

FutureNow FN485-4xSH Installation Manual

Four Channel Intelligent DIN Rail Mountable Shade or Motor Controller Unit
with Local Inputs Controllable via RS-485

OVERVIEW

The FN485-4xSH can be used for controlling window treatment devices such as shades, shutters, blinds and curtains, or any other device equipped with three-wire bidirectional AC motors with built-in limit switches via RS485 bus commands or local inputs.

This manual is intended for installers who need to understand how to install the FN485-4xSH module.

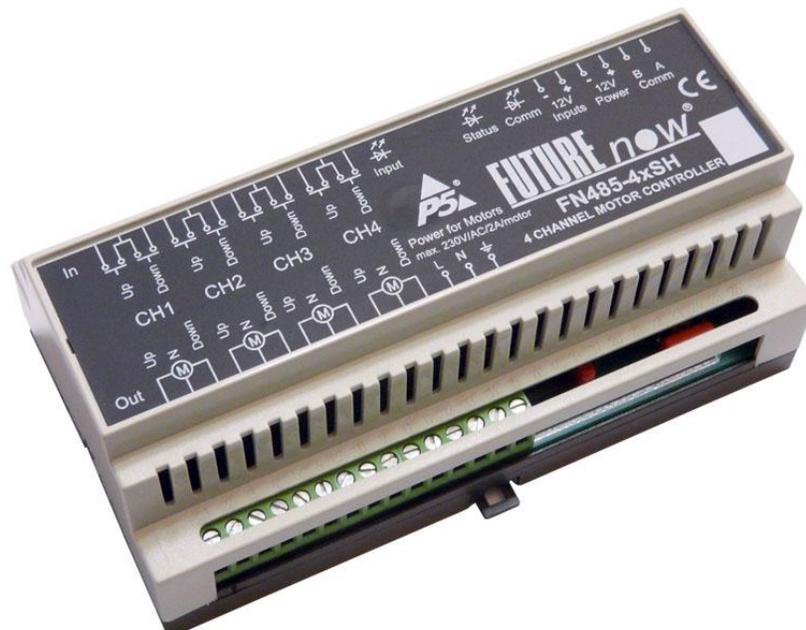


Figure 1. The FN485-4xSH motor controller module

In addition to the outputs, the FN485-4xSH motor controller module also provides local inputs which give the customer the ability of using the system even before a central controller is installed, This is the major difference of the FN485-4xSH module from most

motor controller units available on the market, offering several benefits such as stand-alone operation and improved reliability of the overall system since the operation of the relays do not rely on a controller which is normally a single point of failure.

Due to the local inputs the installation of a control system can be carried out in two steps: After installing several FN485-4xSH motor controller modules and other FutureNow-made FN485 devices (dimmers, relay modules, analog output modules, etc. available through P5's distributors) you can easily have a basic working system. Later, more advanced functions and intelligence can be added by connecting and programming a main controller.

MAIN FEATURES

- Control via RS485 or local inputs
- 4 outputs for controlling 4 three-wire (up/down/neutral) bidirectional AC motors
- 4x2 (up/down) galvanically isolated multi-purpose inputs
- Standard DIN rail mount
- The outputs can be directly operated via the local inputs without a controller
- Up, Down, Stop commands
- Adjustable motor running timer
- Separate power inputs for powering motors with different voltage requirements
- Delay when changing direction to protect the motor
- Mechanical and electronic latch preventing the motor from being driven in both directions at the same time
- 26 groups that can also be used as scenes (patterns)
- 50+ bus commands including setting and recall scene presets, setting the modes of operation via inputs, adjusting times, etc.

OUTPUTS

The module has 4 motor driver outputs each allow for connecting either 230V or 24V three-wire bidirectional AC motors.

INSTALLATION

WARNING! Since the module is directly connected to the mains, the installation should only be performed by a qualified electrician!

Turn off power (main circuit breaker) before installation!

Terminal connections

The terminal connectors of the FN485-4xSH motor controller module as depicted in Figure 2. are described in Table 1.

