

Precision Approach Path Indicator

PAPI-300 (PDL-620)

Operation Manual



Please read this manual carefully before construction, installation and operation of the product.

Please keep this manual properly for further reference.

This manual is subject to change without prior notice.

Airsafe Airport Equipment Co., Ltd.

Revision Description

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1.0 Foreword

ICAO *Airport Service Manual* Part 9 “Airport Maintenance Practices” and FAA AC150/5345-26 *Maintenance of Airport Visual Aid Facilities* are the highest criterions for site installation and maintenance of such lighting fixtures. This manual was compiled with considerable reference to these two criterions.

The content stated in this manual is absolutely important, so construction personnel must read it carefully before construction. After properly understanding the entire content of this manual, construction personnel should carry out the construction in strict accordance with the methods specified herein, to ensure that the product is safely and properly installed in place.

Routine airport maintenance personnel should carry out the routine maintenance in strict accordance with the methods specified by relevant provisions, to ensure that the lighting fixtures are in the best operation condition.

Related personnel must strictly follow safety criterion. Any personnel without specialized training is strictly forbidden to touch the lighting fixtures and devices. Live line work should be avoided under any circumstances. Construction or maintenance personnel should get acquainted with first-aid knowledge, in case of any unexpected events.

1.1 Illustrations and Meanings

- Following illustrations will appear in this manual where necessary to remind or warn construction or maintenance personnel.
- Please continue reading the subsequent content of this manual after properly understanding the meanings of these illustrations.



- To remind that the behavior may cause serious injury or death.
- ※ Detailed description will be given in the box.



- To remind that the behavior may cause injury to people or damage to product.
- ※ Detailed description will be given in the box.



- To notify that the behavior is prohibited.
- ※ Detailed description will be given in the box.

1.2 Safety Rules and Notices



- Using the light fixtures outside of airport is strictly prohibited.
- ※ Inadequate maintenance or casual touch will cause light faults.



- Be careful when handling the precision approach path indicator.
- ※ Fall to the ground or collision will damage the parts or cause personal injury.



- During installation or maintenance, making sure that the power source is disconnected.
- ※ The unknown current impact may damage the device



- Making sure effective earthing according to the requirements of the specification.
- ※ Otherwise it may cause electric leakage or shock



- Making sure that the constant current is no greater than 6.6A.
- ※ Otherwise it may cause internal electric damage, or even failure of power supply



- There is a frangible groove at the lower part of the landing leg and great external force shall not be applied during installation.
- ※ Otherwise the frangible groove on the landing leg may be broken.



- Maintenance of the precision approach path indicator by the non-professional electrician is prohibited.
- ※ Otherwise it may cause electric shock or other personal injuries.



- Touching the lighting fixtures with wet hand is strictly prohibited.
- ※ It may cause electric shock or other accident.



- The power source entry or internal electric wire shall be replaced immediately when it is damaged.
- ※ Otherwise it may cause equipment failure or electric shock.

1.3 Quality Assurance and Responsibility

Any defect in design, material or workmanship, which may occur during proper and normal use over a period of one year from date of installation but less than 15 months from date of shipment, or within the warranty period of the tender, will be repaired or replaced by manufacturer free of charge. The warranty doesn't cover the failures resulting from lamp burnt out, improper maintenance, installation or operation, or damages due to snow ploughs. Manufacturer shall not be liable to any further claims or particularly claims for damages not affecting the goods themselves.

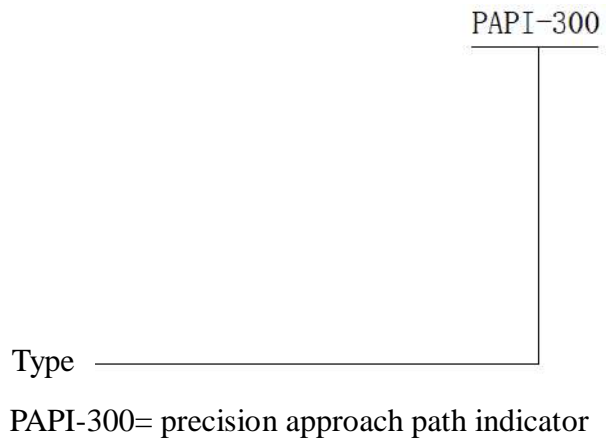
2.0 Introduction

This manual involves the following series lighting fixtures:

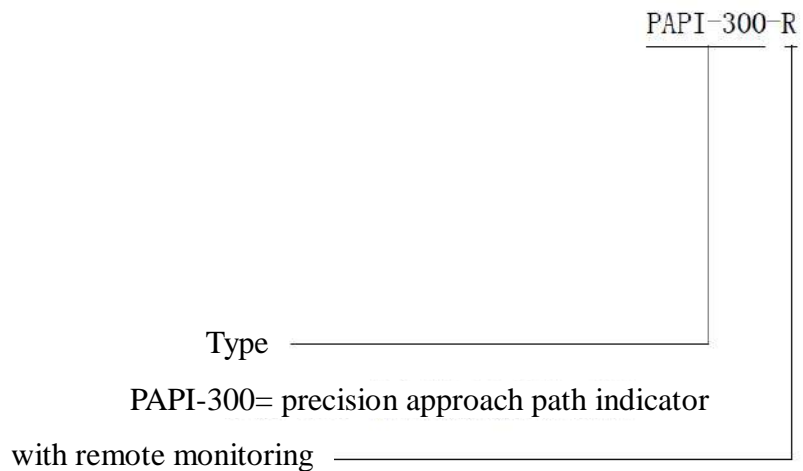
PAPI-300-----Precision Approach Path Indicator

PAPI-300-R-----Precision Approach Path Indicator (with Remote Monitoring)

Type of Precision Approach Path Indicator (PAPI-300):



Type of Precision Approach Path Indicator (with Remote Monitoring) (PAPI-300-R):



PAPI is equipped a 300W/6.6A isolation transformer, which is installed under the lamp or additional separated position.

PAPI system (PAPI-300-R) with the monitoring module is suggested, whose system state and failure information may be fed back to the lamplight station through the CAN communication cable of the monitoring module and information is timely fed back to the monitoring system through 485 standard communication cable to help the user timely, reliably and efficiently monitor it.

2.1 Technical Specifications

This product conforms to the provisions of the following standards or technical specifications. For dated standards or technical specifications, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.


- International Electrotechnical Commission (IEC) TS 61827;
- Convention on International Civil Aviation Annex 14- *Aerodromes* Volume 1;
- International Civil Aviation Organization (ICAO)- *Aerodrome Design Manual- Part 4: Visual Aids*;
- Federal Aviation Administration (FAA) AC150/5345-46;
- Federal Aviation Administration (FAA) EB 67;
- GB/T 7256 *General Requirements of Lighting Fixtures for Civil Airport*;
- Department of Airport of Civil Aviation Administration of China: Advisory Circular, *Technical Requirements for Runway and Taxiway Aid Lighting Fixtures* (AC-137-CA-2015-03)
- Department of Airport of Civil Aviation Administration of China, Advisory Circular, *General Technical Requirements for Civil Airport LED Aid Lighting Fixtures* (AC-137-CA-2015-01)

2.2 Application Environment

- Altitude: below 4,000m;
- Outdoor: -55°C ~ +55°C;
- Relative air humidity: not more than 95%;
- In rain, snow, ice and water;
- Expose to corrosive salt atmosphere
- Basic earthquake intensity VII.

2.3 Application Scope

Precision approach path indicator for Category I, II and III airports.

