OBELUX
AVIATION LIGHTS

Obelux Medium-Intensity 2000cd compact series manual

Medium-intensity 2,000cd red aviation obstruction light

ICAO Medium-Intensity Type B/C
FAA L-864, L-885
NVG Compliant Infrared 850nm

CONTENTS

Changelog

Version	Date	Description	Author
0.1	02.01.2020	Document created.	JSi
1.0	19.05.2020	Release	JSi
1.1	05.10.2020	Updated product codes, heater	JSi

Acronyms and Abbreviations

FAA	Federal Aviation Administration
FPM	Flashes Per Minute
GPS	Global Positioning System
ICAO	International Civil Aviation Organization
IR	Infrared
LED	light emitting diode
MI	Medium intensity
N/A	Not available
PCB	Printed Circuit Board

1 ABOUT THIS PRODUCT

Obelux MI compact series LED obstruction lights provide 2,000cd color aviation red light and Night Vision Goggle (NVG) compliant infrared (850 nm) light. Both Stand-alone and Modbus operation are supported. In Stand-alone mode, no external controllers are required to run the light. In Modbus operation, the light is controlled with an Obelux controller as a part of an aviation light system.

Features:
► Fault monitoring with dry contact alarm relay
► Photocell
► GPS synchronization
► Support for operating in cold climates
► Visibility sensor interface controlled luminous output levels (10%, 30%, and 100%)
► Hot start for radar-controlled systems
► Easy to chain (no need for junction box)
► Embedded Web Server
Optional Controllers:
► CP Series (Interfaces: Ethernet TCP/IP and RS-485/Modbus, AC or DC)
► CP-M1 Series (Interface: RS-485/Modbus, AC or DC)

1.1 ICAO models product codes

Order code	Output	ICAO	Operating voltage	Nominal voltage	GPS	IR	Heater (CCV)	PC	Alarm relay	RS-485 Modbus
MI-ICAO-AC-2KR-IR-B[-10]	2 000 / 200 cd	Type B/C	100-240VAC		No	Yes	Yes	Yes	Yes	No
MI-ICAO-AC-2KR-IR-X [-10]	2 000 / 200 cd	Type B/C	100-240VAC		Yes	Yes	Yes	Yes	Yes	Yes
MI-ICAO-DC-2KR-IR-B[-10]	2 000 / 200 cd	Type B/C	10-60VDC		No	Yes	Yes	Yes	Yes	No
MI-ICAO-DC1224-2KR-IR-X[-10]	2 000 / 200 cd	Type B/C	10-30VDC	12/24VDC	Yes	Yes	Yes	Yes	Yes	Yes
MI-ICAO-DC2448-2KR-IR-X[-10]	2 000 / 200 cd	Type B/C	20-60VDC	48VDC	Yes	Yes	Yes	Yes	Yes	Yes
MI-ICAO-AC-2KR-IR-E1-B[-10]	2 000 / 200 cd	Type B/C	100-240VAC		No	Yes	Yes	Yes	Yes	No
MI-ICAO-AC-2KR-IR-E1-X[-10]	2 000 / 200 cd	Type B/C	100-240VAC		Yes	Yes	Yes	Yes	Yes	Yes
MI-ICAO-DC-2KR-IR-E1-B[-10]	2 000 / 200 cd	Type B/C	10-60VDC		No	Yes	Yes	Yes	Yes	No
MI-ICAO-DC1224-2KR-IR-E1-X[-10]	2 000 / 200 cd	Type B/C	10-30VDC	12/24VDC	Yes	Yes	Yes	Yes	Yes	Yes
MI-ICAO-DC2448-2KR-IR-E1-X[-10]	2 000 / 200 cd	Type B/C	20-60VDC	48VDC	Yes	Yes	Yes	Yes	Yes	Yes

B[-10]: B = basic model
10 = 10-year warranty

X[-10]: IO = 4x Input and 4x Output (IO) Interface
EF = Ethernet Switch, 2x fiber SC multimode Female, 2x copper RJ-45
E = 1x Ethernet copper RJ-45
10 = 10-year warranty

E1 = these product variants fulfil also the -1° and -10° vertical elevation angles maximum intensities requirements

Available mounting set options:
MS-MI-H01 (mounting bracket as AISI304 acid-proof stainless steel, nuts and bolts A4 steel)
MS-MI-H02 (mounting bracket as AISI316 acid-proof stainless steel, nuts and bolts A4 steel)
MS-MI-V01 (mounting set as AISI316 acid-proof stainless steel, nuts and bolts A4 steel)

1.2 FAA models product codes

Order code	Output	FAA	Operating voltage	GPS	IR	Photocell	Alarm relay	RS-485 / Modbus
MI-FAA-AC-2KR-IR-B[-10]	2,000cd	L-864, L-885	100-240VAC	No	Yes	Yes	Yes	No
MI-FAA-AC-2KR-IR-X[-10]	2,000cd	L-864, L-885	100-240VAC	Yes	Yes	Yes	Yes	Yes
MI-FAA-DC-2KR-IR-B[-10]	2,000cd	L-864, L-885	10-60VDC	No	Yes	Yes	Yes	No
MI-FAA-DC-2KR-IR-X[-10]	2,000cd	L-864, L-885	10-60VDC	Yes	Yes	Yes	Yes	Yes

