-motor (permanent magnet and brushed) in applications where a variety of special functions and settings are needed. Starter has an adjustable acceleration and deceleration ramps enabling the smooth starts and stops. Adjustable current limit protects motor against overcurrent. Current limitation for braking is also available (regeneration). EM-282 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 run. STOP input is to stop the motor but there are also available individual limit inputs 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 this way a syncronous stop.

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 in to 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 hand held EM-236 interface unit. With this unit the same settings (adjustments) can also be easily copied to an other or to multible devices. Operation of the controller and some of its functional values can also be monitored with EM-236 interface unit.

TECHNICAL DATA (prog. EM-282C v1.4 and pcb v.3 or later)

Supply voltage nom. 12-42Vdc (abs. limits 10-50V)
Shutdown voltage 10V
Overvoltage limit adjustable 15-50V
Idle current typ 20mA
Motor current max. continuous 100A (at 25°C amb. temp)
80A (at 60° amb temp) and peak 200A (5s)
Motor currents are about 20% lower if pwm frequency is 16kHz
Braking load current (pin 16) max cont 50A peak 100A
Current limit adjustable 1-200A
NOTICE! current limit is 20% boosted during start ramp.
Over temp. limit 100°C
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 = 0-200A
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°C, off 50°C (only pcb v.3 of later)
Fan-output NPN max 40V 100mA
12V Fan (+) max 100mA
Motor and supply connectors 16mm²
Control connectors 1mm²
Dimensions 180x122x60mm
CE-tested for industrial environment (EMC)
Operating ambient temp (Ta) -40...60°C
Weight 750g

EM-282 BLOCK DIAGRAM (board ver. v.3)



CONNECTIONS

Supply voltage must be filtered DC of 12-42V,
and ripple should be less than 20% at full load.
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 ver3 or more

ADJUSTMENT AND SETTINGS (prog. EM-282C v.1.3)
Settings can be done with 3 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. If 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 (EM-282C v1.4 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 N.C. 6=cont. PNP, limits NPN
3= cont. NPN, limits PNP N.C. 7=cont. NPN, limits PNP
4 running speed-1: 0-100% / 0-100 (100)
5 running speed-2: 0-100% / 0-100 (50)
Note: If selected to 0 "speed-2 input" is used as analog 0-5V speed control input.
Note2: If selected to 1 "speed-2 input" is used as analog 0-5V speed control input, and run start automatically and REV. input changes direction
6 current limit : FW 0-200A / 0-200 (30)
7 current limit : BW 0-200A / 0-200 (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

