PURCHASE SPECIFICATIONS

MILITARY AIRFIELD LIGHTING TRAILER

Contents

1. SYSTEM OVERVIEW

1.0. General Requirements

The Military Airfield Lighting Trailer shall include a complete set of airfield lighting equipment applicable for illumination of a temporary (portable) runway in accordance with international military and aviation standards.

The set of equipment included in the Trailer shall be enough to deploy the runway of minimum length of 2500 m in accordance with the technical layouts provided in this document *(Figures 1.1.-1.4).*

The Military Airfield Lighting Trailer shall be easily set up on the airfield.

The Military Airfield Lighting Trailer and all equipment included shall comply with ICAO Annex 14 requirements.

The Portable Airfield Lighting System included in the Trailer shall comply with NATO STANAG 3534 Airfield Lighting, Marking and Tone Down Systems for Non-Permanent / Deployed Operations.

1.1. Bill of Quantities

The Military Airfield Lighting Trailer shall include and accommodate the following set of airfield lighting equipment (*Table 1.1*):

Table 1.1. Set of airfield lighting equipment included in the Military Airfield Lighting Trailer

Item	Quantity
SP-401P Portable Runway Approach Light	34
SP-401P Portable Runway Edge Light Bidirectional White/White	44
SP-401P Portable Runway Edge Light Bidirectional White/Yellow	40
SP-401P Portable Runway Threshold End Light Bidirectional Red/Green	12
Portable PAPI Light	4
Power Bank	2
UR-101 Handheld Controller	1
UR-201 Control And Monitoring Unit	1
Mobile Tablet	1
ALCMS - Airfield Lighting Control and Monitoring System	1
Fuel Generator	2
Trailer	1

