DFDIM: 500W power dimmer module

DFDIM power dimmer module allows the regulation, through the **Domino** bus, of incandescent lamps, halogen lamps (with or without transformer), dimmable LED and ESL/CFL lamps. DFDIM module can handle up to 500W power for incandescent and halogen lamps and up to 100W for LED/ESL/CFL.

DFDIM module uses the MOS transistor technology to control the "duty cycle" (on/off time) of the 230V~ voltage that is applied to the load; the control technique can be selected between "trailing edge" (for resistive and capacitive loads) and "leading edge" (for inductive transformer). This technology also allows to control the EM interferences avoiding the use of noisy chokes. The MOS technology also allows to protect the module against overloads, short circuits and over voltages.

The module can be controlled by pushbuttons connected to **Domino** input modules or by a supervisor or by a video-terminal (e.g. touch screen).

DFDIM module provides a 2-way terminal block for the connection to the **Domino** bus and a 4-way terminal block for the connection to the 230V~ mains supply and to the load. The low level supply needed by the module is carried by the bus itself.

On the top side, the module features a small pushbutton for the address assignment and a green LED that shows the operating status; this LED normally flashes every 2 seconds about to signal that the module is properly supplied and operating. A small connector (PRG) under the bus terminals cover allows the connection to the optional tester/programmer. A pushbutton on the front panel allows to control the load even if the bus is unconnected, while a red LED reports some diagnostic information (see the related paragraph).

DFDIM module takes, inside the **Domino** bus, one output address and one optional input address. A white label on the top panel allows the writing of the programmed module address for an immediate visual identification. For more details about the address assignment and programming, refer to the related documentation. DFDIM module is housed in a standard 2M modular box for rail mounting .

Mode of operation

DFDIM module can be controlled by one or more pushbuttons connected to one or more **Domino** input modules. It is possible to control the dimmer module by two pushbuttons (Up/Down) and/or by a unique pushbutton (Single command) as here described.

Up/Down pushbuttons: pushing and holding Up (Down) button, the brightness increases (decreases) until the max (min) value is reached. When the brightness has reached the desired level, release the button to hold it.

Single Command: holding down the button, the brightness increases until the max value is reached and after 1 second about, the brightness decreases to the min value, then it increases again and so on. Release the button at the desired level to hold it.

When the lamp is ON, a short pulse (one-touch) on any control button will cause the complete switching OFF. When the lamp is OFF, a short pulse on any control pushbutton will cause the switching ON at the last brightness level or at a fixed programmable value.

DFDIM module also allows to define one or more (real and/or virtual) inputs recalling some brightness levels that can be freely set during the setting up.

These levels, called Presets, can be also set by a supervisor simply sending to the module the desired brightness level in the range 0÷100%. This feature allows to create suggestive light scenes.

Standard programming

A typical equation controlling DFDIM dimmer module is as in the following example:

$$O1.1 = UI1.1 \mid DI1.2 \mid MI1.3 \mid P(40)I1.4$$

In this example $O1.1$ is the dimmer module, $I1.1$ and $I1.2$ are the inputs controlling the brightness Up and Down, $I1.3$ is the Single command and $I1.4$ set the brightness to 40%. More Up/Down/Single commands and Presets are allowed in the same equation.

Two Presets have a special meaning: $P(0)$ switch off the output and stores the previous level, $P(255)$ switch on the lamp to last stored level.

The transition from the brightness levels due to Presets and to ON/OFF by one-touch function occurs according to a default ramp (in the range 1 to 60 seconds). On the contrary, the ramp for the brightness regulation by Up, Down and Single commands is fixed.

The module keeps the chosen ramp value even if a power supply failure occurs. The default ramp can be specified in the equation controlling the dimmer as follows:

$$O1.1(30) = UI1.1 \mid DI1.2 \mid P(40)I1.4$$

In this case the default ramp will be set to 30 seconds. If this value is not specified, then the default value will be 2 seconds.

The transition from a Preset to another one may be executed according to ramps different than the default value; to do this, simply specify the chosen value as in the following example:

```
O1.1(3) = MI1.1 | P(80,25)I1.2 | \
         P(0,10)I1.3
```

In this case the first Preset (80%) will be executed by a 25 sec ramp and the second one by a 10 sec ramp. The ramp for the ON and OFF by one-touch function will be 3 sec as specified inside the brackets after O1.1. If no value was specified for Presets, or if the specified value is zero, then the default value will be used.

