DC-MOTOR CONTROLLER FOR DOORS AND HATCHES
EM-231B without RF remote control receiver
EM-231B-RC with RF remote control receiver

FEATURES

- Motor output 24Vdc 3A peak 6A
- 2-pulse line position feedback
- Safety switch input with monitoring
- Proximity switch input (door radar)
- RF remote controlled option (-RC)
- 2 or 4 button keyfob options
- Robust enclosure
- Digitally settable parameters
- Inbuilt 230Vac power supply
- New version B replacing EM-231A
- Not compatible with earlier EM-231
- EM-231B prog v1.3 has added separated speed "open and close"

ACCESSORIES - which you may need

- Parameter setting device EM-328 series or EM-236A
- RF-keyfob transmitters for -RC version EM-A14T-FM or EM-A14T-FM-4

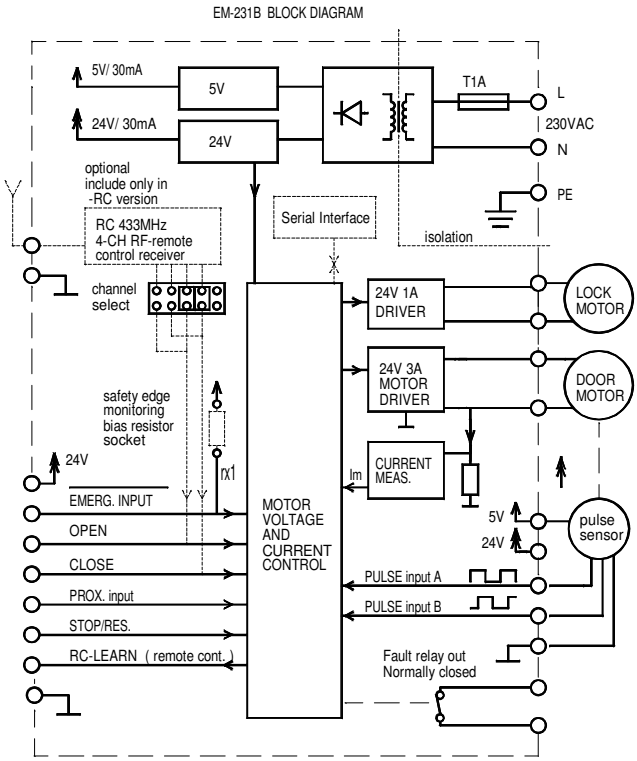
EM-231B is a control unit for doors and hatches with 24V max. 3A DC-motors. The device has a built-in 230Vac power source. The motor and its control circuits operate safely with 24Vdc voltage that has been galvanically isolated from mains voltage. The controller has an extremely good momentary current uptake capability which enables the motor to provide excellent torque. The controller supports a system or a motor that offers the double pulse line feedback. This allows the system to function precisely and smoothly. To handle problems in movement or obstacles on the way of the door, the device has a current limit and it also supports an option to connect a "safety edge", which is installed on the leading edge of a sliding door or some hatch. When the driver detects an obstacle as rising motor current, it automatically performs a safety reverse so that something or someone will not be trapped by the door. The device has also so-called lock motor output option but the standard program doesn't support this feature. Theres two basic control modes to choose from, the 2-button or the 1-button mode. In addition to these modes an automatically closing mode is used every time the door is opened through proximity switch input.