Figure 1.1. Airfield Lighting Design for 2 500 m Runway

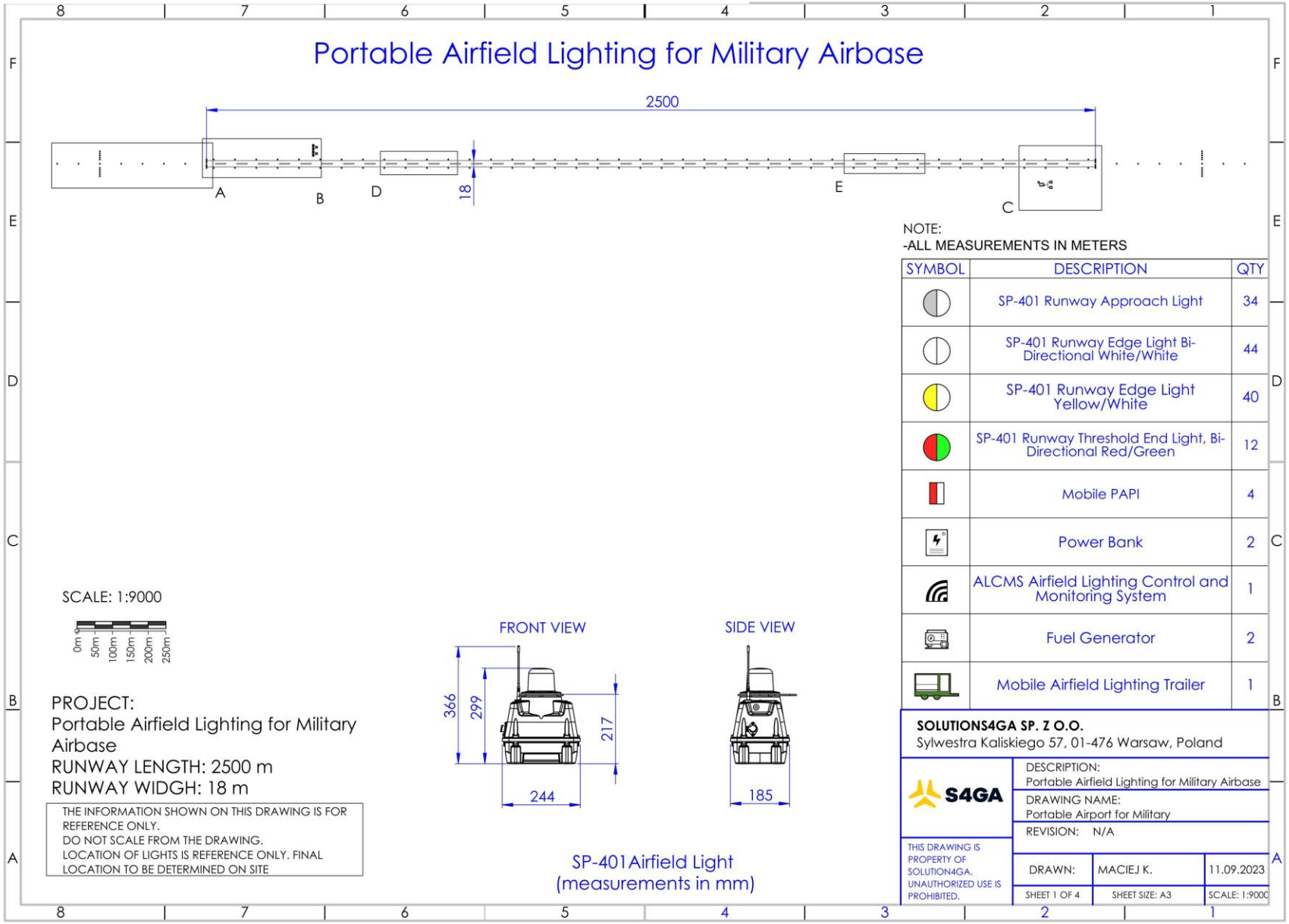


Figure 1.2. Airfield Lighting Design for 2 500 m Runway. Details A, B