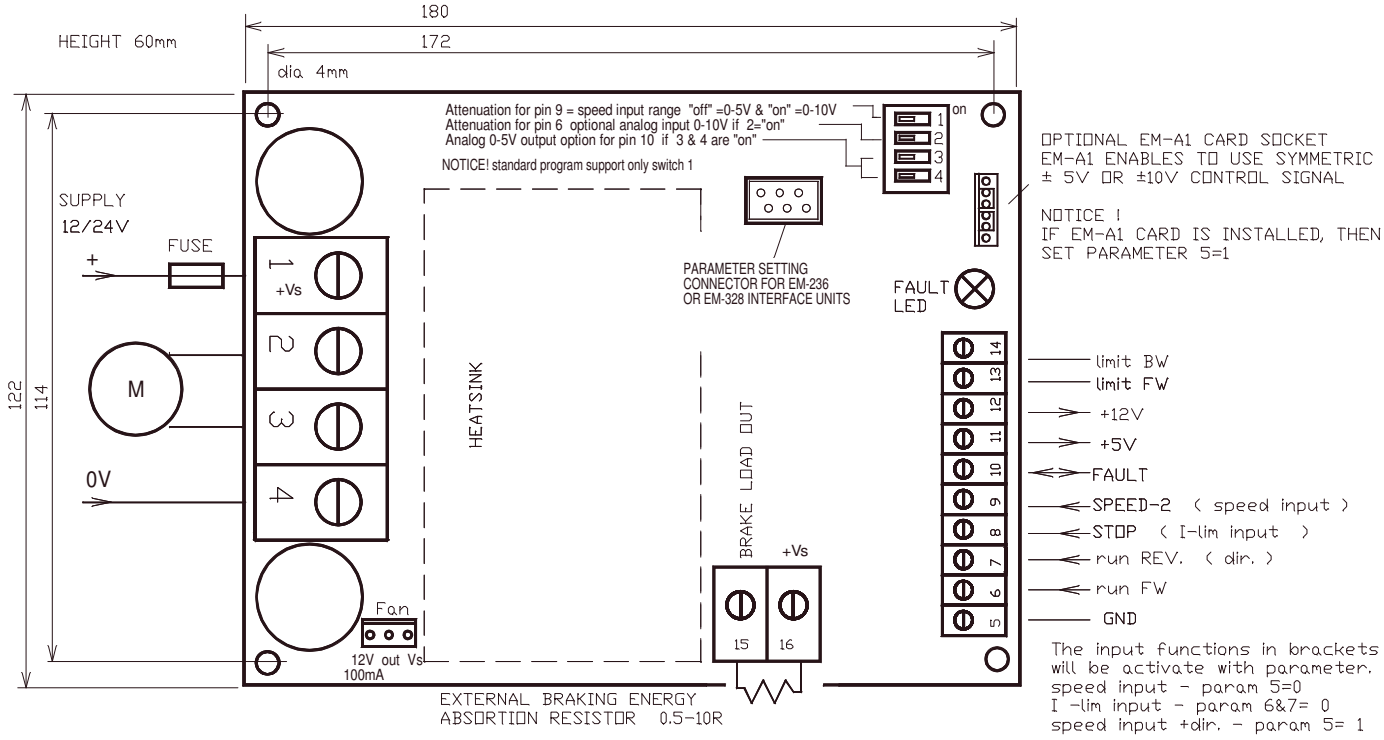
FAULT-LED signal codes

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 (EM-236 / EmenTool)

1 Motor current 0-200A (0-200)
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)

11 overvoltage limit: 15-65V / 15-65 (40)
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 switc 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: 0.2-5s / 0-500 (100)
16 stop ramp: 0.2-5s / 0-500 (100)
17 start kick 0-200ms / 0-200 (0)
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 0-5 (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
4= freewheeling when stopped
5 =freewheeling disabled
20- Pwm frequency 1=2kHz / 2=16kHz
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



EM-231A CONTROL UNIT FOR DOORS AND HATCHES

FEATURES:

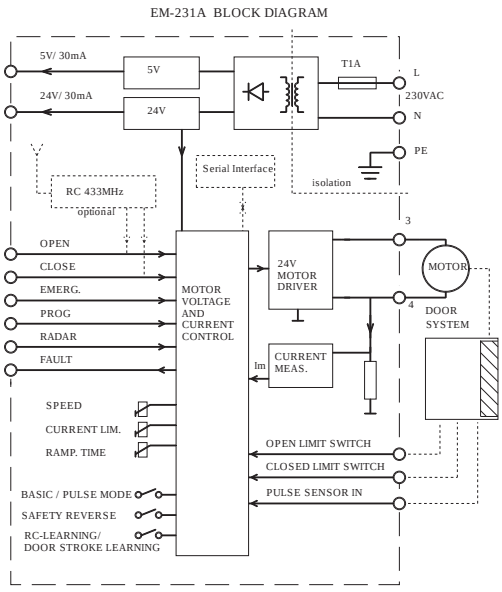
- supply from 230Vac
- for 24Vdc motors
- motor current limit
- safety reverse
- end switch inputs
- pulse encoder input
- radar input
- remote control option
- CE marked

