OBELUX MID ICAO SERIES MANUAL

Medium-intensity aviation obstruction light

ICAO MEDIUM INTENSITY TYPE A 20,000 cd WHITE

ICAO MEDIUM INTENSITY TYPE B/C 2,000 cd RED

Version	Date	Description	Author
0.1	07.05.2020	Document created	JSi
0.2	08.05.2020	Document released for internal review	JSi
0.3	14.05.2020	Updated section 2.2	JSi
0.4	02.02.2021	Updated section 3.1	JSi

Acronyms and Abbreviations

CCV	Cold climate version
cd	candela
DIP	Dual in line package
FPM	Flashes Per Minute
GPS	Global Positioning System
LED	light emitting diode
ICAO	International Civil Aviation Organization
IR	Infrared
MI	Medium intensity
NVG	Night Vision Goggle
PCB	Printed circuit board

CONTENTS

1 ABOUT THIS PRODUCT

Obelux MID ICAO series obstruction lights based on LED technology provide 20,000 cd color aviation white and 2,000 cd color aviation red light. Models are available which provide additionally Night Vision Goggle (NVG) compliant infrared (850 nm) light. The light operation is based on an embedded microcontroller on the light controller board. All models come with an integrated photocell that can drive the transitions between day, twilight and night modes. Alarm relay, GPS synchronization, fault monitoring and Modbus communication are built-in to all models.

1.1 Versions

Obelux MID ICAO series is available as the following models:

Order code	Output	ICAO	Operating voltage	GPS	RED	IR	CCV	Photocell and Fault monitoring	Alarm Relay	Modbus
MID-ICAO-ACWGAM-X	20 000 cd	Type A+B/C	100-240VAC	Yes	Yes	No	Yes	Yes	Yes	Yes
MID-ICAO-ACWIRGAM-X	20 000 cd	Type A+B/C	100-240VAC	Yes	Yes	Yes	Yes	Yes	Yes	Yes
MID-ICAO-DCGAM-X	20 000 cd	Type A+B/C	20-60VDC	Yes	Yes	No	Yes	Yes	Yes	Yes
MID-ICAO-DCIRGAM-X	20 000 cd	Type A+B/C	20-60VDC	Yes	Yes	Yes	Yes	Yes	Yes	Yes

X:
{ } = Without any extension board
IO = Including 4 Input 4 Output (IO) Interface
E = Ethernet interface with 1 RJ-45 copper connector
EF = 4 port switch:
Ethernet Interface with 2 RJ-45 copper connectors and 2 Fiber SC multimode female connectors

ICAO:
Medium-intensity Type A = 20 000 cd / 2 000 cd WHITE flashing
Medium-intensity Type B = 2 000 cd RED flashing
Medium-intensity Type C = 2 000 cd RED steady

