DFSUN: external light measurement module

DFSUN module allows to transmit, over the **Domino** bus, the ambient brightness value detected by a sensor inside the module itself. DFSUN module can be well applied for the brightness regulation for external or internal applications in industrial plants.

The module has been developed for applications requiring a case with integrated sensor, with a good extent of the protection degree, for external use or for detection of brightness in hangars or similar industrial buildings.

Through a 4-way dip switch, DFSUN module can be configured for 5 full scale values: 500, 1000, 2000, 20000 and 100000 lux.

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 green LED and a small push-bottom: the first one shows when the module is ready to receive the address; the second one allows the address programming. The same LED normally flashes every 2 seconds about to signal that the module is properly operating. Under the cover of the bus terminal block, a small 3-way connector (PRG) allows the connection to the optional tester/programmer.

DFSUN module takes, inside the **Domino** bus, 1 input address. A proper area on the lateral label allows to write the programmed module address for an immediate visual identification. For more details about the programming, refer to the related documentation.

DFSUN module is housed inside a plastic module with transparent cover and IP55 protection degree.

Setting the full scale value

To set full scale of DFSUN module, the transparent cover has to be removed. This operation can be performed with the help of a little screwdriver.

In this way, the 4-way dip switch can be accessed (see the figure in the wiring diagram paragraph); allowed settings are the following:

F.Scale [lux]	SW1	SW2	SW3	SW4
500	OFF	OFF	OFF	OFF
1000	ON	OFF	OFF	OFF
2000	ON	ON	OFF	OFF
20000	ON	ON	ON	OFF
100000	ON	ON	ON	ON

The ON position is reported on the dip-switch.

To avoid damage due to electrostatic discharge, it is strongly recommended to avoid to touch other parts of the circuit. After the desired setting has been performed, place back the transparent cover.
The factory setting of DFSUN full scale is 1000 lux.

Operation

As said above, DFSUN module take one input address. The brightness measured by DFSUN module is reported on the bus as analog value in the range 0 to 1023; the value read from the bus will then match, for each one of the available full scale, a value in lux given by:

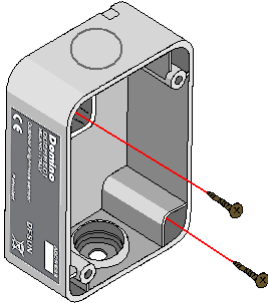| F.Scale [lux]	Formula
500	$L_{lux} = 0.5 \times VAL_{bus}$
1000	$L_{lux} = VAL_{bus}$
2000	$L_{lux} = 2 \times VAL_{bus}$
20000	$L_{lux} = 20 \times VAL_{bus}$
100000	$L_{lux} = 100 \times VAL_{bus}$

where **VAL_{bus}** is the value read from the bus and **L_{lux}** is the brightness value measured by the sensor.
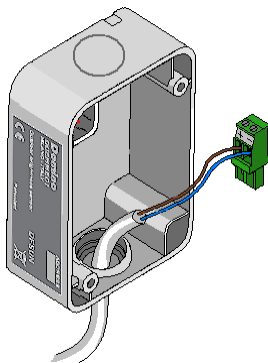On the contrary, a given brightness value will be sent on the bus as:

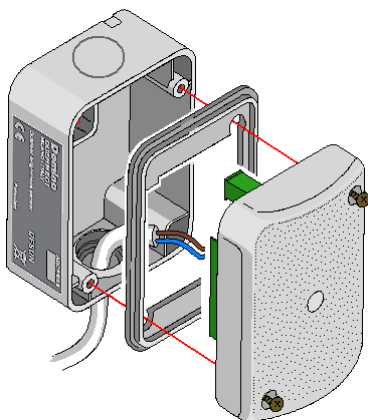| F.Scale [lux]	Formula
500	$VAL_{bus} = 2 \times L_{lux}$
1000	$VAL_{bus} = L_{lux}$
2000	$VAL_{bus} = 0.5 \times L_{lux}$
20000	$VAL_{bus} = 0.05 \times L_{lux}$
100000	$VAL_{bus} = 0.01 \times L_{lux}$

Installation hints

The bottom of the case must be fixed on the wall (vertical or horizontal) by two screws (not provided).