	<ul style="list-style-type: none"> ■ Using the lighting fixtures beyond the specified scope is strictly prohibited. ※ Application beyond the specified scope will cause damage or risk to any component.
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2.4 Technical Parameters

Description	Type	Rated Power	Life of light source at 6.6A
Precision approach path indicator	PAPI-300	3×105W	≥1,000h

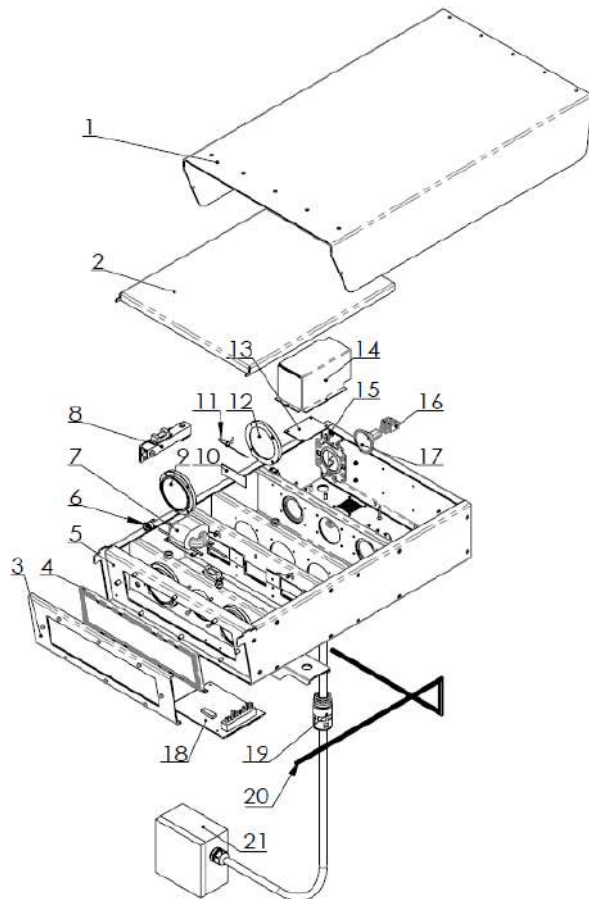
2.5 Technical Features

- Grading and color of the lighting fixtures meet the requirements of Attachment 14 of ICAO;
- Proprietary optical system design makes excellent red and white transition of PAPI and straight transition line;
- Optical parts have self-positioning design and recalibration is unnecessary for replacing the optical components and lamp;
- The filter employs advanced coating technology, with high light transmittance, firm coating and good thermostability;
- A heater strip built in the front windshield may remove the condensation, which does not impact the luminous effect of the lighting fixtures;
- Intelligent electric control system may make PAPI automatically turn off the light in case of abnormal cases;
- Each lighting fixture has a 4-digit LED Nixie tube to timely display the elevation of the lighting fixture with high precision;
- The unit controller may be operated through one key, which is easily operated and conveniently mastered;
- “Operation” and “Calibrate Flight” are set for the control panel for easier use;
- The open-circuit monitoring function makes the system more reliable and safer;
- The optional communication module may make the data of the PAPI system to be directly uploaded to the monitoring system;
- The lighting fixtures have a compact structure, attractive appearance, small face area and high wind loading rating;
- Main body of the lighting fixtures is made of aluminum alloy material with special anodizing surface treatment, and all fasteners are made of stainless steel, thus being applicable to all kinds of harsh environment;
- The landing leg made of the aluminum alloy has the frangible function. After precision mechanical processing, it complies with the requirements of FAA, with stable and reliable performance;
- The energy consumption of 3 105W reflector lamps is only half that of the traditional PAPI;
- Sealing design of the lighting fixtures makes water and dust entry impossible;
- Three landing leg type horizontal support and height adjusting mechanism make on-site PAPI installation and calibration convenient and accurate;
- Independent level gauges are set horizontally and vertically for the lighting fixtures for easy installation and maintenance;

2.6 Structure

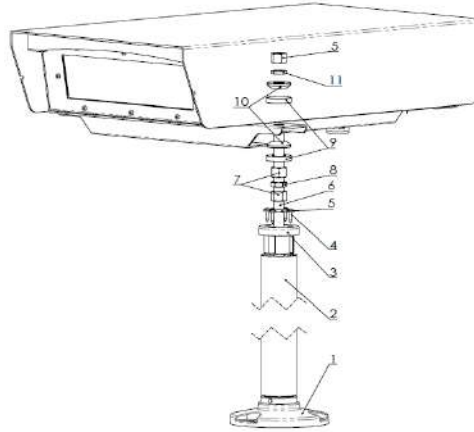
2.6.1 Key Components of Upper Box

1. Upper cover plate assy
2. Dust cover plate
3. Seal pressing bracket
4. Front glass (assy)
5. Box
6. Temperature controlled switch
7. Transformer
8. Longitudinal level module
9. Front glass set
10. Filter disc
11. Compressed spring
12. Rear glass set
13. Circuit board
14. Thermal insulation box
15. Lamp mounting plate
16. Wire holder
17. Lamp
18. Drive assy
19. Hose coupler
20. Electric wire set
21. Junction box



2.6.2 Key Components of Landing Leg Assy

1. Flange
2. Landing leg
3. Front cover of landing leg
4. Tapping screw ST5.5
5. Spring washer 16
6. Screw
7. Hex nut M16
8. Hex thin nut M16
9. Lower washer of sphere
10. Upper washer of sphere
11. Wave spring washer 16



2.7 Interpretation of System Terminology

2.7.1 Elevation

The beam centers of all lighting fixtures in the PAPI system aim at the approach slope according to the defined subtle deviation and the elevation means the included angle of the beam center of the lighting fixtures and the horizontal plane.

2.7.2 Key Buttons and Plug-ins

The general framework of the PAPI control panel is shown in Figure below and definitions of the key buttons and plug-ins are as follows:

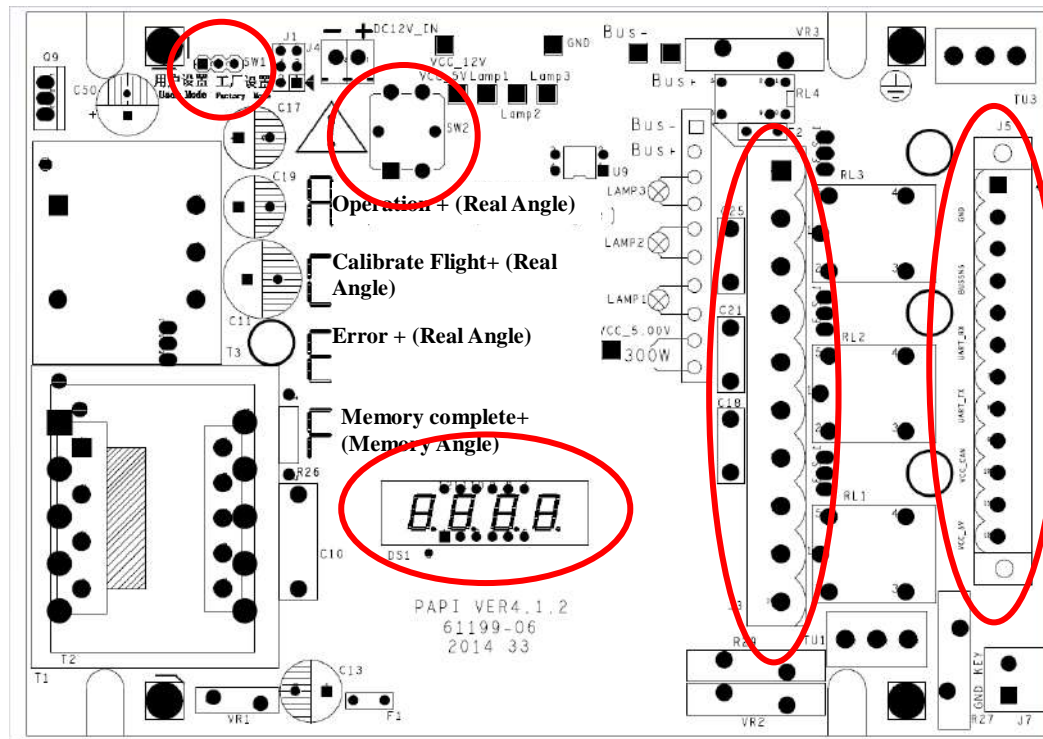
SW1: Setting state switching jumper cap (switching between “Factory Mode” and “User Mode”);

SW2: Mode switching button (switching between “Operation” and “Calibrate Flight”);

J3: Main power source and light source receptacle;

J5: CAN adapter plate receptacle;

DS1: Four-digit Nixie tube.