B[-10]: B = basic model
10 = 10-year warranty

X[-10]: IO = 4x Input and 4x Output (IO) Interface
EF = Ethernet Switch, 2x fiber SC multimode Female, 2x copper RJ-45
E = 1x Ethernet copper RJ-45
10 = 10-year warranty

Available mounting set options:
MS-MI-192 (mounting bracket as AISI304 acid-proof stainless steel, nuts and bolts A4 steel)
MS-MI-160 (mounting set as AISI316 acid-proof stainless steel, nuts and bolts A4 steel)

1.3 Product highlights

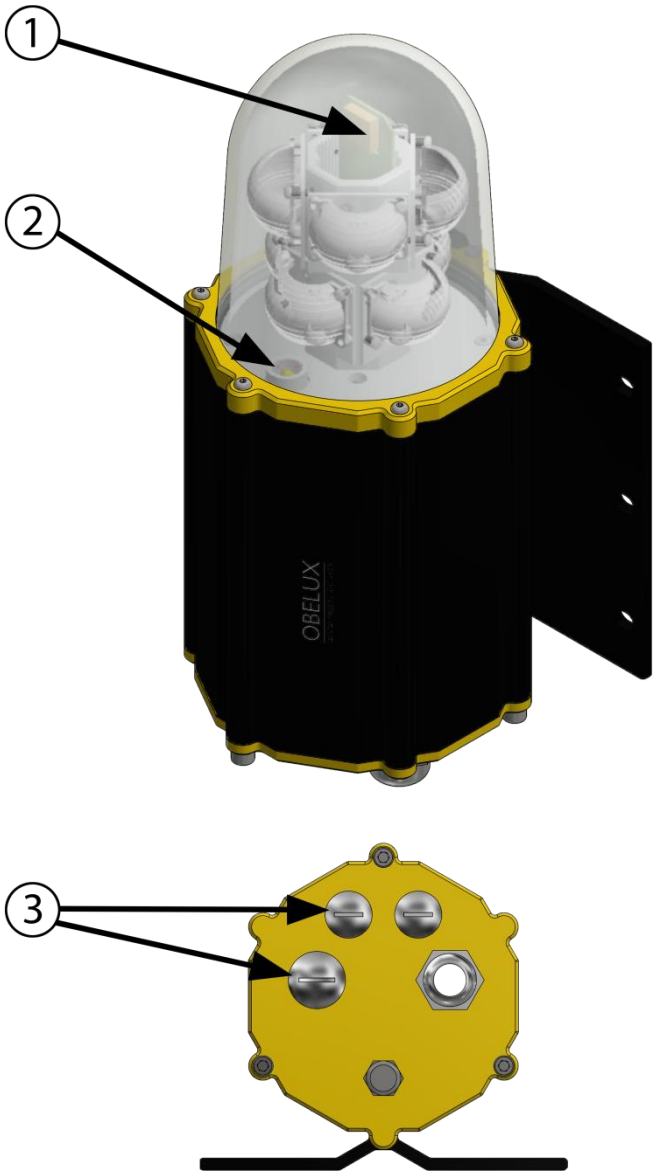


Figure 1: Main functional parts of light head

1. Location of photocell and GPS (do not cover)
2. Spirit level
3. Location of cable glands (M20 (2 pcs), M25 (2 pcs))

Factory installation:

- All models: 1 M25 gland attached to light, all other glands sealed

Accessories:

