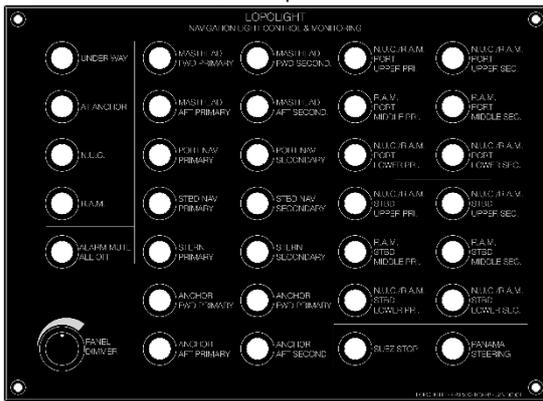


Navigation Light Controller and Control panel

Manual

Rev. 5,1
March 2020

Control panel



Navigation Light Controller (NLC)

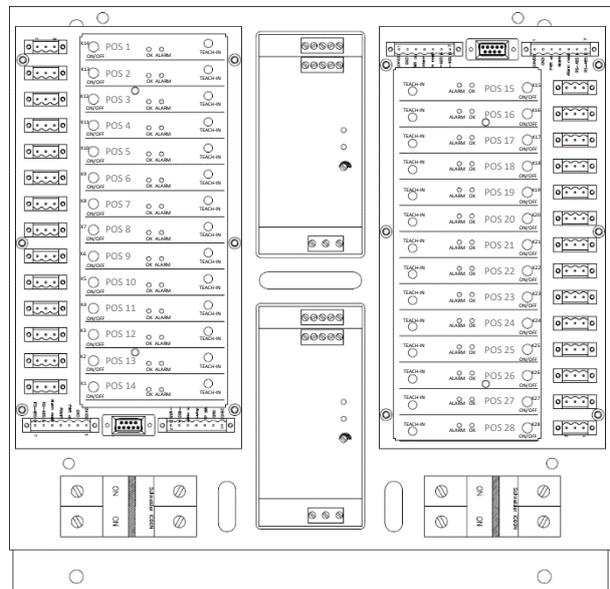


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1.0 Preface

The Lopolight Navigation Light Controller (NLC) and Control panel, described in this document, is a simple to install and simple to operate system, that can control several Lopolight navigation lights.

It is delivered without setup, which must be completed as described in sections 5 and 6 before using the system.

The modular-built system offers integrated power-supplies, monitoring and control functions and an elegant control panel. The system satisfies all required demands for a complete navigation light control installation for all types and classes of ships, meeting and exceeding relevant standards and resolutions.

The system is based on the type approved Lopolight Monitoring Relay (LMR/Q). Refer to section 2 for further information concerning approvals.

The 28-button panel is used in examples in this document as the functionality of all three versions (14, 21 and 28) is identical.

1.1 Modular Principle – up to 28 outputs.

The basic NLC controller consists of up to 14 outputs (navigation light connections), and can be extended with 14 additional outputs, totalling 28 controllable outputs. If more than 28 channels/ connections are required, multiple systems can be installed in parallel.

The panel, which is available in three standard versions containing 14, 21 and 28 buttons respectively, is delivered with customer specified texts for each button. Please refer to www.lopolight.com for ordering information.

1.2 Basic working principle

The complete system consists of two basic components;

1, The NLC

The NLC holds the LMR/Q monitoring relays, primary power-supply, secondary (emergency) power-supply, and navigation light connection terminals as well as terminals for connecting a control panel or other remote-control device.

The NLC is normally operated by a control panel (LPL P/N: 500-100) but can also be operated with a customer designed control system using RS-485 data communication.

2: The CONTROL PANEL

The control panel holds several operation buttons, group buttons, alarm and dimming features depending on the version.

The control panel and NLC are interconnected via a 10m flexible 7 wire cable which comes with the system if a panel is ordered. The cable connects to the control panel with a SUB-D9 connector, and in the NLC with either with a 7-pin terminal connector or a SUB-D9 depending on customer specifications and terminal

availability.

Multi-processor principle:

The controller holds several Lopolight Monitoring Relays (LMR/Q's), that are the basic component in the system. One LMR/Q is assigned to each individual output.

Each LMR/Q is assigned a logical address that can be controlled by a data telegram from the controller (panel or similar). The multi LMR/Q processor principle offers the highest possible degree of redundancy as every navigation light is monitored by a separate monitoring Relay.

2.0 Standards and resolutions

The system meets and exceeds the following standards, type approvals and resolutions:

Lloyds register type approval: 12/70035*
IEC-60945 / EN-60945
MSC 253(83) Annex 31
MSC 79/23/Add.2 Annex 33
IEC 62288
IEC 61162-1

*Refer to "Approvals" under <https://www.lopolight.com/NlcPanel>.

3.0 Navigation Light Controller (NLC) basic data

Installed in cabinet:

Cabinet:	Steel enclosure (Schneider-Electric: Spacial S3D)
Dimensions (WxHxD):	400*400*200mm
Mounting:	4 wall screws (not supplied with system)
Weight:	~13 kg. (full version)
Ingress protec.	IP66 (depending on selected cable entry system)
Cabinet certificates:	BV, CUL, DNV, GL, LR, UL
Colour:	RAL 7035 (Light grey)

Protective ground connection: M6 bolt connection protruding from cabinet
 Theoretical temperature rise: 25°C. above ambient @ 200W load.

Open installation (without cabinet):

Dimensions (WxHxD):	354*350*148.5mm
Mounting:	4 wall screws (not supplied with system)
Weight:	~5 kg. (full version)
Ingress protec.	None, either install in sealed compartment or in Cabinet to achieve IP rating.

Protective ground connection: M6 bolt connection on base plate
 Theoretical temperature rise: 25°C. above ambient @ 200W load.

3.1 Controller power and connections:

Inputs:

Primary power-supply, *Option A*: 100-240VAC 50/60Hz, Maximum 250W
 Primary power-supply, *Option B*: 19-32VDC, Maximum 250W
 Sec. power-supply, *Option C*: 100-240VAC 50/60Hz, Maximum 250W
 Sec. power-supply, *Option D*: 19-32VDC, Maximum 250W
 Internal circuit protection: 100-240 VAC: 6A[C], 19-32 VDC: 20A[C]
 Connections: Elevator type screw terminals: 1.5 - 6 mm²
 Isolation: Power supplies are galvanic isolated from vessel installations.

Outputs:

Number of nav. light connections: Up to 28 LMR/Q* based outputs
 Max. output voltage: 32VDC
 Max. output current: 1 Amp per output – automatic current limiter
 Fuse: One 7A on-board (LMR/Q) fuse per output. (Non-replaceable).
 Max. total output: 220W (total max. consumption must be calculated)
 HW alarm output: Max. 200 mA open collector (sink)
 HW alarm reset: Edge triggered low-going. (apply system minus to reset)
 Power supply to panel: 24 to 32VDC, max 200 mA via data plug(s)

Data communication:

Physical: RS-485: 38400, N,8,1
 Data protocol: Lopolight LMR/Q protocol (protocol code "N". refer to section 5.0)
 Data comm. interface option 1: SUB-D9 (refer to section 3.4)
 Data comm. interface option 2: 7-pin screw terminal plug (refer to section 3.4)
 Termination resistor: 120Ω in screw terminal. Normally located in NLC. Use only one per system.

Control panel:

Lopolight P/N: 500-100-XX may be used to control the outputs. The panel includes status indication and both visual and audible alarm outputs.

Number of control panels: Up to 12 panels may be connected simultaneously to the NLC.

Other control possibilities: A customer designed (computer based) control system may be used, provided it complies with the Lopolight Protocol code "N".

* LMR/Q: Type approved by Lloyds register: certificate #: 12/70035

3.2 Navigation light controller (NLC) installation guide

Placement:

The controller must be installed in a protected* environment at bridge level and is recommended to be installed on a vertical surface (wall mounted). (* refer to EN-60945 / IEC-60945 in section 8.2)

Accessibility:

The enclosure door must be reachable, and it must be possible to open it fully in order to gain access to the manual (emergency) control buttons. It must be possible to gain full access to the manual control buttons within 2 minutes.

