DFLS / DFLS-P: ambient brightness and occupancy sensor (-P type)

DFLS module allows to transmit, over the **Domino** bus, the ambient brightness value detected by the sensor integrated in the module itself. DFLS-P version provides a built-in presence sensor.
DFLS also includes an algorithm for the automatic regulation of the ambient light in conjunction with the DFLDALI64 module, even without a DFCP controller.
DFLS module provides two generic **Domino** digital inputs (ON/OFF with NO/NC settings); one of these ones can be set as input for additional presence sensors (for instance the **DUEMMEGI** module code SRP) that will be paralleled to the presence sensor integrated in the module (in the case of -P version).

DFLS module can be well applied in the brightness regulation of offices, stores and open spaces.
DFLS module is suitable for false ceiling mounting; the sensor detects the light reflected by the surface under it (for instance the floor or a desk). The special integrated sensor has the same spectral sensitivity of the human eye.

As for almost all modules of **Domino** family, the power supply required for the module operation is derived from the bus itself.

The module features a 5-way removable terminal block for the connection of **Domino** bus and of the two inputs. On a side of this 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 blue LED (-P version only) flashes when the presence sensor detects a movement.

On the label of the module, a frame allows the writing of the programmed module base address for an immediate visual identification.
For more details about the programming, refer to the related documentation.
DFLS housing is made by plastic material with IP20 protection degree.

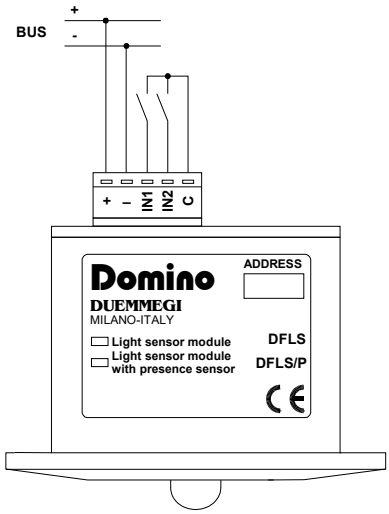
Note: this technical sheet applies to DFLS sensos equipped with firmware 2.0 or higher; the I/V table requires a FW version 3.0 or higher.

Address programming

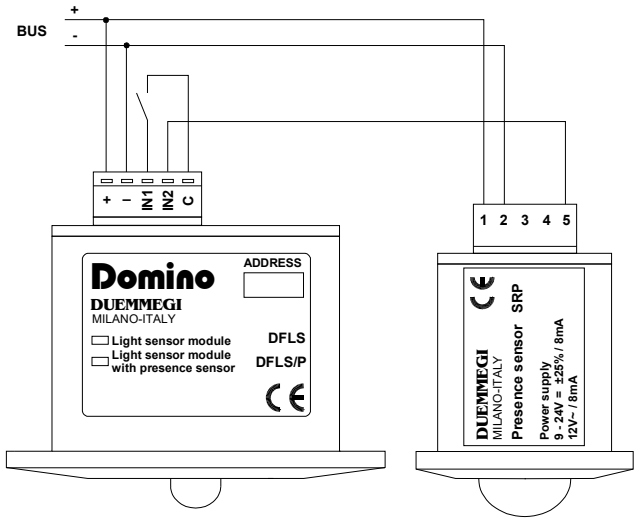
DFLS module takes, inside the **Domino** bus, 2 to 3 input addresses and 0 to 3 output addresses depending on the selected configuration.
Therefore, a base address less than or equal to 253 must be assigned; for details regarding the information relating to each address and configuration, refer to the following paragraphs. For details on assigning the address to the module, refer to the related documentation.