- Basic models: 1 M25 gland
- Other models: 1 M25 gland, 2 M20 glands

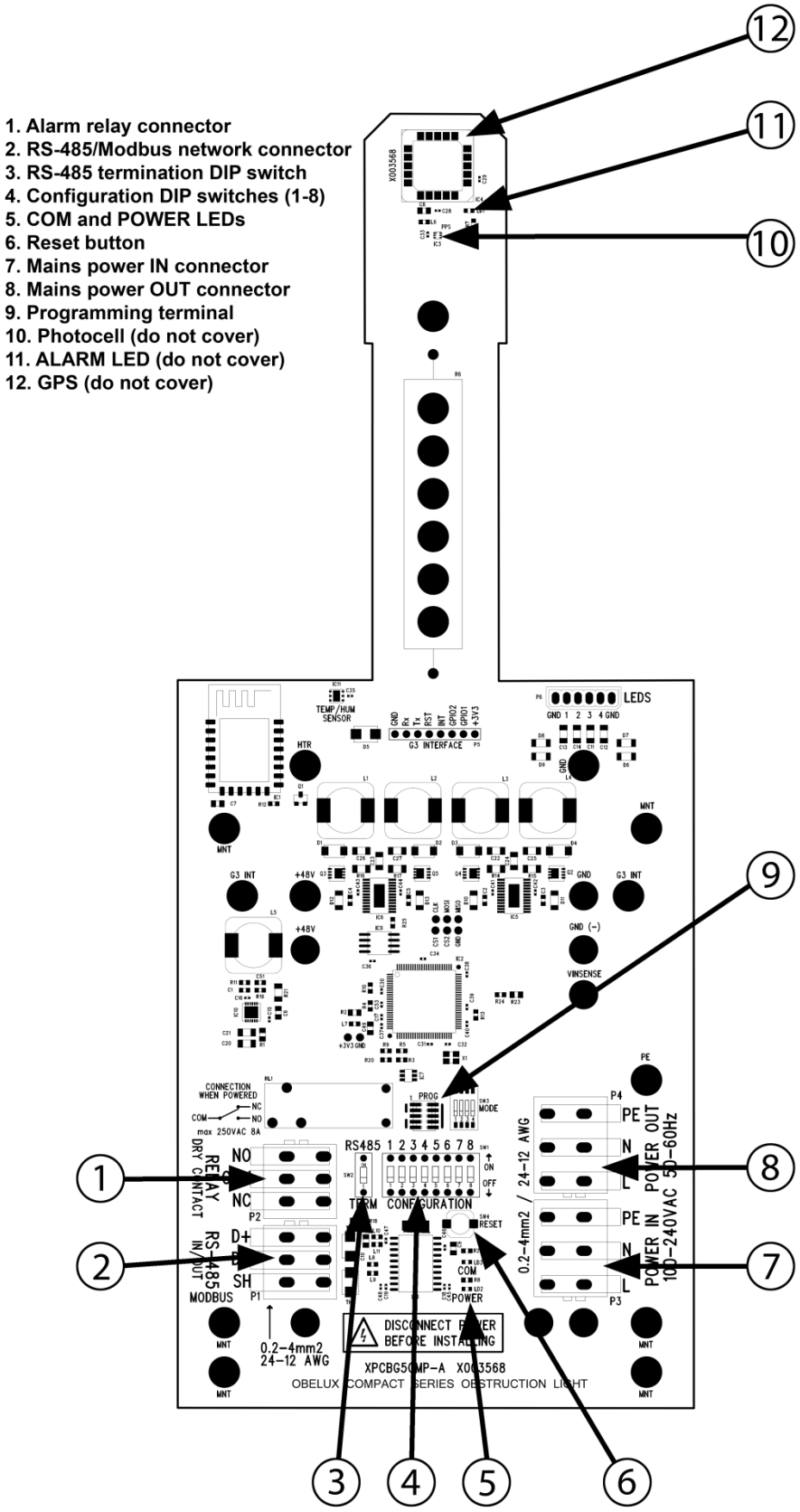
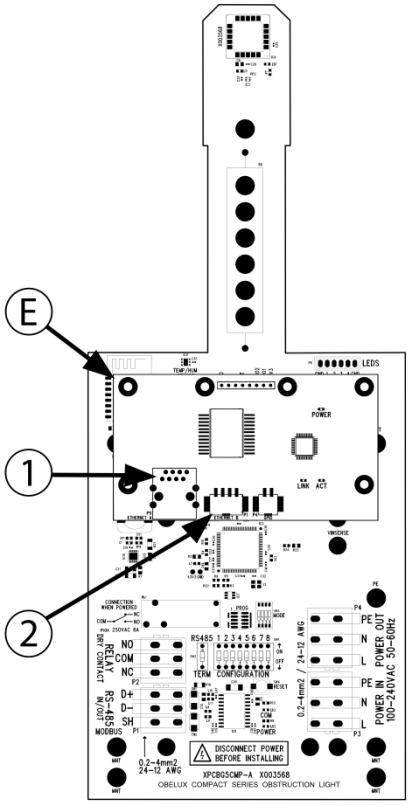
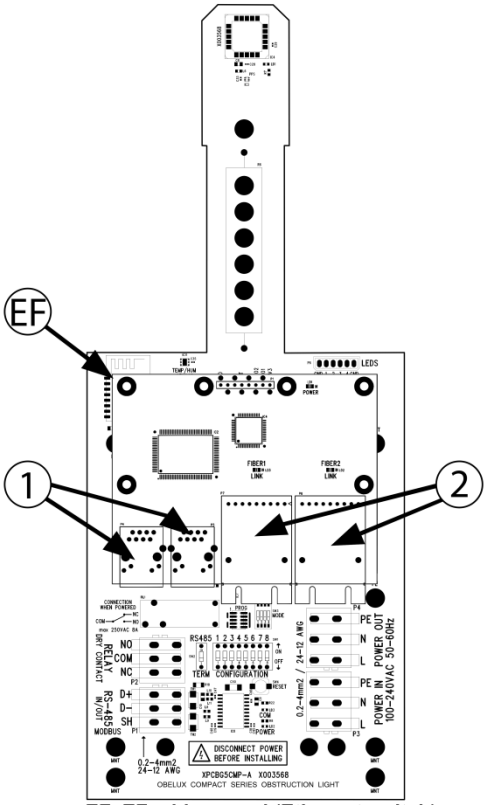


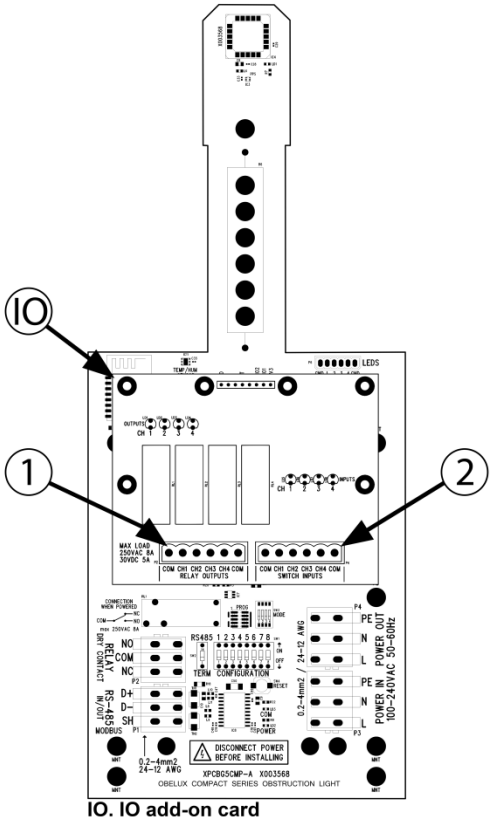
Figure 2: Main PCB of a light head (AC version)



E. E add-on card
1. Ethernet RJ-45 copper connector
2. Ethernet connector



EF. EF add-on card (Ethernet switch)
1. Ethernet RJ-45 copper connectors (2)
2. Fiber SC multimode Female connectors (2)



IO. IO add-on card
1. GPIO outputs
2. GPIO inputs

Figure 3: Main PCB with E, EF and IO add-on cards

2 SAFETY INSTRUCTIONS

In this section are general safety instructions for the device. Please read the instructions carefully before installing or using the device to avoid any personal, environmental or material damages.