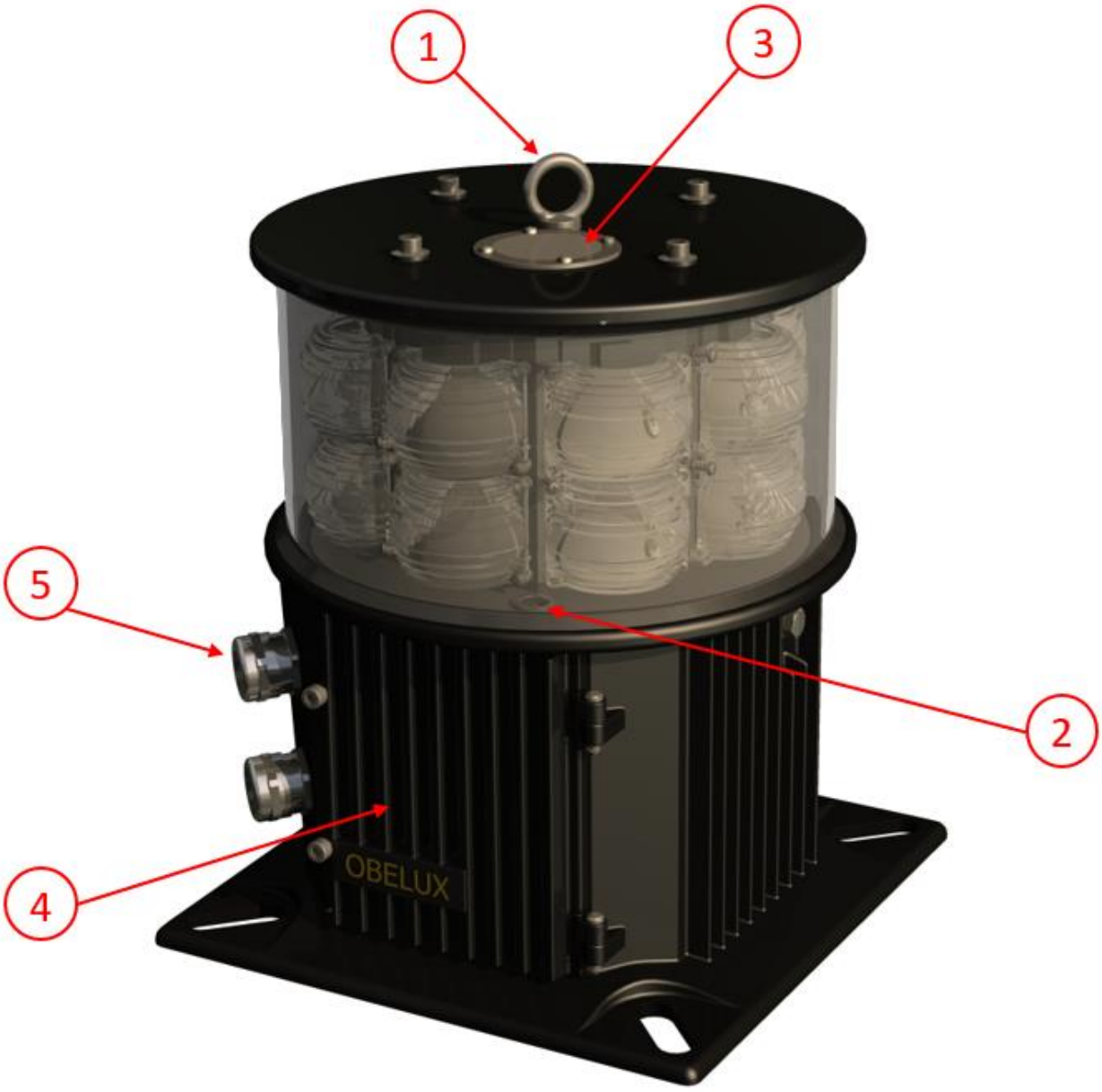


Figure 1: Main functional parts of light head

1. Lug (for lifting the light)
2. Spirit level (for levelling the light during installation)
3. Location of photocell
4. Service access door
5. Cable glands (2 M25 for 11-16 mm cable diameter)

