

EM-337-SPF PARALLEL DRIVER FOR 4 ACTUATORS or MOTORS

12/24Vdc 4x10A For positioning use

337spf 26.1.2020

FEATURES

- positioning with 0-5V or 0-10V signal
- positioning also with Rs-485 Modbus
- synchronized 4 parallel driving
- operates with pulse feedback
- pulse counting PNP or NPN logic
- quadrature pulse counting
- current and temperature limit
- settable drive speed
- 2 or 16kHz pwm frequency
- acceleration and deceleration ramps
- stroke length limitation
- setting with serial interface
- brake (release) output
- safety switch input
- Rs-485 (Modbus) control
- safety reverse function

EM-337-SPF

EM-337-SPF is a parallel synchro controller for up to 4 DC-motors. The controller has four H-bridge power stages. The driver works with actuators that can offer pulse feedback signal. The control can be done with analog set signal and digital inputs or alternatively with Rs-485 bus.

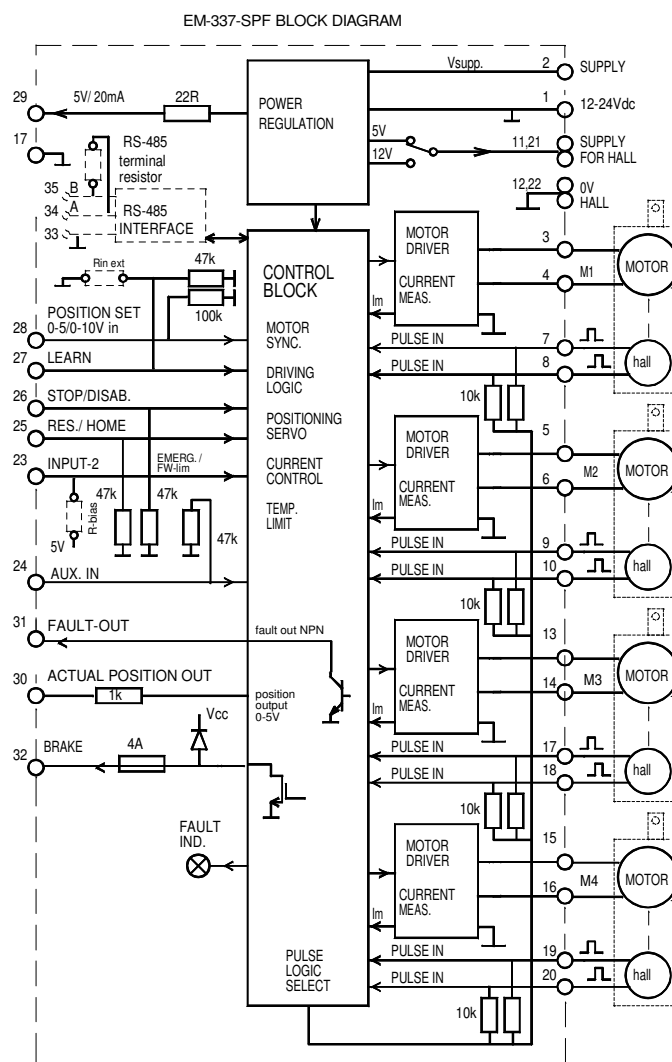
The inbuilt synchronization control will keep all motors in the same speed and position. If synchronous error exceeds the set difference limit, all motors will be stopped. Device includes adjustable acceleration and deceleration ramps, which produce the smooth starts, stops and direction changes. Load compensation also enables good operation with asymmetric loads. Adjustable current limits can be set to protect motor and mechanics against overcurrent (over sized forces).