2.1 General considerations

Install device observing manufactures installation guide.
Use only cables and connectors specified by the manufacturer and in compliance with local electrical code.
Keep your device away from heat sources, dust, smoke or other harmful substances.
Do not modify the device unless otherwise approved by the manufacturer.
If you have any error situation with the device, do not try to fix it by yourself, contact your reseller.

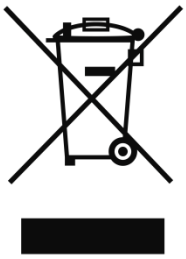
2.2 Environmental considerations

The European Parliament and the Council of European Union issued directive 2012/19/EU to contribute to sustainable production and consumption by, as a first priority, the prevention of WEEE and, in addition, by the re-use, recycling and other forms of recovery of such wastes so as to reduce the disposal of waste and to contribute to the efficient use of resources and the retrieval of valuable secondary raw materials.
Obelux aviation obstacle light products sold inside European Union can be returned to manufacturer if no local WEEE separate collection and re-use services are available. Please contact Obelux for details.
Obelux does not refurbish returned items but forwards them to authorized WEEE treatment facility.

2.3 Personal considerations

HIGH VOLTAGE! Device contains high voltage which is very dangerous; do not try to service the device when it is powered on.
Obelux aviation obstruction lights are Class 2M LED devices. This class is safe for accidental viewing under all operating conditions. However, it may not be eye-safe for a person who deliberately stares into the LED beam by overcoming their natural aversion response to the very bright light.





3 INSTALLATION

3.1 Device installation

Install the obstruction light to selected mounting point using quality-made fasteners. Level the light using a spirit level (bubble level) if necessary. Tighten bolts and nuts. The light has 6 holes for M8 bolts on the mounting plate. Photocell is located on top of the light under the glass and should have an uninterrupted view of the sky to work correctly. There are two different size cable glands used on the device: M25 cable glands for 6-17 mm cable diameter and M20 cable glands for 6-12 mm cable diameter. Make sure that all unused glands or gland holes are sealed.

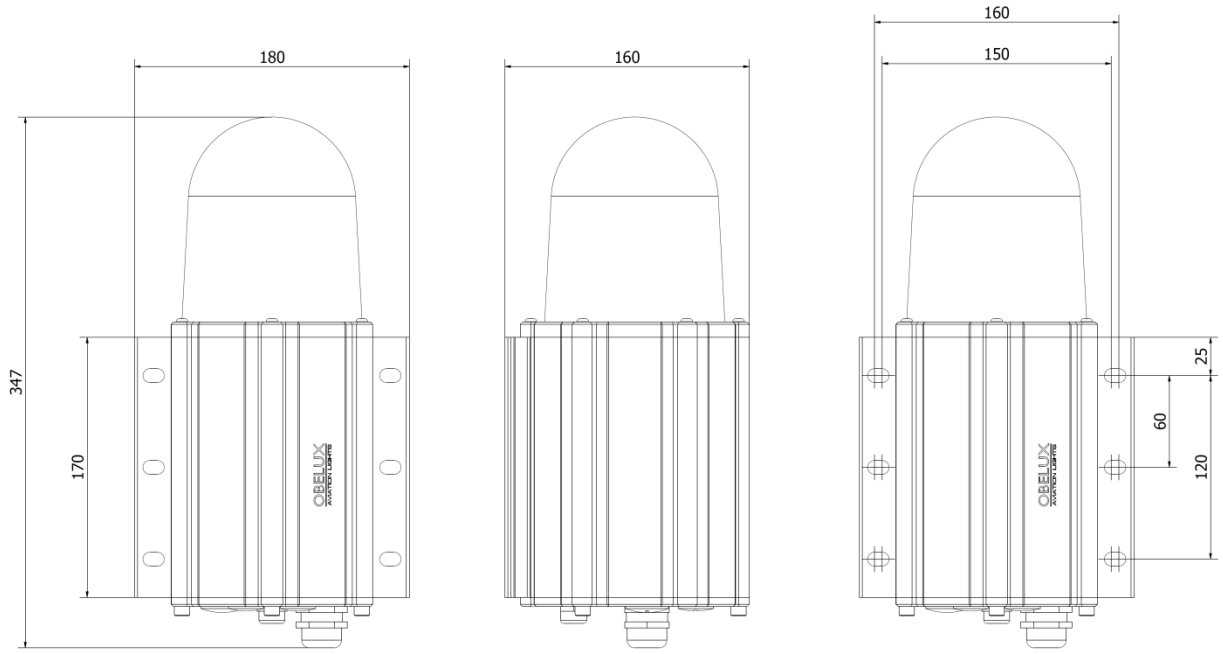


Figure 4: Dimensions (mm)

3.2 Wiring

Route cables using cable glands on back of the light head. Connect power cable wires securely to Power IN terminal block connector. Power OUT terminal can be used to distribute power to the next light head. Connect Modbus/RS-485 cable wires to Modbus/RS-485 IN/OUT connector. Use the same connector to distribute data signals to next light head. Connect alarm relay cable wires to alarm relay connector. Lights are easy to chain using lights' internal connectors.