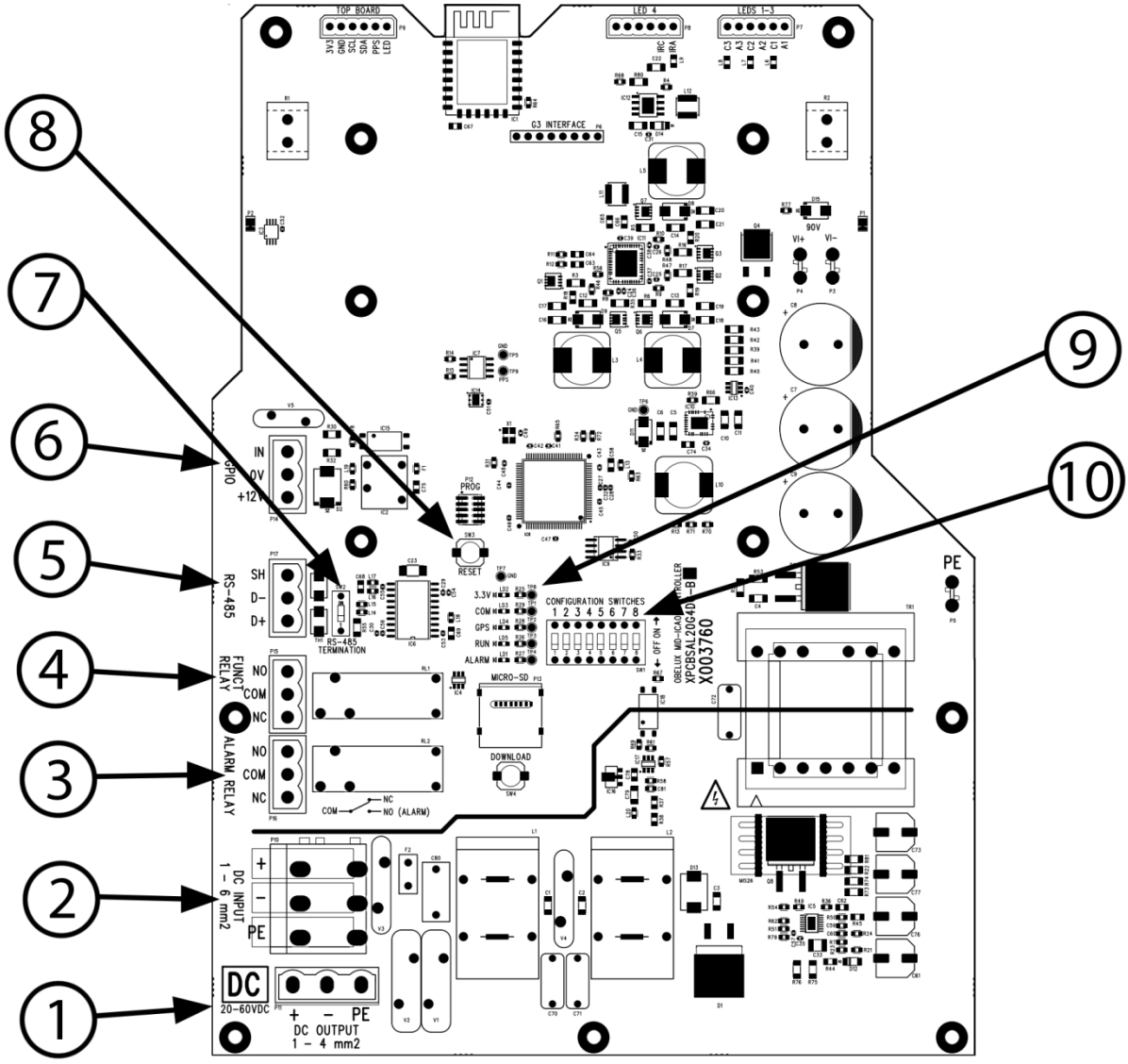


Figure 2: Controller board of light head (DC version)

1. Power output connector
2. Power input connector
3. Alarm relay connector
4. Funct relay connector
5. Communications network connector (RS-485/Modbus)
6. External signal input connector (GPIO)
7. RS-485 termination DIP switch
8. Reset button
9. Status LEDs
10. Configuration DIP switches (1-8)

2 INSTALLATION

2.1 Device installation

Mount the obstruction light to selected mounting point using quality-made fasteners. This aviation obstruction light comes with four bolt holes for secure mounting. One of the mounting points is not painted. This mounting point can be used as additional grounding. Level the light using spirit level (bubble level) if the mounting point is not already levelled. Tighten bolts & nuts. Obelux recommends 100 Nm tightening torque for M12 hot-dipped 8.8 bolts with a suitable washer between the bolts and mounting plate. When the service access door is open, check that there is no inflow of water (incl. hail and snow) into aviation obstacle light. Photocell is located on top of the light. Photocell should have an uninterrupted view of the sky to work correctly. Do not scratch painted surfaces or dent the chassis during installation. Remove glass protecting cover after installation.

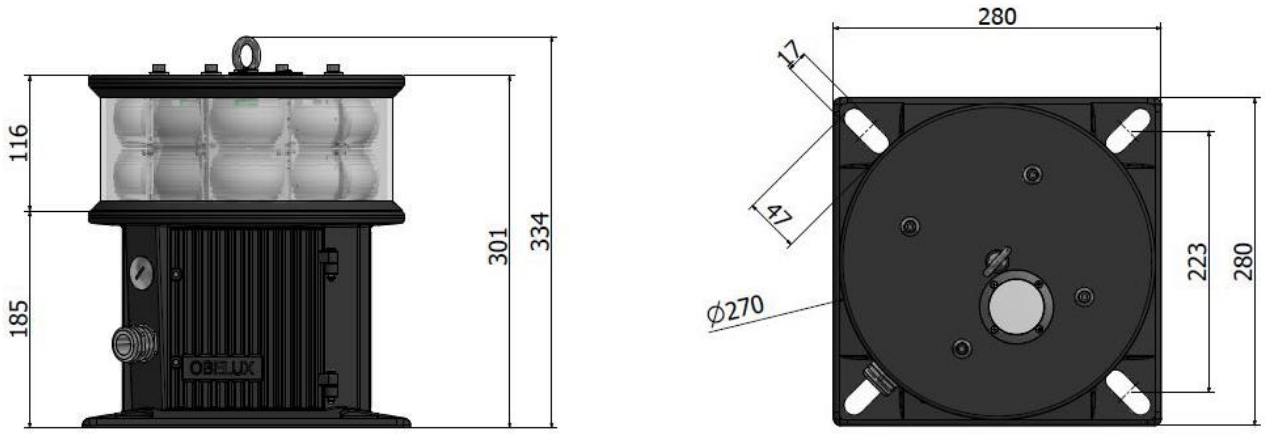


Figure 3: Dimensions in millimetres

2.2 Wiring

Route cables using cable glands on the side of the light head. Connect the cable wires securely to appropriate terminal block connectors. Connectors can be disconnected from the terminals on the main circuit board for easier access. Make sure that all unused glands or gland holes are sealed.