Wiring

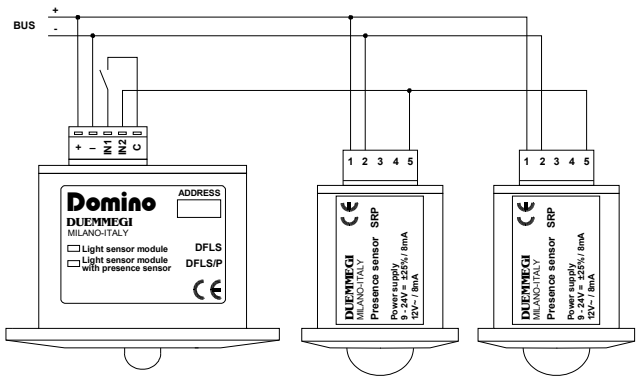
The following schematic diagram shows the required connections for DFLS module.



For both versions, IN2 input can be connected to an external presence sensor (for -P version this one will operate in parallel with the built-in sensor); for the **DUEMMEGI** SRP sensor the wiring is the following:



If more SRP occupancy detection sensors are required, refer to the following schematic:



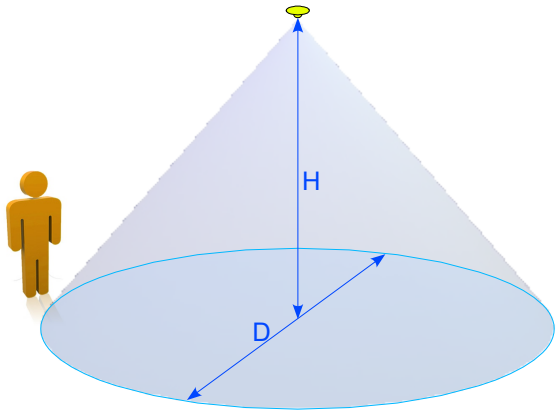
Detection characteristic (-P)

The occupancy sensor can detect a movement in the range of 5 meters under the sensor itself.
When a body is moving, thanks to the detection of infrared radiation emitted by the body itself, the sensor will be able to detect the movement.

For the calculation of the covered area refer to the following formula:

$$D = H \times 2.30$$

where D is the diameter of the cone basis and H is the mounting height, as shown in the following figure.



Installation hints

The correct positioning of the sensor plays a fundamental role in the application of automatic light regulation. Even if it is hard to give a general rule for the positioning of the sensor, because each specific case could be evaluated, as approximated general rule the sensor could be installed on the false ceiling in a proper position avoiding the *direct* incidence of external light entering from windows or other openings (in practice the optimal position is the darker location of the ceiling in all the conditions).

This because, on the contrary, the direct light should be predominant in respect to the reflected light that is, at the end, the light to be regulated (because, generally, the purpose is to make constant the illumination of the working desks).

For instance, in the case of a room with two windows on the same wall, the sensor may be placed near to the same wall between the two windows. Also, a “stable” surface under the sensor is needed: this surface must be at a constant distance from the sensor and it must have always the same color (it may be the floor or a bookcase or other).

The height and position for proper installation must be however evaluated taking in account also the occupancy sensor and the physical shape of the room. Given that the occupancy detection is based on the detection of infrared emissions, it is good practice to take in account also the following aspects related to the use and to the installation of DFLS-P module, in order to avoid errors in the detection by the sensor itself.

Detection of heat sources other than a human body

The following cases show various situations where detection mistakes by the detection sensor may happen.

- ✗ small animals entering in the detection range
- ✗ infrared emissions from sunlight, incandescent light or some other sources of far infrared rays
- ✗ sudden change of the temperature due to the entry of cold or warm air from an air-conditioning or heating unit or water vapor from a humidifier