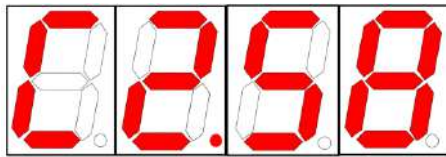
SW1: Setting state switching jumper cap, which is used for switching between “Factory Mode” and “User Mode”;

SW2: Mode switching button, which is used for switching between different state modes under “User Mode”;

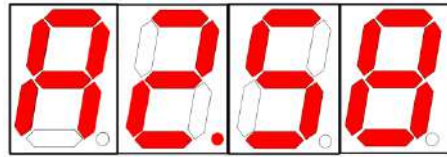
Rightmost J5 on the control panel is an interface reserved for CAN adapter plate, through which the data of the control panel may be transmitted to the monitoring system. J3 near the middle is a key connector, through which all power cables, power source cables and buses are connected with the external cables.

After this system is powered on, the panel control will automatically enter “Operation” and have the function to automatically recover “Operation” with unmanned operation under “Calibrate Flight” to prevent misoperation by the airport personnel.

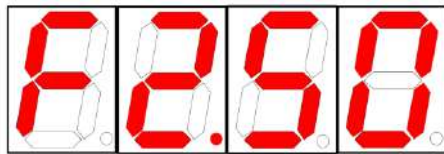
Four-digit Nixie tube: There is a four-digit Nixie tube embedded on the PAPI control panel (as shown in Figure DS1 below), which timely displays the current mode and elevation of PAPI. The angle displayed by the Nixie tube has four characters, with the first character of a letter, showing the state of PAPI and the last three characters showing the “current angle”.



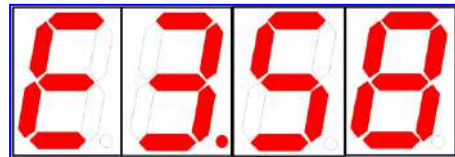
Display under “Calibrate Flight”



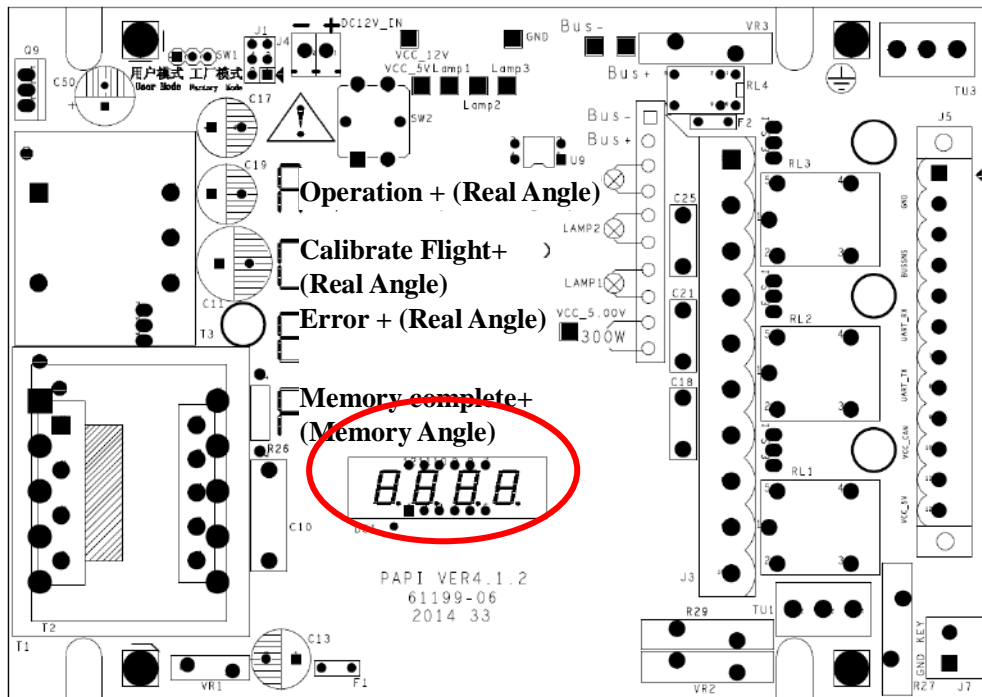
Display under “Operation”



Display under “Memory Angle”

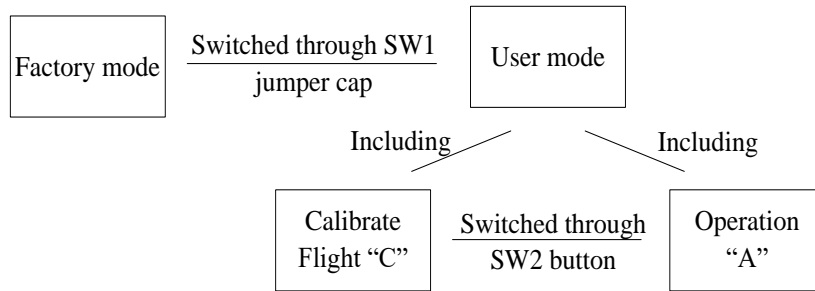


Display under “Error”



2.7.3 Two Working Conditions and Four Modes

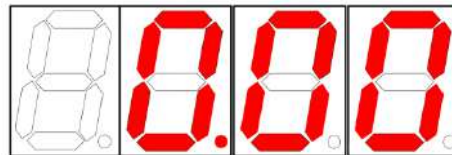
This PAPI system has two working conditions and four modes, whose relations are shown in Figure below:



“Factory Mode” and “User Mode” of PAPI are switched through SW1.

(1) “Factory Mode”:

When PAPI is in “Factory Mode”, the Nixie tube only displays the current angle. “Factory Mode” is only used for the standard calibration of PAPI when it leaves the factory, or clearing the angle when the control panel of PAPI is replaced. During daily normal use, the user shall not enter “Factory Mode”. Otherwise, the Nixie tube will reset and “Memory Angle” of the system will be automatically cleared, as shown in Figure below:



Display under “Factory Mode”

- Switching SW1 randomly is strictly prohibited.
- ※ To enter the Factory Mode may cause loss of data in the PAPI system.

- Metal articles close to SW1 is strictly prohibited.
- ※ Otherwise it may cause automatic trigger of SW1, resulting in loss of data in the PAPI system.

(2) **“User Mode”:**

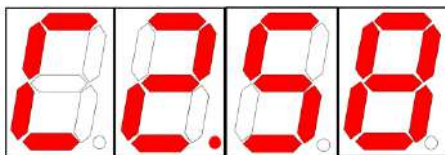
When PAPI leaves the factory, the system is in “User Mode” and PAPI executes various operations.

“User Mode” includes “Calibrate Flight” and “Operation”, which are fixed programs of the lighting fixtures. Under “User Mode”, SW2 is used for switching of various modes and the user may switch “Calibrate Flight” and “Operation” through SW2.

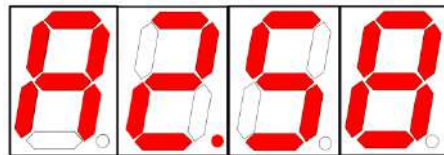
Under “User Mode”, the PAPI system may have “Error” under certain state. After PAPI enters “Error”, the system will automatically turn off the lamp.

Under “User Mode”, the PAPI system support stores the current angle into the system and displays the “Memory Angle” through the Nixie tube.

During daily use, the user shall not switch the jumper cap of SW1. SW1 shall be switched only when the user replaces the control panel and the system shall be set to “Factory Mode”.



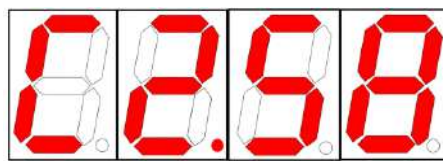
Display under “Calibrate Flight”



Display under “Operation”

(3) “Calibrate Flight”

During flight calibration or daily maintenance, the system shall set PAPI to “Calibrate Flight”. Under this mode, PAPI will not have “Error”, but turn off the lamp to ensure normal on-going flight calibration or maintenance. The display method of the four-digit Nixie tube is 4 characters initiated by the letter C (the Nixie tube displays “C+ value of the current elevation”), with the display shown in Figure below:



Display under “Calibrate Flight”

The above-mentioned Nixie tube information means that PAPI is in “Calibrate Flight” and the current angle is 2.58.