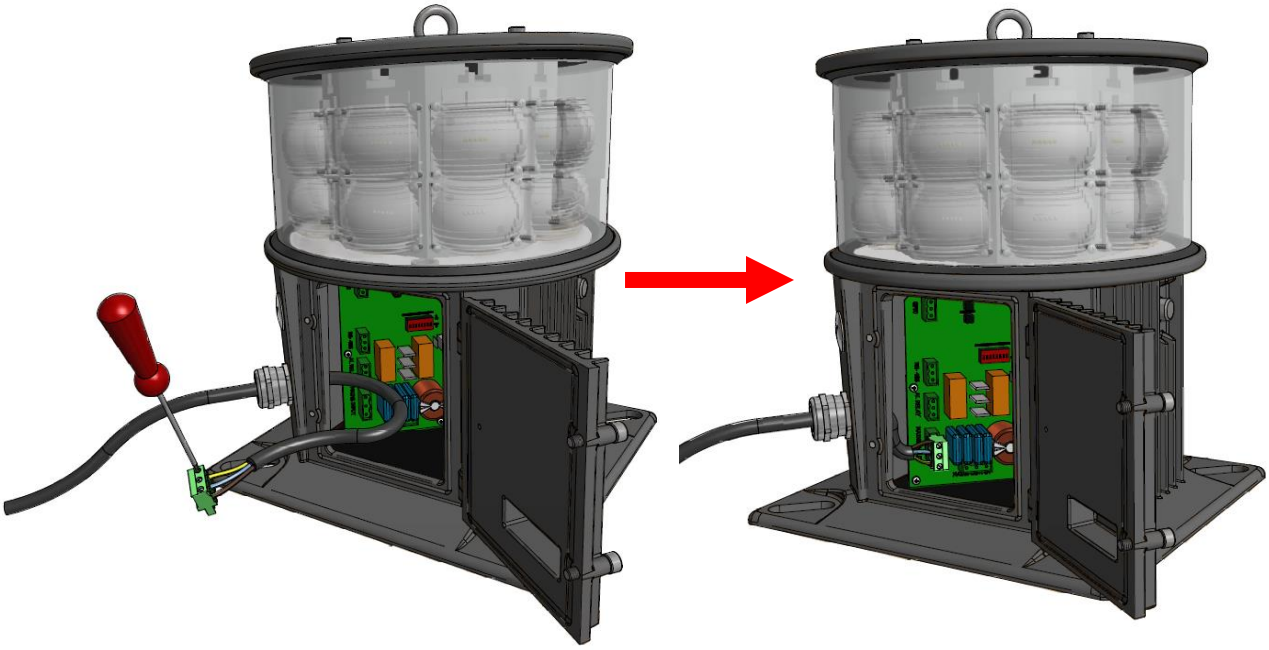


Figure 4: Routing cable through cable gland

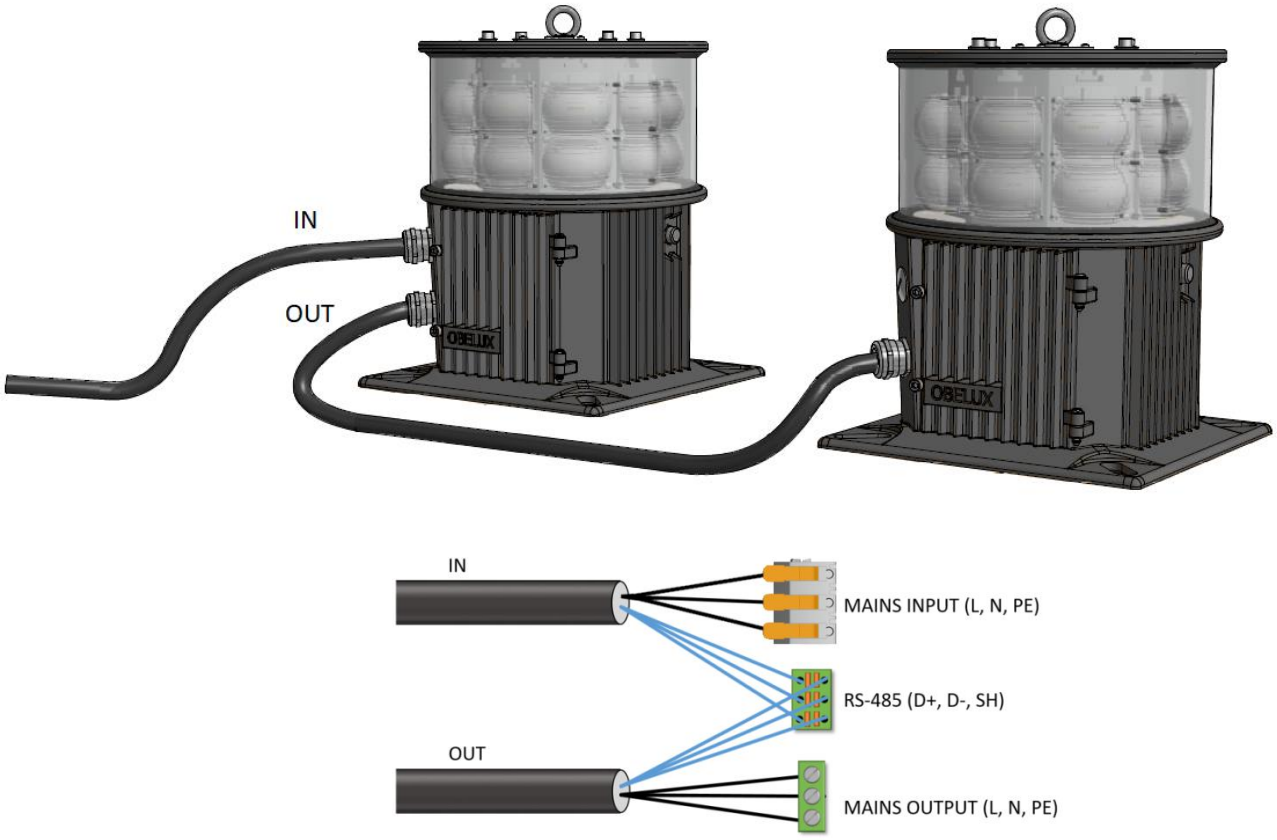


Figure 5: Distributing power and data to next light head

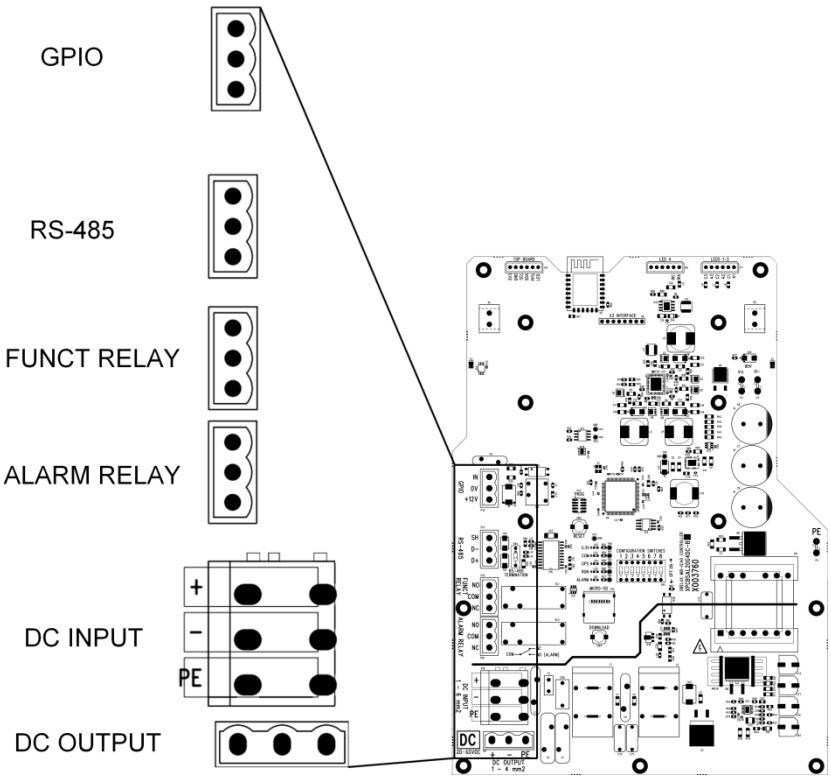
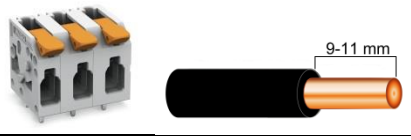


Figure 6: Controller board terminals (DC version)

2.2.1 Mains input (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.

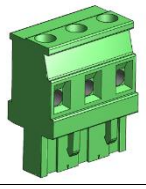
Use a single-phase power supply with Protective Earth. Make sure the mains power supply is powered off before starting the installation process.

Operating voltage	100-240VAC 50-60 Hz
Conductor cross-section	1mm² - 6mm² (18-10 AWG)
Recommended conductor size	2.5mm² (14 AWG)
Connector, Wago Push-in CAGE CLAMP® type	

2.2.2 Mains output (AC versions)

Mark	Description	Information
L	Live terminal	Bridged connection to Mains input L
N	Neutral terminal	Bridged connection to Mains input N
PE	Protective earth	Bridged connection to Mains input PE

This terminal is used to distribute power from the light head to the next light head. Secure the wires using a flat-head screwdriver.