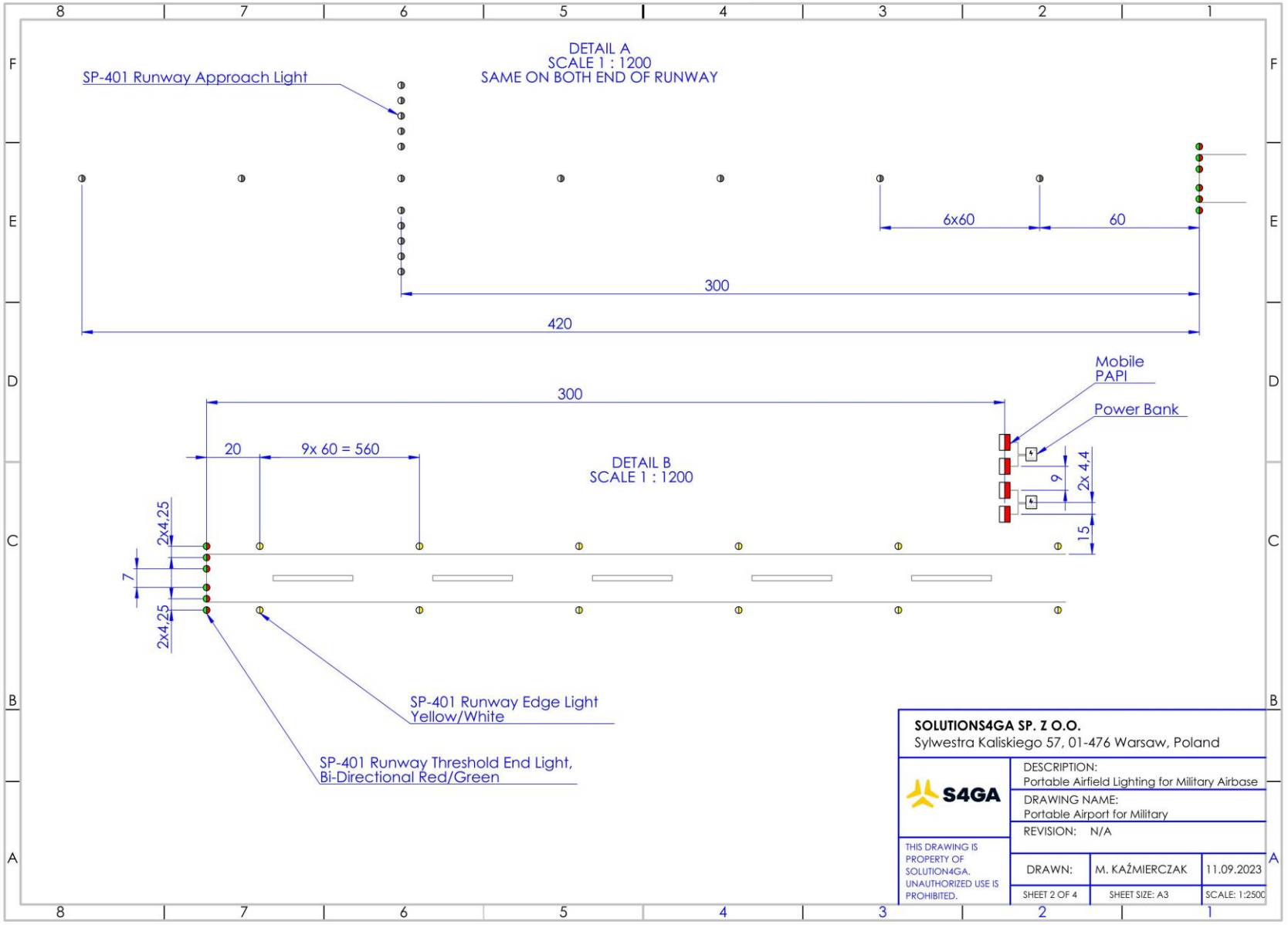


Figure 1.3. Airfield Lighting Design for 2 500 m Runway. Detail C

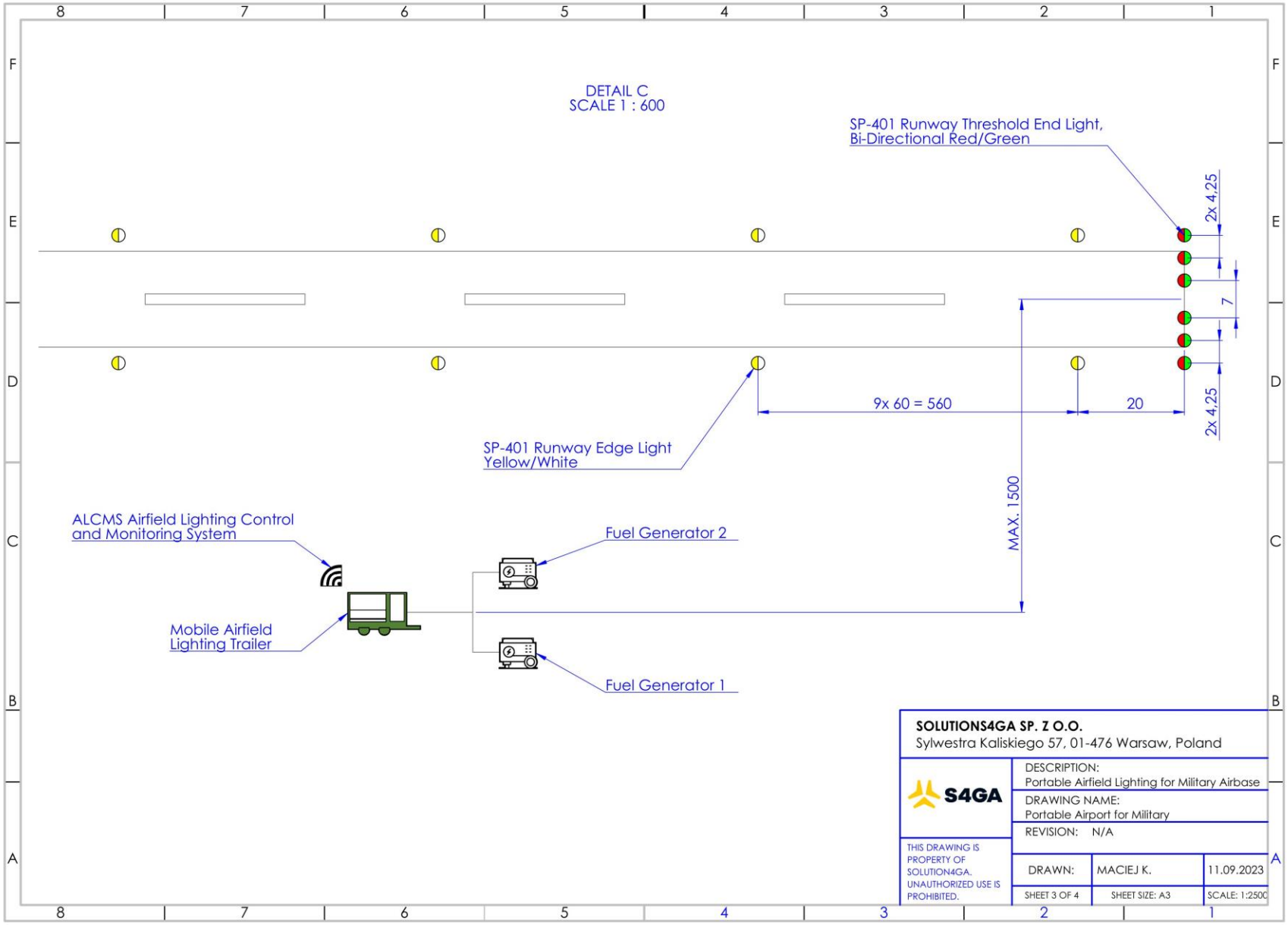
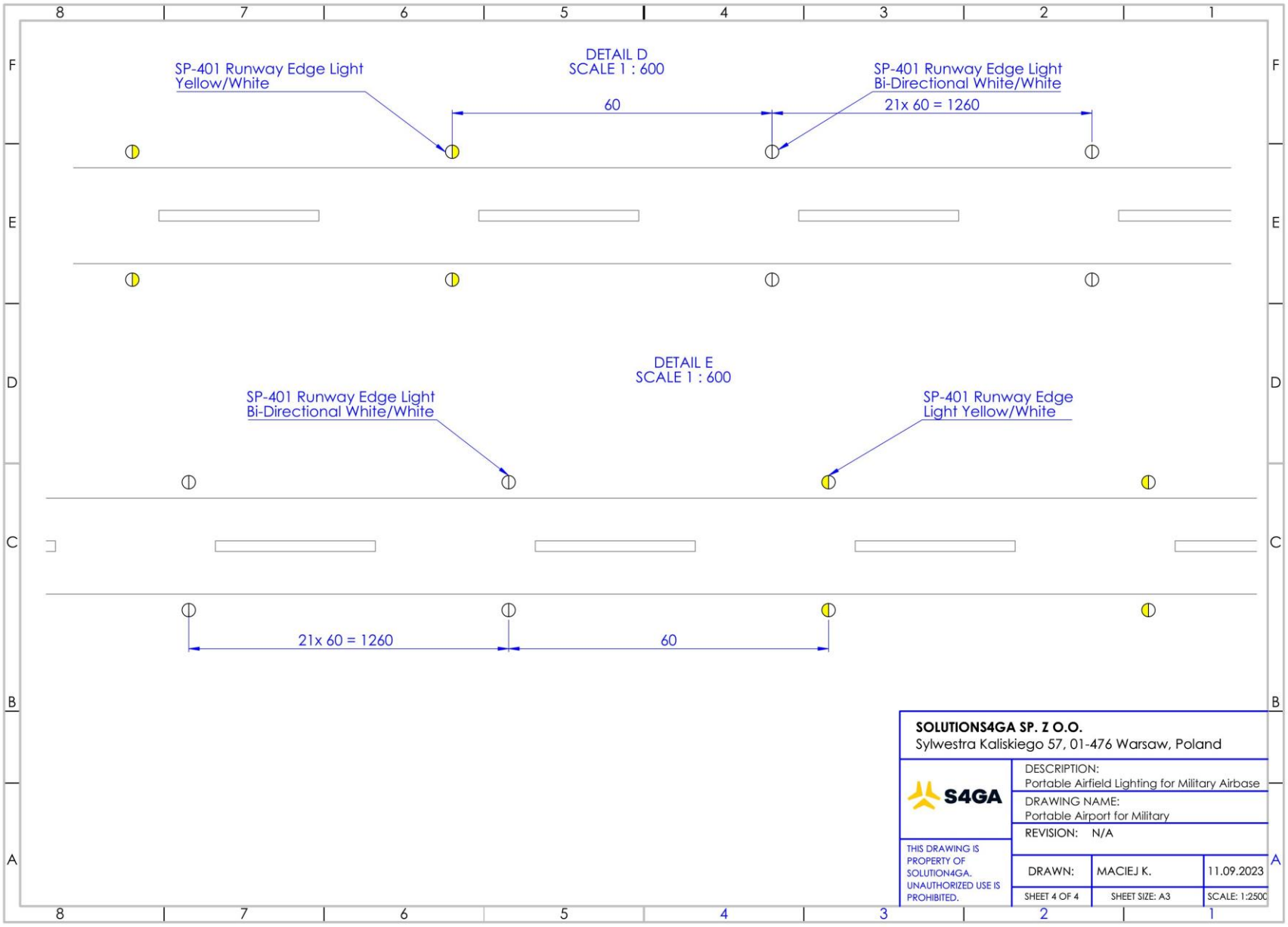