Mains Power **Alarm relay/RS-485**

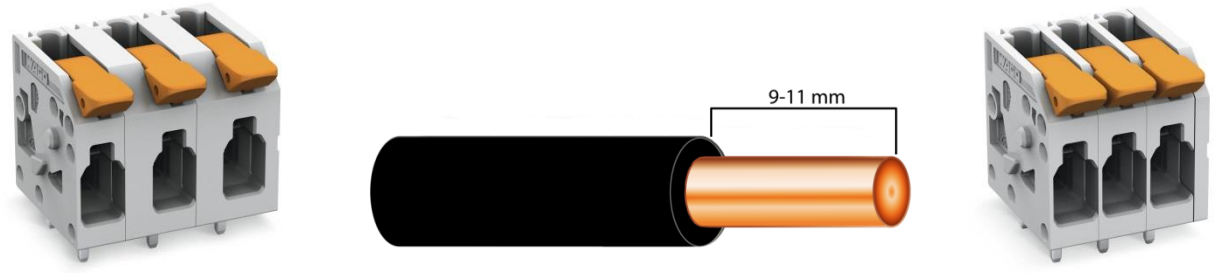


Figure 5: Terminal block connectors and wire strip length

3.2.1 Mains In/Out (AC versions)

Mark	Description	Information
L	Live terminal	Connect the mains power supply Live (brown) wire into this pole.
N	Neutral terminal	Connect the mains power supply Neutral (blue) wire into this pole.
PE	Protective earth	Connect the protective earth (yellow/green) wire into this pole.

Use a single-phase supply with Protective Earth. Make sure the mains power supply is powered off before starting the installation process. The connectors are Wago Push-in CAGE CLAMP® type.

Conductor cross-section	0.2mm² - 4mm² (24-12 AWG)
Recommended conductor size	2.5mm² (14 AWG)

3.2.2 DC In/Out (DC versions)

Mark	Description	Information
+	Positive	Connect the power supply positive wire into this pole.
-	Negative	Connect the power supply negative wire into this pole.
GND	Ground	Connect the power supply ground wire into this pole.

The connectors are Wago Push-in CAGE CLAMP® type.

Conductor cross-section	0.2mm² - 4mm² (24-12 AWG)
Recommended conductor size	2.5mm² (14 AWG)

3.2.3 Modbus (RS-485) In/Out

Mark	Description	Information
D+	Data +	RS485 non-inverting pin
D-	Data -	RS485 inverting pin
SH	Shield	Shield

The RS-485 network (bus) input/output. Unused Modbus connectors can be left floating, i.e. no wiring there is required. The connector is Wago Push-in CAGE CLAMP® type.

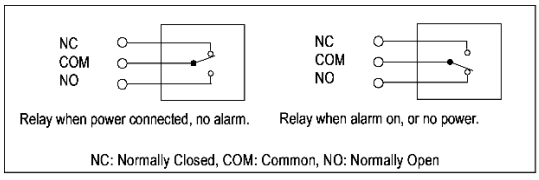
Conductor cross-section	0.2mm² - 4mm² (24-12 AWG)
Recommended conductor size	0.75mm² - 1,5mm² (20-16AWG) or CAT cable

3.2.4 Alarm Relay Output

Mark	Description	Information
NO	Normally Open	Normally open contact; in alarm, connected with COM
COM	Common	Common relay contact
NC	Normally Connected	Normally connected with COM; in alarm, open contact

Unused alarm relay connectors can be left floating, i.e. no wiring there is required. The connector is Wago Push-in CAGE CLAMP® type.

Conductor cross-section	0.2mm² - 4mm² (24-12 AWG)
Recommended conductor size	0.75mm² - 1,5mm² (20-16AWG) or CAT cable
Relay ratings	250VAC, 8A