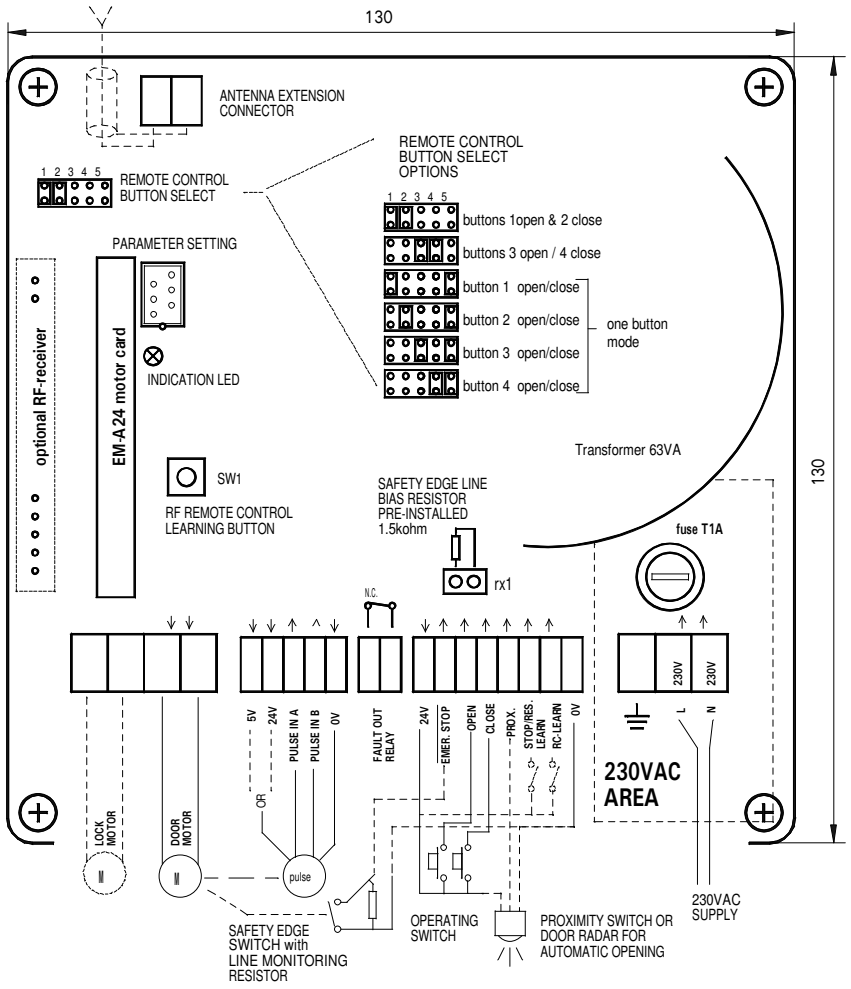
EM-231B-RC version has RF-receiver inbuilt door control unit to receive commands from a keyfob transmitter. There is available 2 or 4 button keyfob transmitter, with 2 button keyfob can be controlled max. 2 control unit and 4-button max. 4 control unit. The remote control system use´s a KeeLoq rolling code protection code that is excellent at preventing outside interferences or code mixups.

TECHNICAL DATA

Operating voltage	230Vac +-10%
Power consumption	max. 120VA
Idle Power	idle 3W
Fuse	T1A (5x20mm)
Output voltage	typ. 24Vdc, max. 34Vdc
Output power	typ. 60W, peak 120W
Output current limit (door)	0.1-6.0A settable
Output current (lock)	cont .1A peak 3A
Motor speed range	0-100% settable
Pulse freq. max. (FB)	max 700Hz
Control input logic levels	0-1V or open = "off" / 4-30V = "on"
Control input impedance	100kohm
Emerg. input logic levels	0-1V = "on" / 4-30V or open = "off"
Emerg input impedance	30kohm or external pull up res. (RX1)
Alarm output (relay out)	Normally closed 1A 30V
Operating ambient temp.	-20..+50°C
Weight	950g
Dimensions	130x130x60mm
EMC	EN-50081 / EN-50082
Remote control freq.	433Mhz
RC receiver type	EM-A14R-FM-4 (inc. in -RC version)
RC transmitter 2-button keyfob	EM-A14T-FM
RC transmitter 4-button keyfob	EM-A14T-FM-4
Remote control coding	Rolling code Keeloq
Remote control output pow.	<10mW

EM-231B BLOCK DIAGRAM





GETTING STARTED

Only an electrician should connec the device, because 230Vac supply ! Notice: Theres a hazardous, 230Vac area on the printed circuit.