Figure 1.4. Airfield Lighting Design for 2 500 m Runway. Details D, E



2. SP-401P PORTABLE AIRFIELD LIGHT

2.0. General Overview

Each light shall consist of or be capable of:

- LED optics,
- Non-corrosive polycarbonate casing,
- Built-in microcomputer with integrated radio-transceiver,
- Two power ports allowing to energize the light simultaneously:
  - via solar panel and,
  - electrical grid,
- Two independent built-in batteries,
- External (replaceable) antenna for wireless control & monitoring,
- Wireless network should be based on mesh (not point-to-multipoint) protocol and using non-licensed frequency band such as 868 Mhz,
- Each Light should be equipped with emergency On/Off button.

The entire light shall be delivered complete and ready to install.

2.1. Physical and Mechanical Parameters

- All batteries and electronics shall be contained within the light,
- Maximum height of the portable light (excl. antenna) shall not be more than 360 mm,
- Maximum weight of the portable light shall not be more than 15 kilograms,
- The body of the light shall be polycarbonate,
- The light's dome shall be glass,
- The light should be equipped with waterproof pressure stabilizing valve,
- Body of the light shall have Ingress Protection rating of min. IP67. Compliance shall be confirmed by test report issued by third party laboratory or institute,
- Light shall have Impact Rating of not less than IK10. Compliance shall be confirmed by test report issued by third party laboratory or institute,
- Lights dome shall be replaceable on site in case of damage,
- The optical LED head shall be replaceable. The manufacturer shall offer complete optics replacement kits including required tools to perform the replacement,
- The batteries shall be replaceable. Replacement should require no special tools and shall take no longer than 15 minutes per light,
- The batteries shall be of standard type available from the local battery stores (worldwide battery standard),
- All type of lights (including runway, taxiway and obstruction) shall be equipped with the same type of battery.

2.1.1. Mounting of the lighting unit

- The light shall be capable for mounting at all types of surface including grass and concrete,
- The mounting shall include frangible coupling.

2.1.2. Light Capabilities

- The light shall be capable of at least 99 x different brilliancy levels,
- The light shall be capable of operation during the day if required,
- The light shall be equipped with manual on/off button to allow for light activation when it is operated without wireless control,
- The lights shall be equipped with led indicator showing: [1] battery level and also [2] charging status.

By switching manual on/off button on any light installed on the airfield the rest of lights located within radio range shall be remotely activated in less than 1 sec.

2.2. Operational Parameters

2.2.1. Optical Performance

LEDs must have a lifespan of at least 100.000 hours.