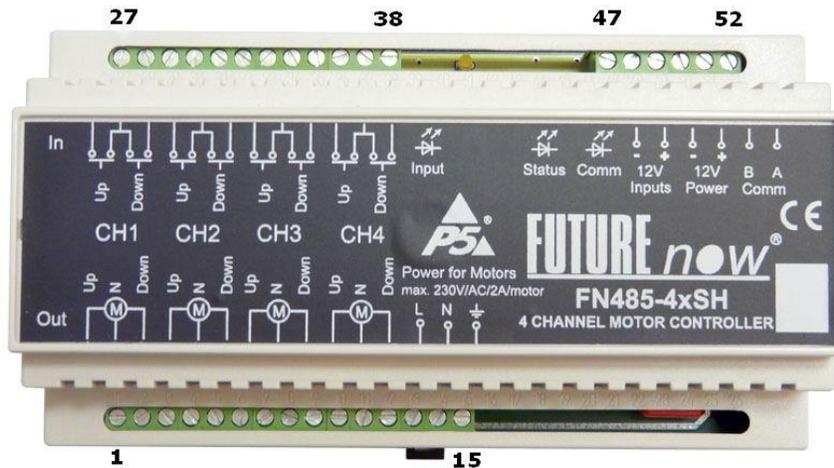


Figure 2. FN485-4xSH front view with terminal connectors

No.	Description	No.	Description
1.	Motor 1. Up Out	27.	Motor 1. Up Input
2.	Neutral	28.	Inputs common
3.	Motor 1. Down Out	29.	Motor 1. Down Input
4.	Motor 2. Up Out	30.	Motor 2. Up Input
5.	Neutral	31.	Inputs common
6.	Motor 2. Down Out	32.	Motor 2. Down Input
7.	Motor 3. Up Out	33.	Motor 3. Up Input
8.	Neutral	34.	Inputs Common
9.	Motor 3. Down Out	35.	Motor 3. Down Input
10.	Motor 4. Up Out	36.	Motor 4. Up Input
11.	Neutral	37.	Inputs common
12.	Motor 4. Down Out	38.	Motor 4. Down Input
13.	Power for Motors Live	47.	Power for the Inputs GND
14.	Power for Motors Neutral	48.	Power for the Inputs +12V
15.	Earth Ground	49.	Power for the Main Circuitry GND
		50.	Power for the Main Circuitry +12V
		51.	RS-485 Comm B (-)
		52.	RS-485 Comm A (+)

Table 1. FN485-4xSH Terminal Connectors

Board layout

The board layout is shown in Figure 3.