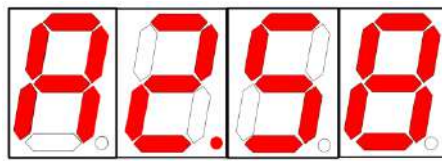
Under this mode, the angle displayed by the Nixie tube is immediate. When the real angle of PAPI has any subtle change, the angle of the Nixie tube will be changed accordingly.

“Calibrate Flight” will automatically recover to Operation after 8h with unmanned operation to prevent misoperation by the airport personnel.

(4) “Operation”

After this system is powered on, the control panel will automatically enter “Operation”.

Under “Operation”, PAPI works normally and achieves control of various states, including such preset functions as error alarm. Therefore, after the flight calibration or daily maintenance is completed, PAPI is switched to “Operation” from “Calibrate Flight” through the SW2 button. The display method of the four-digit Nixie tube is 4 characters initiated by the letter A (the Nixie tube displays “A+ value of the current elevation”), with the display shown in Figure below:



Display under “Operation”

The above-mentioned Nixie tube information means that PAPI is in “Operation” and the current angle is 2.58.

Under this mode, the angle displayed by the Nixie tube is immediate. When the real angle of PAPI has any subtle change, the angle of the Nixie tube will be changed accordingly.



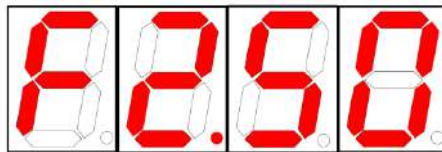
- PAPI must be set to “Operation” for work.
- ※ PAPI cannot achieve error alarm.

It must be recorded and the user shall record this value in the relevant document according to the provisions.

(5) “Memory Angle”:

Press the SW2 button for longer than 5s to store the current angle confirmed through flight calibration into the PAPI system. We call the angle stored into the system “Memory Angle”.

The expression form of “Memory Angle” is four characters initiated by the letter F displayed by the four-digit Nixie tube (the Nixie tube displays “F+ currently memory angle”):

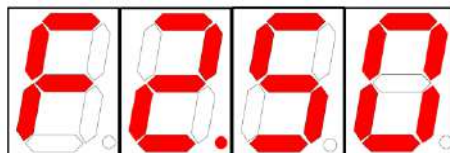


Display under “Memory Angle”

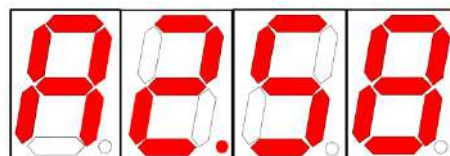
The above-mentioned Nixie tube information displays “Memory Angle” and the angle recorded into the system is 2.50.

When the PAPI under “Operation”, the Nixie tube alternately displays the current angle and memory angle with 5s as a circle. It displays the “Memory Angle” at 2s and “Current Angle” at 3s. The user may understand the difference between the current real angle of PAPI and previously memory angle of the flight calibration.

For example, the current operating angle is “A2.58”. When the current “Memory Angle” (design angle) is “F2.50”, the Nixie tube will display the following two legends alternately:



Display at 2s



Display at 3s

These two data are displayed alternately under “Operation”.

Take the above-mentioned Figures as examples, although the difference between the current operating angle and the current memory angle is 0.08°, it is still within the allowable range and PAPI will not have any action.



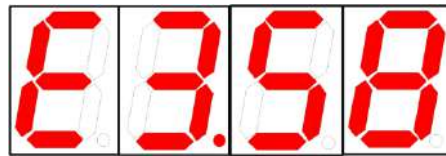
- As an important datum, the “Memory Angle” shall not be changed randomly.
- ※ Otherwise it may cause PAPI have no standard, so as to generate misoperation.

(6) “Error”

When the control panel detects the anomaly of the PAPI system, it turns off the system lamp within several seconds and the error will be prompted on the Nixie tube. This function of the system is called “Error”. The system provides two kinds of “Errors”:

I) The operating angle deviation is greater than the specified value:

Under “Operation”, when the PAPI angle is 0.38° or above lower than the “Memory Angle”, or 0.75° or above higher than the “Memory Angle”, PAPI will have an “Error” alarm, whose expression form is 4 characters initiated by the letter E displayed by the four-digit Nixie tube (the Nixie tube displays “E+ currently memory angle value”):

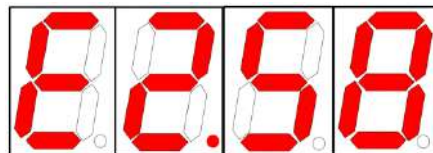


Display under “Error” when there is an angle deviation

The above-mentioned Nixie tube information displays “Error” and the current angle is 3.58. Because the “Memory Angle” in the system is 2.50, the “Current Angle” displays that PAPI deviates upward, with 0.75° above greater than the “Memory Angle”. After “Error” appears, the system will turn off all lamps 20S later according to the provisions. Meanwhile, CCR under voltage is caused and an alarm is given out.

II) Damage to two lamps:

When two or more lamps of the lighting fixtures of certain PAPI unit are damaged, PAPI will have the “Error” alarm (the Nixie tube displays “E+ current elevation value”).



Display under “error reporting state” when the luminance of the lighting fixtures does not comply with the standard

The above-mentioned Nixie tube information means that PAPI is now in an “error reporting state” and the current angle is 2.58.

The system turns off all lights. Meanwhile, CCR under voltage is caused and an alarm is given out.

3.0 Installation of Lighting Fixtures

From the view of the runway threshold, the PAPI or APAPI system shall be set on the left of the runway, unless it is impossible according to the actual situation.

The PAPI system must consist of four lighting fixture units with equal distance.

The APAPI system must consist of two lighting fixture units with equal distance.

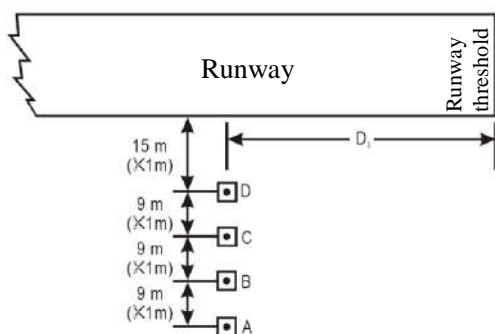
3.1 Position of PAPI and APAPI system

The distance between the inside edge of the PAPI lighting fixture unit closest to the runway and the runway edge shall be 15m (± 1 m); and the distance between the PAPI unit and other taxiway, parking apron or runway shall not be less than 14m.

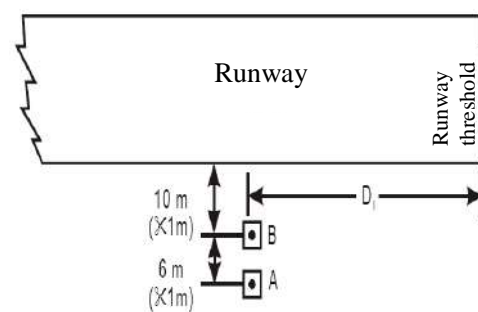
The distance between the inside edge of the APAPI unit closest to the runway and the runway edge shall be 10m (± 1 m); and the distance between the APAPI unit and other taxiway, parking apron or runway shall not be less than 9m.

The gap between PAPI units is often 9m (± 1 m); the gap of no less than 6m may be used only when the width of the takeoff and landing strip is insufficient to accommodate 4 units with the gap of 9m. Now, the distance between the PAPI unit closest to the runway and the runway edge shall not be less than 10m (± 1 m).

The gap between APAPI units shall be 6m (± 1 m).



Typical PAPI unit Layout (Figure 3-1)



Typical APAPI unit Layout (Figure 3-2)

D1 means the distance between the runway threshold and central position of the PAPI lighting fixtures.

3.2 Boundary Dimension

The maximum installation height of the lighting fixtures is 900mm and the dimension of the corresponding luminous center is 820mm.

