GENERAL EM-A24

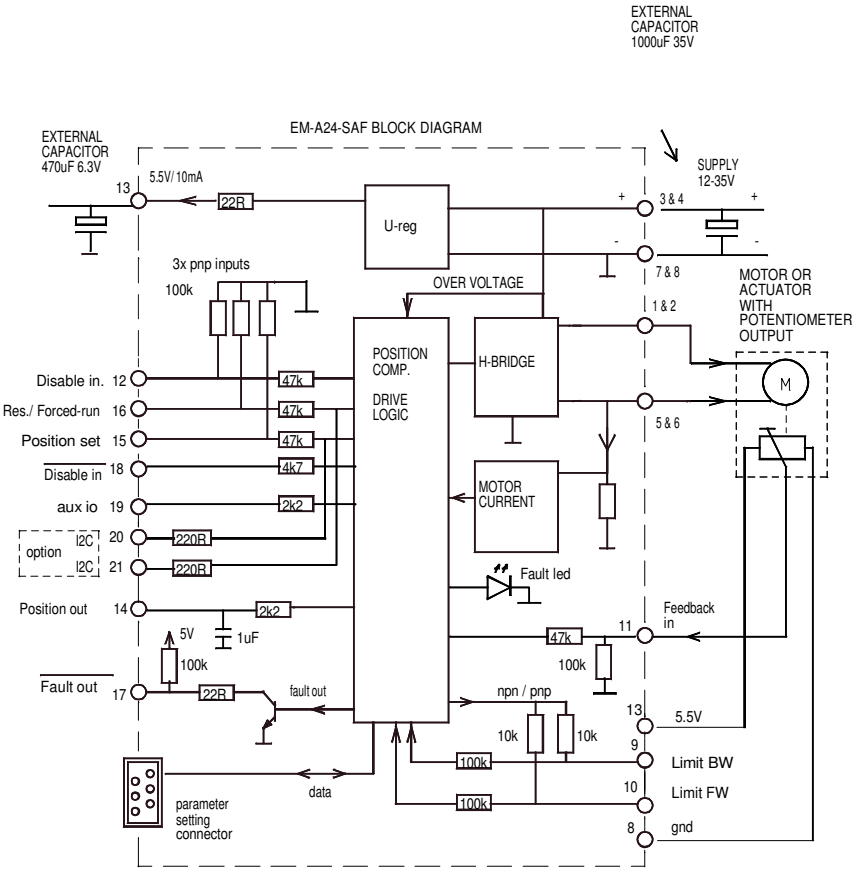
EM-A24 is a DC-motor driver module, It's based on EM-241 driver card. This module is PCB mountable and it needs a very small pcb area, because it will be installed vertically. This module has effective H-bridge power stage. The power stage has low EMC emission and it can meet EMC directives for industry and household enviroments without external components. This is big benefit when integrated this module to the "motherboard". Module has two pwm frequency option 2kHz offer more current, and 16kHz is noiseless.

FIRMWARE EM-A24-SAF

EM-A24-SPF firmware is designed for positioning use with motor or actuator with pulse sensors. Feedback can be analog signal. There basic range for feedback is 0-5.5V . Analog signal source can be for example potentiometer or sensor with analog output.
The positioning set signal can be used an analog control signal 0-5,5V. Input is freely scalable inside the range. The max. electrical accuracy of the driver and feedback is 0.2% which is adequate for most actuator positioning applications.

The driver includes many other dynamic adjustment features like parameter for load compensation, dead-zone setting (positioning window), start and stop ramps for smooth direction change and braking zone for well operating positioning. The settings and adjustments are done with parameters as in all new generation Electromen products. Included in the parameters is also the learn routine which will help to determine the full movement range fast and easily. Additively the movement range can be modified from both ends with SW-limit parameters. Possible cumulating pulse count errors can be avoided with manually or automatically triggerable home drive. Current limits and driving speeds can be set individually for both directions.

The parameter setting and status monitoring is done with EM-236 or EM-328 Interface Units. The right parameters can also be copied easily to other driver units. The on-board LED-light indicates the possible fault situations with blinking codes. The fault alarm can be also given out FAULT port (pin.17). Disable input (pin 18 or 12) will be stop action of card as long this command occurs. Analog position output signal (pin 14). can be used for position incation.