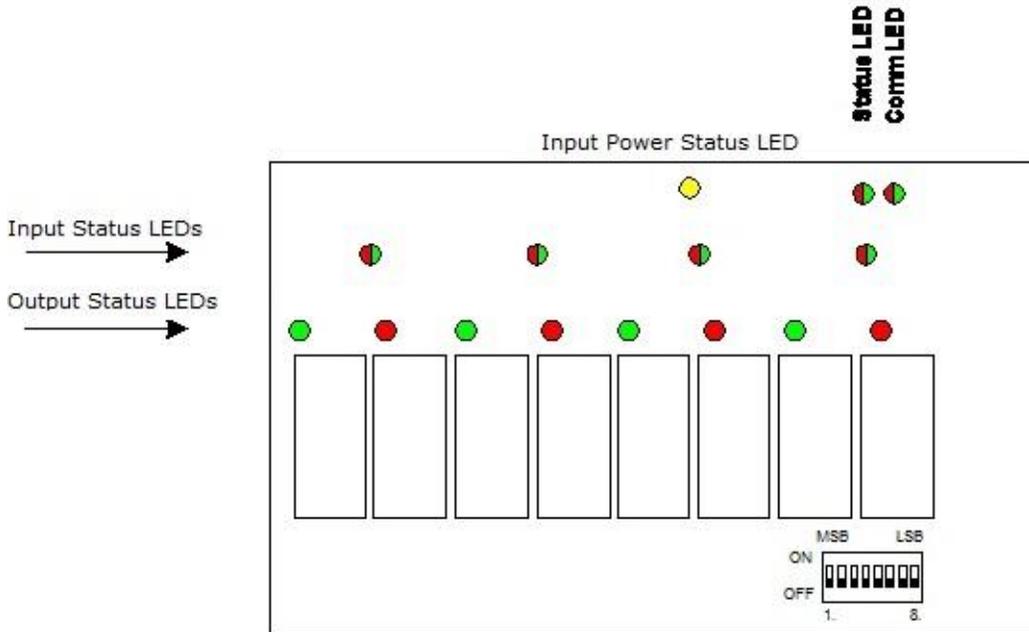


Figure 3. The board layout of the FN485-4xSH

Recommended wire types

Bus cable: Twisted pair, shielding recommended in noisy or industrial environment, with GNDs (Terminal 49) of all units connected together. The commonly available CAT5 patch cable is a widely used option.

Outputs: According to the motors ratings attached to the outputs (current and voltage).

Inputs: A pair of low or high voltage cables.

Power requirements

Calculating power requirement

If multiple FN modules are to be powered by the same power source, the total required power must be calculated as the sum of the maximum power consumption of each of the

modules. For example if three FN485-3x1kDH modules and two FN485-4xSH modules are powered from the same PSU, the PSU must be able to supply the required current of $3 \times 100\text{mA} + 2 \times 500\text{mA} = 1.3$ Amps. If a single PSU cannot power the total required modules, multiple PSUs can be used by splitting the modules into separate groups. Each PSU can then power a single group. However, when using multiple PSUs in this manner, the GNDs of the modules (terminal 49) must be connected together to cancel out any voltage differences that could damage the bus drivers.

If you use the same PSU for powering modules located at different locations, please make sure to calculate the needed power requirements with the voltage drop on the wire length in mind. Use low gauge wiring to minimize or eliminate the voltage drop. Alternatively, use separate PSUs at each location, but remember that the GND (Terminal 49) on each module must be connected together.

Powering the local inputs

Note that the galvanic isolation of the inputs is only effective when a separate power supply is used for powering the inputs. The FN485-4xSH has separate power input terminals (47 and 48) for this purpose. If you choose not to use the extra protection the isolated inputs offer, you can use the same power to supply both the main circuitry and the inputs. In that case, simply connect terminal 47 to terminal 49 and terminal 48 to terminal 50.

Bus connections

You must use twisted cable pair for the RS-485 bus. The maximum length of the bus cable is 1000m.

It is recommended to run an additional wire connecting the GNDs of all units together to eliminate possible voltage differences on units that are supplied by separate power supply units.

Use shielded cable in noisy or industrial environment.

The units must be daisy chained on the bus. Avoid star and tree topologies.

Up to 32 FutureNow modules can be connected on a bus using the standard communication driver chip. A lower impedance driver chip is available upon request which allows for using up to 127 FN modules on one bus.

Installation steps

This part of the manual provides a step-by-step guide for the installation of the FN485-4xSH dimmer module.

Step 1. Making the connections

Make connections as illustrated in the diagram of Figure 4. Don't provide power yet. Each module also has a wiring diagram on the front that can be used when connecting them at installation sites.

The diagram shows two FN485-4xSH modules daisy chained on the bus. The modules share the same input power, but separate power sources are used to power the modules' main circuitry. Because individual power sources are used, the GNDs of the different power supplies must be connected together to cancel out possible voltage differences.

Please note that the motors are powered through the module using the power connected across terminals 13 and 14. This can either be 230V AC (mains) or any other AC voltages the motors need. Please note, that all the four motors connected to the four channels of the same module will use this power, so all the motors have to have the same voltage requirements.

You must not connect multiple motors in parallel to the same outputs. Each motor must be connected to a different output.

The module should only be used with motors with built-in limit switches that turn the power off at the two extreme positions. Otherwise, the motor can be damaged.