EM-231A is designed for door and hatch controlling. Control unit includes the 230Vac isolated mains power which converts the voltage to the 24Vdc for control electronics and door motor. Motor can be a normal low voltage DC-motor. In the basic operating mode the end stop can be realized with current limit or end switches. More sophisticated behaviour can be achieved with pulse encoder feedback. In this pulse mode the controller can be learned with a push of a button. After the controller has learned the stroke length it executes the open/close cycles smoothly anticipating the end stops with slow down ramps. In all operating modes the current limit is active and ready to stop the motor if the adjusted value is exceeded. If desired a safety reverse action can be set to follow this current trip. With safety reverse active eg. a person who is in the way of a closing door will cause the motor to reverse and door to open. Unit includes the inputs for end switches, door radar, OPEN/CLOSE buttons and for pulse encoder. Additionally there are inputs also for emergency drive and learning, and a serial connector for an interface unit. An optional remote control feature can be achieved with a remote control unit and by plugging a receiver hybrid (EM-A6) in to its holder. Speed, ramp times and current limit can be adjusted with trimmers. Operating mode, safety reverse and learning can be enabled and determined with dip switches. To achieve more sophisticated operation and customized settings the serial interface unit EM-236 can be connected to serial connector. With serial interface user can adjust the approaching speed, acceleration zone length, approaching current limit and radar off delay.
EM-231A is housed to a plastic IP30 (IP65) ABS(PC) housing. Unit is CE-marked.

TECHNICAL DATA

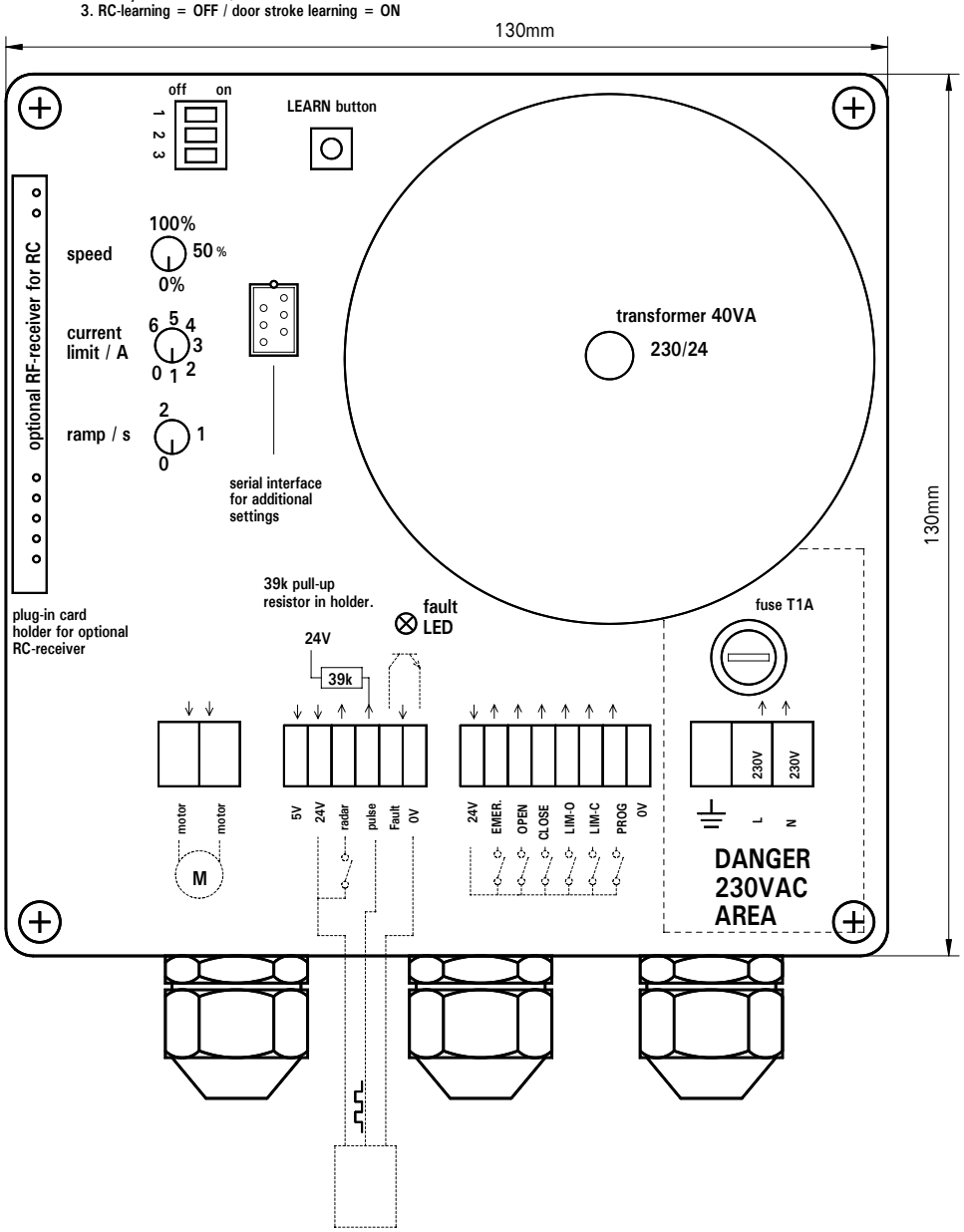
Supply voltage	230Vac / max. 100W
Fuse	T1A 20x5mm
Output voltage	nom. 24Vdc
Output current	1.5A (Uout=24V)
	3A (Uout=18V) 30% duty
Current limit	0-4A
Ramp time	0-2s
Speed range	0-100%
Pulse frequency	max. 1000Hz/50/50%
Pulse length	min. 0,5ms
Input signals	4-30V=ON / 0-1V=OFF
Input impedances	10kohm
Aux. outputs	Total current 50mA
	24V max.40mA
	5V max. 40mA
Fault output	NPN open col. (100mA)
Remote Control	433Mhz typ. range 10m
Housing ABS(PC)	130x130x60 / IP30 (IP65)
Operating temp.	0-50°C
Mains isolation	1000V