The equation can also specify the minimum and maximum desired levels like in the following example:

```
O1.1(30,5,100) = UI1.1 | DI1.2
```

Configuration

The several parameters of DFDIM module can be set by BDTools or DCP Ide selecting from main menu the option "Configuration", "Dimmers" and then "DFDIM"; the following window will appear:

Enter, in the related text box, the address of DFDIM module to be set; set the **Ramp Time**, the **Minimum** and **Maximum** entering the desired values in the related text boxes.
The parameter "**One-Touch ON level**" allows to specify the brightness value (in the range 1 to 100) to be recalled by one touch function; if the value is 0, then the last stored value will be recalled.
The option "**Include Info Bit in Status**" allows to enable or less the bit 12 in the answer of the module to a status request, so that the bit report the output OFF condition (bit12=0) or not OFF (bit12=1); see paragraph about the status request to a dimmer module.
Activating the option "**Real Time Status**", the module sends on the bus the current value of the output level also during the ramps; on the contrary, only the final status will be sent.

"**Input Address**" allows to activate the input section, with the same address of the output section, in order to report the output level and other information (see in the following).
"**Curve**" is the number of the regulation curve to be used and it allows to match the operating range of the dimmer to the installed lamp, particularly when using LED and ESL/CFL lamps; set the curve number to the lower value allowing, at minim level, to have the desire brightness without flickering or other malfunctions.

Specify the load type using one of the following options:
"**Capacitive/Resistive load**": suitable for incandescent and halogen lamps with or without electronic transformer
"**Inductive load**": suitable for lamps with ferromagnetic transformer or small induction motors.
"**Fluorescent lamp**": suitable for ESL and CFL lamps
"**LED**": suitable for LED lamps (with integrated or external driver)

Enabling the "**Enable Multi-Programming**" option and specifying a number in the "No. of Modules" text box, it is possible to perform the sequential programming of more module (e.g., if "Module Address" = 5 and "No. of modules" = 4, then all modules from 5 to 8 included will be programmed (if they are dimmer modules).
The Program button sends to the module the settings shown in the window. Clicking on the Read button, it is possible to check the current setting of the module. The Multi option has not any meaning on the Read function (only the module having the specified address will be read).

Automatic brightness regulation

DFDIM module, in addition to the dimmer standard functions (Up, Down, Single Command and Preset), features an extended function allowing to implement the automatic regulation of the brightness on a room, comparing the value read from a light sensor connected on the **Domino** bus with a fixed setpoint. The keyword identifying this function is "**A**"; the following equation is a typical example:

```
O1.1 = UI1.1 | DI1.2 | \
       V130.1 & A(650,20,2)AI18
```

The block A(sp,h,p)AIx identifies the automatic brightness regulation function, where:

✗ **sp** is the setpoint, that is the brightness level to be maintained; in the example, the setpoint is **650**

✗ **h** is the hysteresis (**20** in the example); the regulation function acts so that the light level will be maintained in the range from (setpoint-hysteresis) to (setpoint+hysteresis); therefore, in the example, the range is from 630 to 670; the hysteresis value must be ≤ 255

✗ **p** is the time period (**2** in the example): the module, every **p** seconds, compares light level read from the sensor and the setpoint (± hysteresis)

✗ **x** is the address (**18** in the example) of a light sensor module (e.g. DFLUX), or of a DFAI analog input module connected to a light sensor

The block `A(sp,h,p)AIx` must be preceded by a consent input (real or virtual point) activating and deactivating the automatic regulation function.

In the previous example, the consent is `V130.1`; activating this point, the automatic regulation will enabled, while deactivating it the automatic regulation will be disabled, but the output level of the dimmer module remains the last one reached. If, with the consent activated, one or more point for manual regulation will be activated (`I1.1` or `I1.2` in the previous example), or if the supervisor sends a brightness value, then the automatic regulation will be disabled until the occurrence of a new OFF to ON variation of the consent (in other words, the consent works on the edge, not on the level).
When the dimmer module has the automatic regulation function activated, the ramp is automatically set to 30 seconds, in order to make imperceptible the fluctuations of the output level due to the variations of the measured light (caused by external factors).

Variable setpoint by a potentiometer

The "fixed" setpoint specified int the block `A(sp,h,p)` can be replaced by the address of a channel of a DFAI module connected to a potentiometer (or, however, to a variable voltage). In this mode, the setpoint can be easily modified. Therefore, the equation of the previous example could be modified as follow:

```
O1.1 = UI1.1 | DI1.2 | \
       V130.1 & A(AI41,20,2)AI18
```

Multiple automatic regulation blocks

More than one block for automatic regulation can be specified in the same equation of a dimmer module, as in the following example:

```
O1.1 = UI1.1 | DI1.2 | \
       V130.1 & A(650,20,2)AI18 | \
       V130.2 & A(400,20,2)AI18
```

In this case, depending on the activated consent, the setpoint will be set to 650 or to 400.