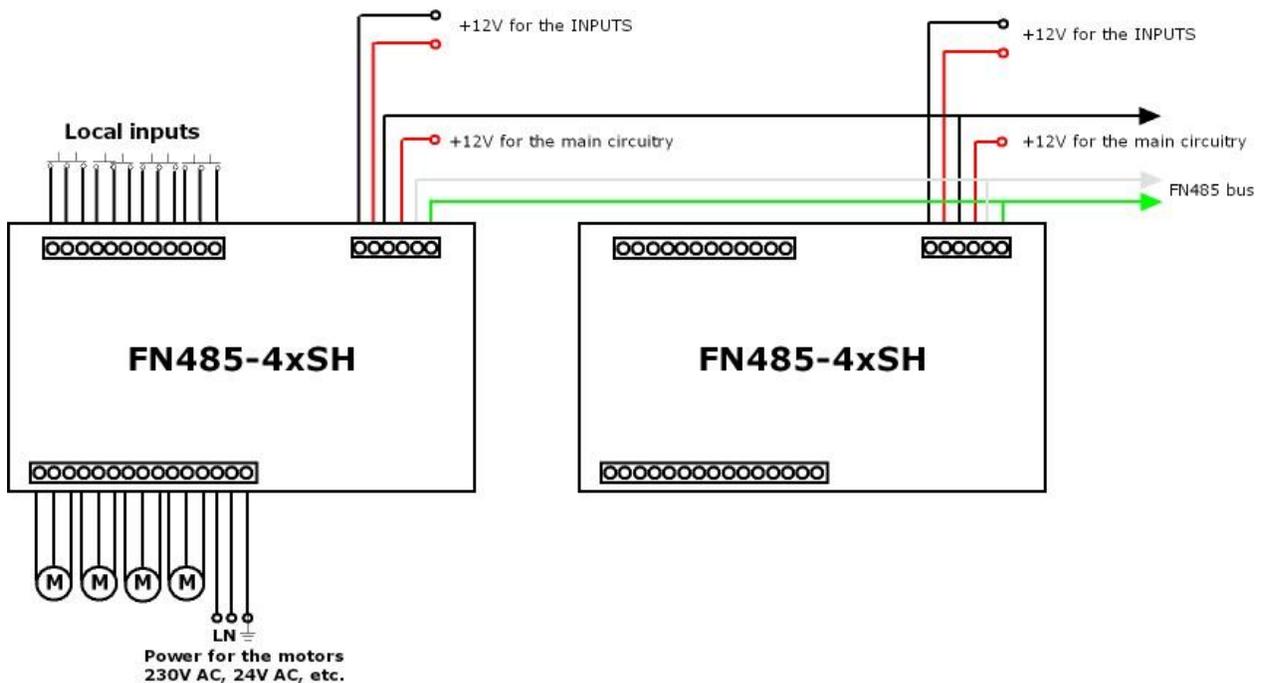


Figure 4. Connection Diagram

Step 2. Removing the bus terminator jumpers

Remove the bus terminator jumpers from all units except the first and the last ones on the daisy chain.

Step 3. Assigning an address to the module

Each daisy chained unit is identified by the unique address set by the DIP switches. The address range is 1-127. Switches #2 through #8 are used for setting the 7-bit long address. Switch #8 represents the least significant bit. A bit is set (1) when the corresponding switch is in the ON position and cleared (0) when the switch is in the OFF position.

Set a valid, non-zero unique address for each of the modules using the DIP switches. It should be noted that in case there's no valid address set, the operation of the module is disabled even from the local inputs!

Note that all units must have a unique address! Be sure not to have two or more units set to the same address!

The address of a module (including the FN Gateway) is independent of its physical location on the bus and of the module's type. Modules do not need to be addressed in the order they are connected to the bus.

Do not use address 0 because it is reserved for broadcast commands.

Switch #1 selects the communication protocol. It must be left in the OFF position.

Figure 5. illustrates a DIP switch with an address set to 3.

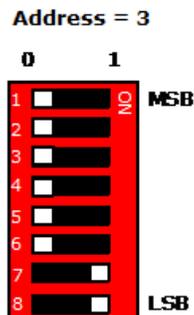


Figure 5. The address of a module set to 3 using DIP switches

Step 4. Applying power to the module

Apply power to the module (12V across terminals 49-50) and the motors (on terminals 13-14). In case the local inputs are used you must also power the inputs with 12V DC across terminals 47-48. Check the status LEDs to see if the power is sensed by the module.

Step 5. Testing to see if the outputs can be activated via the inputs

Check if the outputs can be operated via the inputs (only works if input power is connected across terminals 47-48, see 4.) The status LEDs will assist you in tracking the status of the outputs and see if the inputs work correctly.

