DF4RI: multi-function module with 4 inputs, 4 outputs and 4 virtual points

DF4RI module for **Domino** bus performs, in a single box, the following features:

- 4 digital inputs for potential free contacts
- 4 power-relay outputs which can be set for the ON-OFF command of generic loads or, as pairs, for the management of rolling shutters, awnings, Venetian blinds and similar devices driven by double winding motors
- 4 general purpose virtual points

DF4RI module provides a 7-way terminal blocks for the connection to the bus and to the 4 input contacts; like for almost all modules of **Domino** family, the power supply required for the operation of the module is derived from the bus itself.
Near to the bus terminal block, a small push-button allows the address programming and a green LED shows when the module is ready to receive the address itself; the same LED normally flashes every 2 seconds about to signal that the module is properly operating. A small 3-way connector (PRG) under the bus terminal cover allows the connection to the optional tester/programmer.
The module also provides, on the other side, 2 terminal blocks, 4-ways each one, connected to the contacts of the 4 output relays; these relays feature bistable coils in order to minimize the current consumption and keep the previous contact status even in power supply failure conditions

DF4RI is available in 3-unit modular housing for DIN rail, both in standard version (DF4RI) and in reduced height version (DF4RIR).

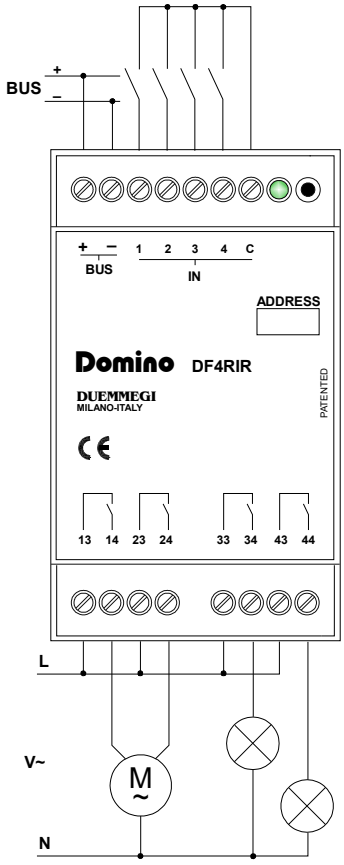
Note: this data sheet applies to DF4RI and DF4RIR equipped with firmware 3.1 or higher.

Address programming

Due to the numerous available parameters, DF4RI module takes, inside the **Domino** bus, from 0 to 3 input addresses and from 1 to 3 output addresses, depending on the functions that have been enabled.
It is however enough to assign to the module a single base address which must be less or equal to 253; for details about the information related to each address and the possible configurations, refer to the following paragraphs.
A white label on the front panel allows to write the assigned base address for an immediate visual identification. For more details about the address assignment, refer to the related documentation.

Wiring

The following schematic diagram shows the connections for DF4RI module.



When connecting motors for shutter, it is mandatory to use the pairs 1-2 and 3-4; It is not allowed to use pairs other than those listed.

Functions of the local pushbutton

Pushing the local button, the module enters the addressing mode, during which the LED on the module is fixed lighted; the addressing mode will be active until the module receives the address and anyway no more than 10 seconds from the last release of the pushbutton.

Information on the bus

DF4RI module takes, inside **Domino** bus, a variable amount of input and output addresses depending on the functions that have been enabled, going from a minimum of 0 input and 1 output addresses to a maximum of 3 input and 3 output addresses. The maximum value of the base address must be less or equal to 253; greater values will be discarded by the module which will return an address assignment error.
Each one of the active addresses provides the information described in the following tables, where n is the base address assigned to DF4RI module.

Input section

IN			
Point	**n**	**+1**	**+2**
1	In 1	Position SHUTTER 1	Position SHUTTER 1
2	In 2		
3	In 3		
4	In 4		
5	Vn.5		
6	Vn.6		
7	Vn.7		
8	Vn.8		
9	Out 1		
10	Out 2		
11	Out 3		
12	Out 4		
13	-		
14	-		
15	-		
16	-		

The 4 points Vn.5, Vn.6, Vn.7 and Vn.8 are the 4 generic virtual points featured by DF4RI module; these points, being virtual, are replicated in the output section and can be programmed using all the functions of the **Domino** world (eg &, |, !, Toggle, Set/Reset, OSC, TIMER, etc.).
Virtual points are always available regardless of module configuration, but provided that the input address has been enabled.