Bad conditions for the detection

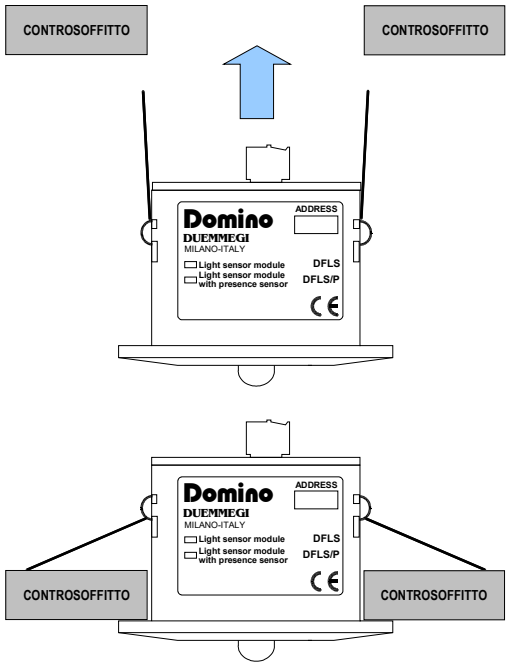
- ✗ the detection of movement by the sensor could be disturbed by the occupancy of glasses objects, acrylic or other materials that may shield the infrared rays
- ✗ a heat source not moving or moving too quickly or moving too slowly may be undetected by the sensor
- ✗ the sensor is less sensible when the temperature of the moving body is near to the ambient temperature

Other handling cautions

- ✗ be careful to keep clean from dust or dirt accumulating on the lens because this will adversely affects the detection sensitivity
- ✗ the lens is made by a soft material (polyethylene); avoid applying a load or impact since this will deform or scratch the lens
- ✗ to cleaning the sensor avoid the use of fluids that may enter inside the sensor causing a deterioration

To install the sensor, make a hole of proper diameter for the introduction of the sensor in the false ceiling and execute the mounting as shown in the following figure. The sensor must be fixed to the false ceiling by means of the two proper mounting springs.

It is suggested to insert the two removable terminal blocks just before the mounting in the false ceiling and however after having executed the needed connections (see paragraph “Wiring diagram”).



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.

Occupancy sensor and digital input

As said before, DFLS module provides two digital inputs (ON/OFF, which can be set as NO/NC).

For DFLS-P version, IN2 input can be set in order to use it for the management of external occupancy sensors like **DUEMMEGI** SRP (for -P version this ones will operate in parallel with the built-in sensor).

When a presence is detected (and/or when activating IN2 if set for external sensor), the point 3 of the input base address n of DFLS will be activated; when the presence detection falls, this point remains activated until the expiring of a delay time which can be configured in the range 1 to 65535 seconds.

This behavior allows to send on the **Domino** bus the presence information including the the chosen delay (e.g. in order to switch off a light source with a given delay in respect to the last detected presence).

DFLS module allows, particularly, to realize energy saving lighting applications, complying with the new European norms about the energetic classification of the plants (European Norm EN 15232).

Information on the bus

DFLS sensor can be set according to 2 main operating modes:

- ✗ Standard Mode: operation exactly identical to the DFLS sensor with FW 1.x, then with 2 input addresses and 0 output addresses
- ✗ Smart Mode: operation includes an algorithm for light regulation; in this case the sensor takes 3 input and 3 output addresses

The meaning of the various addresses is described below.

Input section:

The following information is mapped on this section (n indicates the assigned base address):

IN			
Point	**n**	**n+1**	**n+2 Smart only**
1	Status of IN1	Value proportional to the brightness measured by the sensor	Calculated value for automatic brightness regulation
2	Status of IN2		
3	Status PS+delay		
4	No ON by SP		
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

The meaning of this input information is described below in detail.

n: address n reports information of digital type:

- ✗ Point 1: status of input IN1
- ✗ Point 2: status of input IN2
- ✗ Point 3: it is activated when presence is detected by the sensor (or IN2 if configured for presence) and it is deactivated when the delay set in the configuration expires (see relative paragraph)
- ✗ Point 4: it reports the status of the corresponding output point 4; it is used by the lighting management module (e.g. DFDALI64) to decide whether or not to activate the lighting at presence detection (see below)

n+1: address n+1 reports a value proportional to the brightness detected by the sensor as a number between 0 and 1000

n+2 (Smart mode only): address n+2 reports the value to be sent to the lights (or DALI group) to maintain the desired brightness setpoint