Automatic regulation with parameters set by a supervisor

The master modules, like DFCP, DFTS and DFTouch, must have the possibility to change the value of setpoint, hysteresis and period. For instance, think to **DFCP** controller that evaluate the best setpoint as function of several factors; the result can be stored in a register and then it can be sent to the dimmer module to modify its setpoint.
To send these commands, the high side of the data field sent to the dimmer module has to be used.
To set the setpoint (10-bit value) the following Word has to be sent to the output address of the dimmer module:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	1				Setpoint value (10 bit)						

To set the hysteresis (8-bit value) the following Word has to be sent to the output address of the dimmer module:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	0	1			Hysteresis value (8 bit)					

To set the regulation period (8-bit value) the following Word has to be sent to the output address of the dimmer module:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
0	0	0	0	0	0	1	0			Period value (8 bit)					

Note: when changing setpoint, hysteresis and period by sending the just described commands, the equation of the dimmer module will be changed. This means that reading the program loaded in the dimmer module, the resulting equation will contain the last parameters sent by the supervisor (of course if the automatic regulation is used).

Example: regulation with occupancy sensor

In the following example, `I1.1` is connected to a button for the Single Command function, `I1.2` is connected to an occupancy sensor, `AI18` is a light sensor and `O1.1` is a dimmer output.

```
O1.1 = MI1.1 | \
       I1.2 & A(650,20,2)AI18 | \
       P(0)!I1.2
```

At the activation of the occupancy sensor, the dimmer module enables the automatic regulation, thus it continuously regulates the output level so that the light sensor read a value in the range 630 to 670. At the deactivation of the occupancy sensor, the term `P(0)!I1.2` causes the light switch off. Acting on the Single Command while the automatic regulation is enabled, this last one will be disabled and the module enter the manual mode; in this case too, at the deactivation of the occupancy sensor, the light will be switched off.

Status request to a dimmer module

DFDIM dimmer module features one output address and, if enabled, one input address; the two sections provides the information described in the following.

Output section

If a supervisor (e.g. DFTouch) executes a status request to a dimmer module, this one will answer with the following Word:

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
P	Z	R	S	-	T	V	C	-		Output level					

where :
- ✗ P: the address programming function is activated (this point reflects the fixed ON status of the PRG LED)
- ✗ Z: occurrence of at least 1 protection (T, V or C)
- ✗ R: the automatic regulation is running
- ✗ S: output level is not zero
- ✗ T: over-temperature
- ✗ V: over-voltage
- ✗ C: over-current

ꭓ Output level: the current value of the output level of the dimmer module (in the range 0 to 100)

Input section
The input section, if enabled, reports on the bus the same information just described for the output section; considering the points instead of bits, this information is:

16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1
P	Z	R	S	-	T	V	C	-				Output level			

The availability of this information in the input section makes easy, particularly, the displaying of the output level on a supervisor.

Note: if the line L-N is unconnected, all points T, V and C will be activated.

Special codes

A supervisor or a touch screen video-terminal can set the brightness level of a dimmer module simply sending the wanted value (in the range 0 to 100) to the address of the module itself.
In addition the supervisor can execute special commands (e.g. set the ramp value) sending to DFDIM module some special codes as listed in the following table:

| Code	Function
0	Switch off and store the previous level
101 ÷ 110	Set ramp to 1 ÷ 10 sec (1 sec step)
111 ÷ 120	Set ramp to 12 ÷ 30 sec (2 sec step)
121 ÷ 123	Set ramp to 40 ÷ 60 sec (10 sec step)
124	Switch on to last stored level
127	Save current ramp value as default

Protections

DFDIM module features an internal current limiting circuit working at a well defined value; when the overload is present for more than a defined time, the protection circuit switch OFF the power devices (IGBT), holding them in the OFF state until the next command is sent and however for the next 5 seconds starting from the protection occurrence. This circuit also protects DFDIM module against short circuit on the output.
DFDIM module also features a protection circuit against over voltages on the output that can be generated, for instance, when a strongly inductive load has been connected. In this case too, the module will be maintained in lock condition until the next command is sent and however for the next 5 seconds starting from the protection occurrence.
Finally, DFDIM module features a protection against over temperature of the power devices: when the detected temperature overrides a fixed value, the load will be switched OFF, denying any further switching ON command until the temperature goes down under a fixed safety threshold.
If one of the 3 just described protections take place, or if a disconnection of 230V~ mains supply occurred, the red LED on the front panel of DFDIM module will blink quickly to inform about the lock condition.