TECHNICAL DATA

- Supply voltage 10-35V
- Undervoltage shutdown 8V
- Overvoltage limit 38V
- idle current < 20mA
- Motor current: (@ 2kHz / 16kHz)
 - 4x8A / 4x4A at continuous use
 - 4x10A / 4x5A at duty cycle 25%
 - 4x15A/ 4x8A at duty cycle 10%
 - 4x25A max. in start
- Current limit, setting 1-25A
- Overtemp limit 90°C
- PWM frequency 2kHz or 16kHz
- Input control logic levels:
 - "NPN" ON= 0-1V, OFF=4-30V or open
 - "PNP" ON=4-30V, OFF=0-1V or open
- Control input impedances typ. 47 or 10kohm
- Pulse input freq. max. 700Hz/ input ch
- Pulse inputs pull- up/down 10 kohm.
- Fault out. NPN open coll. max 30V/50mA
- 5V aux. output max 20mA
- Position out 0-5V (Rout 1kohm)
- Position input 0-5V or 0-10V
- Brake out NPN max. 4A
- Rs-485 half-duplex 9.6 or 19.2 kbps
- Supply connectors 4mm²
- Motor/control connectors 2.5/1,5mm²
- Weight 190g
- Recom. oper. temp (Ta) -40...60°C
- Over temp. shut down. 120°C (pow.stage)
- CE Electromagnetic compatibility
- EN-55022B and EN 61000-6-2/ -4-2...6
- Dimension and housing options:
 - Card 142x73x28mm
 - Installed in DIN-rail base 145x127x50mm
 - Fibox PC150/60, (180x130x60mm)
 - Fibox PC175/100 (180x180x100mm) include 300VA supply

APPLICATIONS

- table lifter
- hatch control
- worktop control



BRD. KLEE

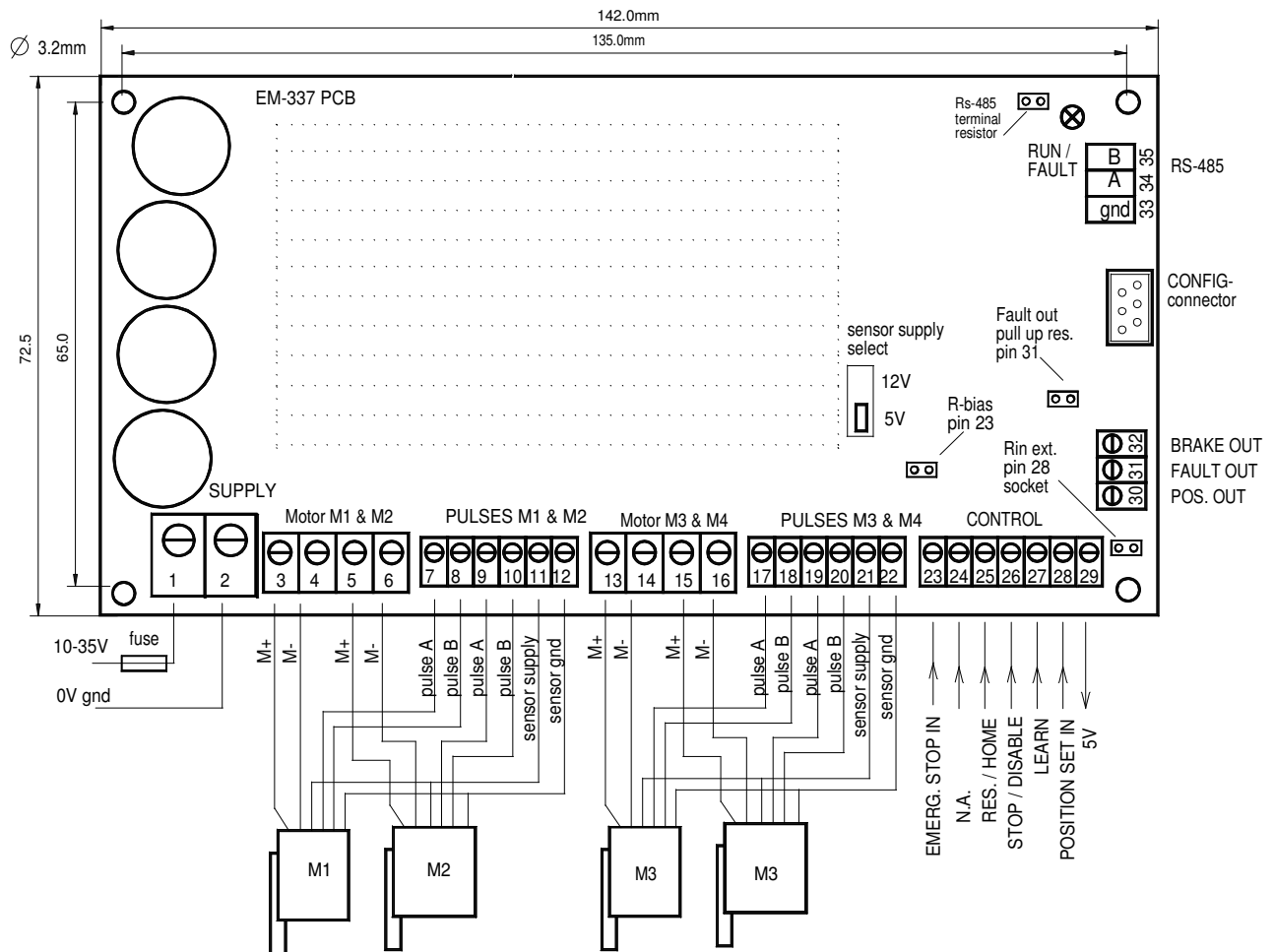
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EM-337-SPF connector & dimensions.