When the device has been connected as in drawing you can turn on the mains power. Notice that all connections are not neccessary, only the motor, operating switches (open, close) and supply. All additional connections are marked in the drawing with dashed line.

In one button mode you will need only one operating switch, to toggle open/close command.

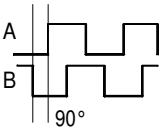
If you have safety edge switch with line monitor resistor, connect resistor about the same value to the Rx1 socket on the board. There is resistor value 1.5kohm as pre-installed.

The RF-remote antenna can be extended with 15cm wire or to position an antenna more far use coaxial cable.

NOTICE !

Every time when main power turns from OFF to ON, the device is in "safety mode" it means that first open or close command starts the automatic HOME cycle at slow speed.

IMPORTANT.



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

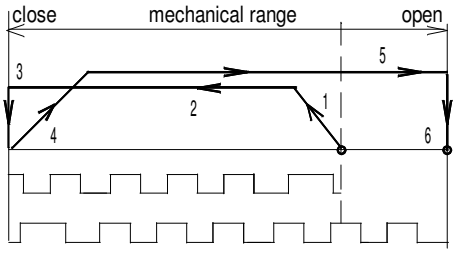
LEARNING CYCLE (position counter range set)

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 and has also marked slowing down points from 20% of each opposite end. The device also sets an end-limit point from 4% of the opposite ends. These values can be adjusted manually with parameters 15-19 to optimize the functionality.

START THE LEARNING CYCLE

There are two different ways to start the learning cycle.
1. The learning cycle can be initiated with the STOP/RES/LEARN input by giving a long (8s) command.
2. Or with parameter setting tool EM-236 or EmenTool prog. + EM-328 USB dongle. If you set parameter 19 to value to "1" and you press SAVE in EM-236, (or "write" in EmenTool prog.) the control device will start the learning cycle.

The details of this sequence are displayed on the drawing below.



LEARNING CYCLE

1. Start to close direction
2. Run to close direction speed-2
3. Reach close end (HOME)
4. Start to open direction
5. Run and count to open direction with speed-2
6. Reach open end, set the range and limit points

LEARNING CYCLE TROUBLESHOOTING (VS. INDICATION LED BLINKINGS)

A. The device refuses to move or moves only short moment:
5 blinks = too small learn range -> Check that the mechanics is free to move, check the motor wires, check that the current limit is high enough for the motor. You can raise the current limit with parameters 5 and 6. Do not set more than 5A. Check the pulse sensor wiring and voltage (5/24V). Also check that pulse sensor logic is right PNP / NPN (logic can be changed with parameter 2).

B. The device refuses to move after learn, or executes only partial learn cycle:
4. blinks = pulse counting direction err. -> swap the pulse sensor line wires.

C. Learning successful but operates in the wrong direction.
Interchange pulse sensor pulse line wires and swap motor wires.
After this, do learning again.

HOMING CYCLE (position counter reset)

The "homing" is a light version of learning, in homing the home position (counter zero value) is re-set in the mechanical home end. The homing is like learn cycles 1, 2, and 3 (see learn drawing). In some occurrences the counter can lose the right position infomation, for example if motor is moved manually while the power is off. In such cases the position counter can be re-matched by driving the homing cycle.

STARTING THE HOMING CYCLE

The homing process is activated with long push (8s) in 1-button mode or simultaneous 5s push in 2-button mode. The homing process is also done automatically after the first drive command after the power is turned on "safety mode". Homing is always done with speed-2 (parameter 4).