The light shall provide optical performance meeting or exceeding the following specifications:

Application	Intensity
Runway Approach Light	The average light intensity of White at the highest level must not be less than 1.480 Candela (cd), (tested and certified by 3-rd Party laboratory)
Runway Edge Light (White/White)	The average light intensity of White at the highest level must not be less than 1.000 Candela (cd), 10% illumination of HIRL light (tested and certified by 3-rd Party laboratory)
Runway Edge Light (Yellow/Red)	The average light intensity of Yellow at the highest level must not be less than 600 Candela (cd), 15% illumination of HIRL light (tested and certified by 3-rd Party laboratory)
	The average light intensity of Red at the highest level must not be less than 300 Candela (cd), 20% illumination of HIRL light (tested and certified by 3-rd Party laboratory)
Runway Threshold Identification Light	The average light intensity of White at the highest level must not be less than 1.000 Candela (cd), (tested and certified by 3-rd Party laboratory)
Runway Threshold Light	The average light intensity of Green at the highest level must not be less than 400 Candela (cd) (tested and certified by 3-rd Party laboratory)
Runway End Light	The average light intensity of Red at the highest level must not be less than 280 Candela (cd) (tested and certified by 3-rd Party laboratory)
Taxiway Edge Light, Turning Pad Light	The intensity of taxiway edge lights shall be at least 2 cd from 0° to 6° vertical, and 0.2 cd at any vertical angles between 6° and 75°.
Obstruction Light – Type A, Low Intensity	The average light intensity of Red at the highest level must not be less than 25 Candela (cd) (tested and certified by 3-rd Party laboratory)

Light intensity and color shall have third-party testing and certification from Intertek or Bureau Veritas or STAC or TUV Rheinland or CAA.

Optionally optics can be additionally equipped with Infra-Red LEDs to enable covert operations using NVG -goggles.

2.2.2. Solar Power Option

- The lighting unit shall be capable to be converted to solar-powered runway edge light by connecting to a solar panel installed separately from light unit body.

2.2.3. Energy Storage

- All models of the light shall be equipped with nominal 12 volt battery systems,
- The lights shall be equipped with two batteries, each battery shall have minimum power capacity of 108 Wh. Total capacity of batteries shall not be less than 216 Wh,
- Failure of one of two batteries shall not stop light form operating – hence the light should be able to operate (on / off) only on one battery,
- The batteries shall be valve-regulated lead-acid (VRLA) or Cyclon type or Li-On type,
- The batteries shall be replaceable,
- Manufacturers offering lights energized by self-designed battery-packs shall offer standard and available worldwide battery,
- Light unit shall be equipped with built-in battery status indicator,
- The battery operating temperature range published by the manufacturer shall be at least from -40 to +80 °C,
- The light's operation and depth of battery cycling while in autonomous mode shall be designed for not less than 1.200 cycles battery life,
- The light shall be able to operate continuously at the minimum intensity level for not less than 170 hours.

2.2.4. Power

The light shall be capable of drawing power from its internal lead-acid battery.

The battery shall be capable to be charged by four alternative methods:

- via back-up charging station,
- via solar panel,
- via electrical cable (24VDC),
- via drop-in charging port.

When connected to external electric grid (24VDC) and in case of battery failure lighting unit shall still be able to continue operation.

2.2.5. Electronics

- The light's control system shall have:
- Temperature-compensated Maximum Power Tracking battery charging,
- Low-voltage cut-off to prevent over-discharge of the battery system,
- Temperature sensor.

The light and controller shall be capable of receiving firmware upgrades.

2.3. Wireless Specifications

- Light shall be wirelessly controlled,
- Wireless communication should use mesh-protocol (manufacturers using point-to-multipoint radio protocol shall offer mesh protocol).

2.3.1. Wireless Signal

- The light's antenna shall be detachable / replaceable,
- The light should be equipped with external antenna to maximize radio range,
- There shall be no limit to the number of lights the controller can communicate with provided they are within the required radio range,
- The wireless system shall communicate using non-licensed 868 MHz radio frequency with power output of no more than 20 mW,
- Frequency band should require no special separate approval or be designated for other types of communication (like GSM carriers: 900 / 1800 MHz),
- The system shall be capable of normal operation in the presence of RF activity typical for an airport environment.

2.4. Quality Assurance

Excluding the batteries, the system, including LEDs, optics, electronics, mechanicals and associated components, shall be guaranteed for a minimum of two years. The batteries shall be guaranteed for 1 year.

The light shall be manufactured by ISO 9001:2008 certified manufacturing facility.

2.5. Turn-Key Operation

The light shall be ready for installation upon delivery. Assembly consists only of threading the antenna onto the light, activating the light through a single button-press on the light, and attaching to the mounting accessories and solar panel (if applicable).

3. Portable LED PAPI (230VAC)

Note: while designing your system select preferred options according to your specific design requirements.

3.0. LED PAPI

Purchase specification shall include supply and installation of the Portable LED Precision Approach Path Indicator (PAPI) system as per following requirements (specification).

Complete PAPI system shall also consist of all necessary items to complete the installation process including but not limited to all cables and connectors, the preparation and installation of all required conduits and fittings and all required mounting structures. This item shall also include the commissioning and testing of the installation and all elements necessary to put the portable LED PAPI system in operation to the satisfaction of the Project Engineer.