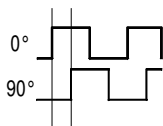
HEIGHT 25mm



CONNECTION

In the drawing above, a typical connection of the card can be seen. Supply voltage should be 12-35Vdc filtered. Ripple less than 20%. Device has no inbuilt fuse, so use an external fuse, max value 60A.

IMPORTANT.



The phase shift of pulse lines should be about 90 deg. Also the frequency of one pulse sensor should be lower than 700Hz.

TERMINALS

PULSE SENSOR INPUTS can be set to work in NPN (pull to gnd) or PNP (pull to positive) mode. The modes are set with parameter 4. The hall switches of motors can be supplied with supply voltage or with 5V from card. Check the right voltage from motor datasheet.

ANALOG INPUT set is a analog in for set value setting. This input range can be set with parameter 5

LEARN INPUT starts learning cycle.

STOP/DISABLE INPUT stops motors and keeps stopped as long as this occurred.

EMERGENCY STOP INPUT stops motor and start safety return cycle, this input set with parameter 7 and 18 This input also has a wiring monitor possibility. When safety stop switch option is selected, R-bias has to install. R-bias socket R-bias should be the same value as the resistor on safety switch.

EMERGENCY STOP INPUT pin 23 is basically PNP input, but it can be work as wiring condition monitor input, in this mode it work as biased analog input. Monitor mode need in safety switch which has inbuilt resistor for wiring monitor. This input can be set with parameter 7 and monitor bias resistor can be installed in R-bias socket

RES. / HOME input is PNP input. Short command resets fault, long command (>5s) starts home routine.

FAULT OUTPUT is normally an open NPN output, but this has an optional 2.2kohm pull up resistor if you want to use it for PNP input. Resistor installed in Fault-out resistor socket. Fault output function can be set with parameter 6

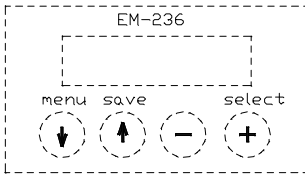
BRAKE OUTPUT is NPN 4A output for releasing magnetic brakes of motors or alternatively for switching brake resistor in overvoltage situation. The function of this output can be set with parameter 8.

POS. OUT is a actual 0-5V position output

RS-485 This halfduplex serial port. Device can be Control and monitor with this bus. (Modbus RTU) Bus communication has own instructions.

PARAMETER SETTING AND MONITORING

Parameter adjusting can be done with the following EM- interface devices.
 -EM-236 is a basic stand alone setting device.
 -EM-328 USB-serial converters, which makes it possible to set parameters with a computer that has EmenTool Lite installed.
 -EM-326 is a Bluetooth-dongle, which can be used in smart devices with the EmenTool App.



