GENERAL EM-A24-PCI

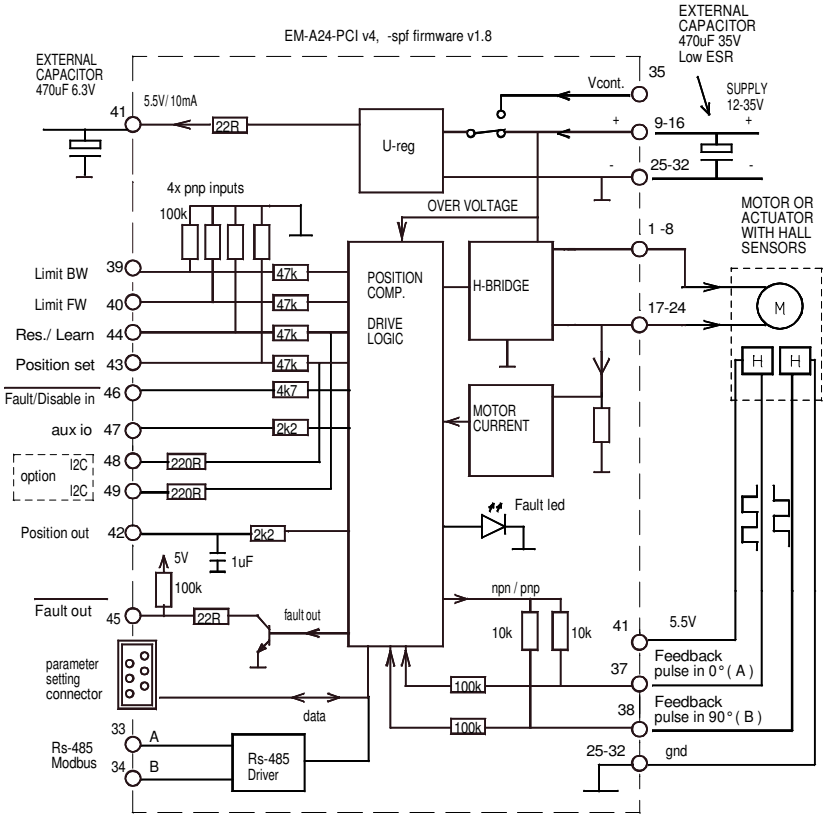
EM-A24-PCI is a DC-motor driver module, It's based on EM-241 driver card. This module is PCB mountable with PCI express 98 connector and it needs a very small pcb area, because it will be installed vertically.
This module has effective H-bridge power stage. The power stage has low EMC emission and it 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.
The board version v4 and later has added Rs-485 bus. This bus can be used to control, monitoring and also parameter setting for device

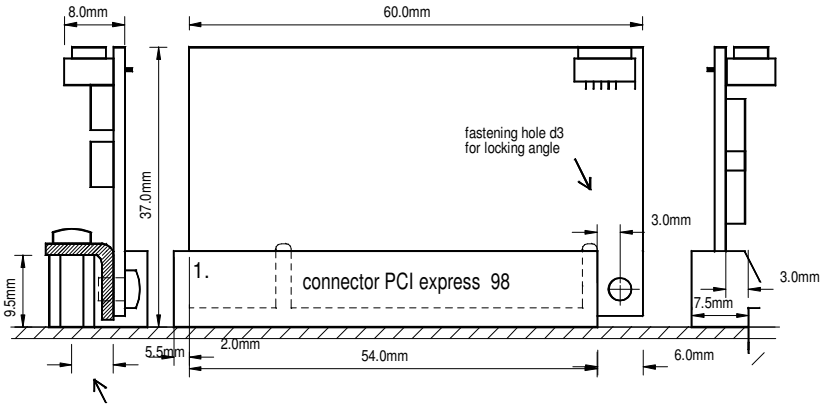
FIRMWARE EM-A24-SPF

EM-A24-SPF firmware is designed for positioning use with motor or actuator with pulse sensors. Feedback is done with one or two line pulse signal. Although position feedback can be done with one pulse line it is always preferred and more secure to do it with two 0°/90° pulse lines.
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 EM328 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. Disable input will be stop action of card as long this command occurs. Analog position output signal can be used for position incation.