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
Continuous current output when ambient temp. is < 50°C
12A at 100% speed / 7A at 5-99% speed (pwm freq. 2kHz)
8A at 100%speed / 4A at 5-99% speed (pwm freq 16kHz)
Peak current (5s.) 25A at 2kHz / 15A 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)
Position set input scale. max. 0-5.5V
Feedback input scale 0-5.5V
Input control logic: high =4-30V, low=0-1V
Control input impedances typ. 100kohm
limit input impedance. typ. 10kohm.
Control input response time typ 5ms.
Fault out. NPN open coll. max 30V / 50mA
Fault in actives Uin < 1V (NPN)
Dimensions as is drawing above
CE-tested for industrial environment (emc)
Operating temp (Ta) -40...60°C
Weight 15g

ADJUSTMENT AND SETTINGS

Adjusting and parameter setting of eg. current limit, ramp times and speed-2 value can be done with various EM-interface units. EM-236A is the basic parameter setting device. EM- 328 is USB-serial converters, which makes possible to set parameters also with computer where is installed EmenTool Lite program.

LIST OF PARAMETERS prog. A24-SAF v1.6 (defaults in brackets)

1 No function (0)
2 Limit input logic (1)
1= PNP
2= NPN
3= PNP inverted
4= NPN inverted
3 Speed FW: 20-100% / 0-100 (100)
4 Speed BW: 20-100% / 0-100 (100)
5 Speed for F-driving: 20-100% / 20-100 (60)
6 Current limit out, FW: 0.1-20A / 1-200 (30)
7 Current limit in, BW: 0.1-20A / 1-200 (30)
8 Current tripp delay: 0-255ms / 0-255 (20)
(0=tripp not in use)
9 Position out (pin 14) function: 1-4 (1)
1= "run" indication
2= "position ok." indication
3= gives position indication with 0 - 5V
4= gives position indication with 0.5-4.5V and fault =0V
10 Over voltage limit: 15-40V / 15-40 (35)
11 Load compensation: 0-255 / 0-255 (0)
12 Time out cut-off: 1-255s. / 1-255 (0= not in use) (0)
13 Hour and start counter reset (0)
set value = 1 and press save -> counters are set to zero
14 Forced run function with >5s command to pin 16 (1)
1= makes F-run to BW direction
2= makes F-run to FW direction
15 Fault reset conditions 0-1 (1)
0= reset with RESET-input or opposite direction request .
1 = fault reset can be done only with RESET-input (pin 16)
16 No function (0)
17 Dead zone : 0,2-5% / 2-50 (10)
18 Braking zone : 1 - 8% / 1 - 8 (3)
19 Start ramp : 0,1-2,5s / 0-250 (10)
20 Stop ramp : 0,1-2,5s / 0-250 (3)
21 Set value min. 0...5,50V / 0-551 (0)
22 Set value max. 0...5,50V / 0-551 (550)
23 Inner (BW) SW-limit: 0...-50% 0-500 (5)
24 Outer (FW) SW-limit: 0...+50% 0-500 (5)
25 PWM freq. 1 = 2kHz / 2 = 16 kHz

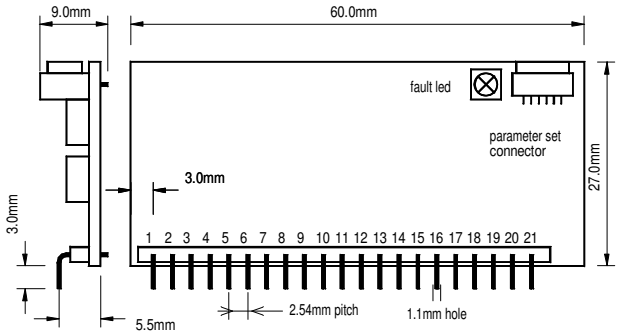
FAULT LED -blinking codes

1. I-trip 1 blink
2. time out trip 2 blinks
3. over temperature 3 blinks
4. over voltage trip 4 blinks

Pls. notice:
when card is powered the LED- blinks onse.