Output section

OUT			
Point	**n**	**+1**	**+2**
1	Out 1	Go to position (0-100%) SHUTTER 1	Go to position (0-100%) SHUTTER 2
2	Out 2		
3	Out 3		
4	Out 4		
5	Vn.5		
6	Vn.6		
7	Vn.7		
8	Vn.8		
9	-		
10	-		
11	-		
12	-		
13	-		
14	-		
15	-		
16	-		

The meaning of information in the previous tables will be detailed in the following paragraphs.

Module type statement

When using DF4RI modules in a Domino bus, it is mandatory to declare the type of module.
When using **DCP IDE**, it is enough to declare the modules in the Configuration tab.
If DFCP controller is not installed, and thus **BDTools** is used, the declaration must be added to the “program body”.
In both cases, the syntax is the same and it is described here below.
Also keep in mind that the statement **does not** configure the module, but simply it “declares” as the module has been configured by the specific configuration panel or by the loaded equations.

Assuming that the base address assigned to a DF4RI is 1, the syntax of the statement is as follows:

```
DF4RI = ( I1, \
          I2, I3, \
          O1, \
          O2, O3 )
```

For the meaning of each address, refer to the tables in the previous paragraph.

The declaration shall, however, specify only the actually used addresses (depending on how the module has to be used and then configured); the examples below show several statements depending on how the module is used.

Examples:
1: DF4RI set as 4 inputs and 4 ON-OFF outputs:

```
DF4RI = ( I1, O1 )
```

2: DF4RI set as 4 inputs e 2 shutters:

```
DF4RI = ( I1, \
          I2, I3, \
          O1, \
          O2, O3 )
```

3: DF4RI set as 4 inputs, 2 ON-OFF outputs and 1 shutter:

```
DF4RI = ( I1, I3, \
          O1, O3 )
```

4: DF4RI set as 4 inputs, 1 shutter and 2 ON-OFF outputs:

```
DF4RI = ( I1, I2, \
          O1, O2 )
```

ON-OFF inputs and outputs

The output base address is (n in these tables) is always enabled, while the input address is optional. These addresses report the following information.

Input section n

IN	
Point	**n**
1	Input 1
2	Input 2
3	Input 3
4	Input 4
5	Virtual point Vn.5
6	Virtual point Vn.6
7	Virtual point Vn.7
8	Virtual point Vn.8
9	Status of output 1
10	Status of output 2
11	Status of output 3
12	Status of output 4
13	-
14	-
15	-
16	-

The points 1 to 4 report the status of the related digital input of the module (1 = input contact closed), the points 9 to 12 report the status of the 8 relays (1 = relay contact closed); these last points allow to use the output status as input of the equations.
Points 5 to 8 are general purpose virtual points.

Output section n

OUT	
Point	**n**
1	Command output 1 (or Open 1)
2	Command output 2 (or Close 1)
3	Command output 3 (or Open 2)
4	Command output 4 (or Close 2)
5	Virtual point Vn.5
6	Virtual point Vn.6
7	Virtual point Vn.7
8	Virtual point Vn.8
9	-
10	-
11	-
12	-
13	-
14	-
15	-
16	-

The points 1 to 4 control the related relay outputs of the module (1 = close relay contact); in the case of outputs configured for shutter control, the commands will be Open and Close and they will be automatically mutually exclusive points with proper safety delay when inverting the direction of the shutter.

The ON-OFF outputs and the virtual points can be programmed using all the typical functions of **Domino** system, like in the following list:

- Logic combinations (& | !)
- Set/Reset (S R)
- Toggle (T S R, included actuation timeout on all 8 ON-OFF outputs)
- Timer (max 8 for module)
- Scheduler
- Analog threshold
- Oscillator (virtual points only)

For more details about the programming of ON-OFF outputs and virtual points, refer to the **Domino** general programming manual.

Warning: *when connecting a shutter actuator to a pair of outputs of DF4RI module that have not been set for that function, the actuator and the module may be damaged if the two outputs are simultaneously activated.*

Rolling shutter function

Operation in rolling shutter mode

The outputs set for rolling shutter management automatically performs different functions as here described.
Assume that a pair of outputs has been programmed for opening and closing from two push-buttons (**Open** and **Close**) connected to an input module (or to inputs of DF4RI itself) and that the setting "Short Command" in the configuration panel has been set to "Auto" (see Rolling Shutter Configuration paragraph).