Temperature:

Ambient temperature range: -15°C to 50°C

NB! Avoid placing the controller near other equipment that creates excessive heat.

Mechanical:

Secure to bulkhead/wall using four pcs. of min. 10mm bolts. Ensure that the bulkhead/wall is suitable of carrying a load of 13 kg – also under heavy vibration.

Power supply:

Ensure that proper cable types and dimensions are used for the power-supply/supplies. Refer to section 3.1 for details (suggested minimum cable dimensions is 2.5 mm²)

Cable entries:

Power, communication and output cables must be strain relieved externally, in accordance with “good workmanship practise” and relevant standards.

Output cable installation – internal:

Connect the individual cables to relevant output plug/terminal using appropriate ferrules to protect the wire strands.

Ensure correct polarity (**L+** = positive, **L-** = negative).

Scr. = screen/protective earth should be connected to cable screen, unless cable screens are ground connected elsewhere near the controller.

Secure plugs with screws before finishing installation.

Recommended cable dimensions: 0.5 to 2.5 mm².

Output cables:

Output cables may be connected directly to the controller. If heavy-duty ships cables are used, it may be necessary to terminate these at an external terminal bar, and then connect the external bar to the output plugs of the controller using cables or wires with a smaller dimension.

If the controller is installed in an enclosure, cables should be drawn from the gland plate (fitted at the bottom of the enclosure) at the underside of the support plate and emerge just before the dedicated connector (K1-14)

Protective ground:

Protective ground must be connected to the cabinets or base plates ground point using proper sized grounding wire or mesh. (suggested minimum: 6 mm²)

Compass safe distance: 0.5 meter (controller only).

3.3 Controller, direct control (emergency operation)

The individual Monitoring Relay (LMR/Q) outputs can be controlled manually by a simple keypress. The output will toggle between on and off at every key press.

The output can be in three states: OK, ALARM and OFF

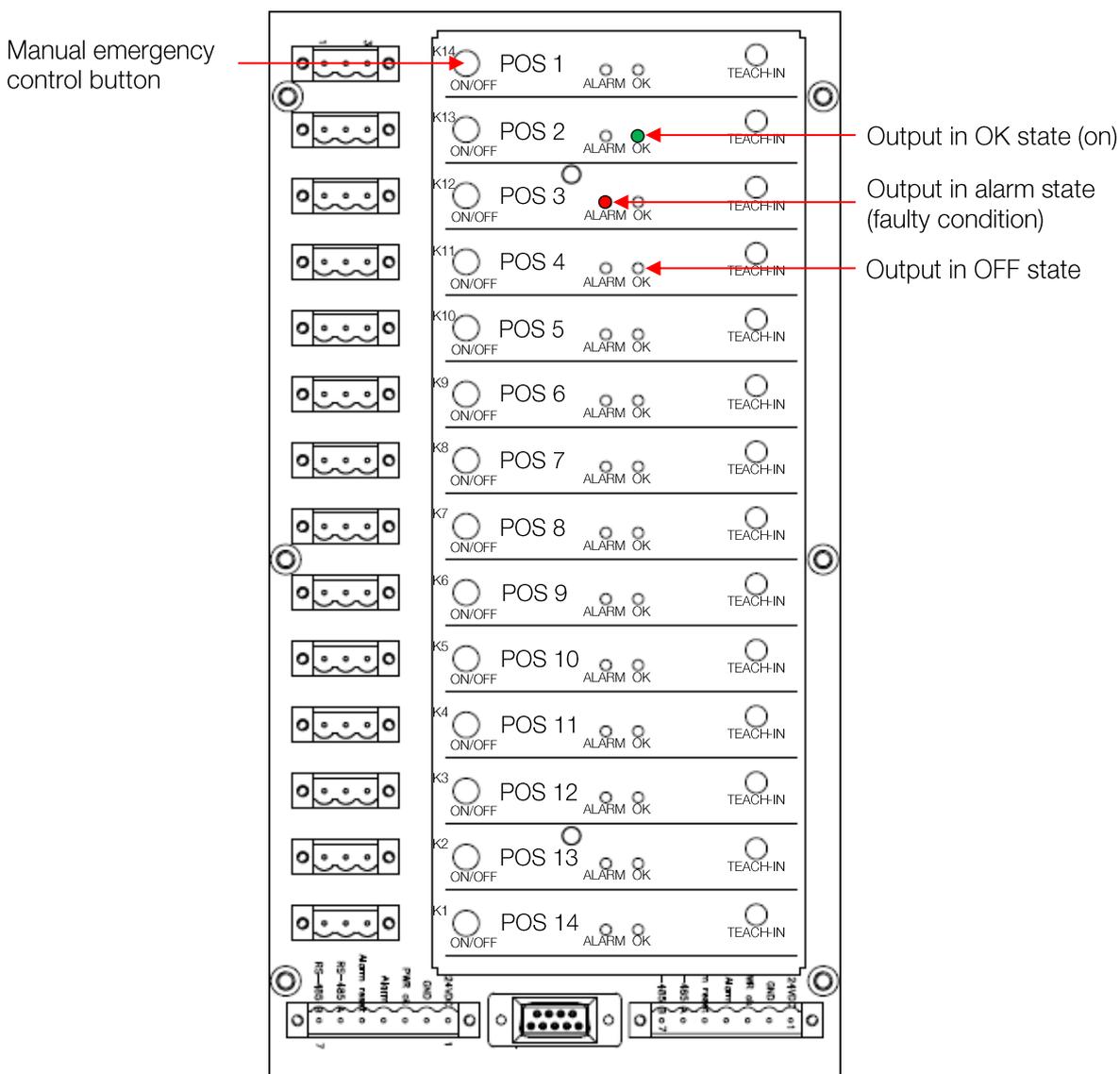
If an output is off, then the indicator will be off.

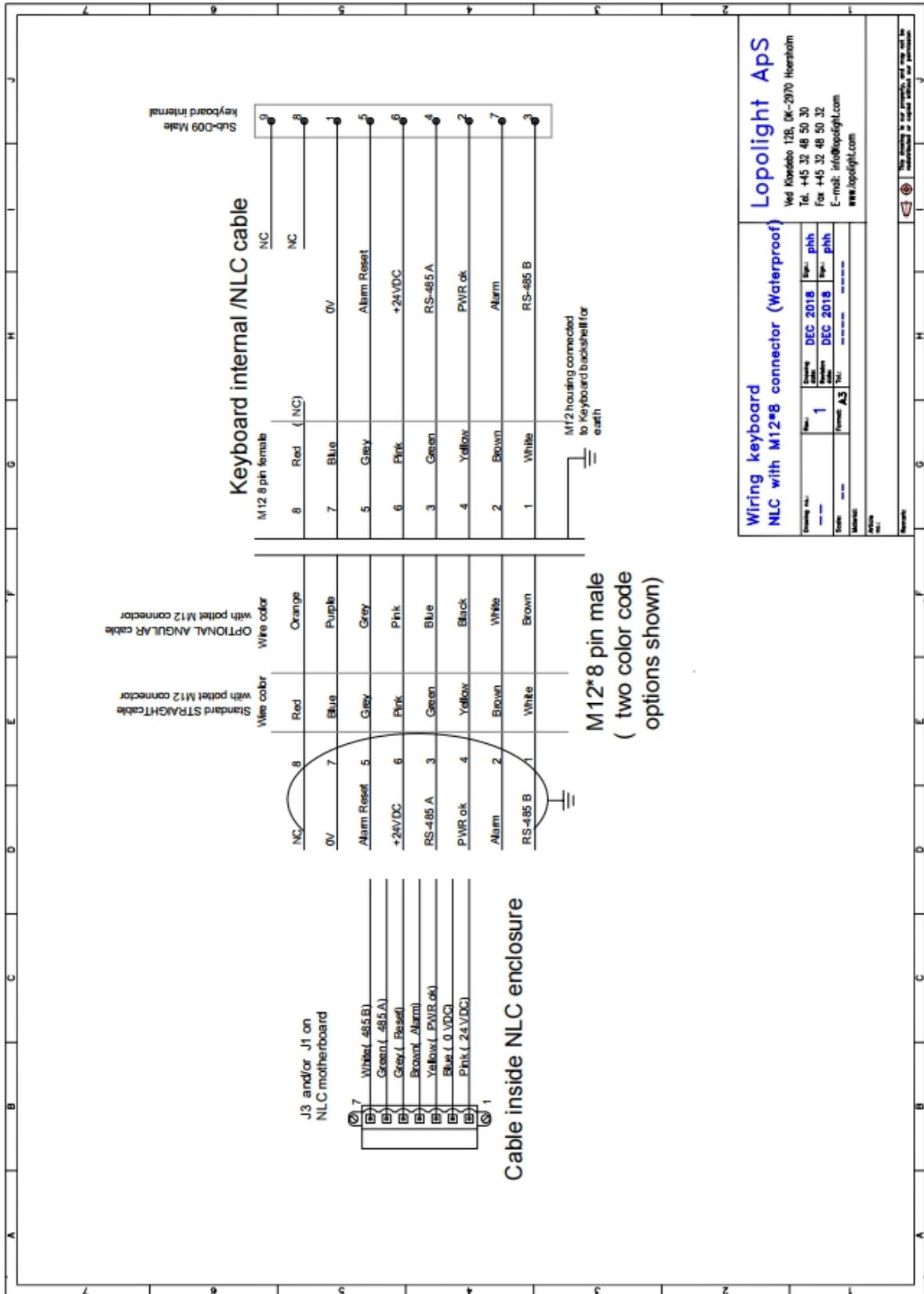
If the output is on, the green “ok” indicator will illuminate.