MONITORABLE VALUES (Can be read with EM-236)

1 fault code (see the fault code list)
2 motor current 0-20A (0-200)
3 target position 0-100,0% (0-1000)
4 realized position 0-100,0% (0-1000)
5 hour counter (max.65535h)
6 start counter (max.65535 starts)
7 start counters over flow counter (max. 65535)



COMPANY		
ELECTROMEN OY		
DRAWN	DATE	TITLE DATASHEET EM-A24-SAF DC-MOTOR DRIVER MODULE WITH EM-A24-SAF v1.6 Firmware
K.M.K	5.06.24	

INSTALLATION

Supply voltage must be filtered DC of 10-35V, and ripple less than 30% at full load.

NOTIFICATIONS !
-Wrong polarity can be damage the unit.
-Module doesn't have an internal fuse, so it is recommended to add external fuse.
-Module needs two external capacitors:
1000uF 35V to supply pins and 470uF 6.3V for 5V output
-If use 5.5V out for sensor voltage notice that max load is 10mA

ABOUT PARAMETERS

1. No function.
This parameter position is not is use in this program.
2 Limit switch input terminals (pin 9 and 10) can be set to work with positive or negative logic. Positive =PNP, negative=NPN. The effect can also be inverted so that when signal is ON status is OK, and signal OFF status is "disable by limit".
3 & 4 are for speed setting of FW (out) and BW (in) directions.
5 the speed setting for "Forced run" (F-run).
6 & 7 current limit setting for FW (out) and BW (in) directions
8 determines the time the current is allowed to be on the limit value before driving is cut off (driver tripps off). Value is in milliseconds and if set to "0", the current tripping feature is disabled.
9 Configuring the position out functions (pin 14). This can give a "position OK" indication after succesfull positioning. It can also be used to indicate the position with a continuous voltage signal (position signal).
10 Over voltage protection switches the motor to free wheel. This saves the controller or other devices in supply line from over voltage in case the motor generates energy during slowing down or braking. This can happen with eg. in vehicle or lifting applications.

11 Load compensation (Rxl-comp) enables good motor torque even with low speeds. It is good to start testing with zero value, but if the motor seems weak when starting with normal load, the value can be increased step by step untill there is power enough to start. Notice: Too high value is recognized from oscillation and/or twiching, If it is not possible to see the behavior of the motor and test the effect with momentary loading of a freely running motor the safest value for this parameter is zero.
12 Time out tripp will cut off the driving if continuous driving to the same direction exceeds the set value (statet in seconds).
13 This parameter is for resetting the start and hour counters. Saving value 1 will set to zero the drivers start and hour counters.
14 Parameter for choosing the forced run direction. F-run is started with long >5s command to RES/F-run terminal (pin 16)
15 Determines how the controller recovers from fault situation.
Val 0. Recovers also with an opposite direction movement request.
Val 1. fault requires a short (<5s) reset command to pin 16.
16 No function. Value of this parameter position has no effect.
17 Dead zone for determining the wanted positioning accuracy. If this window value is small the positioning is tended to be done more accurately. If value is too small the application is not capable to exceed this accuracy, and can not find or maintain the set position steadily. In this case the value should be increased.

18 Braking zone value is determined as a percentage of the full movement range. It determines how early driver starts to slow down before reaching the right position. Main rule is that small value for slow applications and high value for fast applications.
19 & 20 Start and stop ramps are used to smoothen the speed and direction changes. The parameter value is the time from 0-100% and from 100%-0 speed.
21 & 22 are for determining the control signal range limits. Value can be given as Volts, 0 to 550 (0 to 5,5V).
The values can also be measured automatically by setting the parameters to value to 551. The card will then measure the range min. and range max. voltages on the POSITION SET input.
Pls. read also the chapter "Control range setting".
23 & 24 Inner (BW) and outer (FW) SW-limits. With these adjustable limits the movement range can be limited to suite the application.
Notice: the forced run will over drive these points.