3.2.5 Chaining Lights

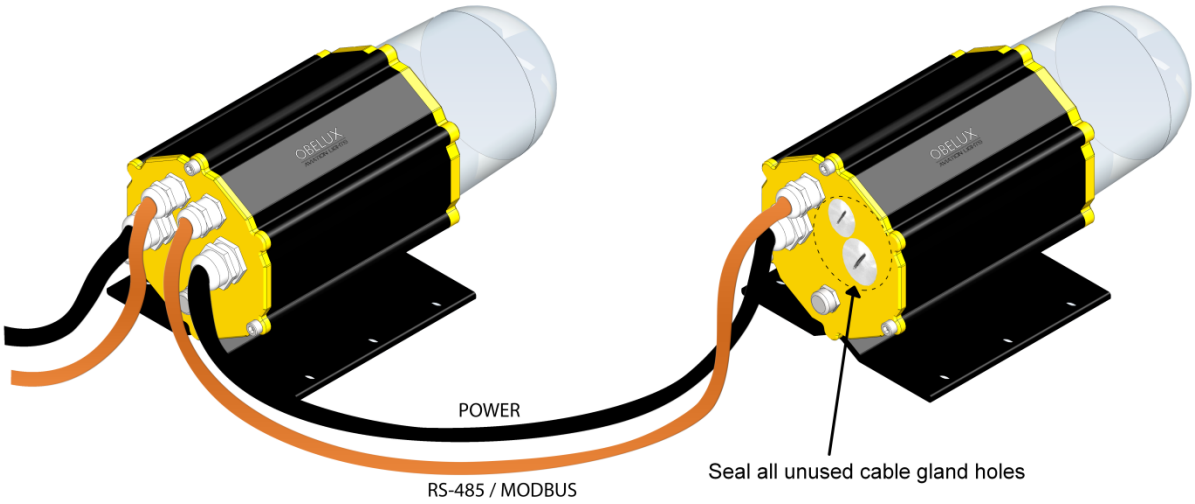


Figure 6. Chaining light heads

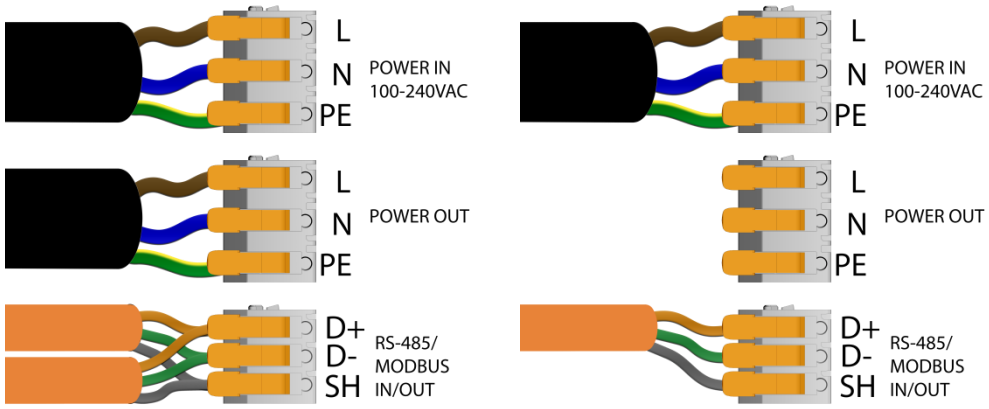


Figure 7. Distributing power and data to next light head of the network (AC version)

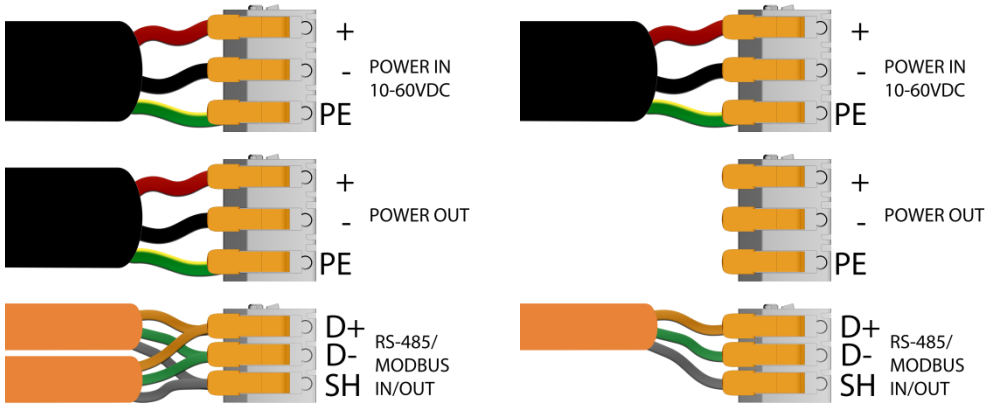


Figure 8: Distributing power and data to next light head of the network (DC version)

When chaining the RS-485 connector, note the maximum conductor size of 1.5mm² (16 AWG).
Remember to set the termination DIP switch on both ends of the RS-485/Modbus bus (Figure 2 (3)).

4 OPERATION

To configure the obstruction light, open the three M6 screws that secure the lower flange to the chassis using a hex key and pull out the PCB. Using the configuration DIP switches, configure the desired parameters into the light. The DIP switches are numbered 1-8. Embedded software in the obstruction light reads configuration switches regularly. Configuration change becomes effective within a few seconds. The light can be configured between two different operating modes. Light reset is needed when changing between the modes.

Stand-alone mode: In this mode, the light operation is configured with its DIP switches. No additional controllers are needed. Light head will use its internal photocell to determine the time of day (day, twilight or night). The light will change its flashing mode based on photocell data and how the user has configured the light. Light heads will synchronize their flashing with the built-in GPS module. After light head start-up, it will take some time for the light head to acquire a GPS lock.

Modbus mode: In this mode, the light is being controlled with an additional Obelux controller. If connection is lost to the controller, the light will keep working on its own. It will use its internal photocell and GPS to synchronize flashing and determine the time of day. The light will return to normal operation when the connection is recovered.

4.1 ICAO models

4.1.1 ICAO Stand-alone mode (basic model)

Flashing mode is selected with DIPs 1-3.

DIP switch			Flashing mode
1	2	3	Night
off	off	off	2,000cd red, ICAO (flashing, check DIPs 4-5)
on	off	off	2,000cd red and infrared, ICAO (flashing, check DIPs 4-5) *
off	on	off	2,000cd red (steady)
on	on	off	2,000cd red and infrared (steady)
off	off	on	200cd red and infrared, ICAO (flashing, check DIPs 4-5)
on	off	on	200cd red and infrared (steady)
off	on	on	Reserved
on	on	on	Reserved

Flashing rate is selected with DIPs 4-5. Steady modes don't flash. A steady mode can be selected with DIPs 1-3.