Step 6. Testing the bus communication

Test the bus communication by driving the bus from a controller or a PC hooked up to the bus through an RS-232(USB)/RS485 convertor or FN485 Gateway and running the FN Commander utility. The COMM LED will help you troubleshoot communications problems.

Step 7. Setting the motor running time

Set the motor running timer (using bus command #225) to a slightly greater value than the real running time of the motor. This way the limit switch (which should be set correctly beforehand) will switch the motor off before the timer expires. This ensures that the window treatment will always stop correctly at the extreme positions. In case the actual motor running time is shorter than 1 min, you can choose to leave the timer at the factory default value, which 1 min.

Status LEDs

In order to make installation and debugging easier, communication and channel status are displayed via LEDs.

STATUS LED – Indicates modules status

Color	Status
Solid Green	Normal operation
Solid Red for 1 second after power up	The control of outputs is disabled for that time.
Flashing red	The unit address is set to 0 (not allowed)
Off	The module is writing to non-volatile memory (i.e. when executing commands like defining input modes, group assignments, etc.)
Solid yellow for 0.2 seconds	When receiving a command addressed to all outputs of the module.
Solid yellow for 1 second	When receiving a command addressed to all modules on the bus.

COMM LED – Indicates bus communication

Color	Status
Solid green*	The module is receiving a valid command from the bus
Solid red*	The module is sending a response

*If the “reply to commands” option is enabled (factory default), the LED will flash yellow indicating that both a valid command has been received and that the module is replying to the command.

Output status LEDs

Each output has two dedicated (red and green) output status LEDs. The green LED is on when the corresponding output is activated (the motor is powered). The red LED indicates the direction of movement. It is off while the motor is moving up and on while the motor is moving down.

Input status LEDs

Each channel has two dedicated (red and green) input status LEDs. The green LED is on while the “up” input is active and the red LED is on while the “down” input is active.

Input power LED

When on, indicates that the input power is present.

Local inputs

For each output, there is a local input to allow for manual operations. If you do not wish to use local inputs, this section may be skipped.

Connect momentary switches across the appropriate input terminals and the input common terminal for both the ‘up’ and the ‘down’ directions.

Low voltage for the inputs is supplied by the FN485-4xSH.

Warning! Avoid supplying voltage on these terminals!

All input ports are galvanically isolated to protect the unit against unwanted effects of ground loops, overvoltages or misconnections.

To assure an additional level of safe and reliable operation, the inputs are also software protected against the effects of noise spikes that usually occur when heavy inductive loads (motors, fans, etc.) are switched nearby. In most systems lacking this level of protection, these spikes may result in unwanted operation.

Note that the galvanic isolation is only effective when an independent power supply is used for powering the inputs. The FN485-4xSH has separate power input terminals for this purpose. When you choose not to use this extra protection you can use the same power to supply both the main circuitry and the inputs. In that case simply connect terminal 47 to terminal 49 and terminal 48 to terminal 50.

Three-way switches can be implemented by simply connecting multiple momentary switches parallel.

Operation via local inputs

The inputs are activated when the appropriate input terminal is shorted to the input common terminal.

Throughout this section it is assumed that momentary switches are connected to the local inputs.

In order to power the circuitry for the local inputs, an input power of 8-16V must be applied across terminals 47 and 48. In case local inputs are not needed, this power connection is not necessary.

There are two inputs modes. The input modes work as follows:

Active inputs (input mode 1/factory default)

There are separate directional inputs for the two possible motor directions. If the motor is inactive (off) and an input is activated, then the motor will start moving in one direction. If the same input is activated again while the motor is still running, it will stop. Activating the other input while the motor is stopped will cause the motor to move in the other direction. The motor will continue running until the motor running timer expires (factory default is 1min.) or the built-in limit switch in the motor turns the power off at the motor.

In this way, you only have to activate one of the directional inputs briefly to move the motor to one of its directional limits. Activating it again will cause the motor to stop at any intermediate position.

Activating the input for the opposite direction while the motor is still moving will cause the motor to change its direction after a short delay.