RF-REMOTE CONTROL (EM-231B-RC version)

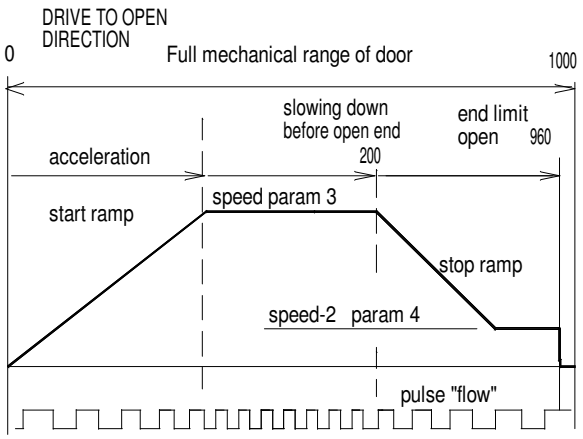
The door control unit can be outfitted with a RF-receiver which can receive control commands from transmitter. In this remote control system, each transmitter is identified with its own keeloq code. Due to this each transmitter must be taught to the receiver to identify the remote control unit. One receiver can be taught to identify max. 16 transmitters. And one transmitter can control max. four door units.

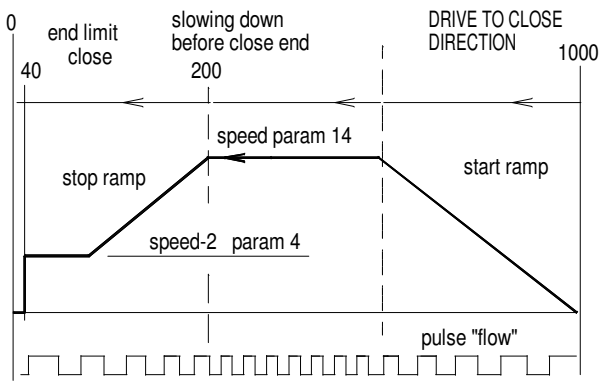
LEARNING AND CHOOSING A CHANNEL

The remote receiver learning process is activated with the circuit board's SW1 button or with the RC-LEARN input. Use a short 2s command and after that press the transmitter's top button for a moment. Wait for 15 seconds and after this the remote control should be ready for use, and should work according to "channel select" jumper settings. The remote control works parallel with the normal operating inputs. Transmitter channel (button) configuration is done by setting jumpers according your choice. Location of jumper pieces is displayed on page 2.
4-button remote control transmitter can control 2 devices in 2-button mode, and 4 devices in 1-button mode
2-button remote control transmitter can control 1 device in 2 button mode and 2 device in 1-button mode

CLEARING THE MEMORY OF REMOTE RECEIVER

If you want to delete earlier learned transmitter connections, push RC-learn button for 30s or give 30s command to RC-learn terminal.





ADJUSTABLE FEATURES

When the operating range has been determined, all of the special functions can be set with parameters.
- Drive mode - continuous/impulse and 1- or 2-button drive, Param.1
- Drive speed, Parameters 3,4 and 14
- Maximum Torque, Parameters 5,6
- Approaching torque (at speed-2) , Parameters 7,8
- Motor toughness at slow speed (load compensation), Param. 9
- Acceleration and deceleration time, Parameters 11,12
- End stop advance and shut down points param. 15-18
- Pulse range param. 19 (this normally set in the end of learning cycle)
- Power stages frequency audible/quiet, Parameter 21
- Proximity switch "open" delay, Parameter 22

PARAMETER SETTING AND MONITORING TOOLS

The parameter adjusting can be done with many different Interface devices
-EM-236 is basic stand alone setting device, for parameters and monitor values
-EM- 328 USB-serial converter enables to set parameters, monitoring and program up-date. Its used as connected to a PC and with free EmenTool Lite software. Three versions available from industrial isolated to low-cost shrink tube housed model.
-EM-326 can be used to communicate with compatible BlueTooth device like IPhone. Free EmenTool App can be loaded from Appstore.