Conductor cross-section	1mm² - 4mm² (18-12 AWG)
Connector	

2.2.3 DC input (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.
PE	Protective earth	Connect the power supply ground wire into this pole.

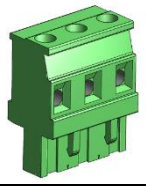
The connector is Wago Push-in CAGE CLAMP® type.

Operating voltage	20-60VDC
Conductor cross-section	1mm² - 6mm² (18-10 AWG)
Recommended conductor size	2.5mm² (14 AWG)
Connector, Wago Push-in CAGE CLAMP® type	

2.2.4 DC output (DC versions)

Mark	Description	Information
+	Positive	Bridged connection to DC input +
-	Negative	Bridged connection to DC input -
PE	Protective earth	Bridged connection to DC input PE

This terminal is used to distribute power from the light head to the next light head. Tighten the connector screws using flat-head screwdriver.

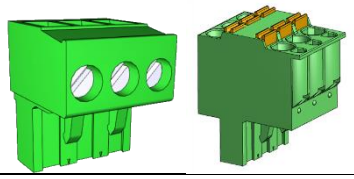
Conductor cross-section	1mm² - 4mm² (18-12 AWG)
Connector	

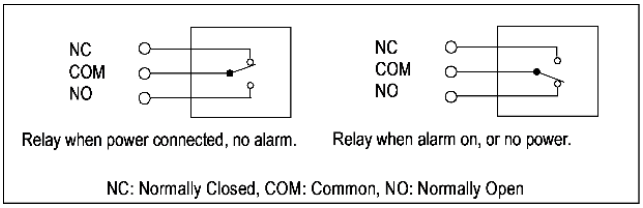
2.2.5 Alarm Relay / Funct Relay

Mark	Description	Information
NO	Normally Open	In alarm, connected with COM
COM	Common	Common relay contact
NC	Normally Connected	During normal operations, connected with COM

Unused alarm relay connectors can be left floating, i.e. no wiring there is required. Funct relay monitors the Alarm relay and alarms if the Alarm relay has a malfunction.

Conductor cross-section	0.2mm² - 2.5mm² (24-14 AWG)
Relay ratings	250VAC, 8A

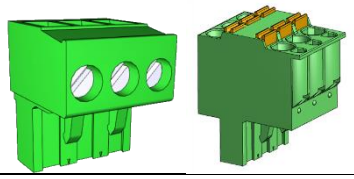
Connectors	



2.2.6 RS-485 input/output

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

The RS-485 network input/output. Unused Modbus connectors can be left floating, i.e. no wiring there is required.

Conductor cross-section	0.2mm² - 2.5mm² (24-14 AWG)
Recommended conductor size	0.75mm² - 1,5mm² (20-16AWG) or CAT cable
Connectors	

3 OPERATION

Open the two bolts that secure the service access door to the chassis using a 5 mm hex key. Using the DIP switches, configure the desired parameters into the light. 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 Stand-alone and Modbus operating modes. Light reset is needed when changing between the modes. Configuration change becomes effective within few seconds.

Stand-alone mode: In this mode, the light operation is configured with 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 it to acquire a GPS lock.