MONITORABLE VALUES

- 1 fault code, as indication led blink count
- 2 motor A current - 0.1A/digit
- 3 motor B current - 0.1A/digit
- 4 motor C current - 0.1A/digit
- 5 motor D current - 0.1A/digit
- 6 current limit setting 0.1A/digit
- 7 motor A pulse counter value
- 8 motor B pulse counter value
- 9 motor C pulse counter value
- 10 motor D pulse counter value
- 11 normalised actual position 0-1023
- 12 normalised position set 0-1023
- 13 operating voltage 0.05V/digit
- 14 emerg. input level 0.05V/digit

INDICATION LED (number of blinks)

- Cont. light = homing/learning in progress
- 1 blink = homing/learning failed or position corrupted
- 2 blinks = overcurrent
- 3 blinks = no pulses detected
- 4 blinks = motor position difference too big (synchronisation error)
- 5 blinks = overvoltage
- 6 blinks = safety edge wiring failure
- 7 blinks = Bus communication time-out

PARAMETER LIST EM-337-spf v1.4
(default in brackets)

- 1 Motor output max. voltage 10-30V / 0-30 (0)
0-9= max. is same as supply voltage
10-30 = max voltage = parameter value
- 2 Overvoltage 15-40V / 15-40 (35)
- 3 PWM frequency 1=2kHz , 2=16khz (1)
- 4 Feedback (Hall) pulse logic 1=PNP , 2=NPN (2)
- 5 Position set input max. range (1)
1= 0-5V
2= 0-10V (doubles param. 23 and 24 voltage values)
- 6 Not in use
- 7 Emergency stop input options (pin 18) (2)
1= safety switch input with opening contact (N.C.)
2 =safety switch input with closing contact (N.O.)
3 =safety switch with (N.O.) and with line monitoring
- 8 Brake output activation (pin 19) (0)
0= overvoltage (exeeding param. 2 value)
1 = "run" indication
- 9 Motor Speed 20-100% / 20-100 (100)
- 10 Motor Speed-2 20-100%/ 20-100 (60)
- 11 Current limit FW 0.1-25A / 1-250 (20)
- 12 Current limit BW 0.1-25A / 1-250 (20)
- 13 Not in use
- 14 Fault output modes 1-6 (see also switch SW1) (1)
1= output activates (= pull down) if fault detected
2= output shifting on/off, if homing or learning faults
3= output shifting on/off in phase with indication led
4= output activates when position is "positioned"
5= analog position output 0-5V
6= analog pos. output 0.5-4.5V and fault =0V
- 15 Start ramp 0.1-2.5s/ 0-25 (2)
- 16 Stop ramp 0.1-1s / 0-10 (2)
- 17 Pulse lost reaction time 0-2,55s / 0-255 (40)
- 18 Safety reverse option 3x 1-10s / 0-30 (0)
0= disabled
1-10 = reversing time 1-10s. both dir.
11-20 = reversing time 1-10s. only REV. dir
21-30 = reversing time 1-10s only FW dir.
- 19 Load compensation 0-255 / 0-255 (0)
- 20 Synchronisation strength 1-30 / 1-30 (10)
- 21 Braking area 1-8% / 1-8 (4)
- 22 Dead zone 0.1-5% / 1-50 (10)
- 23 Set input min 0-5.50V / 0-551 (0)
- 24 Set input max. 0-5.50V / 0-551 (550)
above parameter 551 is a auto setting mode
- 25 Range limit BW direction 0-50% / 0-500 (0)
- 26 Range limit FW direction 0-50% / 0-500 (0)
- 27 Full range 0-65000 pulses / 0-65000 (65000)
- 28 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
- 29 Modbus address 1-247 (1)

CONNECTION

Connect motors and supply as in picture (page2). Supply voltage 12-35Vdc must be filtered. Ripple less than 20% . Device has no inbuilt fuse, so use external fuse, recommended value range 10-40A.

START-UP

First when the device is turned on a parameter check should be made. Connect interface unit in to device and change parameters to suit the application, most important is to check: Input logic, current limit and full range.

HOMING CYCLE (position counter reset)

At the start of use the pulse counters of device has to reset, and in some situation device might lose the position information, for example when it moved manually while the power is off. In above cases the position counter can be matched with homing routine. In the homing the motors run at speed-2.