If the connected navigation light is faulty the red alarm indicator will illuminate.

The direct controls are independent from the control panel and are classified as “Manual Emergency Control”

(Refer to section 7.0 for full description.)





Wiring keyboard NLC with M12*8 connector (Waterproof)

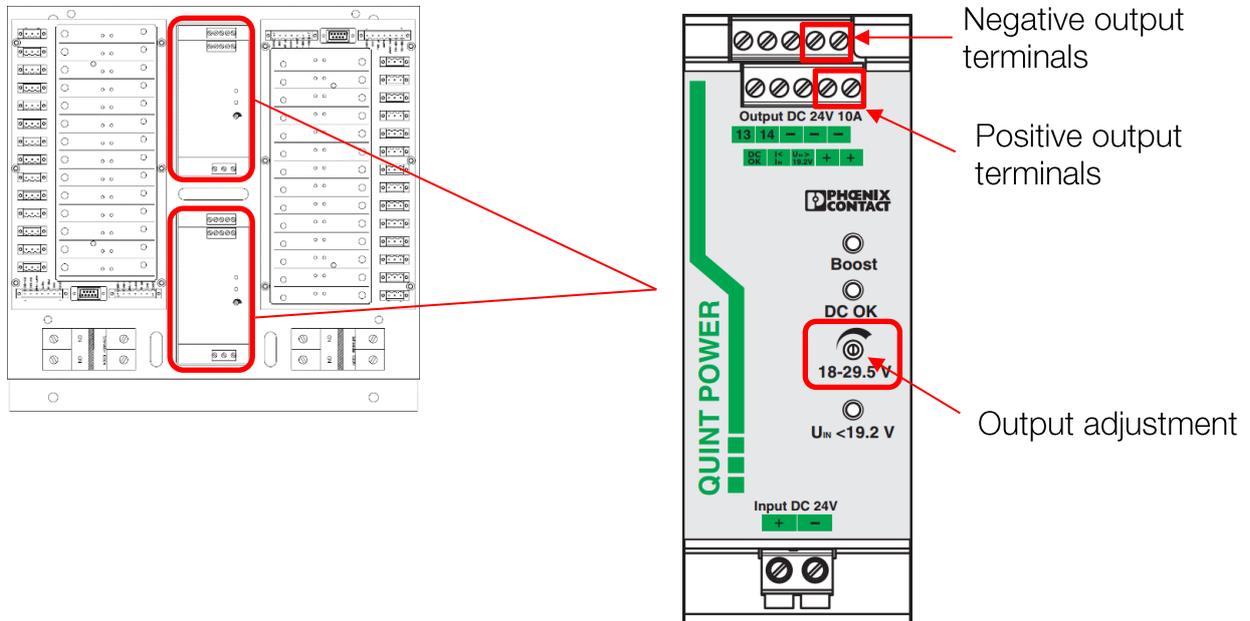
Ordering No.	1	Issue	DEC 2018	Rev.	phh
Rev.	---	Revised	DEC 2018	Rev.	phh
Material	---	Formed	A3	---	---

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3.5 Controller, service and maintenance

Adjustment of power-supplies; (only applies if redundant power-supply is fitted)

Using a digital multimeter set to DC voltage, measure across the any of the positive and negative output terminals on the power supply.



The power supply shown is a DC/DC, however the terminals and adjustment potentiometer is located in the same place on an AC/DC power supply

Adjust the power-supply in accordance with the listed outputs;

- Primary power supply output: 26.2 VDC.
- Secondary power supply output: 24.2 VDC.

LMR/Q replacement:

For replacing the LMR/Qs, please refer to the “Replacing the LMR in a Lopolight NLC” instructions.

4.0 Panel, basic data

Sizes:

The control panel comes in three (3) sizes depending on the amount of control buttons required for the individual project.

If the total number exceeds 28, a dual system will be set up and the lights divided amongst them in the most logical way unless otherwise specified.

- A) 1-14 lights, 180 x 205 x 40mm, panel cut-out: 150 x 175mm
- B) 15-21 lights, 230 x 205 x 40mm, panel cut-out: 200 x 175mm
- C) 22-28 lights, 280 x 205 x 40 mm, panel cut-out: 250 x 175mm
- D) 1-21 lights (waterproof), 250 x 225 x 43,4mm, panel cut-out: 220 x 195mm

Ingress protection:

IP-56 from front but can be upgraded to IP67 is required. Panel must be sealed along the edges towards the waterproof console if installed in a wet environment.

The waterproof panel is rated as IP-68.

The control panel consists of:

- A waterproof aluminium base plate with laser engraved customer specific texts for each button.
- Navigation light control buttons, including dimmable status indicators.
- Four programmable function buttons.
- One control panel indicator dimmer dial.
- One alarm reset button with dimmable alarm status indicator.
- One buzzer for audible alarms.

Power-supply:

The control panel is powered by the NLC via the SUB-D9 male (Com 1).

Interfaces:

COM 1, Male SUB-D9;

Usage: Connection to Navigation light Controller only (RS485, 38400,N,8,1)

Pinout:

- 1: GND
- 2: PWR-ok*
- 3: RS-485 B
- 4: RS-485 A
- 5: Alarm reset**
- 6: +24V
- 7: Alarm***
- 8: NC
- 9: NC

* PWR ok: signal is low when both primary and secondary PSUs are working properly

** Alarm reset: Pull down to system GND to reset audible alarm

*** Alarm: Signal pulls down to system GND when in alarm state. Max sink: 200mA

COM 2: Female SUB-D9;

Usage: NMEA-0183 (RS-232, 4800, n,8,1) connection to VDR, AMS and other auxiliary equipment in accordance with IEC-61162.

Pinout:

- 1: NC
- 2: NC
- 3: NC
- 4: NC
- 5: GND
- 6: NC
- 7: RS232 Rx
- 8: RS232 Tx
- 9: NC

M12 connector (waterproof panel);

Usage: Connection to Navigation light Controller only (RS485, 38400,N,8,1)

Pinout:

- 1: RS-485 B
- 2: Alarm***
- 3: RS-485 A
- 4: PWR ok*
- 5: Alarm reset**
- 6: +24V
- 7: GND
- 8: NC

* PWR ok: signal is low when both primary and secondary PSUs are working properly

** Alarm reset: Pull down to system GND to reset audible alarm

*** Alarm: Signal pulls down to system GND when in alarm state. Max sink: 200mA

Protective ground:

M3 bolt at rear of panel, marked with earth sign.