Pushing and holding down the Open push-button or the Close push-button, the rolling shutter will be opened or closed; releasing the push-button, the rolling shutter will stop in the position reached at that moment.

If the limit switch has been reached before the push-button releasing, the rolling shutter will stop anyway (**provided that the motor assembly includes proper limit switches** to switch off the motor power; these limit switches have no connection with the **Domino** system).

A short touch on Open push-button or on Close push-button causes the movement of the motor until the limit switch is reached or until a programmable time out elapses (full opening and closing function, called automatic mode). If during the automatic movement any Open or Close button is pushed again, the shutter stops at that position (this operation is called counter-command).

It is also possible to define **centralized** commands ("**Open Priority**" and "**Close Priority**"), that work like local commands as previously defined except that **the priority command is only automatic** and it will be always executed regardless of the status of the rolling shutter (moving or not moving). In other words, if the rolling shutter was moving, **a priority command will be never executed as counter-command.**

It is possible to define additional commands performing the unconditional **Halt**, allowing to stop the motor regardless of the function currently in execution.

Finally, it is possible to add **GoTo** commands to perform partial movements, so as to close the shutter to a given percentage with respect to the total displacement. Since a position information is not generally available for standard shutter, this function is based on the timing of the command, after appropriate configuration (see related paragraph); please note that the time of opening and closing can vary with time and climatic conditions because of the variation of friction, therefore it is possible a certain error in the positioning.

Notes:

- *As previously mentioned, DF4RI module cannot identify the reaching of the limit of allowed movement; check that the selected actuator integrates the proper limit switches, otherwise the motor and the module may be damaged.*
- *To avoid damages to the motor and dangerous inrush currents, DF4RI module automatically wait for 1 second about before to invert the motor direction.*

During the automatic opening and closing functions, the relays driving the motor remain excited even if the limit switch has been reached; DF4RI module automatically switch off relays after a fixed time (Actuation Timeout). This time, by default, is 60 seconds but its value can be in the range 1 to 254 seconds, see paragraph about setting and programming. If the Actuation time out value has not been specified in the equation, it will be automatically set to the default value (60).

Setting Actuation Time out to 0 (zero), the automatic function will be disabled (but this is not true for centralized commands).

It is also possible to define a time, called "Delay from command", which will delay the starting of the shutter in respect to a centralized command; this avoids that all rolling shutters start at the same time.

The "Delay from command", is set by default to 0, but it can be increased up to 255s (4 minutes and 15 seconds).

Venetian Blinds

When using Venetian blinds that allow the inclination adjustment of the slats, set "Short Command" in the configuration panel to "Manual" (see Rolling Shutter Configuration paragraph). In this way, short presses on the Open or Close button will cause the motor to operate for a short fixed pre-set time, thus allowing the inclination of the slats to be adjusted. For the rest, everything that was said before for the shutter mode is valid.

Rolling shutter programming

Note: *the following equations are those to be loaded into the module; these equations cannot be loaded into DFCP.*

When connecting motors for movement of rolling shutters, it is mandatory to use the pairs 1-2 and 3-4; in the related equations, however, only the odd point of the pair must be specified, therefore `On.1` and `On.3`.
Supposing to have assigned the base address 1 to DF4RI, the equation controlling a rolling shutter output of the module looks like that in the following example:

```
O1.1 = OI1.1 | CI1.2 | OPI9.1 | CPI9.2 | \
       HI15.1 | G(50)I17.1 | G(80)I17.2
```

In this example, `O1.1` is the first output of the DF4RI (the motor will be then connected to relays 1 and 2), `I1.1` and `I1.2` are the inputs controlling the opening and the closing, `I9.1` and `I9.2` are the inputs for the centralized opening and closing. Input `I15.1` is the Halt command, while `I17.1` and `I17.2` force the closing to 50% and 80% respectively (GoTo).

Note that, in this example, `I1.1` and `I1.2` are inputs of the same DF4RI, but inputs of other modules (e.g. DF4I, DF8I) can be of course used (e.g. DF4I, DF8I).

More opening, closing (local and centralized), Halt and GoTo commands are allowed, simply adding them to the equation.