The LED PAPI system shall consist of 4 (four) light units.

This item shall conform to the requirements of ICAO, Annex 14th, Volume I, 8th Edition dated July 2018, Figure A2-23, EASA CS ADR-DSN, Figure U-26, TP312, 5th Edition dated 2015, clause 5.2.16.12, Figure B-19 and FAA AC 150/5345-28H, Figure 3-1. The LED PAPI shall be a certified by the third party accredited laboratory for ICAO, EASA, FAA and TP312 photometric and chromaticity. The LED PAPI shall be as manufactured by S4GA (www.solutions4ga.com) or approved equal.

3.1. LED PAPI Light Head Assembly (LHA)

The PAPI LHA shall use a Light Emitting Diode (LED) optics to reduce energy consumption and maintenance. To maximize optical efficiency, the optical system shall consist of a sealed and ventilated optical chamber. The LED module and front glass shall be easily replaceable without requiring PAPI unit re-calibration. Each LHA power requirement shall not exceed 120 W including the lens heater (aka arctic kit).

The LHA shall be compact and easy to handle not exceeding the following dimensions per unit: H 225 mm) x W 305 mm) X L 669 mm) and weight no more than 47kg.

The outer optical lens shall be protected from sandblasting by a separate, hardened front glass which is temperature controlled and is designed to ensure that the outer glass is clear of frost/dew.

The average intensity in red light shall be at least 19,000 Cd for a horizontal beam spread of -6° to +6° and a vertical angle of 3.5° below transition. The transition sector shall not exceed 3 minutes of arc over the full beam width.

The average intensity in the white light shall be at least 47,000 Cd for a horizontal beam spread of -6° to +6° and a vertical angle of 3.5° above transition. The transition sector shall not exceed 3 minutes of arc over the full beam width.

Additionally for ICAO, the intensity value in the white sector of the beam shall not be less than 2 and shall not exceed 6.5 times the corresponding intensity in the red sector.

Each PAPI LHA shall have a tilt sensor. The unit design shall ensure all lamps in the system are de-energized when one light unit in vertical axis is lowered more than ¼ degree or raised greater than ½ degree, additionally when light unit in horizontal axis tilt over 1,75 degree in either direction. The light unit tilt sensing shall be fail-safe so any malfunction, including loss of input power, de-energizes the PAPI light unit.

Each PAPI LHA shall be constructed as follows :

The PAPI LHA shall be made from sheet of stainless steel marine grade fully protected against corrosion.

The PAPI LHA shall be fully weatherproof.

For quick deployment , the PAPI LHA shall be mounted within the special crete structure. The cabinet shall be made of steel.

Precision elevation adjustment shall be possible in less than 5 minutes per unit, making use of the supplied external inclinometer (one per system)

3.1.1. Style A System Requirements

Each LHA shall be equipped with separate Power Control Unit (PCU). Optionally Each Light Unit shall be equipped with dual power units (so LHA can be connected to two independent power circuits for higher safety operations). Input power to the PCU shall be 94-265 VAC, 50/60Hz. For any system configuration, the input power required by the PAPI shall be 350 VA maximum.

PAPI Projector shall be optionally equipped with IR LEDs for operations using NVG googles.

IR LED signal will be steady / flashing (2 Hz). Projector shall be optionally equipped with selector switch to manually activate IR LEDs / set manually intensity up to 6x levels.

Each projector unit shall be equipped with internal fault detection logic. In case of LED failure resulting with significant loss of illumination PAPI projector shall de-energize automatically.

Optionally each projector shall be equipped with Emergency Selector Switch allowing for 100% Manual Setting in Visible Light Spectrum / Infrared Light Spectrum.

Optionally PAPI LED Projector unit shall be equipped with Bluetooth allowing for local wireless communication via dedicated Mobile App for airport maintenance Team.

PAPI LED Projector unit shall be equipped with S4GA radio communication unit allowing for remote control and monitoring of individual unit using : UR-101or UR-201 or ALCMS Control & Monitoring Software.

The intensity of the PAPI system shall be automatically selected (to high intensity during the day and low intensity at night) using a photocell connected to the PCU.

3.1.2. Remote Control Options:

- The FAA L-880/881 versions shall use a photocell for Day night determination and remote control for Night intensities only 5% or 20% intensities.
- ICAO or non-FAA installations shall allow for control up to 6 intensities manually (up to 8 x intensities via Airfield Lighting Control and Monitoring System).
- Separate de-activation switch will be installed in projector to by-pass a faulty indication from photo-sensor / tilt switch.
- Powered from a 50/60 Hz AC voltage source (for example, Power Bank). A hard wired connection to the PCU shall provide for On/Off control and intensity selection via remote control per FAA or ICAO.

3.2. Construction Methods

3.2.1. Installing the PAPI LHAs and PCU

The portable LED PAPI shall be optionally mounted {on a concrete base} at the location shown on the drawing. The portable LED PAPI shall be vertically aligned according to the requirements in the drawing using the aiming procedures detailed by the manufacturer. The tilt sensor shall be set on all portable LED PAPI LHAs according to the manufacturer's instructions.