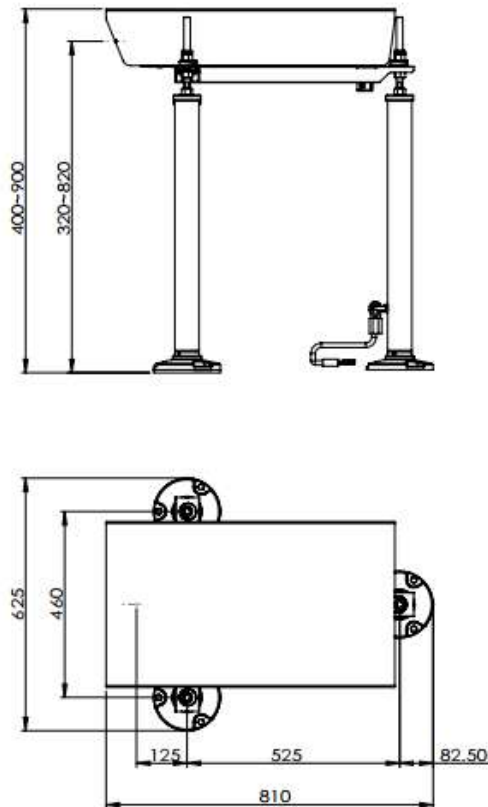
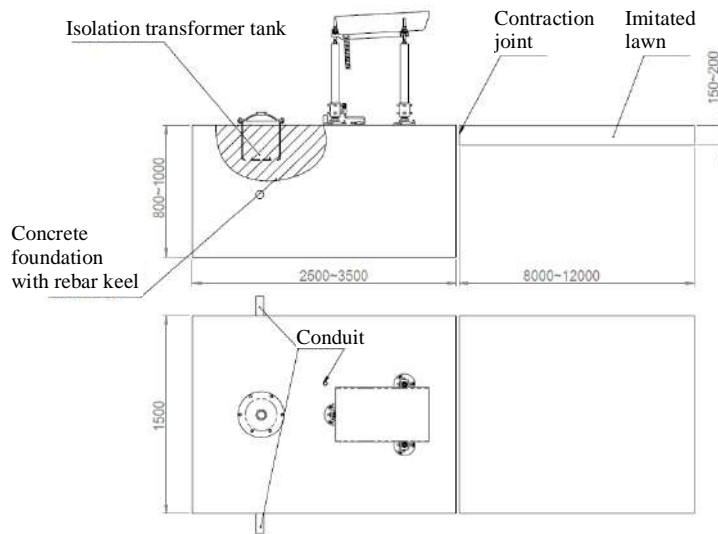


Figure 3-3

3.3 On-site Installation of PAPI Lighting Fixtures

In order to ensure the operating stability of the PAPI system, the manufacturer suggests that the PAPI lighting fixtures should be installed on a prefabricated cement foundation. For the dimension of the prefabricated cement foundation, please refer to the Figure below. If the designer has a specific drawing, such specific drawing shall prevail.



3.3.1 Flange Fixation

In order to ensure that the lighting fixtures are installed firmly and reliably, the manufacturer suggests using the method to embed the foundation bolt in the prefabricated base. It is suggested to use the stainless steel M10 foundation bolt (with the length of greater than 150mm), as shown in Figure 3-5.

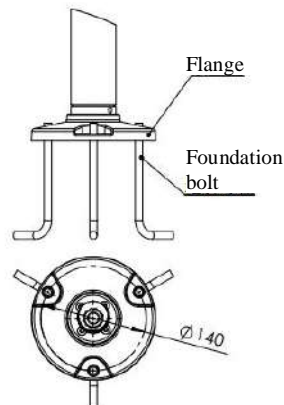


Figure 3-5

When embedding the foundation bolt in the cement foundation, the auxiliary installation sample (Figure 3-4) may be used. According to the position of the lighting fixtures, 9 Φ 10 holes position the position of the embedded bolt.

For the installation of the lighting fixtures, the manufactures distributes a set of installation sample. The corresponding position and dimension of the installation sample and lighting fixtures is shown in Figure below:

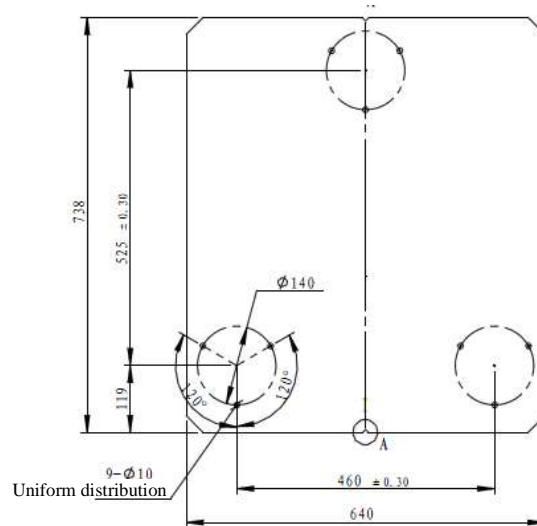


Figure 3-4

When it is impossible to embed the foundation blot in the cement foundation, the stainless steel expansion bolt may be used, with the bolt dimension of no less than M10 \times 120. When the expansion bolt is installed, it is first positioned with the installation sample. After Φ 10 central hole is drilled, remove the installation plate, expand the hole to Φ 14 and load the stainless steel expansion bolt into it.

The manufacturer does not suggest the fixation method with the expansion bolt, because the fixation will not be firm if the construction is not in place.



- The fixation method with the expansion bolt shall be avoided.
- ※ The fixation with the expansion bolt is unreliable, which may be loosened in case of operation for a long time.



- The stainless steel products shall be used for embedding the foundation bolt or expansion bolt.
- ※ The airport environment is harsh and thus the iron products may be easily corroded, resulting in fixation loose.

3.3.2 Installation of Landing Leg

First, put three flanges into the embedded foundation bolt and fix them with nuts.

According to the height design requirements of PAPI and on-site actual situation, determine the length of the extension pole of the PAPI lighting fixtures. Please note that the lengths of the extension pole of four lighting fixtures are inconsistent. The length of each extension pole shall be carefully calculated. An aluminum alloy cutter is used to cut the remaining part of the end without thread.

Calculation method of landing leg: $L=H-170$ (Unit: mm)

Where, L= length after adjustment of the landing leg and H= design height of the PAPI beam



- A special aluminum alloy cutter must be used when cutting the extension pole.
- ※ The inferior causes burr on the cutting surface, resulting in difficulty to subsequently install the front cover.



- Please reconfirm it when cutting partial length on the upper part of the landing leg.
- ※ Casual cutting may cause too short landing leg.

Screw three landing legs with determined length into the flange and tighten them to ensure that they are in a vertical state. Place the front cover on the plane of an end cut of the extension pole and fix it on the extension pole with four tapping screws to ensure to screw them in place.

Screw the adjusting screw with nut into the front cover thread on the extension pole. Please note that the adjusting screw protrudes about 190mm from the landing leg and tighten the M16 hex nuts of the front cover of the landing leg and lower end of the screw to make it to be fixed. Take out the first half spherical washer and nut on three adjusting screws and load the lighting fixture box into the screw. Re-screw the first half spherical washer and nut into the adjusting screw. Place the spherical washer and nut on the screw in the middle of the adjusting screw, so that there is enough space when the unified height of 4 PAPI boxes is adjusted.

3.3.3 Same Height Setting of Lighting Fixture Set

When the PAPI lighting fixture system is installed, it must be ensured that the beam centers of four luminous units are on the same level while ensuring that the height of the beam center of the PAPI system meets the design requirements.

There is a gap in front of the upper cover of the PAPI lighting fixture box, which is on the same level with the beam center (see Figure 3-6). The height of this gap from the ground is the same with that of the beam center of the lighting fixture. During construction, this gap is used as a standard measuring point to adjust the height of all light boxes.