In the previous example the Actuation Time out, being not specified, is equal to 60 seconds default value; if another value is required by the specific application, for example 40 seconds, simply specify it in the equation as follows:

```
O1.1(40)= OI1.1 | CI1.2 | OPI9.1 | \
          CPI9.2 | HI15.1 | \
          G(50)I17.1 | G(80)I17.2
```

To delay the motor start after a centralized command (Delay from command), for example 5 seconds for opening and 10 for closing, simply specify these values in the equation as follows:

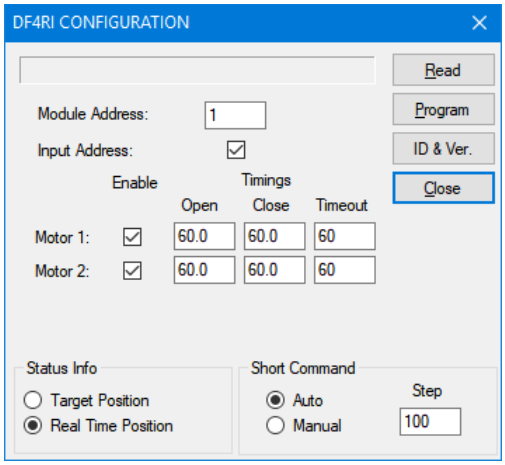
```
O1.1(40)= OI1.1 | CI1.2 | OP(5)I9.1 | \
          CP(10)I9.2 | HI15.1 | \
          G(50)I17.1 | G(80)I17.2
```

If not specified, the Delay from command will be zero.

Rolling shutter configuration

Note: *If the program loaded into the module includes equations that determine the functioning of the related outputs as ON-OFF or shutter, the module will auto-configure itself accordingly; in this case they will be rejected different configurations that may be sent from the configuration panel described below.*

The parameters of DF4RI module can be set by BDTools or DCP Ide selecting, from main menu, "Configuration", then "Mixed Modules" and "DF4RI"; the following window will be shown:



Enter, in the related text box, the address of DF4RI module to be configured (or read). The input address of the module can be disabled removing the check mark from Input Address option; in this case DF4RI can be used like a simple 4relay output module (e.g. as replacement of a DF4RP module).

Remove the check mark to outputs not used as rolling shutter control.
Enter, in the Timings section, the exact times measured to perform a whole opening and closing, for all motors connected to the module. The maximum allowed value of the opening and closing times is 127.5 seconds (2 minutes about) with resolution of 0.5 seconds.

Timeout is the maximum time for the motor command and a value greater than the opening and closing time must be chosen (e.g., if the opening and closing times are 30 seconds, the Timeout may be set to 45 seconds).

The "Status Info" options in the window allow to choose the type of the answer of the module (in shutter mode) to a status request, as here described: DF4RI module reports, at input addresses n+1 or n+2 (depending on the motor and stated that related outputs have been configured for shutter mode), the current percentage position of the related shutter. During the movement of the shutter, this information can be configured among the following 2 options:

- Target Position
- Real Time Position

In the first case, the reported information will be the percentage value, in respect to full closing, toward which the shutter is moving. In the second case, instead, the value is continuously variable during the movement of the shutter.
In all cases, the reported value is the position of the shutter as percentage 0...100% of the fully closed position (0=fully open, 100=fully closed).

Finally, the Short Command option allows to determine which effect should have a short press on the Open and Close buttons:

- Auto: a short press causes the motor to be opened or closed up to the limit switch or until the timeout expires; choose this option if the shutter is designed to adjust the inclination of the slats.
- Manual: a short press causes the driving of the motor for a fixed time specified in the Step text box in ms (100 means 0.1s); choose this option if the shutter (or Venetian blind) allows the inclination adjustment of the slats.

Input and output addresses for shutter mode

When the program loaded into DF4RI contains an equation for the shutter management, the related input and output address will be automatically activated.

For instance, if outputs 3-4 have been programmed for shutter control, the input and outputs addresses n+2 will be activated, while the address n+1 will be deactivated. The information reported at these optional addresses will be detailed in the two following tables.

Input section n+1, n+2

IN		
Point	**n+1**	**n+2**
1	Current position (0-100%) SHUTTER 1	Current position (0-100%) SHUTTER 2
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		

Each one of these inputs, when activated, reports a value in the range 0 to 100 whose meaning is the percentage of closing of the shutter (0=fully open, 100=fully closed).