3.2.2.Tests

The completed system shall be fully tested by continuous operation for not less than 24 hours prior to acceptance. The test shall include the functioning of each intensity control in both Remote and Local not less than 10 times at the beginning and end of the 24-hour test. The test shall insure the tilt switch is operational and all units turn off when the signal is opened.

4. POWER BANK FOR PORTABLE PAPI

4.0. General Overview

Power Bank is designed to power S4GA portable LED A-PAPI system that consists of 2 x Light Head Assemblies (LHA).

4.1. Description

Power Bank shall consist of the following components:

- 1 x Inverter-charger,
- 1 x Air filter,
- 2 x batteries 12V / 110Ah (total capacity of 2640 Wh),
- 2 x Output sockets 110-230V 16A (military standard sockets),
- 1 x Input socket 110-230V 20A (military standard socket),
- 1 x Emergency Shut Down Switch,
- 1 x Ventilation panel.

Shall be equipped with Victron Multiplus C12/1600/17 Inverter-Charger.

Shall have Ingress Protection rating of minimum IP67.

Shall be able to operate in the temperature of -20° C to 50° C or better.

4.2. PAPI Autonomy Provided by Power Bank

Power bank shall provide up to 10 hours of LED A-PAPI (2-LHA system) autonomy at maximum intensity.

Power Bank capacity shall not be less than 2640 Wh.

4.3. Power Supply

Input power supply shall be 110-230V 20A.

Output power supply shall be 2 x 110-230V 16A.

4.4. Casing

Power bank casing shall have the following features:

- Watertight, crushproof, and dustproof,
- Stainless steel hardware and padlock protectors,
- Automatic Pressure Equalization Valve,
- Open cell core with solid wall design,
- O-ring seal.

5. UR-101 HANDHELD CONTROLLER

5.0. Handheld Controller Specification

Handheld Controller provides User with the ability to remotely control S4GA LED Runway Lighting.

Handheld Controller shall allow for:

- Remote control of Airfield Lighting System and other S4GA radio controlled equipment,
- Independent control (activation and change of brilliancy) over minimum 5 separate groups of airfield lighting (for example Runway, Approach, Taxiway A, Taxiway B, PAPI),

Handheld Controller shall offer the following features:

- Grouping entire airfield lighting/equipment in at least 5 major groups (controlled separately),
- Minimum 3-step intensity level of group of lights,
- Control of entirely lighting system or separate groups of lights,
- Selecting operating modes such as dusk-till-dawn, or NVG (on level of entire system or separate groups),
- Operating frequency: 868 MHz
- Rechargeable back-up battery providing minimum 48 hrs of autonomy (with all functions operations at all times),
- Battery charging and power supply shall be via 110-230 VAC Charger,
- Detachable antenna.

5.1. Wireless Control Range

The system shall be capable of reliable wireless control up to a 1.100 meters in line-of-sight distance between the controller and any light.

6. UR-201 CONTROL AND MONITORING UNIT

6.0. Control & Monitoring unit Specification

Control & Monitoring Unit (CMU) provides User with the ability to remotely control and monitor S4GA Portable LED Runway Lighting. It provides remote control over the lights from the Trailer, ATC tower, pilot radio (on defined 118-136 MHz frequency) and over cellphone (GSM-based).

Control & Monitoring Unit shall allow for:

- Remote control and monitoring for Portable Airfield Lighting System and other S4GA radio controlled equipment,
- 3-way remote control over airfield lighting:
  - From the Trailer, manually – by using knobs located on the control unit front panel,
  - Via Air-Band Radio: frequency range 118-136 MHz,
  - Via GSM Phone (voice call or SMS),
- Independent control (activation and change of brilliancy) over minimum 3 separate groups of airfield lighting (for example Runway + Approach, Taxiway, PAPI),
- In case of Wireless signal failure the light shall allow for manual activation using Emergency On/Off Button,
- Automatic Alarm SMS: in case of light's critical failure (e.g. lack of wireless control over the light or low battery) – user will automatically receive alarming SMS informing about critical failure.

Control & Monitoring Unit shall offer the following features:

- Rechargeable back-up battery providing minimum 24 hrs of autonomy (with all functions operations at all times),
- Power supply via 90-240 VAC,
- Detachable antennas,
- Externally mounted (on the high mast) antenna for optimal radio range,
- Immediate and simultaneous on/off control of the airfield lights,
- Grouping entire airfield lighting/equipment in at least 3 major groups (controlled separately),
- Control of entirely lighting system or separate groups of lights,
- Selecting preferable operating modes such as dusk-till-dawn, remote (allows for remote activation of lights) or flash,
- Ability to remotely activate the system via VHF, GSM and manual switches,
- Minimum 3-step intensity level of group of lights,
- Setting timer for remotely activated lights,
- Built-in circuit breaker protecting against short circuit / overload,
- Built in antennas lighting strike arresters,
- Built-in transportation fuse,
- Built-in USB port / HDMI Port.

6.1. Wireless Control Range

The system shall be capable of reliable wireless control up to a 1.400 meters line-of-sight distance between the controller and any light.