Mapping

DFDIM module can be displayed on the map of BDTools or DCP Visio as in the following picture; to activate the displaying of the input section on the left side (provided that the module has been properly set), check the IN box. On the contrary the input section will be shown in gray color.
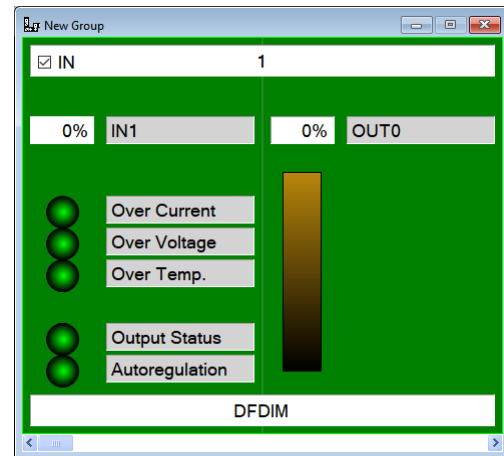
As for all **Domino** modules, the background of the module is in green color if the module is connected and properly working, otherwise the background is in red color.
The input section shows the output level in numerical format (0..100) and some information.
In the output section the bar graph shows the output level of the module, and the number over the bar shows the same value in numerical format. To change the output level, click on the bar graph using the left button of the mouse, enter the desired value and then push Enter button.

Functions of the button on front panel

The pushbutton on front panel of the module allows to control the load even if the **Domino** bus is unconnected.
Holding down this pushbutton, the brightness increases; at the releasing, the brightness will be maintained to the reached level. A further long pushing will cause the decreasing of the brightness until the releasing of the button.
When the lamp is OFF, a short pushing on the button will cause the switching ON of the load to 100%; when lamp is ON, a short pushing on the button will cause the switching OFF of the load.
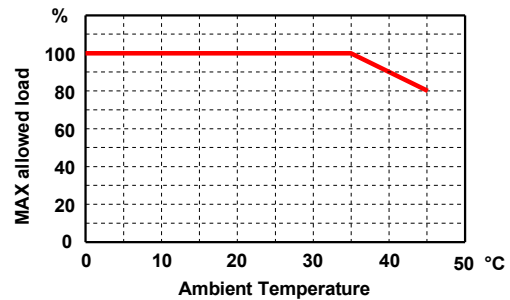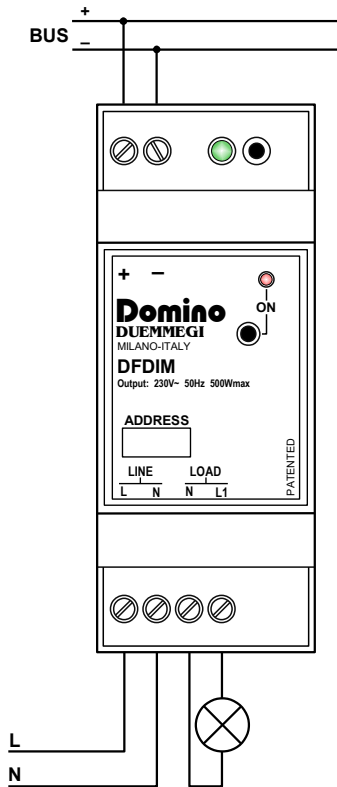
LED on the front panel

The LED on the front panel reports the operating status:
• OFF: output is OFF
• Fixed ON: output is ON (any not-zero level)
• Slowly blinking: unconnected load
• Quickly blinking: at least one protection occurred

Module connection

DFDIM module can be connected to 230V~ 50Hz load, according to the limits listed in the technical characteristics; the following figure shows the proper connections to be made.

Cooling

Ensuring a good cooling is an essential condition for reliable and safe operation. DFDIM module produces about 1.2% heat with regard to the connected load; for instance, with 300W connected load, the dissipated power is around 3.6W, therefore the installation must take in account this data and an adequate air volume and recirculation must be foreseen.

The module must be installed in vertical position, so that the ventilation slots on the housing allow an adequate exchange of air.

Operating conditions

The power section of DFDIM module has been developed for 230V~ ±15%, 50Hz mains supply. The maximum power of the connected load must not override 500W at 35°C max ambient temperature when using incandescent or halogen lamps and 100W when using LED or ESL/CFL lamps. At higher temperature values, however lower than 45°C, a derating of the maximum power is applied according to the following graph:

The installation, outside the module, of a protection fuse on the line L is recommended. Check periodically, after removing the power supply, that the screws of the terminal blocks are correctly tightened, that the ventilation of the module is adequate and that no signs of humidity are present.