Sezione di Uscita:

The following information is mapped to this section, **for Smart mode only** (n is the assigned base address):

OUT (Smart only)			
Point	**n**	**n+1**	**n+2**
1	Reset PS delay	Set the setpoint for the automatic brightness regulation	Set PS delay
2	Disable PS		
3	Force Presence		
4	No ON by PS		
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			

The meaning of this input information is described below in detail.

n: address n allows the following operations:

- ✗ Point 1: Reset delay of the presence sensor. It works on the OFF-ON transition and it forces the expiring of the presence sensor delay time, thus it switches off the "Status PS+delay" input point. If this point is left active, the "Status PS+delay" input point is activated when the presence is detected and remains activated
- ✗ Point 2: Disable the PS. It works on level and, when ON, the PS delay is reset and the "Status PS+delay" input point is switched off regardless of whether the PS is detecting or not. For as long as the point Disable PS remains active, the presence sensor (and also the status of the following point 3 Force Presence) is ignored and the "Status PS+delay" input point remains OFF. Thus it can be used to disable the presence sensor
- ✗ Point 3: Force Presence. If active, it forces the presence in the DFLS; in other words, this output point behaves as the "physical" presence sensor of the DFLS (delay included). This point is useful, for example, when the presence of a DFLS must "trigger" the presence on another DFLS
- ✗ Point 4: No ON by PS. The status of this point is simply reported on the corresponding input point; the status of this point is used by the lighting management module (eg DFDALI64) to decide whether or not to activate the lighting at presence detection (see below). This point does not in any way affect the operation of the DFLS, but it is simply a sort of virtual point used by the light module; when active, the ignition of lights does not take place from the presence sensor, but only by a local pushbutton

n+1: it allows to set the desired setpoint value for the light regulation; in practice, when the system is in regulation, the value at the input address n+1 (measure brightness value) "follows" this setpoint. Allowed values are 0 to 1000

n+2: it allows to set the, in seconds, of the presence sensor; the allowed values are 0 to 65535

The status of the output points at the base address is stored in the non-volatile memory of the module so that the settings are retained even if the a power failure occurs.

Module type statement

When using DFLS 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.

Assuming that the base address assigned to a DFLS is 1 and it has been set for standard mode, the syntax of the statement is as follows:

```
DFLS = ( I1, I2 )
```

If DFLS has been set for Smart mode, the statement is:

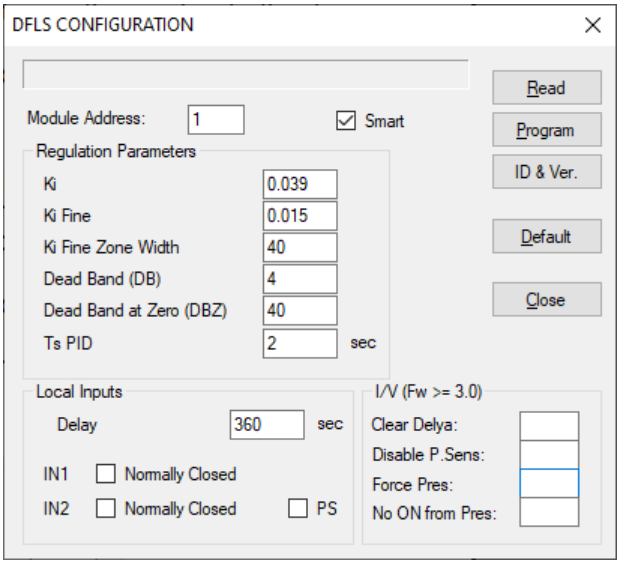
```
DFLS = ( I1, I2, I3, O1, O2, O3 )
```

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

Also keep in mind that the statement **does not** configure the module, but simply it "declares" that the module has been installed in the plant.