EM-231A BLOCK DIAGRAM



DIP-switch settings

1. basic mode = OFF / pulse mode = ON
2. safety reverse active, ON / OFF
3. RC-learning = OFF / door stroke learning = ON

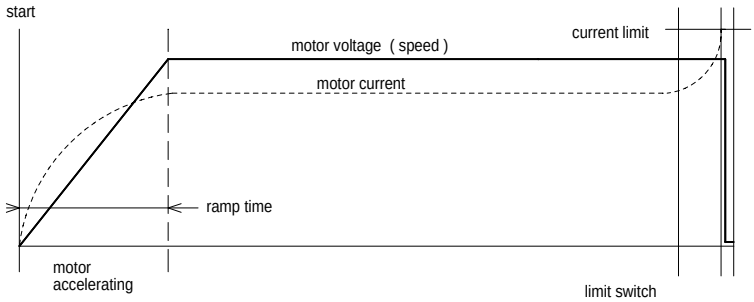


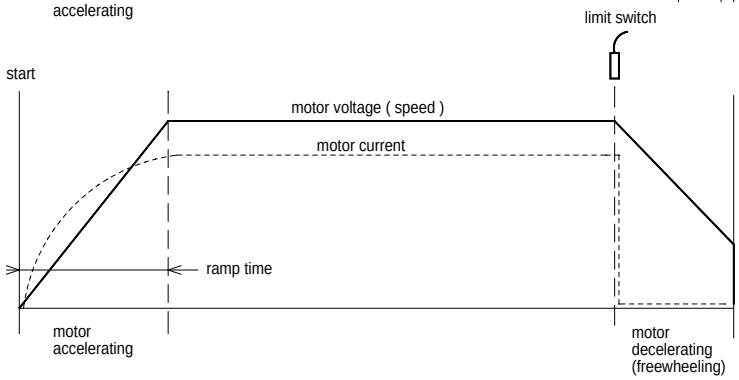
CONNECTIONS
Make sure that the mains supply is not on when making the connections. NOTICE! that there is 230Vac area in this device. Do not let any other than 230Vac wiring in this area. Do not use the same inlet for others than 230Vac cabling. Device has a terminal for connecting the protective earth (PE). It can be used if there is need for leading the PE to the auxiliary devices.
Check that the current consumption of limit switches, pulse encoders and radar do not exceed the max. current feed capability of 24/5V auxiliary outputs (altogether 50mA). Control inputs operate with positive 4-30Vdc signals, with input impedance of 10kohm. The pulse encoder input can be configured for PNP or NPN signal, that is with up or down pullin transducers. Eg. Hall-transducers are mostly of the NPN-type (pull down), in that case the 39kohm line pull up resistor should be in its holder.

