

## 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.

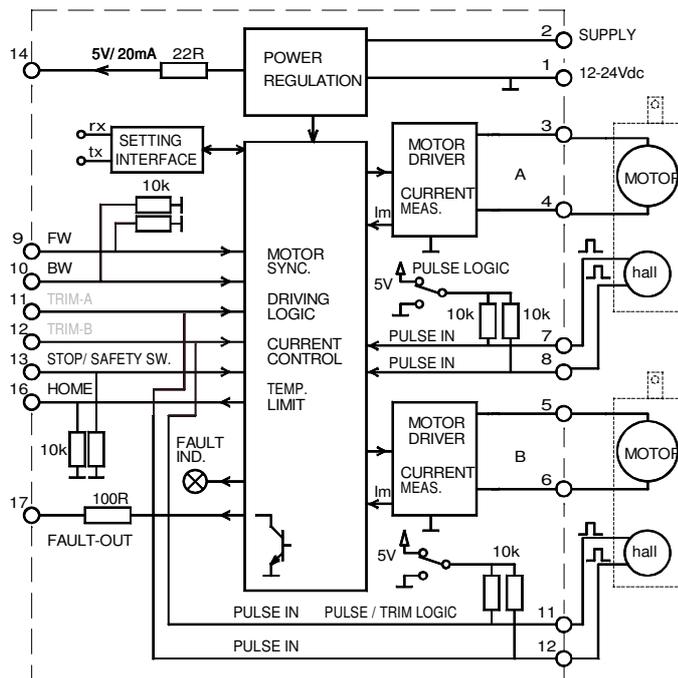
The basic control is done with FORWARD-, BACKWARD- and STOP-commands. FORWARD and BACKWARD can be done in continuous or in impulse control mode. In continuous mode the drive is done as long the command is on. In impulse mode the command impulses start and stop the driving. For help in assembly and in 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-software 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°C ( 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 °C  
 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

### 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.

- EM-236 interface unit
- EM-268 interface unit with EmenTool Lite PC-software
- 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 command, 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 synchronisation 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.

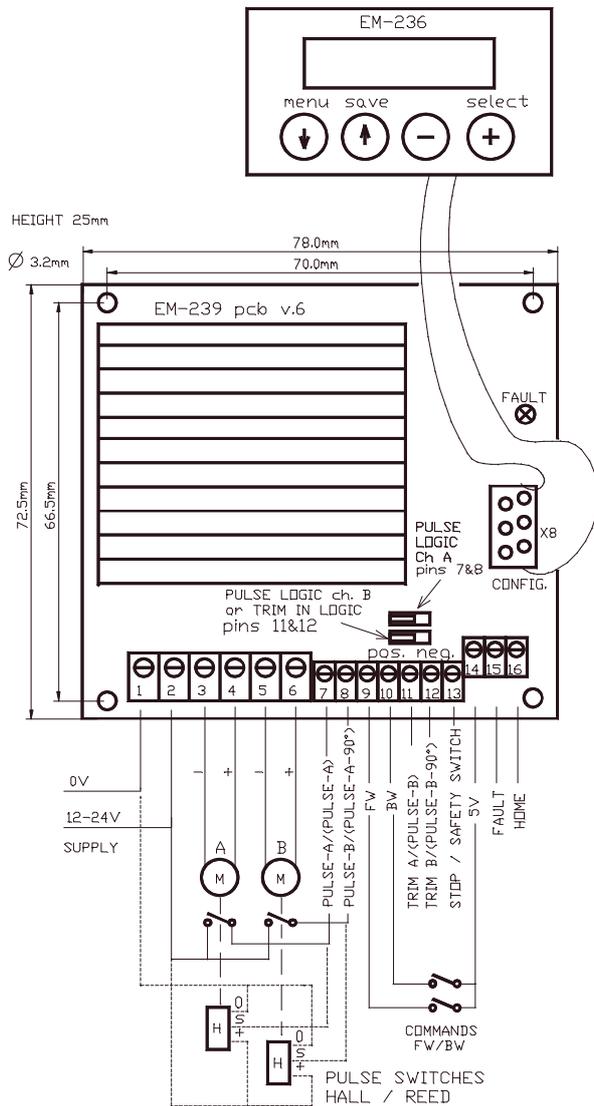
"Mode" sets the driver control mode. In continuous mode the motor runs as long as command ( fw or bw ) is ON. In impulse mode a short command starts the motor and the direction is changed with opposite command. Motor will stop only with stop command. In impulse-2 mode motor starts with short (FW/BW) 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 possible to use two pulse sensors for one motor and this way driver can always detect the right direction of the movement. This is recommended always 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



### 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 board 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:

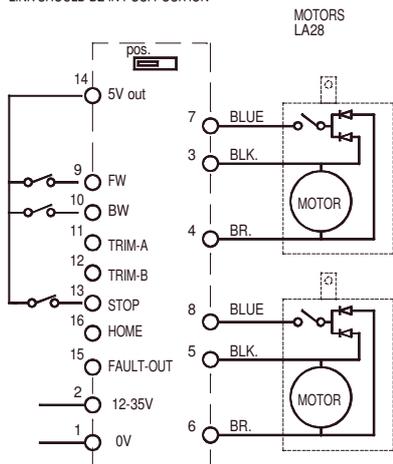
- difference limit exceeded
- pulses have disappeared
- too high temperature
- current limit exceeded ( if enabled )

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

EXAMPLE 1.  
3-WIRE MOTOR WITH REED SWITCH  
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 )

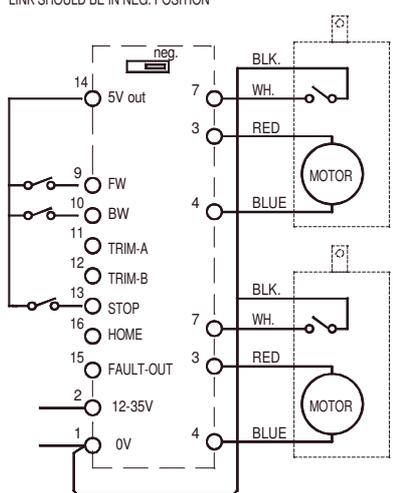
Auto balance starts balancing routine before "real" home. The trigger point is set with parameter 12. If auto balance is active it balances the system automatically in the end of stroke. This will prevent the possible pulse error cumulation. Auto balance works always to the home direction and with "home-speed" 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 follows:

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

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



TRIM and override

TRIM input allows 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.

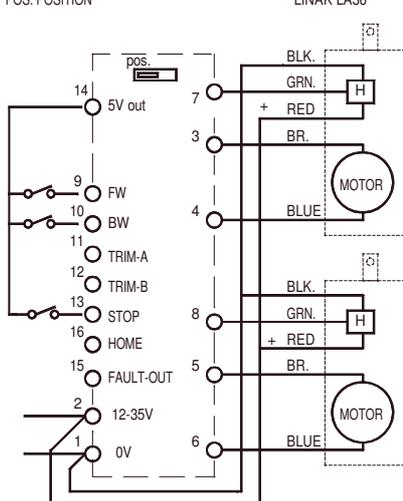
During the normal use it is possible to monitor the function of driver with EM-236. Select the monitor mode in EM-236 and you can check the following values:

- 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.

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