Recommended grounding cable dimension: 2.5 mm²

Waterproof panel: M4 bolt at rear of panel, marked with earth sign.

Working principle:

When a button is pressed, it is interpreted and converted into a RS-485 telegram using either the "N" or "P" protocol and sent on the Com port(s).

The telegram can control four Lopolight products:

- 1: Lopolight NLC (described in this manual)
- 2: LMR (free-standing monitoring relay P/N: 400-018)
- 3: Equipment based on the Lopolight NPC driver (nav. lights with integrated RS-485 com ports. Typically used on navy and SAR vessels)
- 4: Equipment based on the Lopolight MTG driver (High power LED driver)

4.1 Panel, installation guideline

Make an appropriate rectangular cut-out in the console. De-burr sharp edges

Type A, ≤14 lights: 155*180mm +/- 2.5mm

Type B, 15 – 21 lights: 205*180mm +/- 2.5mm

Type C, 22 – 28 lights: 255*180mm +/- 2.5mm

Position the panel in the cut-out and align as needed.

Mark the four holes for mounting the panel, remove the panel, and drill.

The holes may be threaded to M4, else use appropriate nuts.

Bolts should be DIN 912, as these will seat neatly into the countersink in the panel front.

Protective Ground must be connected to ground-point located at the back of panel. It is recommended to use star washer under a ring terminal to ensure proper GND connection.

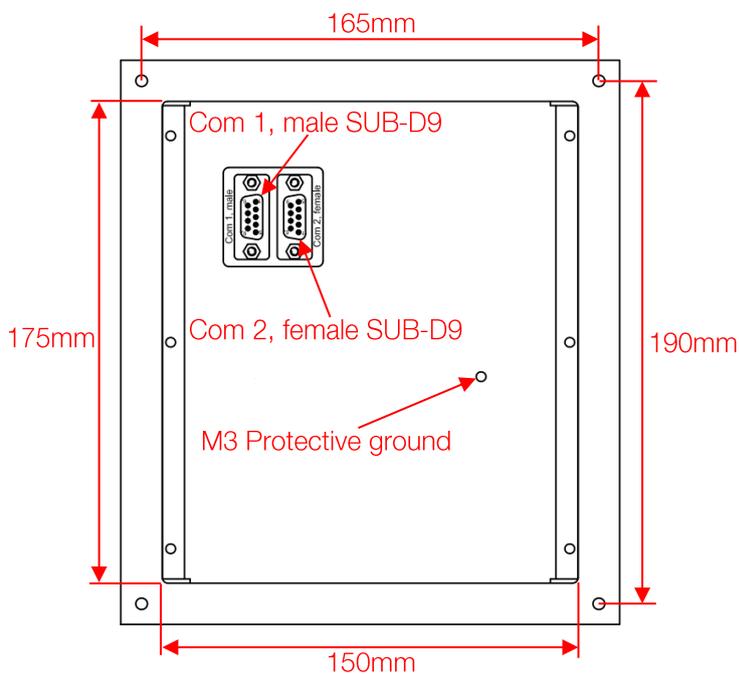
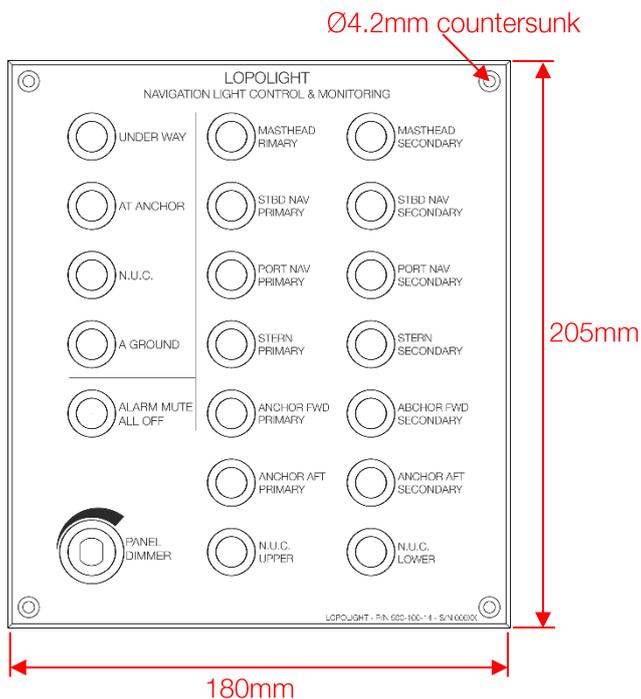
Connect the SUB-D9 connector of the interconnection cable to COM-1 and fasten the screws to ensure proper connectivity.

Connect the free end to the NLCs J1 or J3.

Screen must be connected to the GND rail in the NLC.

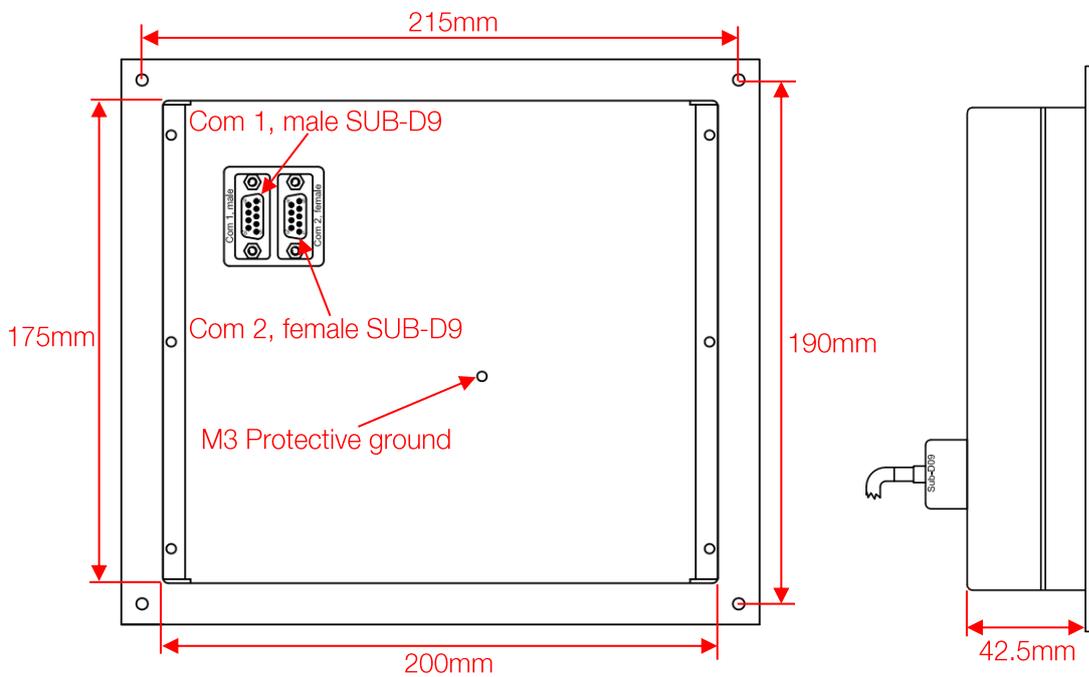
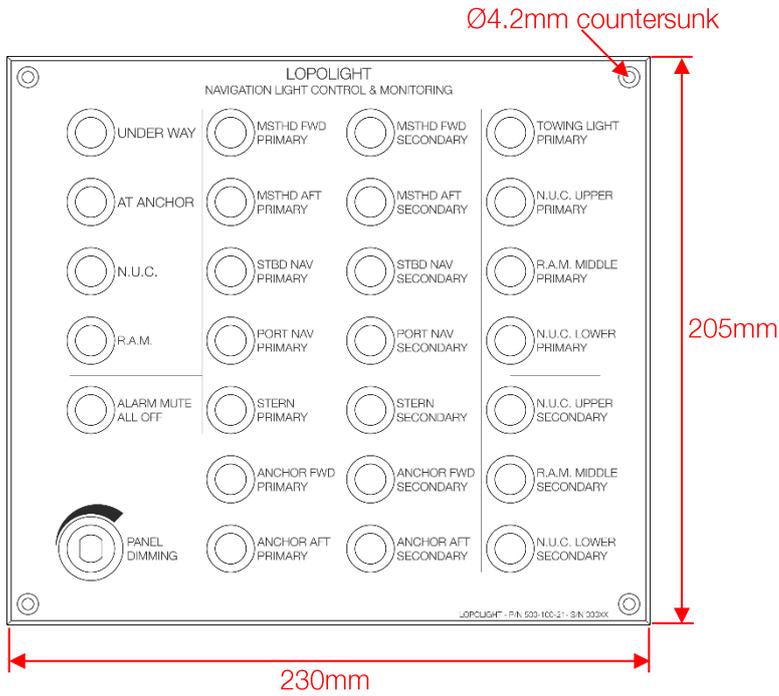
If two panels are connected they must be connected J1 or J3 in the NLC in parallel.