DIP switch		Flash rate (FPM)
4	5	
off	off	20
on	off	30
off	on	40 *
on	on	60

Photocell operation is configured with DIP6. When photocell controls the light, the light will change its flashing mode based on ambient luminosity.

DIP switch	Photocell mode
6	
off	Photocell is disabled *
on	Photocell controls the light

Turn DIP7 on for correct operation.

DIP switch	Master/Slave mode
7	
off	This device is slave *
on	This device is master (must be on)

Turn DIP8 off for correct operation.

DIP switch	Operating mode
8	
off	Stand-alone (must be off) *
on	Modbus

* Factory default

4.1.2 ICAO Stand-alone mode

Flashing mode is selected with DIPs 1-3.

DIP switch			Flashing mode
1	**2**	**3**	**Night**
off	off	off	2,000cd red, ICAO (flashing, check DIPs 4-5)
on	off	off	2,000cd red and infrared, ICAO (flashing, check DIPs 4-5) *****
off	on	off	2,000cd red (steady)
on	on	off	2,000cd red and infrared (steady)
off	off	on	200cd red and infrared, ICAO (flashing, check DIPs 4-5)
on	off	on	200cd red and infrared (steady)
off	on	on	Reserved
on	on	on	Reserved

Flashing rate is selected with DIPs 4-5.

DIP switch		Flash rate (FPM)
4	**5**	
off	off	20
on	off	30
off	on	40 *****
on	on	60

Photocell operation is configured with DIP6.

DIP switch	Photocell mode
6	
off	Photocell is disabled *****
on	Photocell controls the light

DIP switch	Master/Slave mode
7	
off	This device is slave *****
on	This device is master

DIP switch	Operating mode
8	
off	Stand-alone *****
on	Modbus

* Factory default

4.2 FAA models

4.2.1 FAA Stand-alone mode (basic model)

DIP switch			Flashing mode
1	**2**	**3**	**Night**
off	off	off	2,000cd red and infrared (flashing) *****
on	off	off	2,000cd red (flashing)
off	on	off	Reserved
on	on	off	Reserved
off	off	on	Reserved
on	off	on	Reserved
off	on	on	Reserved
on	on	on	Reserved

DIP switch		Flash rate (FPM)
4	**5**	
off	off	20
on	off	30 *****
off	on	40
on	on	60

DIP switch	Photocell mode
6	
off	Photocell is disabled *****
on	Photocell controls the light

Turn DIP7 on for correct operation.

DIP switch	Master/Slave mode
7	
off	This device is slave *
on	This device is master (must be on)

Turn DIP8 off for correct operation.

DIP switch	Operating mode
8	
off	Stand-alone (must be off) *
on	Modbus

* Factory default

4.2.2 FAA Stand-alone mode

DIP switch			Flashing mode
1	2	3	Night
off	off	off	2,000cd red and infrared (flashing) *
on	off	off	2,000cd red (flashing)
off	on	off	Reserved
on	on	off	Reserved
off	off	on	Reserved
on	off	on	Reserved
off	on	on	Reserved
on	on	on	Reserved

DIP switch		Flash rate (FPM)
4	5	
off	off	20
on	off	30 *
off	on	40
on	on	60

DIP switch	Photocell mode
6	
off	Photocell is disabled *
on	Photocell controls the light

DIP switch	Master/Slave mode
7	
off	This device is slave *
on	This device is master

DIP switch	Operating mode
8	
off	Stand-alone *
on	Modbus

* Factory default

4.3 Modbus mode

The light is in Modbus mode when DIP8 is on. Light is being controlled with an Obelux controller.

DIP switch	Operating mode
8	
off	Stand-alone
on	Modbus

Configuration DIP switches 1-4 are used to give the light a RS-485 bus address. Duplicate addresses on the same bus are not allowed. Give lights connected to the same communication bus an address starting from address one.

DIP switch				Modbus Address
1	2	3	4	
on	off	off	off	Address 01
off	on	off	off	Address 02
on	on	off	off	Address 03
off	off	on	off	Address 04
on	off	on	off	Address 05
off	on	on	off	Address 06
on	on	on	off	Address 07
off	off	off	on	Address 08
on	off	off	on	Address 09
off	on	off	on	Address 10
on	on	off	on	Address 11
off	off	on	on	Address 12
on	off	on	on	Address 13
off	on	on	on	Address 14
on	on	on	on	Address 15

RS-485 bus should be terminated with on-board 120 ohm resistors by turning on the termination DIP switch on both ends of the communications bus.

4.4 Test mode

To enter test mode, set DIP7 and DIP8 on and all other DIPs off. The light will enter test mode when power is turned on. To leave the test mode, turn off DIP7 and DIP8 and turn off the power.

DIP switch		Test mode
7	8	
on	on	Test mode enabled. All other DIPs off.
off	off	Test mode disabled.

Light mode is selected with DIPs 1-2. There is normally a delay when changing time-of-day modes (day, twilight and night) based on photocell data. Using accelerated photocell mode will decrease the delay to a minimum.

DIP switch		Light mode
1	2	
off	off	Accelerated photocell light behavior
on	off	RED light only
off	on	IR light only
on	on	Reserved

Flashing rate is selected with DIPs 4-5.