7. MOBILE TABLET

Mobile Tablet provides User with the ability to remotely control S4GA Airfield Lighting using portable tablet with touchscreen.

Mobile Tablet shall allow for:

- Remote control and monitoring of Airfield Lighting System and other S4GA radio controlled equipment,
- Independent control (activation and change of brilliancy) over minimum 6 separate groups of airfield lighting
- Remote monitoring of individual light status.

Mobile Tablet shall offer the following features:

- Shall be capable to use ALCMS Basic or ALCMS Advanced Airfield Lighting Control and Monitoring Systems,
- Rechargeable back-up battery providing minimum 1 hr of autonomy (with all functions operations at all times),
- Power via AC adapter (65W, 100-240VAC, 50/60 Hz),
- Shall have multi-touch screen,
- Shall have Ingress Protection rating of minimum IP65,
- Shall be vibration and drop-resistant.

Mobile Tablet shall be obligatory equipped with UR-201 Control And Monitoring Unit.

8. ALCMS – AIRFIELD LIGHTING CONTROL AND MONITORING SYSTEM

8.0. Airport Lighting Control & Monitoring Interface

Computer Interface is software-based visual interface allowing user to control & monitor entire airfield lighting system using touchscreen monitor.

Interface software shall have password protection for User and Administrator modes.

Software interface shall enable individual control & monitoring capability for individual light unit:

At least following parameters of light shall be monitored

- Battery level in %,
- Operating time left on battery only (per light/equipment / per group / per system,
- Co2 savings calculation by using solar powered equipment,
- Solar Panel Charging efficiency in %,
- Equipment internal temperature in Celsius or Fahrenheit,
- Charging source (wire/solar),
- Online connection status,
- Total equipment up-time,
- Total lights illumination time,
- Battery preventive maintenance scheduling (days and battery cycles used).

Computer Interface shall offer the following features:

- Grouping entire airfield lighting in maximum 150 x individual groups,
- Control of entirely lighting system or separate groups of lights,
- Minimum 5-step intensity level of group of lights (optionally up to 8-steps),
- Selecting preferable operating modes such as dusk-till-dawn, NVG (noctovision) or remote activation mode (via GSM, via VHF radio),
- Enabling or disabling remote activation (via GSM or VHF radio),
- Setting timer for remotely activated lights,
- Individual light status – providing user with real-time monitoring of each individual lights' parameters (battery level, charging status, online connection, solar panel charging level, maintenance requirements, etc.),
- Monitoring of Control unit (GSM signal, back-up battery level, power connection),
- Alarm log that stores every critical failure of the system,
- Colors of interface indicating general status of lights (red: critical fault, amber: requires attention).

8.1. Wireless Control Range

The system shall be capable of reliable wireless control up to a 1,5 kilometers line-of-sight distance between the controller and any light.

9. TRAILER

9.0. General Overview

Military Portable Airfield Lighting Trailer is intended to store, charge and transport mobile airfield lighting system.

The Trailer shall be designed the following way:

- Shall have enough space to accommodate an entire mobile airfield lighting system,
- Shall provide safe/secure storage and transportation of airfield lighting equipment,
- Shall allow for charging of lighting equipment inside the Trailer.

9.1. Description

The Trailer shall be divided into 5 compartments:

- Two compartments shall be placed on the left and right side of the Trailer,
- One compartment shall be placed at the rear part of the Trailer,
- Hermetic lockable box with switchboard shall be placed at the front of the Trailer,
- Hermetic lockable box with UR-201 Control & Monitoring Unit shall be integrated into a Trailer.

The Trailer shall accommodate the following items:

- up to 132 x SP-401 portable airfield lights (to cover min. 2.500 m / 8.000 ft RWY length),
- up to 1 x full portable PAPI system (PAPI = 4 x PAPI projectors),
- 1 x UR-201 Control and Monitoring Unit,
- 1 x UR-101 Handheld Controller,
- 2 x Electric Generators,
- 2 x Power Banks for Mobile PAPI.

9.2. Physical and Mechanical Characteristics

- The height, length, and width of the Trailer shall comply with the road regulations of the country (countries) where the Trailer is going to be used,
- The walls of the Trailer shall be made of aluminum,
- The chassis of the Trailer shall be made of stainless steel,
- Can be optionally equipped with automatic retractable high mast flood light,

- Shall be equipped with the following types of lighting:
    - internal lighting (color red),
    - internal lighting (color white),
    - external lighting (color white),
- Can be optionally equipped with the following types of lighting:
    - internal NVG flood light,
    - external NVG flood light,
- Shall have braking system,
- Aluminum blinds (doors) shall be lockable,
- Shelfs where lights are placed shall be extendable (optional),
- All compartments when closed shall be waterproof and dustproof.

9.3. Electrical & Charging

- Shall be capable to use minimum two power sources for charging airfield lights:
    - 110-230 VAC,
    - electric generator (optionally),
- Shall be equipped with drop-in charging platforms for mobile lights,
- Shall have internal battery of min. 100Ah, 12V to support off-grid Trailer operations.