Type A, ≤14 lights



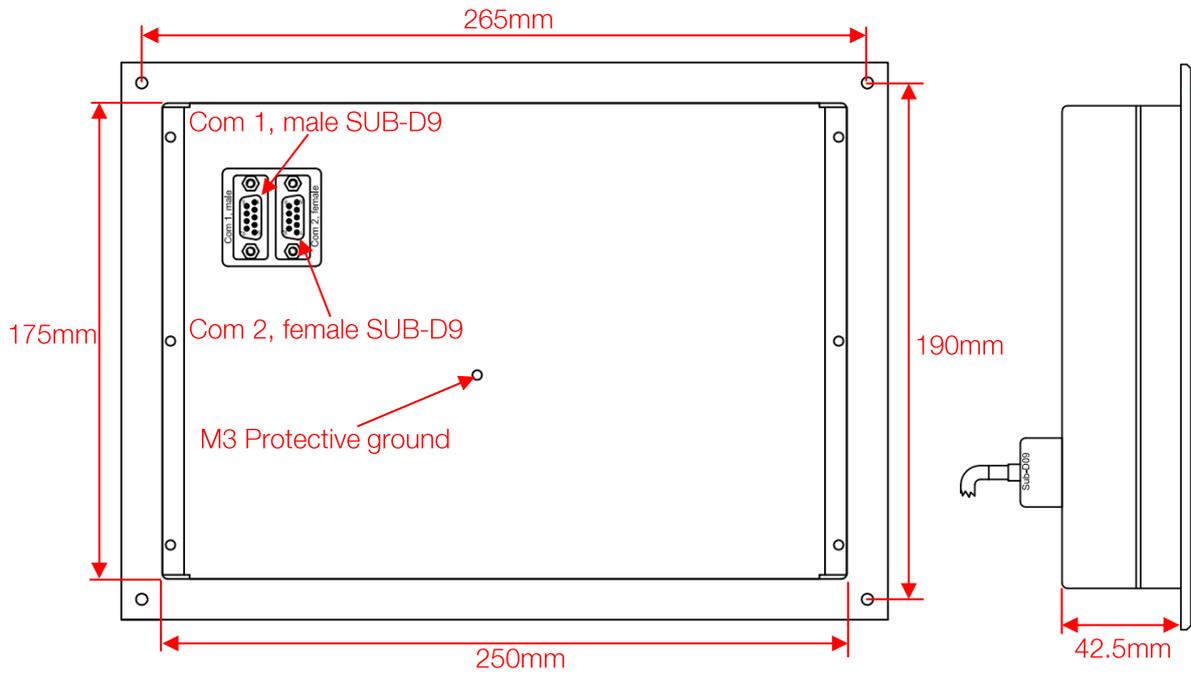
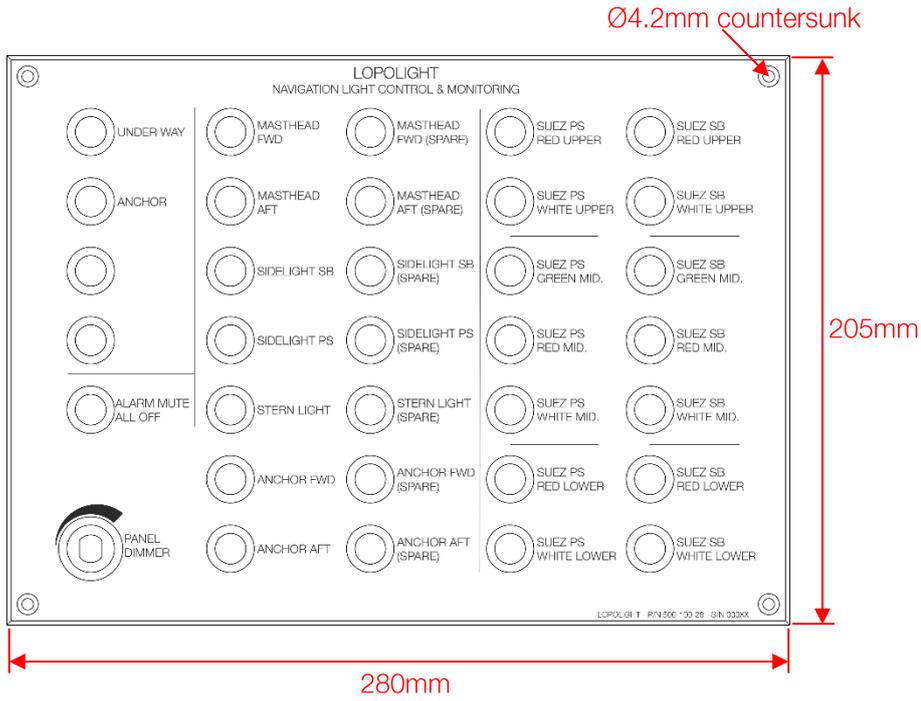
Recommended cut-out dimension: (HxW) 180 x 155 mm

Type B – 15 - 21 lights



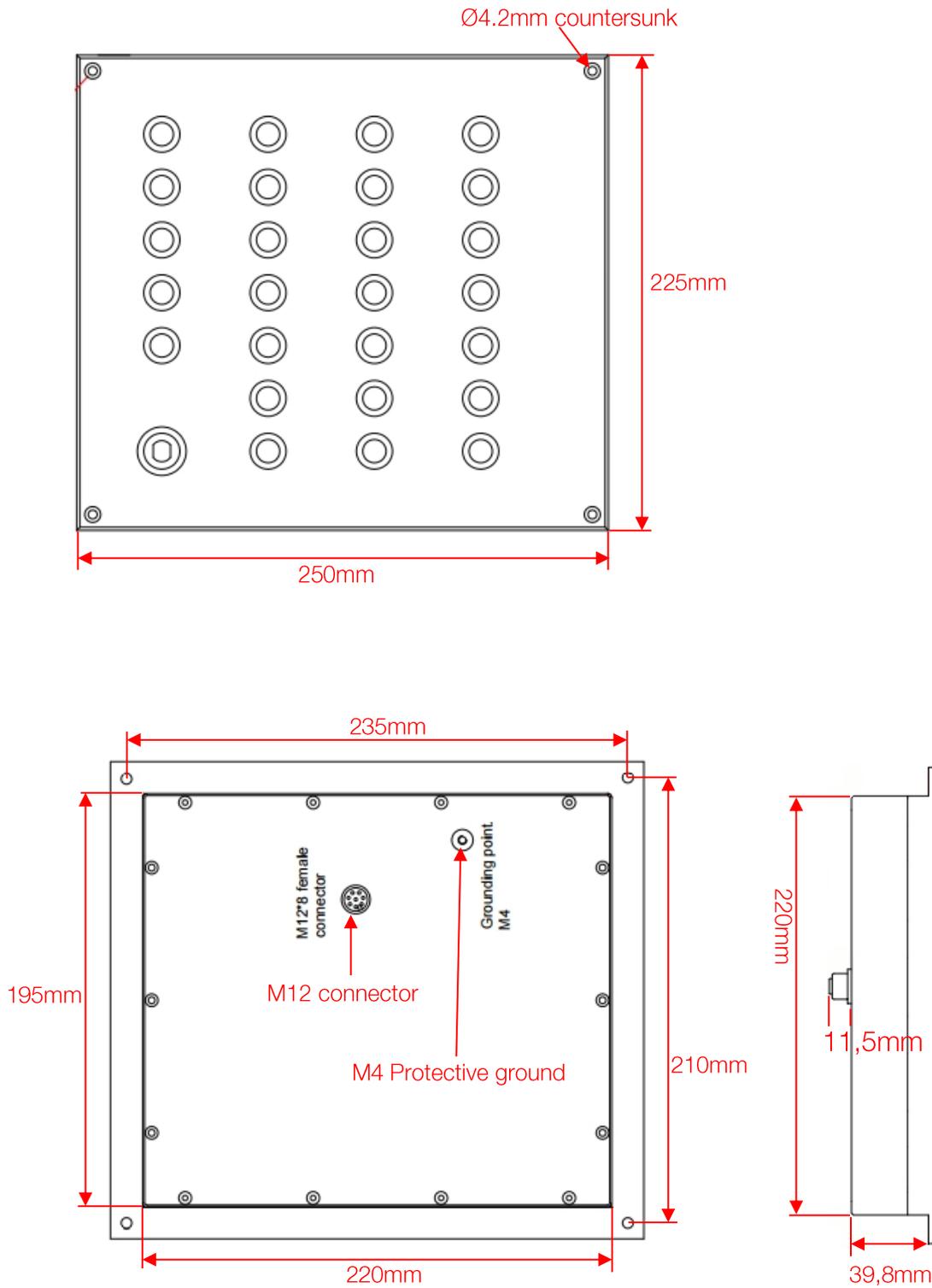
Recommended cut-out dimension: (HxW) 180 x 205 mm