Introduce the bus through the cable bushing: pay attention to the coupling between them in order to assure the water-proof characteristic of the module. After that connect the bus cable to the 2-way removable terminal block: pay attention to the polarity.
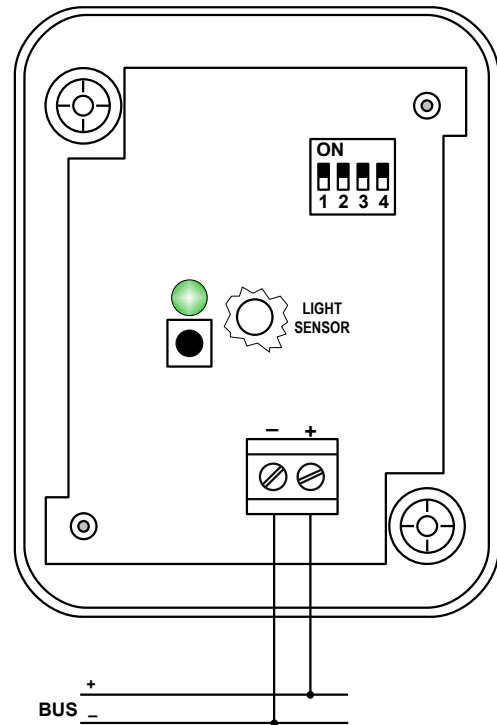

Finally, insert the removable terminal block into the related male connector.Place in the correct way the gasket on the cover and apply to the the bottom of the module: pay attention that the removable terminal block be on the opposite side of the cable bushing.

Module connection

The required connections for the proper operation of DF-SUN module are those related to the **Domino** bus as shown by the following wiring diagram.

Using the information returned by DFSUN and threshold equation

The analog values read from DFSUN module can be used as inputs in the **Domino** equations, both those contained in the **DFCP** controller and, in simpler applications, those directly uploaded into output modules DF2R, DF4R, DF4RP and into virtual modules DF4I/V.

Concerning the using of DFSUN module in **DFCP** based applications, refer to the user's manual of the controller.
The following will instead describe the threshold function, which can be uploaded directly into output modules as said before.
Threshold equation controls a digital output (that can be both a real or a virtual point) as function of the result of comparison between an analog value (for instance that returned by a DFSUN module) and a threshold, eventually with a hysteresis.

The following equation is a typical threshold equation:

$$O1.1 = AI1 >= 240,12$$

where **O1.1** is the output (real out in this case) controlled by the threshold function, **AI1** represents the analog input which address is 1, **>=** is the comparison operator (greater or equal to), **240** is the threshold and **12** is the hysteresis (the comma symbol must be placed before it).

Allowed comparison operators:

<   lower than
<=   lower or equal to
==   equal to
!=   not equal to
>   greater than
>=   greater or equal to

The hysteresis has a different meaning depending on the comparison operator as here described:

<   the output goes ON when $AI<T$ and it returns OFF when $AI>=(T + H)$

<=   the output goes ON when $AI<=T$ and it returns OFF when $AI>(T + H)$

==   the output goes ON when $AI=T$ and it returns OFF when $AI>(T + H)$ or when $AI<(T - H)$

!=   output goes OFF when $AI=T$ and it returns ON when $AI>(T + H)$ or when $AI<(T - H)$. This behavior is complementary to the previous case.

>   the output goes ON when $AI>T$ and it returns OFF when $AI<=(T - H)$

>=   the output goes ON when $AI>=T$ and it returns OFF when $AI<(T - H)$

Note: *if hysteresis has not been specified, then it will be assumed equal to zero.*

Of course, threshold and hysteresis values, for DFSUN module, must be in the range 0 to 1023. Other allowable operators are AND (**&**) and OR (**|**). More threshold functions can be combined in the same equation as shwn by the following examples.

O4.1 = AI1 >= 730,2
The output goes ON when the analog value is greater or equal to 730, and it goes OFF when it is lower than 728.

V130.1 = AI1 == 240 | AI2 >= 30
The virtual output goes ON when the analog value AI1 is exactly equal to 240 or when AI2 is greater or equal to 30.

O1.4 = AI1 < 128 & AI1 > 30
The output goes ON when the analog value is in the range 30 to 128 (greater than 30 and lower than 128).
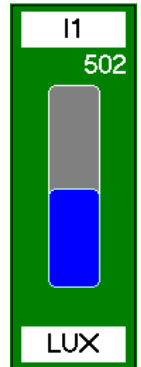
O3.2 = AI9 > 30 & AI9 < 128 | AI5 > 600
The output goes ON when the analog value AI9 is in the range 30 to 128 or when AI5 is greater than 600.

Mapping

DFSUN module is displayed on the map of BDTools (*release 6.1.1 or higher*) as in the picture on this right side.
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 bar graph shows the detected brightness level and the the number over the bar shows the same value in numerical format (in the range 1..1023). Note that this value is represented as number of points, it is not the lux value, because this last one depends on the dip switch setting; to find the lux value refer to the paragraph about the module operation.

Technical characteristics

Power supply (bus side)	By specific centralized power supply mod. DFPW2
Sensor type	Photodiode with integrated filter for adaptation to human eye sensitivity
Full scale	Configurable among: • 500 lux • 1000 lux • 2000 lux • 20000 lux • 100000 lux
Resolution	1023 points
Measurement error	±5% of full scale value
Operating temperature	-5 ÷ +50 °C
Storage temperature	-20 ÷ +70 °C
Protection degree	IP55

Outline dimensions