Output section n+1, n+2

OUT		
Point	**n+1**	**n+2**
1	Go to position (0-100%) SHUTTER 1	Go to position (0-100%) SHUTTER 2
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		
16		

Writing a value to one of these output addresses, if activated, in the range 0 to 100, the related shutter will be moved to the wanted closing percentage position (0=fully open, 100=fully closed).

Shutter commands by Master devices

The master modules, e.g. DFCP, DFWEB and DFTouch, must be able to send commands to shutter modules in order to properly activate the motors.
The commands may be of the type “Open/Close” or “Go to position x”. Generally, the several Masters belonging to **Domino** family manage themselves these commands; in all other cases (e.g. ModBUS supervisors) the syntax of the Word to be sent to the module must be as here bottom described.

Open/Close Commands

In this case it is enough that the master writes the points Open and Close of the output base address (see output section n). Writing "1", the shutter will move in the related direction, writing "0" the shutter will stop. Activating the Open command while the shutter is closing (or vice versa), the motor will be stopped before reversing the movement; in other words the Open and Close are mutually exclusive commands.

“Go to position x” (GOTO) commands

In this case the Master has simply to write to output address n+1 or n+2 (depending on the shutter to be moved and stated that that related output has been configured for shutter mode) the percentage value at which the shutter must be closed (0=fully open, 100=fully closed).

Virtual points

As said before, the DF4RI module provides 4 generic virtual points that can be programmed using all the typical functions of the **Domino** system, as shown in the following list:

- Logical combinations (& |!)
- Set / Reset (S R)
- Step-by-step (T S R, including implementation timeout on all 8 ON-OFF outputs)
- Timer (maximum 8 per module)
- Time slot
- Analog threshold
- Oscillator

The only condition required for using these virtual points is that the basic input address of the module has been activated. These virtual points, when programming the module, must be indicated as `Vn.5`, `Vn.6`, `Vn.7` and `Vn.8`, where `n` is the base address of the module. Here are some examples of virtual points programming (supposing that the base address of DF4RI is 21):

```
V21.5 = I47.1 | V78.3
V21.6 = TI9.1 | TI9.2 | RI120.1
V21.7 = TIMERP(V21.5, 0, 1.5)
V21.8 = SI100.1 & RI100.2
```

Mapping

BDTools and DCP Ide allow to display the map of DF4RI module. The shown graphics will change depending on how the module has been configured; in the examples shown in Figure 1 DF4RI module has been configured in 3 different modes and precisely (from top to bottom):

- 4 ON-OFF outputs
- 2 ON-OFF outputs and 1 rolling shutter
- 2 rolling shutters

The points identified IN1..IN4 belong to the base input address (if enabled); the status of these points is represented by a green filled circle if the related point is OFF or by a red filled circle if the point is ON.