Type C – 22 - 28 lights



Recommended cut-out dimension: (HxW) 180 x 255 mm

Type D (waterproof) – 1 - 21 lights



Recommended cut-out dimension: (HxW) 220 x 195 mm

5.0 Initial installation and set-up.

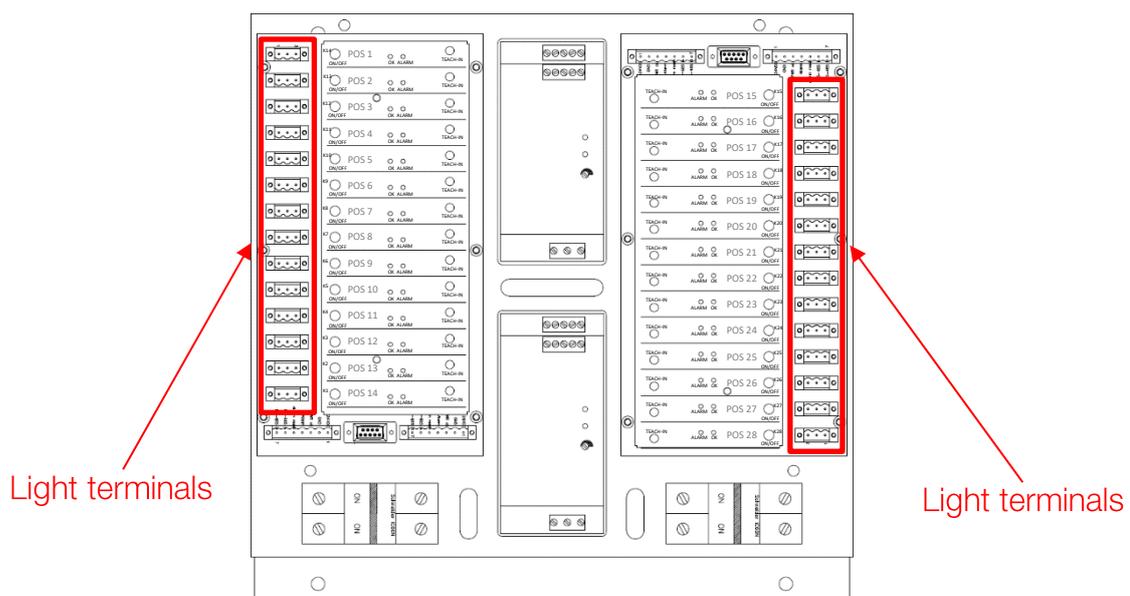
Protective ground connections - general guidelines:

The NLC must be connected to ships protective ground (hull) via the external grounding point, marked PE. Use the M6 terminal and appropriate lock washers to ensure good connectivity even under challenging circumstances.

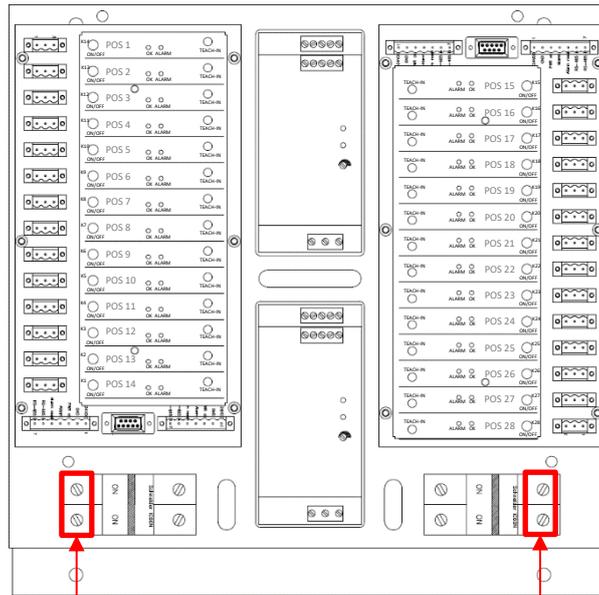
If the feed wires to the individual navigation lights are of a screened type, then the screens must be connected to a PE point. This can be accomplished by using the middle pin on the 3-pin connector(s) for the lights or connecting to a PE point outside of the enclosure. It is permitted not to use un-screened cables the last ~2 meters before the enclosure.

Hardware connections, NLC:

- 1) Make sure the two circuit breakers are open.
- 2) Connect the individual navigation lights to the NLC light terminals located along the right hand and left-hand side of the NLC.



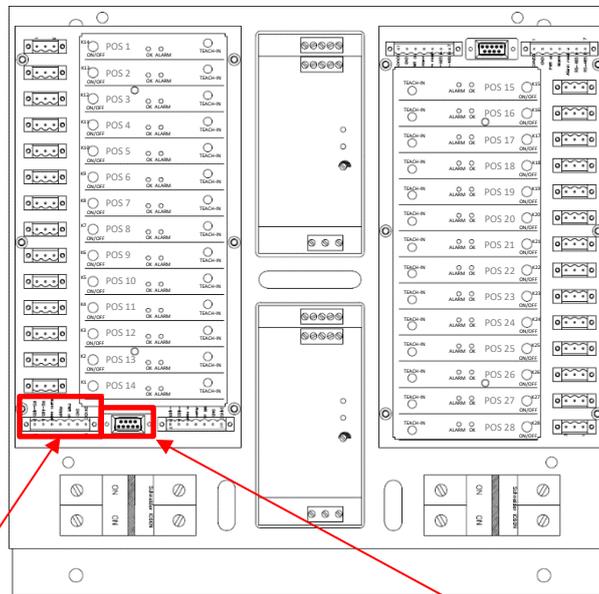
3) Connect primary and secondary power to the NLC.



Primary power input terminals

Secondary/Emergency power input terminals

4) Connect the cable from the control panel to either J1 or J2 in the NLC.
Lead colours and connections can be seen on the schematics on page 11 in this document.