Independent inputs (input mode 0)

Inputs can be disconnected from their corresponding outputs, in which case they will have no effect on them. Please note that the status of inputs can still be queried via the bus. This can be useful for example, if the input will be interpreted by software exclusively.

Operation via RS-485 bus commands

To achieve the best possible integration with most home and commercial applications, modules can execute a wide range of instructions and queries. The most widely used commands are up, down, stop, group definition, group up/down/stop, scene definition, scene activation, and input mode selection.

All settings and states can be retrieved by query commands. The timer values, input modes, and group and scene settings are stored in non-volatile memory and will not be affected by a power outage.

Basically, any controller that can implement the FN485-4xSH's simple communication protocol can control the FN485-4xSH. The following controllers and remotes are the most widely used:

- AMX
- Comfort II.
- Control4
- Crestron
- Cue
- HomeVision
- Philips pronto remotes

There have been software modules/plug-ins written for all of the above controllers and are available upon request.

Besides these special-purpose controllers, there are many applications using embedded industrial PC boards and PCs running both Linux and Windows.

The description of the communication protocol, a utility software for testing/reviewing the commands (FNCommander485), and a bus tester application are available upon request.

Checking the status of inputs and outputs via bus commands

Since RS485 is a master-slave bus architecture, the changes of inputs and outputs will not be reported automatically on the bus. The bus participants cannot send unsolicited messages, they can only reply when asked by the master. The actual status of the inputs and whether they have changed since the last query can be retrieved via query commands from the controller(master on the bus). The actual status of outputs can also be queried.

The controller must send a query every time it needs the status of outputs or inputs. So, if user feedback is needed on the input/output statuses, the units must be polled constantly.

However, if the local inputs are not used, the output statuses need not be queried, since the outputs cannot get out-of-sync with the controller.

On the other hand, if you want to trigger events by the change of an input, the inputs must be polled quite frequently to get the event fired within an acceptable time.

It is worth mentioning that frequent polling requires heavy resources from the controller. Since the status of inputs and outputs usually change relatively rarely compared to the frequency of polling, most of the queries are sent unnecessarily.

In order to save the controller from the burden of polling, there is a separate FN Gateway (poller) module available which can be connected between the controller and the bus. This poller will only send a message to the controller when something has changed on the bus that it is polling. See FN Gateway documentation [FutureNow FN Gateway Introduction].

Technical specifications

Power requirement

Main circuitry: 9-13.8V DC, max. 500mA@12V (when all motors are moving down + communication is in progress)

Motor Power Input Terminal: 230V/50Hz or any other AC voltages the motors require

Inputs: 8-16V DC, max. 120mA@12V

Outputs

Type: 4 x Up/Down relay outputs

Load: max. 4x2A@230V AC for inductive ($\cos(\phi)=0.4$) loads

Inputs

Power: 8-16V DC

Current: Approx. 15 mA@12V per closed inputs

Type: 4x2 galvanically isolated, noise protected common GND digital inputs for dry contacts

Functions: Assigned to the corresponding outputs (up/down/stop) or independent

Bus communication

Max. Bus Length: 1000m

Max. No. of modules on a bus: 32 (127 with special comm. chip)

Type: RS485 half duplex

Baud rate: 9600 Baud

Parity: None

Bits: 8

Stop bits: 1

Terminals

Type: Screw terminals for max. 2.5 mm² wires

Other parameters

Operating temperature: 0 °C – 70 °C (32-158 °F)

Dimensions: W x H x D = 157 mm x 86 mm x 57 mm (9 DIN module width)

Weight: 0.4 kg

Color: Light grey with black cover plate

Standards

EN 61000-6-1:2007

EN 61000-6-3:2007

EN 60669-2-1

RoHS

Test methods

EN55022:2007/A2:2007

EN 61000-4-3:2006/A1:2007

EN 61000-4-6:2008

EN 61000-4-2:2009

REFERENCES

FutureNow FN485-8x16A Installation Manual

FutureNow FN485-3x1kDH Installation Manual

FutureNow FN485-4x0-10V Installation Manual

FutureNow FN Gateway Introduction

CONTACT DETAILS

support@p5.hu