Settings

The various parameters of DFLS and DFLS-P module can be configured using BDTools or DCP Ide selecting, from the main menu, “Configuration”, then “Sensors” and finally “DFLS”; the following window will be shown:



The meaning of the fields and of the buttons in this window will be here described.

Module Address: it is the address of DFLS module to be configured or to be read

Smart: set DFLS for Smart mode

Ki (integral coefficient): this parameter, multiplied by the error (difference between setpoint and value measured by the sensor), defines the amount of the increase or decrease, compared to the previous value, of the value placed on input n+2 and which will then be sent to the lights (eg from DFDALI64); this parameter is applied when the measured value is far from the setpoint. The greater the value of Ki, the faster the set point is approached; when the the setpoint is “near” to the measured value (see Ki Fine Zone Width), the coefficient becomes the Ki Fine defined at the next point. For optimal values of Ki, see table at the end of this paragraph

Ki Fine (fine integral coefficient): as for the Ki described in the previous point but of smaller value; this parameter is applied when the measured value is close to the setpoint (see Ki Fine Zone Width). For the optimal values of Ki Fine, see table at the end of this paragraph

Ki Fine Zone Width: defines the area around the setpoint where the fine integral coefficient (Ki Fine) is applied

Dead Band (DB): defines the area around the setpoint in which the regulation algorithm does not perform any calculation; so if the measured value lies is in this area, no new values to be sent to the lights will be calculated (and then sent). This value can also be 0

Dead Band at Zero (DBZ): when the regulator has calculated an output value equal to zero, the dead band becomes equal to this parameter, which must be greater than the one in the previous point. It is used to prevent oscillations when the calculated level is zero

Ts PID: it is how often, in seconds, the regulation algorithm performs the calculation

Delay: this parameter is the delay time (in seconds) after the last presence detection before the no presence information is sent on the bus

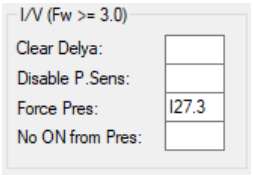
IN1 Normally Closed: when checked, the input IN1 is set for normally closed contact

IN2 Normally Closed: when checked, the input IN1 is set for normally closed contact

IN2 SP: when checked, input IN2 is set for the connection to external presence sensors; in practice input IN2 will be delayed at the deactivation, with delay as set in the Delay field

Read: to read the parameters from DFLS and to show them into the window.
Program: to transfer the parameters currently shown in the windows to DFLS module
ID & Ver: to check that DFLS module with the specified address is connected to the BUS and to show the firmware version
Default: to restore the parameters in the window to the default values
Close: to close the configuration panel

The I/V section (Fw> = 3.0), also called the I/V table, allows you to link real or virtual inputs to the related function; in other words, each of the 4 digital output points of a DFLS can be controlled by a bus input. For example, suppose you have a DFLS addressed 27 which must operate as a simple presence sensor which in turn must activate the regulation on another DFLS addressed 1. In DFLS I you must enter:



When the DFLS 27 detects a presence its input point I27.3 is activated and this, in turn, will force the presence on the DFLS of address 1.

Note: this function is only active for DFLS with FW 3.0 or higher.

<u>To set the parameters of the light controller, we recommend to follow the following procedure:</u>

- ✗ obscure the ambient from external light sources (or perform the procedure after sunset or otherwise on a dark day)
- ✗ force the lights in the area to be adjusted to 100%
- ✗ read the brightness value Lfs (full scale brightness) measured by the DFLS (at the base input address +1)
- ✗ the optimal values of the parameters Ki, Kif, Kif ZW, DB and DBZ (respectively Ki, Ki Fine, Ki Fine Zone Width, Dead Band and Dead Band at zero) are those in the table on the line closest to measured Lfs