J1 – 7-pin terminal

J2 – 9-pin Sub-D female connector

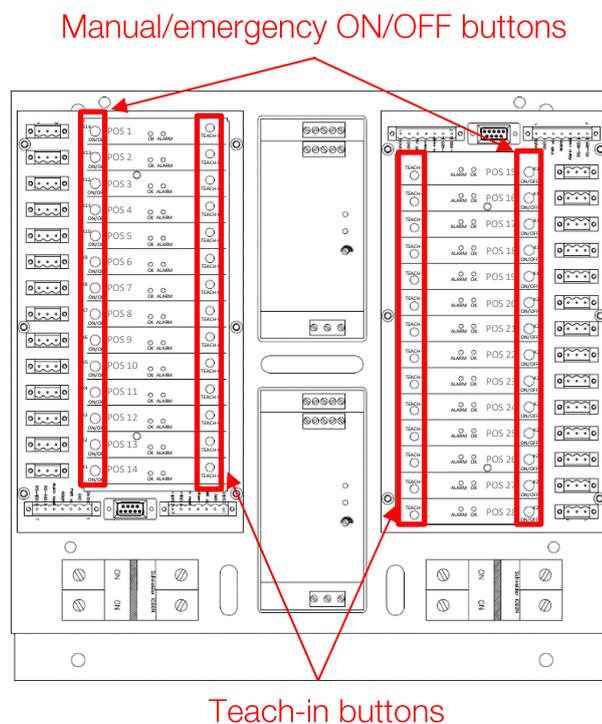
- 5) Turn on system by closing the circuit-breakers. (Alarm will sound now. Can be silenced by pressing Alarm reset button on panel)
- 6) The system is now ready to be set-up.

5.1 Teach-in procedure:

Every LMR/Q must learn the individual characteristics of the light connected in order for the monitoring to be accurate and avoiding false alarms.

- 1) The Teach-in process makes sure that present consumption (in Watts) is stored in the local memory of the LMR/Q for monitoring purposes.
- 2) Turn off all lights, using the individual control buttons.
- 3) Turn on the light connected to POS1 either using the control panel or the manual/emergency button located on the LMR/Q.
- 4) Activate the teach-in switch for POS1. (Insert a 2mm plastic pin or another non-conductive item and pry carefully to activate the switch. The alarm LED will turn off and the OK LED will light up.)

If activating the teach-in button proves troublesome, it may help if the LMR cover is removed to ease the access to the teach-in buttons.



- 5) Turn off the light connected to POS1.
- 6) Repeat step 2 through 5 for all installed positions.

6.0 Programming the panel

The panel can be programmed with various features depending on the needs of the installation.

- a) Panel number: The panel can be programmed as number 1 or 2, this is mostly used in systems containing more than 28 lights and an external control which needs to control the individual lights, or register which light was controlled.
- b) Pairing: Two (2) keys in the panel can be paired in an either-or configuration which is commonly used for primary and secondary lights of the same physical position. When two lights have been paired only one can be switched on at any given time, however if the light being switched on fails, the alternate light will automatically be switched on instead. An alarm will still sound, and a visual indicator will show which light failed.
- c) Grouping: A number of lights can be assigned to a group with a group key being assigned. This feature is normally used to combine different quick sets of lights, for example the masthead, port and starboard sidelights as well as stern light could be switched on at the same time with a group button indicating the vessel is "Under way". The same feature can be used to show any variety of signals the vessel is capable of, such as "Not under command", "Restricted ability to manoeuvre", "At anchor", "Fishing", "Trawling" etc. The only limit is the amount of lights connected to the NLC (Maximum 28) as the group feature does not work across panels.
- d) Monitoring or relay: The monitoring function in the LMR/Qs can be disabled and enabled using the control panel. This feature is commonly used on strobe lights as the flashing will cause the measured effect used by the light to fluctuate and thus create false alarms in the system.

Panel number configuration procedure:

To configure the panel as #1, press and hold keys 1 through 4 for approximately 20 seconds.

To configure the panel as #2, press and hold keys 5 through 8 for approximately 20 seconds.

The panel number can be verified by reading status messages on an external device such as a PC.

All groups and pairing is removed when setting the panel number, these must then be re-applied manually afterwards.

Pairing procedure:

Press the two keys to be paired simultaneously for 10 seconds. They will both light up and switch off when the pairing is successful.

To de-pair, press two already paired keys simultaneously for 10 seconds.

Grouping procedure:

Turn on the lights that should be grouped.

Press the desired “Group key” and the key marked “Alarm reset / All off” simultaneously for 10 seconds.

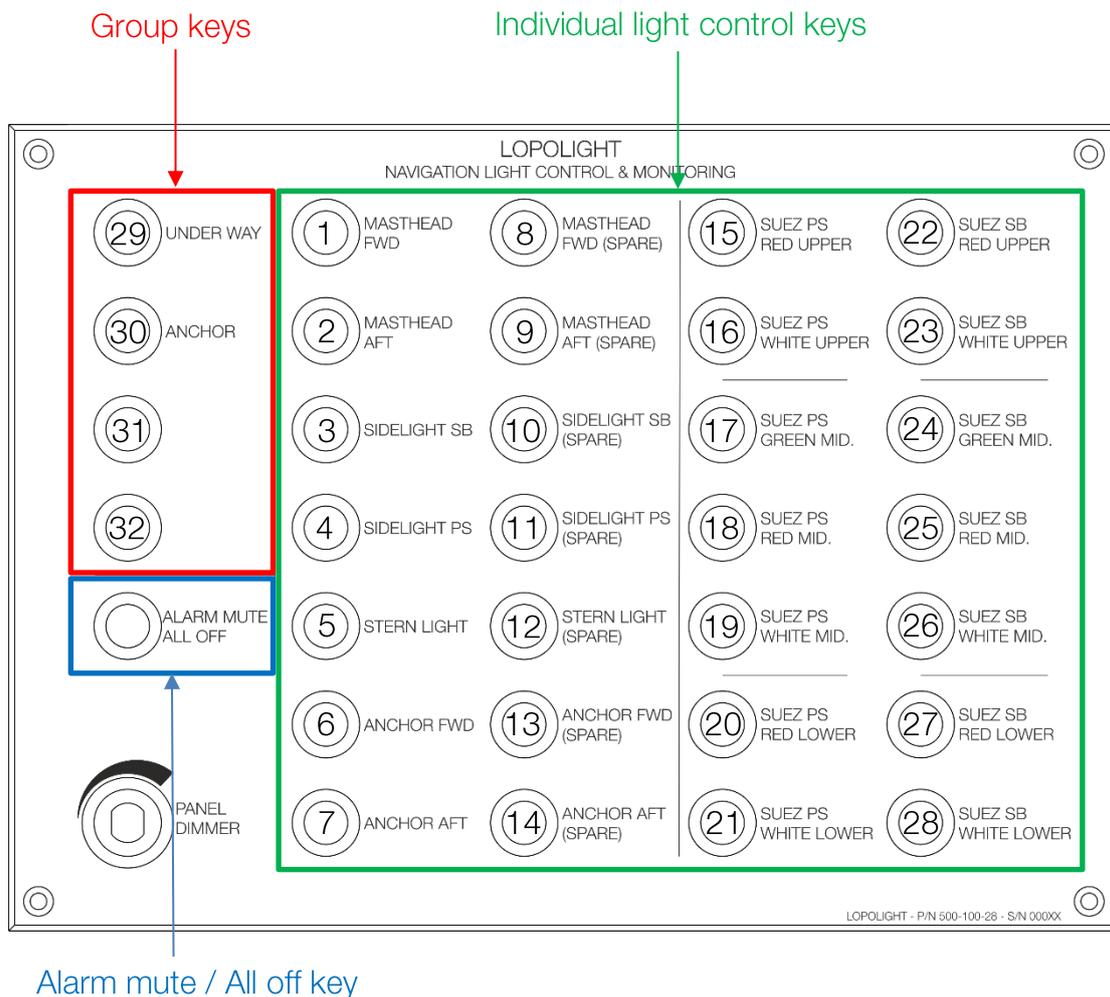
To de-group: Activate the group key and press and hold the group key and the key marked “alarm reset / all off” simultaneously for 10 seconds.

Disabling monitoring of a light:

To disable the monitoring of a light, press and hold the button for the light for 15 seconds.

To re-enable the monitoring, press and hold the button again for 15 seconds.

The below image shows the keys and their addresses on a 28 key control panel.



7.0 Manual control:

Every navigation light is connected to an individual monitoring relay (LMR/Q) in the NLC. Each LMR/Q carries a manual/Emergency control button labelled “ON/OFF”, two status LEDs (Green = ON, red = alarm). Using the manual/emergency on/off button the lights can be controlled directly from the LMR/Qs, however if a panel is connected and active, an alarm will sound as the command was not sent through the system to operate the light in question. To avoid this, simply disconnect the panel before utilizing manual control.