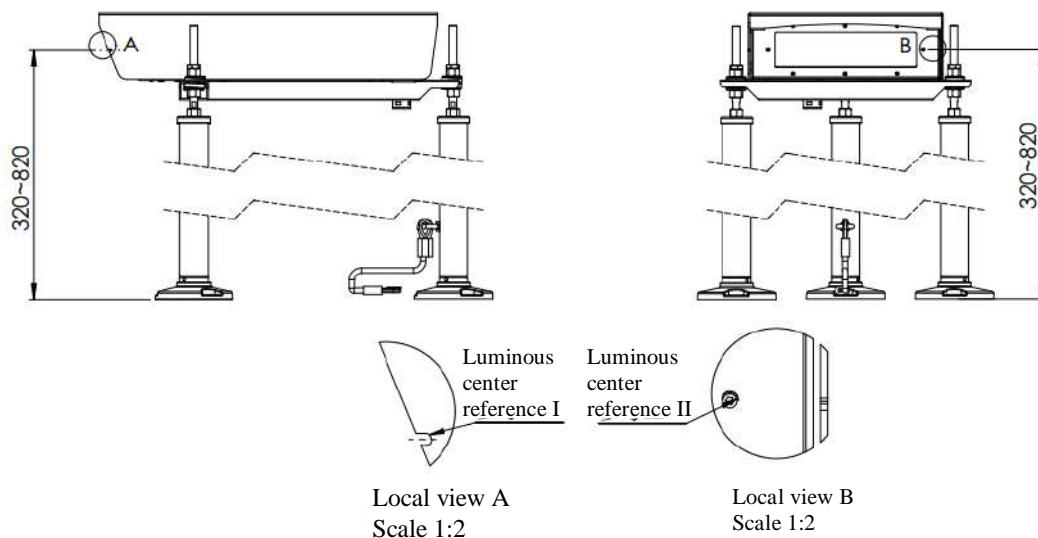


Figure 3-6

A central datum line with the beam height meeting the design requirements in front of all lighting fixture boxes of the PAPI system. Unscrew M16 hex nut and hex thin nut M16 under the stay (see Figure 3-7). Adjust the upper and lower positions of these nuts (see Figure 3-7) to make the central indicating gap or hole (see Figure 3-6) in front of 4 lighting fixture boxes to be aligned with the standard level.

On this basis, continuously adjust M16 hex nuts on both sides of PAPI gently (see Figure 3-7) to make the bubble of the horizontal bubble level indicators of all lighting fixtures in the middle.

M16 hex nut behind PAPI makes PAPI box basically level.

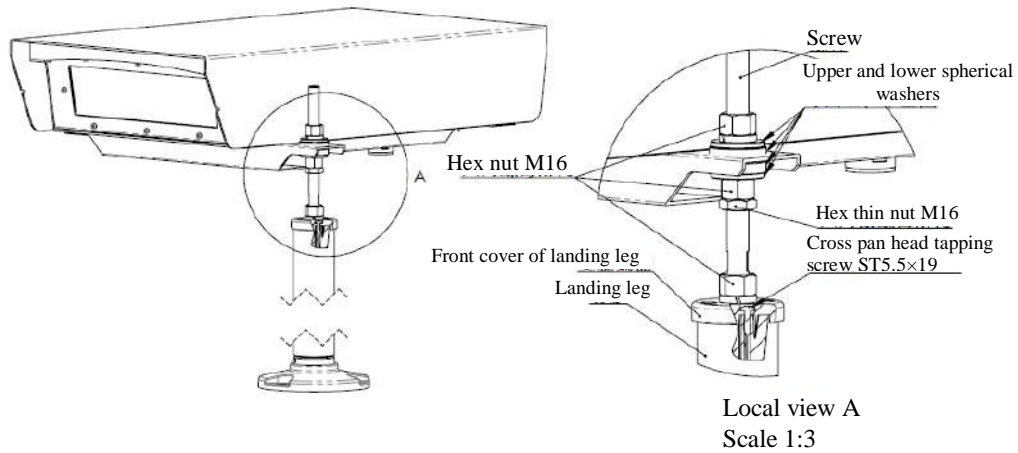


Figure 3-7

The height error of the beam center (lens center) of all lighting fixtures adjusted is not greater than 5cm.



- Making sure that the screw is naturally threaded to the center of the stay screw hole under the box
- ※ Loading the screw with brute force may break the frangible part.



- When the screw is inserted into the box, the thread on the screw shall not be scratched
- ※ Damage of the thread impacts the angle adjustment of PAPI.



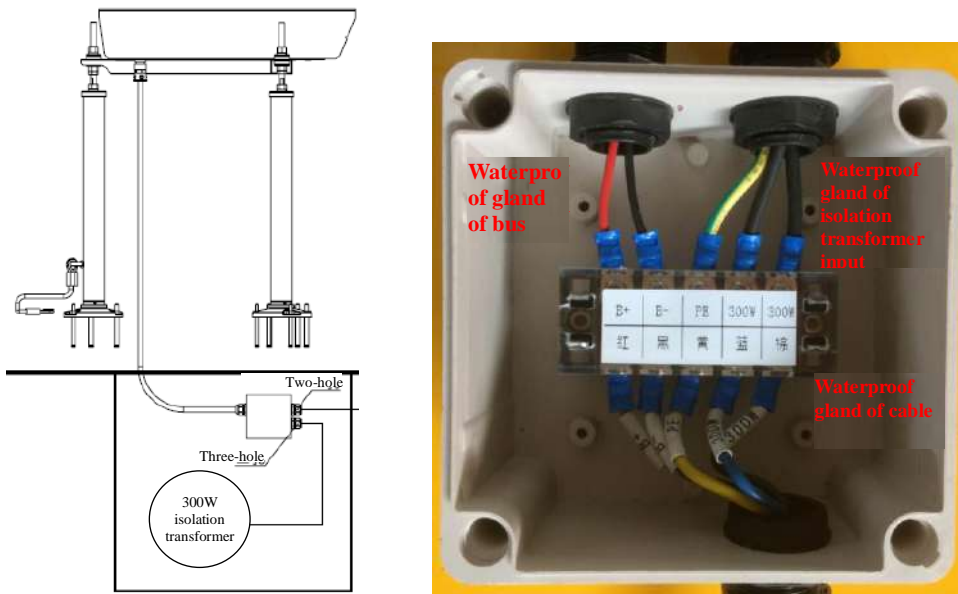
- Unless it is necessary, keep the upper cover in a closed state during installation
- ※ The on-site dust may impact the optical system in PAPI.



- Touching the optical components with naked or dirty hands is strictly prohibited
- ※ Otherwise it may impact the luminous accuracy of PAPI.

3.3.4 Electrical Wiring of Lighting Fixtures

PAPI has an external junction box and wiring of PAPI may be completed externally. The external junction box is often placed in the auxiliary isolation transformer tank of PAPI.



The junction box has 3 waterproof glands, which are placed on both sides of the junction box. The waterproof gland of the cable connecting PAPI light body is on one side and the waterproof glands of the isolation transformer input and bus are on the other side.

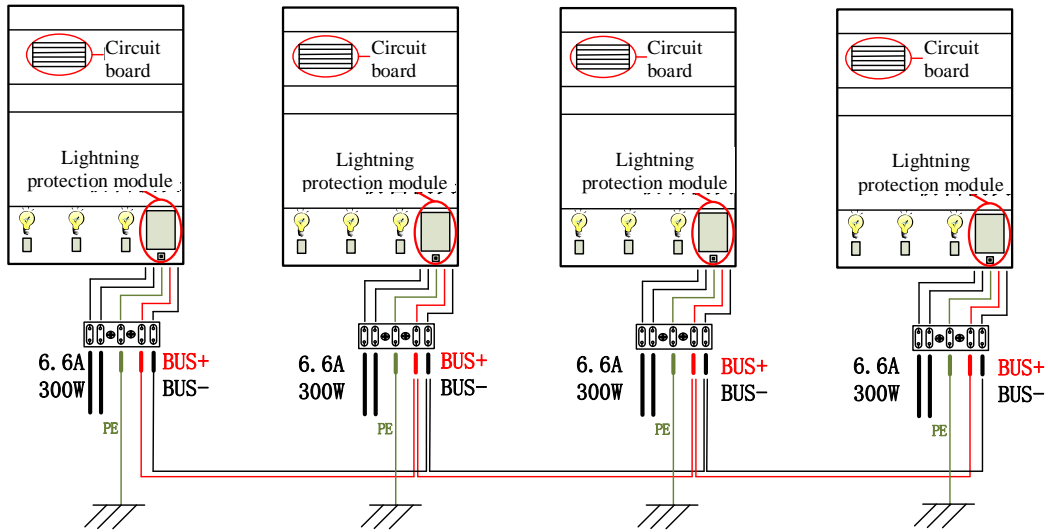
The PAPI system consists of four lighting fixture units, which are controlled through bus. The red bus is a positive bus and the black bus is negative bus, which shall not be connected reversely (four-color CAN bus shall be used with the PAPI adapter plate, which is an optional accessory).