EM-231B prog. v1.3 parameters

1. command mode (1)
   0= continuous fwd. / rev (open/close)
   1= impulse fwd./rev with stop
   2= impulse fwd./rev. without stop
   3= One button mode, impulse for open input starts open and close
   4= One button mode, impulse for close input starts open and close
2. Pulse input logic selection 1= PNP / 2=NPN (2)
3. Speed-1-O "drive speed open" 0-100% / 0-100 (100%)
4. Speed-2 "approach speed" 0-100% / 0-100 (40%)
5. Current limit open 0.1-25A / 1-250 (3A) recommended max 6A
6. Current limit close 0.1-25A / 1-250 (3A) recommended max 6A
7. Current limit open with speed-2 0.1-25A / 0-250 (0 = follow param 5.)
8. Current limit close with speed-2 0.1-25A / 0-250 (0 = follow param 6.)
   (0 in param. 7 & 8 is a special case)
9. Load compensation 0-250 (0)
   This gives boost against load increase at slow speed. Increase the value gently and test run with 50% speed. Too high value will make motor twitch, over shoot and behave restlessly . Values from 10 to 40 are usually suitable.
10. Counter reset
    To reset start and hour counter, set parameter value=1 and save it.
11. Start ramp. acceleration time for 0-100% speed, 0.1-2.5s/1-25 (1s)
12. Stop ramp. slow down time 100% to 0% speed, 0.1-2.5s/ 1-25 (0.5s)
13. Emerg. safety input options. (0)
    0= not in use
    1= safety edge, reverse when closing and safety edge gives signal
    2= safety edge, like above, but disabled in slowing down area
    3= sagety edge will release the motor
14. Speed--1-C "drive speed close" 0-100% / 0-100 (100%)
15. End limit "close" value 0-65000 (0= disabled) (40)
16. END limit "open" value 0-65000 (0= disabled) (960)
17. Slowing down before close end 0-65000 (200)
18. Slowing down before open end 0-65000 (200)
19. Pulse range 0-65000 (1000)
    Set this to value 1 and SAVE to start learning cycle
20. Not in use
21. PWM frequency selection 1=2kHz / 2= 16kHz (2)
22. Proximity sensor "keep open" time 0-1000s / 0-1000 (2)

OPERATION EXAMPLES.

Above drawing of basic driving cycles. But if the end limit parameter is set = 0 the stop is done to the mechanical end by the current limit. This way the whole mechanical movement range can be used.

FAULT OUTPUT

The fault output is "dry" contact output, which is normally closed. It will open in cases of: Supply voltage disappear, safety switch line fault, and overtemp.

SAFETY SWITCH INPUT and FUNCTION

Closing contact of the safety switch will stop closing of the door and will start the automatic open.
Safety switch line has a line monitoring feature. It measures that the wiring is correct. The safety switch line resistor and the on card bias resistor should be matched to be about the same value. In card theres pre-installed 1500ohm resistor on the socket which is easy to pull-out and change (no welding required).
If safety switch input is used without line monitor resistor pls. remove pre -installed on board resistor also.

PROXIMITY or DOOR RADAR INPUT (automatic door)

This input enables automatic door function and it starts automatic opening and door stay open a time which has defined at param 22. and then closing automatically.

COMPENSATION ADJUSTMENT

If the motor seems weak when used with slow speed (speed-2) the strenght can be improved with load compensation (par 9). Gently increase the parameter value for example by 10 units and make loading test, repeat this until you have torque enough to run at low speed. However, setting a too high value will make the motor twitch, overshoot and behave nervously.

INDICATION LED CODES

1 blink = Home run in progress
2 blink = Stopped by current limit
3 blink = Stopped by pulse lost detection
4 blink = Stopped by wrong pulse counting direction
5 blink = Stopped by small range count in learn (< 50p)
6 blink = In safety mode
7 blink = Stopped by overheat
8 blink = Stopped by overvoltage
9 blink = Stopped by safety edge detection
10 blink = Safety input line fault
11 blink = Motor released by safety edge input (par. 13)

MONITOR VALUES
1. Fault codes (see ind. led codes)
2. Current of motor 10=1A
3. Current limit 10=1A
4. Hour counter 1=1h
5. Start counter 65535
6. Start counter overflow 1=65535
7. safety switch line 0-1024
   400-700 = line ok
8.Position counter value