in this picture "locking angle" option is added

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-236 is the 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. Alternatively this parameters can be set with Rs-485 Modbus

LIST OF PARAMETERS prog. - spf v1.8 (defaults in parentheses)

1 Feed-back mode : one-pulse=1, dual-pulse=2 (1)
2 Limit and pulse input logic (1)
1= limit inputs PNP / pulse inputs PNP
2= limit inputs PNP / pulse inputs NPN
3= limit inputs PNP inverted / pulse inputs PNP
4= limit inputs PNP inverted / pulse inputs NPN
3 Speed FW: 20-100% / 0-100 (100)
4 Speed BW: 20-100% / 0-100 (100)
5 Speed HOME/LEARN: 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 trip delay: 0-255ms / 0-255 (100)
(0 = tripp not in use)
9 Combiport (pin 13) function: 1-3 (1)
1= gives position info out with 0-5V
2= gives position info with 0.5-4.5V and fault =0V
3= gives 5V when positioned
10 Over voltage limit: 15-40V / 15-40 (35)
11 Load compensation: 0-255 / 0-255 (0)
12 Time out: 1-255s. / 1-255 (0= not in use) (0)

13 Hour and start counter reset (0)
set value = 1 and press SAVE -> hour and start counter reset
14 Home run / learn function: 1-7 (1)
1= Home run with RES / LEARN input to BW direction (>5s. comm.)
2= Home run with RES / LEARN input to FW direction (>5s. comm.)
3= Auto-Home from BW LIMIT input to BW direction (pin 9)
4= Auto-Home from FW LIMIT input to FW direction (pin 10)
5= Auto-Home triggered with inner soft limit to BW direction
6= Auto-Home triggered with outer soft limit to FW direction
7= Learn routine with >5s command to RES /LEARN input (pin.11)
15 Fault output logic (0)
0= Fault pull down, 1=Normally pulled down fault open,
2= Output pull when "run", 4= Output pull when positioned
16 Not in use
17 Dead zone : 0,2-5% / 2-50 (10)
18 Braking zone : 1-8% / 1-8 (3)
19 Start ramp : 0.1-2.5s / 0-25 (10)
20 Stop ramp : 0.1-2.5s / 0-25 (3)
21 Set value min: 0...5.50V / 0-551 (0)
22 Set value max: 0...5.50V / 0-551 (550)
For parameters 21 and 22 value 551 will do an auto setting
23 Inner (BW) SW-limit: 0...+50% / 0-500 (5)
24 Outer (FW) SW-limit: 0....-50% / 0-500 (5)
25 Full range (pulse edges) 100-65535 / 100-65535 (1000)
26 PWM frequency 1 = 2kHz, 2=16kHz (1)
27 Serial line configuration, speed, parity, and number of stop bits (1)
1 =9600bps 8N1 5 =19200bps 8N1
2 =9600bps 8N2 6 =19200bps 8N2
3 =9600bps 8E1 7 =19200bps 8E1
4 =9600bps 8O1 8 =19200bps 8O1
28 Modbus address 1-247 (1)
29 LOCAL / BUS - input pin 39 - (0)
0 = pin 39 is BW end switch, local/bus selection only with BUS
1 = pin 39 defines control mode local/bus, pin open=LOCAL
2 = pin 39 defines control mode local/bus, pin open=BUS

MONITORABLE VALUES (Can be read with interface unit)

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

FAULT LED -blinking codes

1. I-trip 1 blink
2. pulse lost 2 blink
3. over temperature 3 blink
4. over voltage 4 blink
5. time out trip 5 blink
6. learn corrupted 6 blink
7. Bus. com. time-out 7blink
8. homing on going 8 blink
9. learning on going 9 blink