- The bus is divided into the positive and negative bus, which shall be connected in strict accordance with the specification requirements.
- ※ If the positive and negative buses are connected reversely, the system will not work normally.



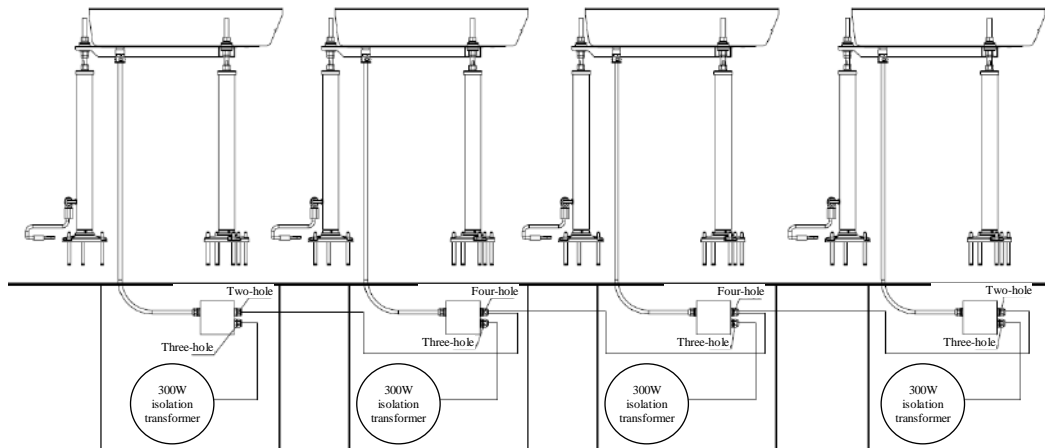
- The crimping terminal is required for all wires connecting the wire holder.
- ※ Otherwise there will be looseness, which may burn out the wire holder.




Overall Wiring Diagram of 300W Isolation Transformer

Overall wiring diagram of 4 PAPI units is shown in Figure above (excluding CAN adapter plate)

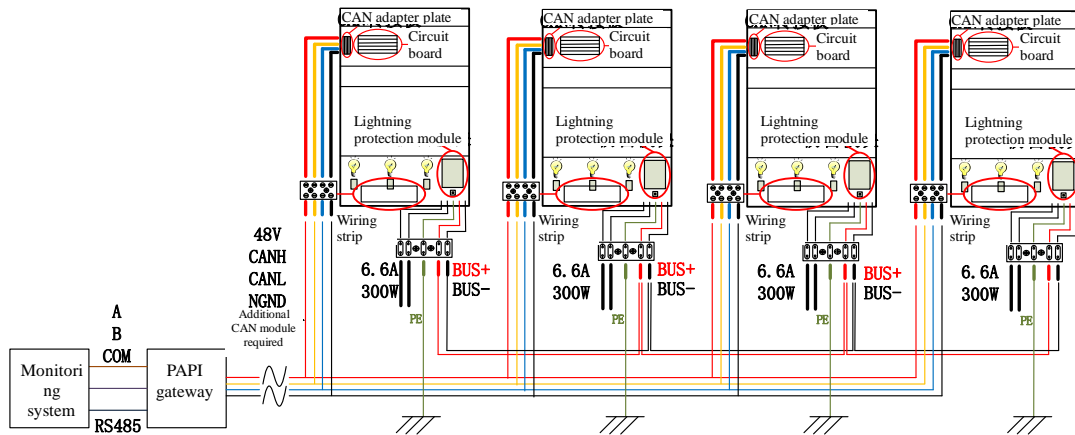
The overall wiring diagram is shown in Figure below. Please note that the waterproof gland of the bus of the external junction box has 2 or 4 interfaces. The 2-interface waterproof gland (CAN entry) is used for connecting PAPIs on both sides and 4-interface waterproof gland (CAN entry and lead) is used for connecting the middle PAPI.





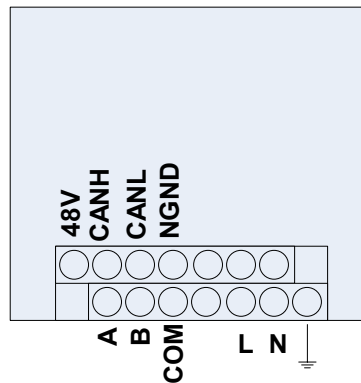
- An external junction box has 2 or 4-interfaces.
- ※ Different external junction boxes are used at different positions and water may enter them when they are used together.

If PAPI has the remote monitoring mode (PAPI-300-R), the corresponding installation method is shown in Figure below:



Overall Wiring Diagram of 300W Isolation Transformer

Overall wiring diagram of 4 PAPI units is shown in Figure above

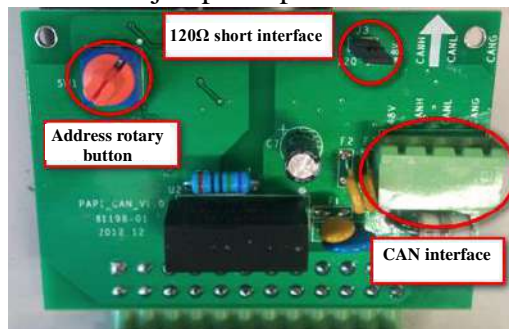


PAPI Gateway Binding Post

Correctly connect CAN adapter plate, CAN bus and gateway.

The address rotary knob of the CAN adapter plate starts from 1.

The PAPI unit which is farthest from the gateway makes 120Ω resistance short circuit junction have a short circuit with a jumper cap.





- CAN connection requires to distinct the cable color. Please perform wiring in strict accordance with the requirements of the specification.
- ※ Any wiring problems may cause abnormal work of the system.



- Making sure that all wiring is firm and reliable.
- ※ Great current during operation may burn out the connector.



- Confirm that the input power source has constant AC of 6.6A.
- The communication buses of all lighting fixtures are connected in parallel and reverse wiring is prohibited.
- ※ Otherwise it may damage the circuit.

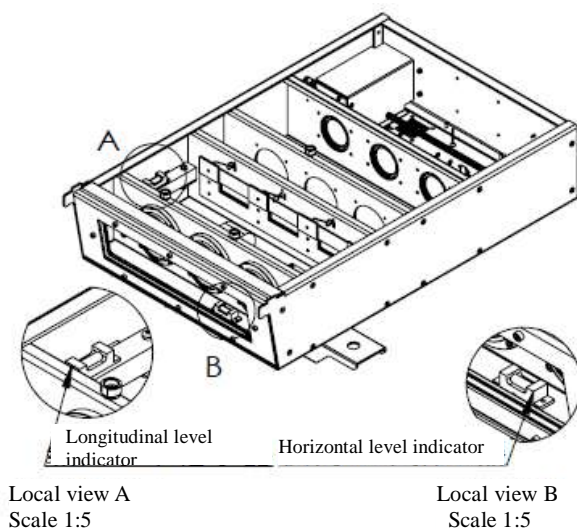
3.3.5 Adjustment and Setting of Lighting Fixture Elevation

Four PAPI units placed on site have different elevations respectively. Therefore, elevation setting is an important step for installing the PAPI lighting fixture units. The correct elevation ensures that the PAPI system works. According to the provisions, the unit with the greatest elevation in the PAPI system shall be at the position close to the runway and that with the lowest elevation in the PAPI system shall be on the most outside which is the farthest from the runway.

When leaving the factory, PAPI lighting fixtures are set to “Calibrate Flight” and the elevation may be directly adjusted.