START THE HOMING CYCLE

The homing routine is activated with 5 second command for RES/HOME input. After starting motors run BW direction and ind. led turn on. **NOTICE !** Keep command "on" until motor stops and led stop turn off . If one of the motor does not reached the end or led stay blinking, then start homing routine again so many time that all are reached the end and indication led is turned off

LEARNING CYCLE (position counter range set)

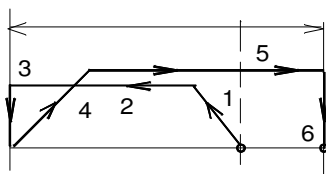
The learning cycle idea is learn the right range for device with special running cycle. After completing the learning cycle successfully, the device has automatically set a mechanical operating range for itself. The range can be compressed manually with parameter 25 and 26

NOTICE! learning is not necessary if already known the full range pulse count. then can be set manually full range parameter

START THE LEARNING CYCLE

Learn routine starts with positive command for learn input (pin 27) Motors start to run and led turn on. **NOTICE !** - Keep command "on", until led turns off. If led stay blinking then try again drawing below shows how the learning should progress.

Full Range = mechanical range end to end



HOME makes steps 1 to 3
LEARNING steps 1 to 6

1. Start to BW direction (led turn on)
2. Run to BW direction speed-2
3. BW end (led turn off in homing)
4. Start to run FW direction
5. Run and count to FW direction with speed-2
6. Reach FW end, device set full range (led turn off)

NOTICE ! the first start after homing or learning is a "kick start" it means that device gives 100ms full drive, this to release possible stuck after driven into the mechanical end.

TROUBLE SHOOTING AT HOMING AND LEARNING ROUTINE

- A: motor run only about second and indication led blinking
- check parameter 4
 - check pulse sensor voltage
 - pulse sensor phasing is wrong = wrong counting direction
 - > swap the pulse wires
- B: motor run not at all:
- current limit is too low, check parameters 11 and 12
 - motor or system is mechanically stuck
- C: The homing works, but into the wrong direction, then swap the motor wires and also swap the pulse sensor wires.

SET RANGE (position set input range)

The analog position set input is pin 9, This input can be set with parameters 5, 25 and 26. The max. range selected with param. 5 options is 0-5V or 0-10V. Parameter 23 and 24 is for fine tuning of range.

Example 1 control signal is 0.1-3V, then set param. 23 = 10 and param. 24 = 300.

Example 2: Control signal is 4...20mA, then plug in Rin-ext resistor 250ohm, this convert mA signal to voltage signal 1-5V, then set param. 23 = 100 and param. 24 = 500.

Example 3: Control signal is 0-10V, set param. 5=2 and 23=0 and 24 = 500. Notice the parameter 5 selection has doubled the voltage values of param.

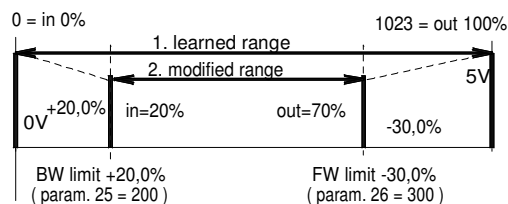
Example 4: Auto set

Adjust the control signal to the min. value, set param. 23 to value 551 and SAVE, card will save automatically adjusted value to the parameter value. Same time Adjust max. value to the input and set param. 24 to the value 551 and SAVE. Now the min. and max. should be set.

RANGE LIMITATION

The learned range can be limited with param 25 and 26

1. Original learned range = mechanical full range = position counter normalized to 0 - 1023 in learning
2. Modified range example:
BW limit = 20,0% and FW limit = 30,0%.
Now the stroke of actuator is compressed to 0-5V --> 20% to 70%

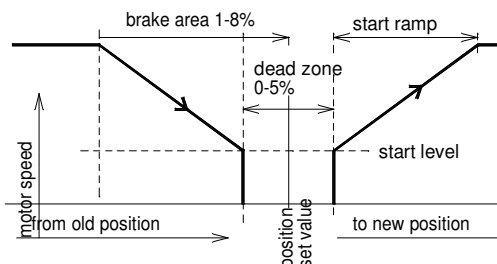


FULL RANGE.