Technical characteristics

Power supply (bus side)	By specific centralized power supply Mod. DFPW2
MAX allowed load	• Incandescent or halogen lamps: 20÷500 W, 230V~ 50Hz ([1]) • Ferromagnetic or electronic transformers with secondary winding closed on resistive load (low voltage halogen lamps): 20÷500 VA, 230V~ 50Hz ([1]) • dimmable LED lamps 230V~: 100W ([1]) ([2]) • dimmable energy saving lamps (ESL): up to 100W ([1]) ([2])
Power consumption on 230V~ side (load OFF)	1W MAX
Dissipated power	1.2% of the nominal power of the connected load
Internal protection	150°C thermal fuse on line L
Electronic protections	Short circuit, over current, over voltage and over temperature
Electronic protections	Short circuit, overload, over voltage and over temperature
Operating temperature	-5 ÷ +45 °C
Storage temperature	-20 ÷ +70 °C
Protection degree	IP20

Notes:

([1]) The maximum specified load values are intended to be at a maximum ambient temperature of 35°C; at higher temperatures, the derating shown in the load/temperature graph of the previous paragraph has to be applied.

([2]) In the case of LED or ESL/CFL lamps, operation is strictly dependent on the type of lamp used; it is not possible to guarantee a good operation with this type of lamps, even if they are declared dimmable.

Outline dimensions

90,5cm

36mm

62mm
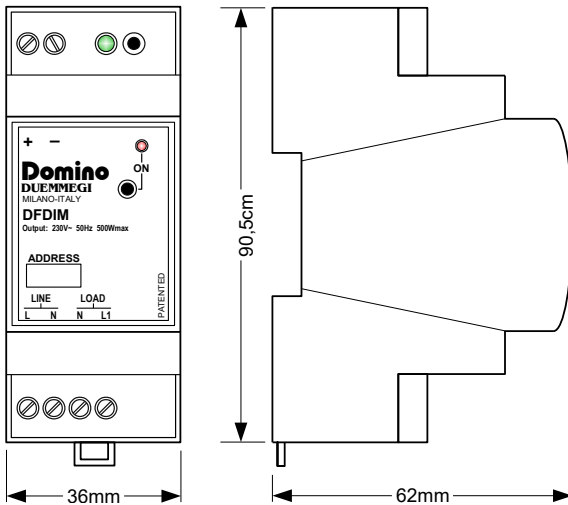
Correct disposal of this product

(Waste Electrical & Electronic Equipment) (Applicable in the European Union and other European countries with separate collection systems). This marking on the product, accessories or literature indicates that the product should not be disposed of with other household waste at the end of their working life. To prevent possible harm to the environment or human health from uncontrolled waste disposal, please separate these items from other types of waste and recycle them responsibly to promote the sustainable reuse of material resources. Household users should contact either the retailer where they purchased this product, or their local government office, for details of where and how they can take these items for environmentally safe recycling. This product and its electronic accessories should not be mixed with other commercial wastes for disposal.

Installation and use restrictions

Standards and regulations

The design and the setting up of electrical systems must be performed according to the relevant standards, guidelines, specifications and regulations of the relevant country. The installation, configuration and programming of the devices must be carried out by trained personnel.

The installation and the wiring of the bus line and the related devices must be performed according to the recommendations of the manufacturers (reported on the specific data sheet of the product) and according to the applicable standards.

All the relevant safety regulations, e.g. accident prevention regulations, law on technical work equipment, must also be observed.

Safety instructions

Protect the unit against moisture, dirt and any kind of damage during transport, storage and operation. Do not operate the unit outside the specified technical data.

Never open the housing. If not otherwise specified, install in closed housing (e.g. distribution cabinet). Earth the unit at the terminals provided, if existing, for this purpose. Do not obstruct cooling of the units. Keep out of the reach of children.

Setting up

The physical address assignment and the setting of parameters (if any) must be performed by the specific softwares provided together the device or by the specific programmer. For the first installation of the device proceed according to the following guidelines:

- Check that any voltage supplying the plant has been removed
- Assign the address to module (if any)
- Install and wire the device according to the schematic diagrams on the specific data sheet of the product
- Only then switch on the 230Vac supplying the bus power supply and the other related circuits

Applied standards

2014/30/UE (EMC)
2014/35/UE (Low Voltage)
2011/65/UE (RoHS)

Note

Technical characteristics and this data sheet are subject to change without notice.