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

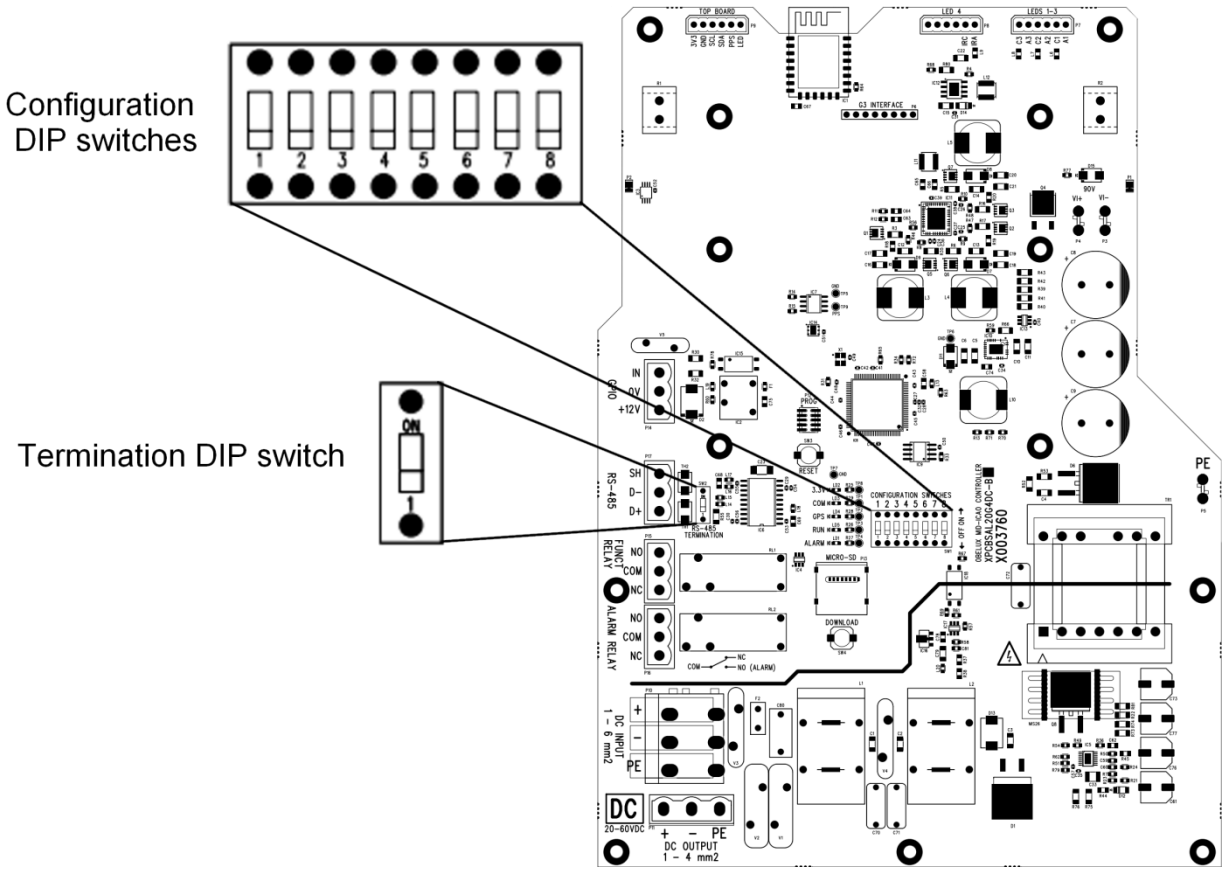


Figure 7: Location of the DIP switches

3.1 Stand-alone mode

The light is in stand-alone mode when DIP switch 8 is off.

DIP switch 8	Operation mode
off	Stand-alone
on	Modbus

Flashing mode of the light is selected with DIPs 1-3. All lights don´t have infrared light included. Using IR configuration in a non-IR light will give an unnecessary alarm. Flash pulse length is fixed to 200 ms. Photocell light limit for the day mode is 1600 lux and 157 lux for the night mode.

DIP switch			Light Type (MID ICAO)	
1	2	3	Day / Twilight	Night
off	off	off	20,000cd white (flashing)	2,000cd white (flashing)
on	off	off	Not used	Not used
off	on	off	20,000cd white (flashing)	2,000cd white and infrared (flashing)
on	on	off	Not used	Not used
off	off	on	20,000cd white (flashing)	2,000cd red (flashing, 200 ms)
on	off	on	20,000cd white (flashing)	2,000cd red and infrared (flashing, 200 ms)
off	on	on	Reserved (if selected, the light will be OFF)	
on	on	on	Reserved (if selected, the light will be OFF)	

Flashing rate (FPM) 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

Night mode operation is configured with DIP 6.

DIP switch 6	Night mode operation
off	Red and infrared LEDs flash at selected flash rate
on	Red and infrared LEDs in steady-burning mode

Using DIP switch 7, the obstruction light can be set to operate as a master in a light network. Only one obstruction light shall be the master in a network domain. Master unit broadcasts time and illumination data to slave units. Time is typically received from GPS and illumination information comes from photocell. If the information flow from master unit to slave units is interrupted, the slave units will use local photocell setting and local clock in their operations. As data flow resumes, the slaves automatically synchronise themselves with the master unit.

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

RS-485 bus should be terminated with on-board 120 ohm resistors on both ends of the bus. Turn on DIP4 from the termination DIP switches. Location of the termination DIP switches can be seen in Figure 7.

3.2 Modbus mode

Light is in Modbus mode when the DIP switch 8 is on. The light is being controlled with an Obelux controller.

DIP switch 8	Operation mode
off	Stand-alone
on	Modbus

Configuration DIP switches 1-4 are used to give the light 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 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 on both ends of this communications bus. Turn on DIP4 on from the termination DIP switches. Location of the termination DIP switches can be seen in Figure 7.

3.3 Test mode

To enter test mode, turn off the power and set DIP7 and DIP8 on. The light will enter test mode when power is turned on. To leave test mode, turn off the power. Then set back the normal settings. When power is turned on again, the light returns to normal operation.