Full range parameter 27 can be set also with manually instead of learning routine. If you already known the full range of application, then you don't need to make learning. You can also manipulate the mechanical full range of system with adjusting full range parameter. Decreasing of the value will expand the mechanical range and vice versa.

POSITIONING COMPARATOR (positioning behaviour)

Positioning accuracy and dynamic (param. 19 and 20) Brake area is a slowing down slope when approaching the set point, faster application will need wider braking area. The dead zone is area where motor is "positioned" Narrow area means better accuracy, but too narrow window could generate vibration.



START AND STOP RAMPS

ramps smooths start and speed changing. These are set with parameter 15 and 16

CURRENT LIMIT (torque limit)

All motor has own current limit measuring, if current of another motor exceeds the current limit, then both motor will shut down. Overcurrent shut down is disabled during start ramp, but the current limitation is always active and it protects against overtorque. Current can be set separately for FW and BW direction with parameter 11 and 12.

PWM FREQUENCY

Driver has two option for pwm frequency 2 or 16kHz, with 2kHz power stage has lower losses and it can give more output current. But 2kHz can also generate whistling voice, this can be avoided with selecting 16kHz frequency.

SPEED

Driver has two speed setting parameter 9 and 10. The parameter gives proportional value of supply voltage or if motor output regulating is active, then it gives proportional value of parameter 1. The speed-1 is normally in use. The speed-2 is enabled in homing, and in slowing down area when approaching end point. Speed-2 can be also enabled with input-1 or input -2 if particular function is selected with input options parameter

MOTOR OUTPUT MAX. VOLTAGE (speed regulating)

This function regulates motor speed so that changes of supply voltage will not affect the motor speed. This is enabled and adjusted with parameter 1. For example, if supply voltage varies 25-32V, then you can set this parameter to value 24V. which means that motor output 100% =24V. If this function is disabled (param. <10) then 100% output is = supply voltage

LOAD COMPENSATION (torque at low speed)

If the motor seems to be lag of torque at high load, specially at small position changing its endurance can be improved with compensation parameter 19. Increase slowly the parameter's value for example by 10 units and make loading test, repeat this until you get torque enough for low speed. However, setting a too high value will make the motor twitch.

SYNCHRO STRENGTH

The parameter 20. defines how strong the synchronisation is between motor A and B. The bigger value means stronger synchronisation, which means that motors follow stronger to each other, but too big value could generate twitching.

DIFFERENCE LIMIT (unsynchronous. shutdown)

If difference between motor increases more than 50 counts, then difference limit detection will shutdown motors. Recovery from this situation only with home or learning.

SAFETY "REVERSE" FUNCTION

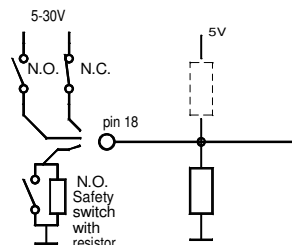
This function reversing motors automatically if system meets obstacle. With parameter 18 can be set the direction when function is enabled and also how long time motor reversing. This function trigs on from current limit or with command from emergency stop input. Notice! that emergency stop input start safety reverse only BW direction

PULSE LOST REACTION TIME

Parameter 17 defines delay time for pulse lost shutdown. If some of motors don't give pulses then all motors stopped. Default value for reaction time is 0.5s

EMERGENCY INPUT OPTIONS

This input is especially for external safety switch. Safety switch has usually monitoring resistor, which has used to monitoring the condition of safety switch wires. This input has possibility to monitoring this line when "safety switch" option has selected with parameter. R-bias has to set same as resistor in safety switch. Line fault will be detect with fault output. In this input can be also use basic N.O. or N.C safety switch, wiring examples below. Parameter 7 allows you to select a mode.



FAULT RESETTING

Current limit and pulse lost errors will be reset with "new" opposite direction command or also with reset command to pin 16.

Homing failure and difference limit errors have to reset with new "homing" routine

Overtemp and overvoltage error will be reset automatically, when error situation disappear