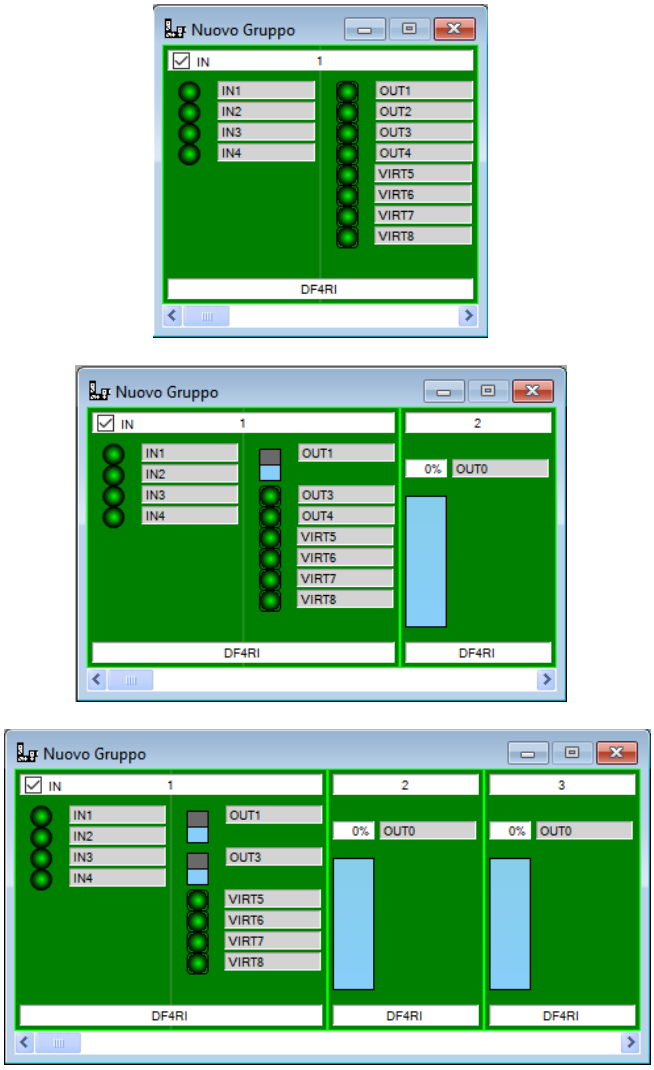


Figure 1: Map of the module

The points identified OUT1..OUT4 belong to the base output address; the points identified VIRT5..VIRT8 refer to the 4 virtual points. The status of these points is represented by a green filled square if the related point is OFF or by a red filled square if the point is ON. In the case of rolling shutter output, the symbol change as shown in the figures.

The addresses related to the rolling shutters, when enabled, (addresses 2 and 3 in the examples shown in Figure 1) are input and output addresses at the same time and they provide an evaluation of the closing percentage of the related rolling shutter.

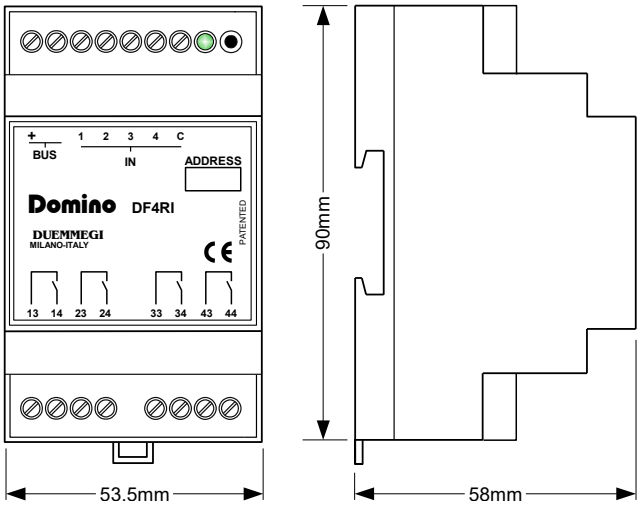
As usual, the background of the module is in green color if the module is connected and properly working, otherwise the background is in red color.

Technical characteristics

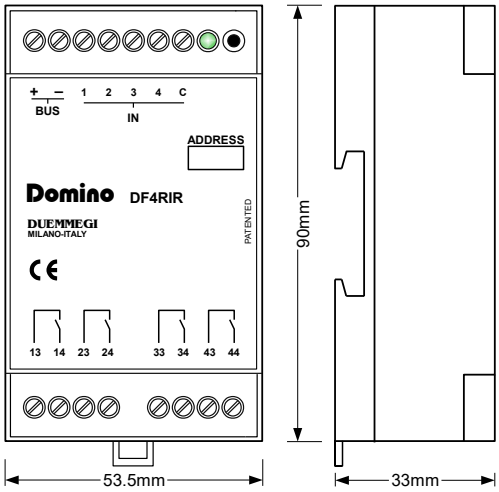
Power supply (bus side)	By specific centralized power supply mod. DFPW2
Current consumption	Equivalent to 1 standard **Domino** modules
Number of digital inputs	4, for potential-free contacts
Current for each digital input contact	1mA (closed contact), 0mA (open contact)
MAX allowed length for digital input wires	20 meters
Number of virtual points	4 (general purpose)
Number of outputs	4, power relays with 2 coils latching type
MAX Contact rating (each output)	• Resistive load (cosfi = 1): 12A at 250V~ (3000VA) • Inductive load (cosfi = 0.5): 3.6A at 250V~ (900VA) • Incandescent lamps: 8A at 250V~ (2000VA) • Fluorescent lamps: 350W with 42uF MAX power factor correction capacitor
Rating on single phase motor	550VA (0.75HP)
MAX switching voltage	250V~
Housing: DF4RI DF4RIR	 DIN standard 3M DIN stand. 3M reduced height
Operating temperature	-5 ÷ +50 °C
Storage temperature	-20 ÷ +70 °C
Protection degree	IP20

Outline dimensions

DF4RI:



DF4RIR:



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

This device complies with the essential requirements of the following directives:
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.