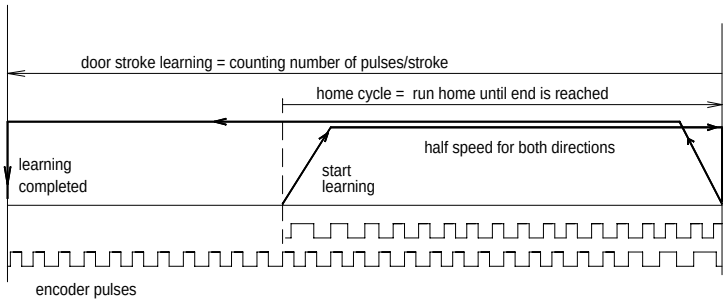
SETTINGS
Set the desired operating mode with dip-switch (see the page OPERATING MODES). Adjust the speed, ramp time and current limit with trimmers. If you need more detailed setting, attache the EM-236 serial interface to this control unit, and you have access to a lot wider range of parameters (see the page 3 OPERATING MODES). Especially in pulse mode can be achieved better adjustability with EM-236.
The safety reverse can be enabled with dip switch 2. When safety reverse is enabled, the motor will automatically reverse after exceeding the adjusted current limit eg. in case of encountering an obstacle during close run.

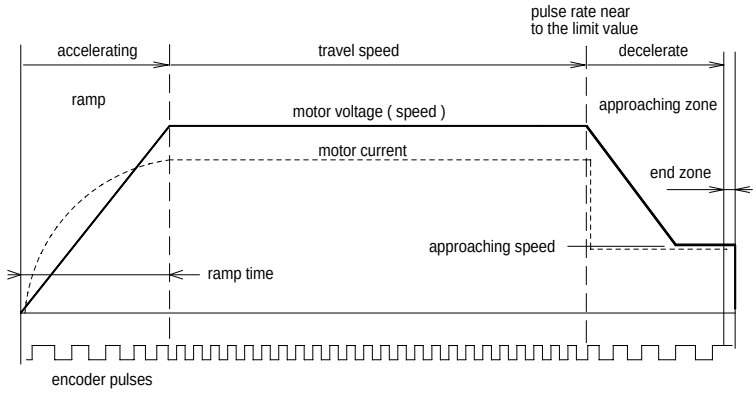
LEARNING
In pulse mode the control device must be learned for the right driving cycle of a door or hatch. This is done by switching the dip-switch 3 to ON-position and pressing the learn button. After this the device will execute the learning cycle (see page 3 OPERATING MODES). After this the functionality can be adjusted with parameters. NOTICE. Learning can be triggered also with a 4-30V signal to the prog. terminal.

RC-learning (if the optional RC receiver EM-A6 is attached)
To be able to remotely control the device it has to be learned the code of the specific remote control unit. Set the dip-switch 3 to OFF position, keep the learn button pressed and press the remote controllers OPEN button so long that the door is started (about 1s). Afterwards return the dip switch 3 to ON position. Also in this case the prog. input can be used instead of the learn button. NOTICE. Remote control will not work at the same time as the interface unit is connected to the control unit.