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 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)
Positionh set input scale. max. 0-5.5V
Input control logic: high =4-30V, low=0-1V
Control input impedances typ. 47kohm
Pulse input impedance. typ 10kohm.
Pulse input freq. max. 800Hz / pulse line
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

COMPANY ELECTROMEN OY		
DRAWN K.M.K	DATE 5.2.2023 A24pspf	TITLE DATASHEET EM-A24-PCI-SPF Dc-motor driver with pulse feedback positioning

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 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
-Max. input pulse frequency is 800Hz max.
For example: 3000rpm x 4pulses/round = 200Hz
-If pulses counter did not count. then check parameter 3 settings
(pulse input PNP or NPN)

ABOUT PARAMETERS

1. Feedback mode is a mandatory setting to be done according to the application. 1= for one pulse line only, 2= two pulse lines for 0° and 90° pulses.
2. Limit and pulse inputs (pins 9, 10, 2 and 3) can be set to work with positive or negative logic. Signal can be either pulling up =PNP or down to 0V which is often marked as NPN signal.
3 & 4 driving speed to FW (out) and BW (in) directions.
5 The speed setting for "home run" and "learn" routines.
6 & 7 Current limit setting for FW (out) and BW (in) driving directions.
8 Current tripp delay time 1-255ms, if set to 0 the tripp is disabled
9 Combiport configuration (pin 13). This terminal can work as combined input-output. It can be fault output and disable input or an on position indicator giving an "on position" signal after a succesfull positioning. It can also be used to indicate the position with continuous voltage signal 0-5V (val.3) or 0,5-4,5V + 0V fault (val.4).
Notice: With val. 3 or 4, also the DIP3 must be set to "ON" position.
10 Over voltage limit. Motor is switched to free wheel if the selected voltage level is exceed. This saves the driver or other devices in supply line from over voltages in case the motor generates surplus energy during slow down or braking.
This can happen eg. in vehicle or lifting applications.

11 Load compensation (RxI-comp) ensures good torque with low speeds. It is good to start testing with zero value, but if the motor seems weak when starting or slowing down to the right position this value can be increased carefully and step by step.
Notice: Too high value is recognized from oscillation and/or twiching.
12 Time out tripp will cut off the driving if continuous driving to the same direction exceeds the set value (statet in seconds).
13 Usage counter reset parameter is for manual reset of counters. Choosing and saving value 1 will reset the hour and start counters.
14 Home run direction and start condition setting or enabling the learn routine for finding the full movement range.
Home run can allways be started with RES/LEARN input (pin 11).
Auto home can be started with actual limit switch inputs or with so called SW-limits (par. 23 and 24). Last special option (value 7) is for starting the learn routine. That is an end to end drive routine to count and determine the real full movement range.
15 In case the pin.13 is used for indication, the limit switch inputs pin 9 or 10 can be configured to work as disable input.
16 Not in use in this program version.
17 Dead zone is for determining the suitable positioning accuracy. If this positioning window value is small the positioning is tended to be done more accurately. If value is too small compared to the accuracy of the other parts of the application, the system might not be able to work properly. Notice. Other parameters like braking zone and FW/BW speed settings will also affect to the positioning behaviour.

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. Its the time from 0-100% or vice versa
21 & 22 are for determining the control signal range limits. Value can be given as Volts, 0 to 550 (0 to 5,5V), or the min. and max. values can be measured automatically by setting value to 551. Then the card will measure the signal in 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: if either of these SW-limits is used for auto-home (par.14) the motor will drive over the limit when executing the home run.
25 The full-range is determined by setting the known or calculated full range pulse edge count to be the parameter value. Alternatively the value can be defined by making the learn run (par.14 val.7)
Notice. The learned pulse edge number is up dated to the EM-236 Interface unit display when you make a new Load & Edit data query or try to change the value right after learn routine.
to change
26. pwm freg. 2kHz offer better efficiency. 16kHz offer quiet run.
27 and 28 are parameterd for Modbus communication for Modbus communication has own instruction sheet
29. configuration parameter for input pin 39

TAKING IN TO USE

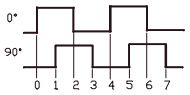
The setting of the controller is done with parameters, and the parameters can be set and edited with EM-236 Interface Unit. Making changes is easy and precise. Copying the parameters to multible units is simple and accurate. The same parameters that are saved to one unit can be copied to an other unit with one push of a button. After the two first parameters have been set according to the application, the actuator and control wires can be connected and operation can be adjusted with the remaining parameters.