Lfs	Ki	Kif	Kif ZW	DB	DBZ
100	0,170	0,065	5	0	5
200	0,095	0,037	10	1	10
300	0,070	0,027	15	1	15
400	0,058	0,022	20	2	20
500	0,050	0,019	25	2	25
600	0,045	0,017	30	3	30
700	0,041	0,016	35	3	35
800	0,039	0,015	40	4	40
900	0,037	0,014	45	4	45
1000	0,035	0,013	50	5	50

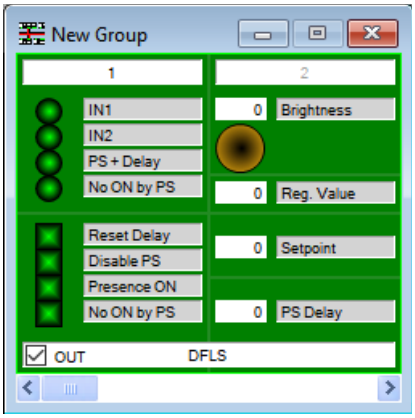
These values can however be adjusted according to the characteristics of the application. Keep in mind that large values for Ki and Kif could cause oscillations.

Brightness regulation

As already mentioned, the DFLS sensor, configured in Smart mode, is optimized to implement an automatic brightness regulation system in conjunction with the DALI DFDALI64 gateway module. For further details on how to implement this system, refer to the DFDALI64 manual.

Mapping

BDTools and DCP Ide allow to display the map of DFLS as in the following figure



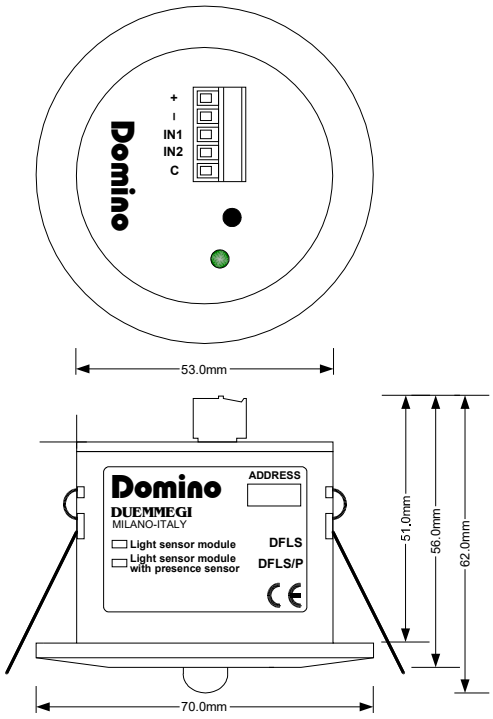
If the OUT box is checked, the module will be shown in Smart mode, otherwise in Standard mode.
The points identified IN1 and IN2 report the status of the related inputs on the terminal block; the status of these points is represented by a green filled circle if the related point is OFF or by a red filled circle if the point is ON.
The point “PS+Delay” reports the status of the built-in presence sensor (or the status of IN2 input if set as PS), including the chosen delay; “No ON by PS” is the status of the output point having the same name.

Brightness is the value proportional to the ambient light measured by the sensor of DFLS, “Reg. Value” is the value calculated by the brightness regulator and “Setpoint” is the brightness value to be maintained.
“PS delay” is the PS delay, in seconds.
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	Equivalent to 3 standard **Domino** modules
Number of digital inputs	2, for potential-free contacts, can be set as NO/NC
Current for each digital input contact	1mA (closed contact), 0mA (open contact)
MAX allowed length for digital input wires	20 meters
Light sensor type	Photo sensor with spectral response equivalent to the human eye sensitivity
Full scale light sensor	1023 points
Occupancy sensor: Aperture angle Range of detection MAX	Passive infrared principle (PIR) 100° 5 meters
Operating temperature	-5 ÷ +50 °C
Storage temperature	-20 ÷ +70 °C
Protection degree	IP20

Outline dimensions



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.