OPERATING MODES OF EM-231A

BASIC MODE with current trip

-open/close command starts motor
-motor accelerates with ramp
-motor runs with adjusted speed
-door meets the end point and motor current starts to rise until it exceeds the current limit, which causes the motor shut down
-the current limit also shuts down the motor, if the door meets an obstacle during drive cycle
-the action is same to both directions
-the safety reverse function is not available in this mode
-Notice ! In this mode there should be some kind of bumper in the end of stroke to smoothen up the end stop.

BASIC MODE with a limit switch

-open / close command starts motor
-motor accelerates with ramp
-motor runs with adjusted speed
-door reaches the limit switch and motor will be shut down.
-door slides with decelerating speed to the end of stroke.
-If door meets an obstacle inside stroke, the current limit will shut down the motor.
-If safety reverse function is activated, and current limit is exceeded during close cycle, the door will stop and then start automatically to open direction.

PULSE MODE

In this mode the device uses pulse counting to control the stroke lenght of the door.
Recommended pulse rate is 200-10000 pulses/stroke, and pulse frequency should be below 1000Hz

When system is taken in use for the first time, run the " learning" routine first:

- push learning button
- motor starts to run at approaching speed until the door reaches the end of stroke.
- Then motor starts automatically to opposite direction. During this calibration cycle the device counts the number of pulses of the full stroke and in the end of this cycle the motor stops and the number of pulses is stored to memory.

After learning has been done the system is ready to run

- open/close command starts the motor
- motor accelerates with "ramp"
- motor runs at "travel speed"
- door reaches the edge of "approaching zone", motor speed is changed to "approaching speed" and current limit to "appr. current lim."
- motor is stopped if:
  - current limit is exceed
  - pulses stop coming
- if motor stops inside the "end zone ", the device will reset the pulse counter and is ready for re-start
- but if shut down happens before counter has reached the "end zone" value, the device will go to "limb mode" and next cycle will be driven with approaching speed.
- If "safety reverse" setting is actived and the door meets an obstacle during closing cycle, the door will stop and reverse (open) automatically.

SETTINGS & PARAMETERS

Trimmer setting ranges

"ramp" 0-2s
"travel speed" 0-100%
"current limit" 0-6A

Automatically set parameters

"approaching speed" 50% of travel speed
"approaching current limit" = current limit
"approaching zone" 10% of full range
"end zone" 2% of full stroke
radar input make off delay 5s.

Dip switch settings

1. Basic mode = off / Pulse mode = on
2. safety reverse active on / off
3. RC-learning = off / door stroke learning = on

ADDITIONAL SETTINGS VIA SERIAL INTERFACE

The next settings are possible to set individually if serial interface unit is connected to device. If serial interface is selected to be active (param.1) the interface unit will over write trimmer- and automatic settings. With interface unit it is also possible to monitor the current and pulse counter values during drive.

	default settings
1. serial interface active 0=no / 1=yes	0
2. "travel speed" 0-100% (0-100)	100
3. "approaching speed 0-100% (0-100)	50
4. "current limit" 0-6A (0-60) 0.1A/step	30
5. "approaching current lim." 0-6A (0-60) 0.1A/step	30
6. "approaching zone" 3-30% of full stroke (3-30)	10
7. "end zone" 1-5% of full stroke (1-5)	2
8. radar input off delay 0-255s. (0-255)	5
9. "ramp" 0-2s (0-20) 0.1s/step	10

MONITOR VALUES

1. motor current 0-60 (0-6A)
2. pulse counter value 0-65535

Other Electromen

A) Brushless Controllers

Continuous Current limit (amps)	Volts	Model #
1.5	12-24	EM-240
2	12-35	EM-269A
4	12-35	EM-291A
5	20-56	EM-206-48
7	12-24	EM-106A
10	12-36	EM-206
10	12-35	EM-316A
10	12-35	EM-346
25	12-24	EM-151B
40	12-36	EM-347
30	24-48	EM-347-48
Interface Unit		EM-236

B) Stepper Motor Controllers

Continuous Current limit (amps)	Volts	Model #
1	12-40	EM-121
3	12-24	EM-318
4	12-45	EM-136
5	20-80	EM-186-72
6	12-24	EM-314

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