POSITION FEEDBACK

Select 1 or 2 pulselines with parameter 1 according to your application.
The position information has more risk to be corrupted when controller is used with one pulse line, as the signal does not have information about the direction of the movement. For example in fast direction change with difficult loads few pulses are more easily counted to wrong direction.
So it is recommended to use two pulse lines (0° and 90°) when ever available.

Pulse edges of 1 and 2 pulse lines

One pulse mode includes
no direction information
(pulses to input A)



Two pulse,quadrature pulses
offers also the direction information

FULL RANGE (mechanical range)

Full range is the full mechanical movement of the linear motor or positioning system. At first it is always needed to determine the full range before it is possible to drive the system. When the full range is determined it is also set to correspond the selected and set control range that can be for example 0-5V. Position feedback is received as pulses, and full range is determined as the number of pulse edges received during the full movement from start to end. If this number is known it can be set as the value of parameter 25 (Full range). The mechanical range can be adjusted also with parametr 23 and 24.

LEARN ROUTINE

Learning is a special option for finding the full range and taking the system in use with out knowing the number of pulses for full range. Learn routine is selected with par.14 val.7. and started with 5s command to RES/LEARN input. Learn routine will drive the motor forward (FW) untill it reaches the outer end then it starts the motor backwards (BW) and drives to inner end. During this routine the driver "learns" the number of pulse edges for full range and also retrieves the absolute position by resetting the counter in the inner end. After learn routine is done the driver can be used for positioning and par 14 should be set to some suitable value for normal use of the application.
Notice: Learn routine is ran to the hard end (or to the limit switches if wired).
Notice: To see the learned and right number of the full range pulse edges, you have to down load (OK to Load&Edit) the parameters from driver with EM-236 Interface Unit once again. Or if you are wieving the par.25 while learn routine you can try to change the value and the EM-236 Interface unit will first display the learned range. After this its possible to edit this reading.

CONTROL SIGNAL RANGE (position set)

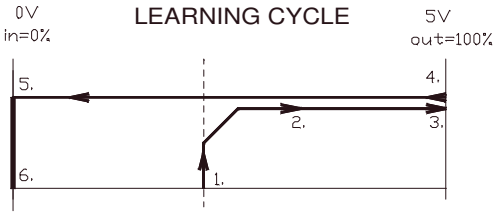
Maximum range is 0 to 5,5V, The range can be adjust
Your individual control scale you can either set with parameters 21 and 22
For example: if control signal is 1.0 -5.0V, then set param 21 = 100, and 22 =500
An another way is to let the driver to measure the values. So first connect and adjust minimum 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.

HOMING (home routine)

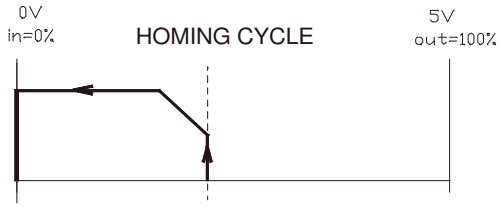
The position feedback is received as pulses so the driver can not know the righ position before its pulse counter is reset in some known position.
Home run command will drive the motor to selected end of the full range and there it will reset the pulse edge counter. Before the positioning can be used the home run must be done. After home run the position is saved to the drivers memory and will be valid even after the power is cut off and restored.
Home run is configured with parameter 14, values 1 or 2.