DIP switch		Test mode
7	8	
on	on	Test mode enabled.

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

DIP switch		Light mode
1	2	
off	off	Accelerated photocell light behavior
on	off	WHITE light only
off	on	RED light only
on	on	IR light only
off	off	WROT mode (overrides all FPM except steady)

DIP3 will force all RED and IR light modes to function with WROT flash sequence.

DIP switch	WROT mode
3	
off	WROT mode off
on	WROT mode on (overrides all FPM except steady)

Flashing rate (FPM) 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 with using DIP 6 and DIP 7. Dimming is light brightness as percentage of full power.

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

3.4 Heater operation

All models have a 60 W heater on back side of the main PCB. The heater starts working when the light internal temperature drops below 10 °C. The heater reaches 100% power when temperature drops below 5 °C and stops working after the temperature rises above 10 °C.

3.5 Causes for ALARM

The following events can cause an ALARM:

- Internal 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.

3.6 Onboard LEDs

Status indication LEDs are located on the controller board.

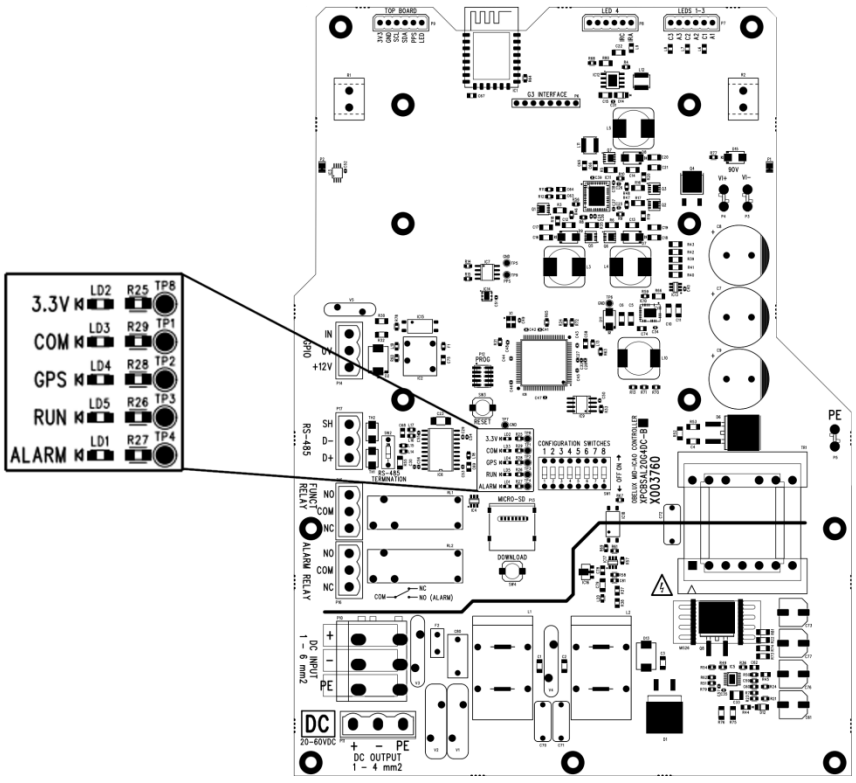


Figure 8: Location of the status LEDs

The lights have five status LEDs on the controller board. These status LEDs are visible only when service access door is open.

LED	Description
3.3V	**Internal operating voltage (GREEN)** OFF: Power off ON: Unit is powered on
COM	**Communication (GREEN)** OFF: Waiting for external signals FLASHING: Master-slave communications occurring on the network
GPS	**GPS fix (GREEN)** OFF: No GPS fix FLASHING: Light GPS module has fix on GPS place and time. Light is not yet fully synchronized. ON: Light GPS module has fully resolved the UTC time. It may take several minutes for the GPS module to receive the necessary data.
RUN	**Synchronization (GREEN)** OFF: All outputs are off ON: At least one output is active. Led is flashing at same time and frequency as the aviation light.
ALARM	**Alarm indicator (RED)** OFF: Normal operation, no alarms ON: Active alarm condition

3.7 Troubleshooting

The light doesn´t start

- No power (check that the 3.3V and 12V status LEDs are 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 (120 ohm) 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 and has no dirt.
- Check that there are no external light sources that interfere with the photocell.
- Photocell is sampled once in a minute and read value 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. Antenna needs non-blocked view to GPS satellites in orbit. After start-up, GPS receiver may take up to 30 min to obtain correct time data from GPS satellites. This operation requires data from several GPS satellites.

3.8 Spare parts

Part code	Description
SSAL20G4PSU	Main board