RESET / FORCED RUN input
Short signal reset fault situation and enables drive again.
Longer (>5s) command starts forced run, which means that motor drives despite of feedback. The drive direction defined with parameter 14. see also parameter 15

DISABLE in (pin 12)
Positive command in input disables drive as long as occured
DISABLE in inv. (pin18)
negative command in input disables drive as long as occured
The disable inputs has highest priority

POSITION output (pin 14)
This pin function can be set parameter with 9
Options are "positioned" indication or analog position signal 0-5.5V

FAULT output (pin 17)
This is NPN output pulls down in case of fault, e.g: I-trip, overtemp, and overvoltage.

TAKING IN TO USE

The setting of the driver is done with parameters, and the parameters can be set and edited with EM-236 Interface Unit. This makes changing easy and precise. Also the copying of the same parameters to multible units is simple and same time accurate. The same parameters that are saved to one unit can be copied to an other unit with just one push of an button.
Start by checking and setting the hardware related parameters. After that the actuator can be connected and operation fine tuned with other parameters.

Control range setting
the hardware control range is 0 -5,5V, so the set value should be inside this range
An individual control scale you can either set with parameters 21 and 22 as Volts or you can let the driver to measure your min. and max. control values.
If you choose to set the min. and max. as Volts, pls. notice that the values are in ratio to the lowest range 0-5,5V.
Most precise way is to let the driver to measure the values. So first connect and adjust minimum value to set input (pin.12) and change the par.21 to val. 551.
After value stops blinking the dispaly shows the measured value. Then adjust the maximum control value to pin.12, and change par.22 to 551. After a while you will see the measured value in display. Always remember to to save with long push to save button, before disconnecting EM-236 and taking power off from the driver.
Notice: If control min. value is set higher than max. value the movement range will be inverted and set accordingly.

Feedback
Feedback signal range is also 0 to 5,5V
If the actual feedback signal can not reach the ends of the default range, parameters 23 and 24 can be used to acommodate the ranges.
Setting the inner and outer software limits to suitable percentace values will compensate the narrow control signal range to the default range.

Forced run (F-run)
Forced run enables the motor to be driven to the mechanical end. That means that the motor or actuator can be driven beyond the determined soft ware limits. The SW-limits are used to determine the operational movement range. But the parameter 14 value and the use of F-run will enable the wider driving range for service use or for use in some special situations of the application. F-run is started with a long command (>5s) to pin 16. The F-run speed is determined with parameter 5 and the driving is stopped with current trip or limit switch that cuts off the motor current. Motor will return to its servo position right after the signal to pin 16 disappears.
Notice. The same pin 16 is used also as a reset input with short command (<5s).

POSITIONING DYNAMIC SETTING (see also picture below)

Dead zone (par.17) is to determine the accuracy of positioning.
This parameter has the major effect to positioning accuracy.
The smaller it is determined the more accurately the positioning is done.
Notice. If it is set too small compared to accuracy level of the mechanics an oscillation or unstability in positioning will occur.

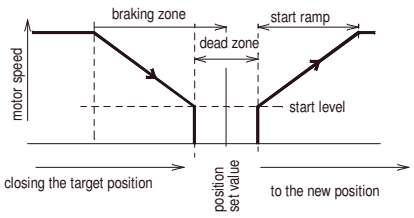
Braking zone (par. 18) is used to optimize the time needed for positioning.
Too high value slows down too early, and too low value will cause an fast position passing and needs a corrective return driving.

Start and stop ramp (par. 19 & 20) are to smoothen the direction change.
Often suitable value for stop ramp is half of start ramp. Too long stop ramp can make the direction change too time consuming and too short can cause mechanical stress and non desired agressivity.

Load compensation (par.11) when set to right value, will ensure the needed force to start driving and to taking the load in to the right position.
With high load and too low load compensation value, the motor dont have force enough to reach the right position. Start testing with zero value and increase value untill motor behaves unstable and twitching. Thumb rule in this point is to decrease the value with 25%.

Current limits should be set according to the motor nominal max. current or according to the required current of the application (if lower than nom).

P0SITIONING WINDOW IN SERVO USE



MOST OFTEN OCCURED PROBLEM

Motor goes to mechanical end after learning and not move after this. Swap the motor wires and try again. If system start to work after this but moving to the wrong direction, then swap both motor wires and hall pulse wires
The above means that servo signal are opposite referrinf ask and result of this the servo comparator drives wrong direction