DIP switch		Flash rate (FPM)
4	5	
off	off	Steady
on	off	20
off	on	40
on	on	60

The light can be dimmed by using DIP6 and DIP7. Dimming is light brightness as percentage of full power. Note that the light stay in test mode despite DIP7 is turned off.

DIP switch		Dimming
6	7	
off	off	100%
on	off	30%
off	on	100%
on	on	10%

4.5 Master light mode

Any obstruction light can be set as a master of a light network. Only one light shall be the master in the network. Master unit broadcasts time and illumination data to slave units via RS-485 / Modbus. Time is typically received from GPS and illumination information comes from photocell. If the information flow from the master unit to slave units is interrupted, the slave units will use local photocell setting and local time in their operations. As the data flow resumes, the slaves automatically synchronise themselves with the master unit.

Chain the lights as shown in section 3.2.5.
Set a lamp to master mode by switching its DIP7 on. Set DIP7 off in the slave lamps to put them to slave mode.

DIP switch	Master/Slave mode
7	
off	This device is slave (slaves)
on	This device is master (master)

Set the master light to stand-alone mode and the slave lights to Modbus mode with DIP8.

DIP switch	Operating mode
8	
off	Stand-alone (master)
on	Modbus (slaves)

Use configuration DIP switches 1-4 to give the slave lights RS-485 bus addresses. Duplicate addresses on the same bus are not allowed. Give lights connected to the same communication bus an address starting from one. RS-485 bus should be terminated with on-board 120 ohm resistors by turning on the termination DIP switch on both ends of the communications bus.

In the master lights Web interface, configure:
► Data Tables -> Settings -> Slave Options
- B0: Transmit Behavior Bits

► Data Tables -> Settings -> Slave behavior
- B0: LI Red Twilight
- B1: MI Red Twilight
- B2: HI Red Twilight
- B3: LI Flash (visible)
- B4: LI Flash (IR)

► Data Tables -> Settings -> Options2:
- B2: Do not use own photocell (will use default ToD, if no master connection)
- B3: Use Default FPM if master connection lost
- B6: Transmit FPM (Master mode only)

Then reset the lamps for the settings to take effect.

4.6 Heater operation

All models have an integrated 20W heater element. The heater starts working when the light internal temperature drops below 10°C. Heater reaches 100% operation when temperature drops below 5°C. Heater stops working after the temperature rises above 10°C.

4.7 Causes for ALARM

The following events can cause an ALARM:

- Internal hardware or power failure.
- Light source failure, including decreased intensity level below rated level of light.
- Loss of GPS synchronization signal or GPS module failure.
- Incorrect photocell operation.

The ALARM LED will turn on and ALARM relay will activate.

4.8 On-board LEDs

Status indication LEDs are located on the controller board. Some of the status indicators have three operating states (off, on and flashing). The lights have three status LEDs on the controller board. These status LEDs are visible only when service access hatch is open, except the ALARM LED that can be seen through the glass cover.

LED	Description
POWER	**Internal operating voltage (GREEN)** LED OFF: Unit has power off LED ON: Unit has power on
COM	**Communication (GREEN)** LED OFF: Waiting for external signals LED FLASHING: Master-slave communications occurring on the network
ALARM	**Alarm indicator (RED)** LED OFF: Normal operation, no alarms LED ON: Active alarm condition

4.9 GPS operation

In stand-alone mode, light heads will automatically synchronize their flashing with their built-in GPS module. After light head start-up, it will take some time for the light head to acquire a GPS lock, because the lights need a signal from multiple GPS satellites. The GPS provides same timing information for all the lights, so they will flash in sync.

4.10 Troubleshooting

The light doesn´t start

- No power (check that the POWER status LED is illuminated).
- Incorrect configuration (check DIP switches, make sure Test mode is turned off).
- Loose wires (check that all wires are properly seated in terminal block connectors).
- Do not exceed maximum operating voltage. Mains power supply input is protected with overvoltage protection circuit that is tuned to stated operating voltage range.

No Modbus data connection to Obelux controller

- Check DIP settings. Check that light has a correct Modbus address and that there are no conflicting addresses. Make sure the light is configured to Modbus mode (DIP8).

- Too many RS-485 termination resistors (120ohm) on the same RS-485 communication bus. Only the last light on the bus should have the termination resistor in use.
- Check Modbus data wiring.

Light does not change modes between day, twilight and night

- Check that the photocell has an uninterrupted view of the sky.
- Check that there are no external light sources that interfere with the photocell.
- Photocell is sampled once in a minute and read values are averaged to avoid sudden state changes. Unless test mode is enabled, it takes approx. three (3) minutes to change system state between day, twilight and night.

Light does not flash in sync

- GPS antenna is mounted on top of obstruction light's PCB under the glass cover. Antenna needs a non-blocked view to GPS satellites in orbit. After start-up, GPS receiver may take up to 30 mins to obtain correct time data from GPS satellites. This operation requires data from several GPS satellites.

4.11 Spare parts

Part code	Description
SP-MICMP-CTRL	Replacement main control board
SP-MICMP-PSUAC	Replacement power supply unit (100-240 VAC)
SP-MICMP-PSUDC12	Replacement power supply unit (10-20 VDC)
SP-MICMP-PSUDC24	Replacement power supply unit (20-60 VDC)
SP-MICMP-GC	Replacement glass cover including gaskets