8.0 Test procedure

- 1, Ensure that all navigation lights are connected, and teach-in has been performed.
- 2, Switch on all individual lights using the keys on the control panel.
- 3, Check that the lights are operating as intended.
- 4, Press All Off for 5 seconds.
- 5, Check that the appropriate lights switch on.
- 6, Switch the group off using the same group button and continue to test each group until all groups has been verified.
- 7, Switch a paired light on and then activate the key for the other part of the pair, the first light should go off and the second light go on.
- 8, Switch a paired light on and then disconnect the light from the terminal in the NLC, the first light should go off and the second light go on and an alarm will sound within 15 seconds as well as a visual indicator showing which light was disconnected
- 9, Perform steps 7 and 8 for all pairs.
- 10, On systems with emergency power supply, disengage the primary circuit-breaker.
- 11, Check that an alarm is given, and all navigation lights still are active.
- 12, Engage primary circuit-breaker again.
- 13, On systems with emergency power supply, disengage the secondary circuit-breaker.
- 14, Check that an alarm is given, and all navigation lights still are active.
- 15, Engage secondary circuit-breaker again.
- 16, Press All Off for 5 seconds.
- 17, Switch the individual lights on using the manual/emergency on/off button located at the LMR/Qs, verify that the lights are switched on. An alarm will sound every time a light is switched on.
- 18, Switch the individual lights off using the manual/emergency on/off button located on the LMR/Qs, verify that the lights switch off.

If any of the above listed checks fail, contact relevant technical support.

8.1 System reset:

A system reset shall be performed when setting the system up for the first time. Normally this has been done from the factory. Main function: the panel scans for present LMR/Q's.

Press and hold key 1 through 4 simultaneously for 20 seconds for panel #1, 5 through 8 for panel #2.

When a system reset is performed all groups and pairing are removed as well and must be set up manually as described earlier in this manual.

8.2 Setting the address of the LMR/Qs:

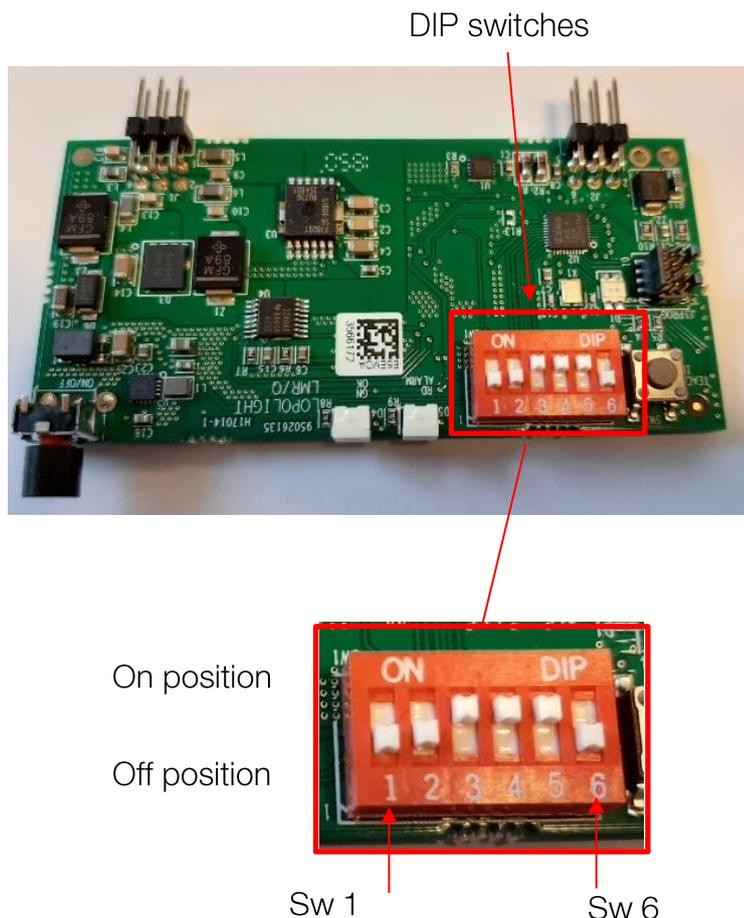
Each individual LMR/Q must be assigned an individual address used by the RS-485 network in order to respond to commands sent from either the control panel or an external device.

When a system is delivered from Lopolight, all LMR/Qs has already been set up with their corresponding addresses.

Address 1 through 28 are all legal. Whereas address 0 (zero) is NOT.

Address 29 through 32 are reserved for the group keys, but in special circumstances these can be used for individual lights if LMRs or LMR/Qs are installed for this.

The addresses are set using binary logic on the small dipswitch on the LMR/Q.



The following table shows the configuration of the LMRs for each position.

Table 1

Position	SW 1	SW 2	SW 3	SW 4	SW 5	SW 6
1	On					
2		On				
3	On	On				
4			On			
5	On		On			
6		On	On			
7	On	On	On			
8				On		
9	On			On		
10		On		On		
11	On	On		On		
12			On	On		
13	On		On	On		
14		On	On	On		
15	On	On	On	On		
16					On	
17	On				On	
18		On			On	
19	On	On			On	
20			On		On	
21	On		On		On	
22		On	On		On	
23	On	On	On		On	
24				On	On	
25	On			On	On	
26		On		On	On	
27	On	On		On	On	
28			On	On	On	

The numerical values for each bit are binary, thus giving each bit the following values for addresses;

- Sw 1 = Binary 1
- Sw 2 = Binary 2
- Sw 3 = Binary 4
- Sw 4 = Binary 8
- Sw 5 = Binary 16
- Sw 6 = Binary 32

9.0 Spare parts:

<i>Lopolight P/N:</i>	<i>Name:</i>
400-018/Q	LMR/Q
600-917	115/240 VAC power-supply
600-918	24/24 VDC power-supply
600-944	Sub-D panel/NLC connection cable, 5 meters
600-945	Sub-D panel/NLC connection cable, 10 meters
600-946	Sub-D panel/NLC connection cable, 20 meters
600-927	Circuit-breaker (20A) for 24VDC
600-928	Circuit-breaker (6A) for 115/240VDC
600-930	3-pin plug for navigation light connection in NLC
900-733	Ground strap for NLC enclosure (15 cm mesh)

10.0 Using the panel

Navigation light control panel

User manual

Panel dimming: The indicators on the panel can be dimmed from 0 to 100% using the dimmer in the lower left corner of the panel. Make sure the dimming is NOT set to absolute 0 when operating the panel as this will make it too difficult to see changes in status.

Individual keys: Press to switch a light ON. Press again to switch it OFF. The light connected is active when the indicator shows a green light.

Group keys: Press the key that corresponds to the ships situation. If any navigation light in the given group is detected faulty, then the group indicator will not be lit, and alarm given. IF a faulty navigation light is paired with a secondary navigation light, and this is activated automatically by the panel, and the group indicator will remain lit. An alarm will still be given to draw attention to the defective light.

All Off / Alarm reset key:

Primary function: Press and hold this key for 6 seconds to turn all active navigation lights off.

Secondary function: Activate this key briefly to silence the acoustic alarm signal. The alarm condition will remain active, but the alarm indicator will change from flashing to steady light.

Alarms: The system responds with an alarm in the following cases;

- a) Faulty navigation light: The corresponding key and alarm reset key will flash.
- b) Faulty primary or secondary power-supply: The Alarm reset key will flash, individual indicators will remain active.
- c) No data-communication between panel and NLC: All indicators will flash.

Action in case of alarm:

Please note that these are guidelines only, and DO NOT have priority over ships procedures.

Alarm case a): Activate secondary navigation light if present. (may already have happened automatically). Notify technical officer.

Alarm case b): Notify technical officer.

Alarm case c): Navigation lights can be controlled manually directly from the NLC. Notify technical officer – The panel may be disconnected when controlled manually to avoid further alarms during manual operation.

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