AUTO HOMING

Auto home is an automated home run that is triggered during normal operation when ever the motor is run to the FW or BW end switch or close to the sofware end limit (SW-limit). Well configured auto home can effectively prevent cumulating position error. Its specially useful when working with only one feedback pulse line. Auto home configures with par. 14 (values 3,4,5 or 6).
Notice. The auto-home will be ran to the hard end (or to the limit switches if wired).
If you choose the auto-home triggered from limit switch inputs or SW-limits, the option of using the 5seconds command to RES/LEARN input is also available.



1. start learning by giving a 5s sommand to RES/LEARN Notice, that parameter 14 should be set 7 to enable learn
2. motor starts to run "out" direction with learn speed
3. current limit stops the motor when mechanical end is reached
4. motor starts to "in" direction and makes a full stroke. During stroke the pulse counter calculates the range.
5. motor reaches the mechanical end "in", and current limit stops the motor.
6. Device stores full range value (param. 25) and reset position counter = home position Learning is now ready. After that device moves to to normal operating mode and start to seek the target position



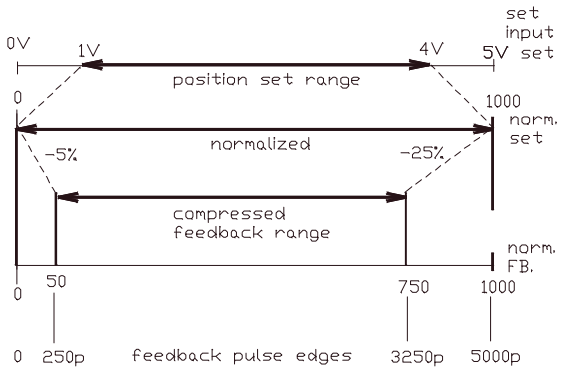
Alternatively if you want to use RES/LEARN input only for "homing", then select the parameter 14 to value 1-6. At the homing the motor start to run directly to "in" direction and when it reach end (home) it resets position counter

MOST OFTEN OCCURED PROBLEM on HOMING and LEARNING

Motor runs only about 1s. and give 2 led blinks after stop.
Pulses not found, check parameter 1 and 2, and pulse wiring

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

SET and FEEBACK SCALING



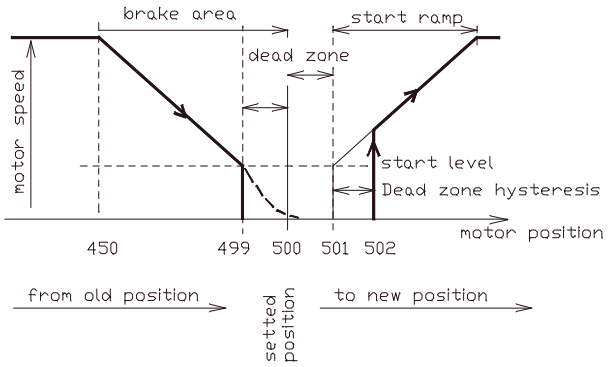
The program uses normalized feedback and set values.
These both are normalized to range 0-1000
These normalized value can be monitored with monitor values
3 = normalized set position and 4 = normalized feedback position

In this example want to use analog set value 1-4V
The set range can be scaled with parameters
21 = 100 and 22 = 400 which means the 1...4V signal is normalized in program to the range 0-1000. (set position range)

The full mechanical range in this example is 0-5000 pulse edges, and this is normalized in the program 0-1000 (= feedback range)
Feedback range can be compressed with parameters 23 and 24, in this example the inner limit is -5% and the outer limit is -25%. result of that the normalized feedback position is compressed to 50-750

The final result is that the control range 1-4V corresponds operating range 250-3250 pulse edges

POSITIONING WINDOW EXAMPLE



PARAMETERS SETTINGS ABOVE
Dead zone 0.1% (= 1)
Braking area 5% (=50)

SET position changes 0 to new position 500
Motor run speed FW until position reach value 450. Motors starts slowing down, Until position reach value 499 and motor shut down and motor should stopped to value 500.

Motor will start again when position SET changes over 502

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).