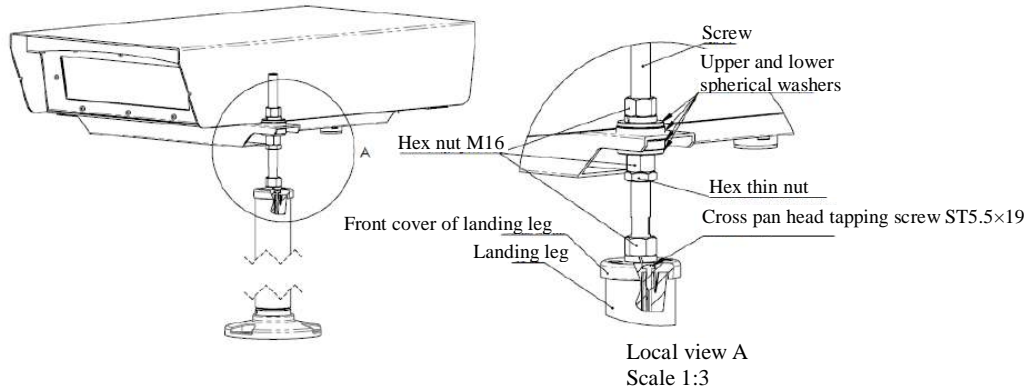
Gently unscrew two M16 hex nuts in the left and right on the PAPI stay (see Section 3.3.2). Adjust the vertical height of the M16 hex nut under the screw stay of the rear extension pole of the lighting fixtures (see Section 3.3.2) and observe the lighting fixture elevation changing displayed by the Nixie tube on the control panel until such angle is equal to the design elevation.

Because the elevation display by the Nixie tube on the control panel is a decimal degree, while the design elevation is often a degree of degree-minute system, the fractional part of the design elevation shall be converted into the decimal degree value prior to adjustment. The decimal degree value may be obtained by dividing the fractional value with 60, or the conversion may be performed according to the conversion table in Chapter 8.0. Assume that the design elevation is $2^{\circ}32'$, first convert the fractional value $32'$ into a decimal degree value 0.53° (namely, first convert $2^{\circ}32'$ into 2.53°), then make an adjustment until the Nixie tube displays 2.53° .



Due to mutual impacts of the horizontal level and longitudinal angle, the fine adjustment of the horizontal level indicator and longitudinal elevation must be made alternately and repetitively. M16 hex nuts are finally used for locking (see Section 3.3.3).

Repeat the above-mentioned steps until four PAPIs have their elevation setting completed.



After adjustment and setting of 4 lighting fixtures are completed, the on-site installation of the PAPI system is basically completed.

Reconfirm whether the bubble of the level angle instrument is in the middle and the angle displayed by the Nixie tube is equal to the design elevation.

Reconfirm whether all screws of PAPI are tightened and reliable.



- Elevation is the most important parameter of PAPI, which shall be accurate.
- ※ Incorrect elevation may impact safe landing of the aircraft.

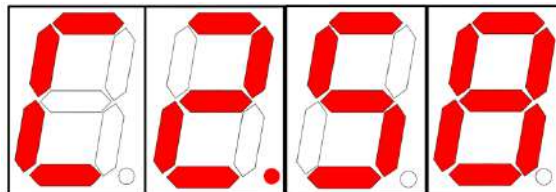
4.0 Flight Calibration Inspection and Adjustment of Lighting

Fixtures

Before the PAPI system is formally put into use, an flight calibration must be performed.

The airport may independently perform the flight calibration for the PAPI system, or arrange it with that of the airport runway at the same time.

During flight calibration, making sure that the electrical control of all lighting fixture units is in “Calibrate Flight”. If not, click button SW2 on the control panel to make the display of the Nixie tube shown in Figure below:




Display under “Calibrate Flight”

When the system is in “Calibrate Flight”, if the elevation exceeds the limited deviation or the lamp of the light box of certain unit is damaged during flight calibration, the system will not turn off the lamp to cause failure of flight calibration.

During flight calibration, the ground coordination personnel must be experienced, who shall properly adjust the lighting fixture elevation through finely adjusting M16 nut under the stay behind the box according to the instructions of the flight calibration pilot.

Because all light boxes of PAPI have been set to the design elevation prior to flight calibration, the elevation adjustment must be fine during flight calibration if any.

	<ul style="list-style-type: none">■ During flight calibration, adjustment of the M16 nut must be very fine.※ Casual amplitude adjustment may cause tedious rehandling.
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The flight calibration of PAPI may be often completed one time. If the pilot thinks that it is necessary, the secondary flight may be performed. After all requirements are met finally, lock M16 nuts on the rear stay of four light boxes.

Now, the flight calibration of the PAPI system is completed completely.

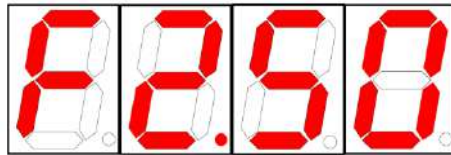
4.1 Disposal after Flight Calibration

After flight calibration, the correct elevations of all lighting fixtures obtained through flight calibration must be recorded and archived for maintenance reference in the future. Except production of various documents specified by the airport management authority and flight calibration procedures, this PAPI system provides the following storage.

(1) Angle storage in electrical system

This PAPI system requires that the user must store the angle confirmed after flight calibration into the PAPI unit, based on which the system may control the PAPI system.

Continuously press the button for longer than 5S and the Nixie tube may display "F" shown in Figure below:



Display under "Calibrate Flight"

After "F" appears, release the button. The unit recovers back to its original state. Now, the current angle value has been stored into the controller chip.

After the angle is stored, release the button, the Nixie tube recovers its display: "C+ current elevation value", namely, "Calibrate Flight". Repress the button to make the mode to be switch to "Operation" and the Nixie tube will alternately display "A+ current elevation value" and "F+ Memory Angle of flight calibration".

With the same method, adjust and set other lighting fixtures in the PAPI system and finally confirm that all lighting fixtures are in "Operation".




- After flight calibration, all lighting fixtures must be switched to "Operation"
- ※ During operation, the system will not turn off the light



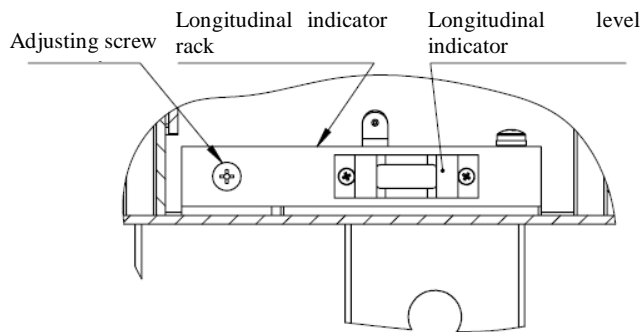
- After the angle confirmed through flight calibration is stored, repressing the button for longer than 5s is prohibited
- ※ Otherwise the elevation stored in the chip confirmed through flight calibration will be removed.

(2) Memory through longitudinal level indicator

Unscrew the adjusting screw in Figure below and the rack will rotate along the spindle to make the bubble in the longitudinal level indicator locate in the middle of the scale.




- The elevation indicator must be set according to the requirements.
- ※ When the control panel is out of order, the bubble may prompt whether the PAPI elevation is correct.




(3) Label recording


A blank label is pasted on the longitudinal indicator rack of the PAPI lighting fixtures for recording the angle after actual flight calibration of the PAPI unit. After flight calibration, the actual elevation of the lighting fixtures may be recorded on the label paper posted on the longitudinal indicator rack with an oily marking pen for reference.



- Check whether all fastening screws on the PAPI unit have been
- ※ Otherwise it may cause failure of the PAPI system



- Check whether all 4 PAPI units are in “Operation”
- ※ Otherwise PAPI may not work normally.



- Making sure to check whether the upper cover of the PAPI is closed
- ※ Otherwise it may cause PAPI failure.

5.0 Replacement of Components of Lighting Fixtures

When any damage or failure occurs to any consumable or other component of the lighting fixtures, it is required to timely dismantle the lighting fixtures for replacement of the component. Replacement of components needs to dismantle the lighting fixtures, so any minor error will cause adverse consequences. The manufacturer requires users to attach importance to the following warnings. It is required to be careful during disassembly, to conduct comprehensive inspection of lighting fixtures, to replace some vulnerable parts as required, conduct the air seal test and to ensure the performance of the lighting fixtures after disassembly.



- Take care when opening and closing the upper cover of the lighting fixtures.
- ※ Otherwise it may hurt your hands or be damaged due to drop.



- Maintenance of the lighting fixtures on the rainy day is prohibited without rain-proof measures.
- ※ Otherwise it may damage the circuit and optical parts.



- Touching any internal optical device is prohibited.
- ※ The position change or surface contamination of the optical device may cause change of the light path.



- Handling the internal electrical device is prohibited without authorization.
- ※ Otherwise it may cause damaged to the circuit.

5.1 How to Replace Lamp

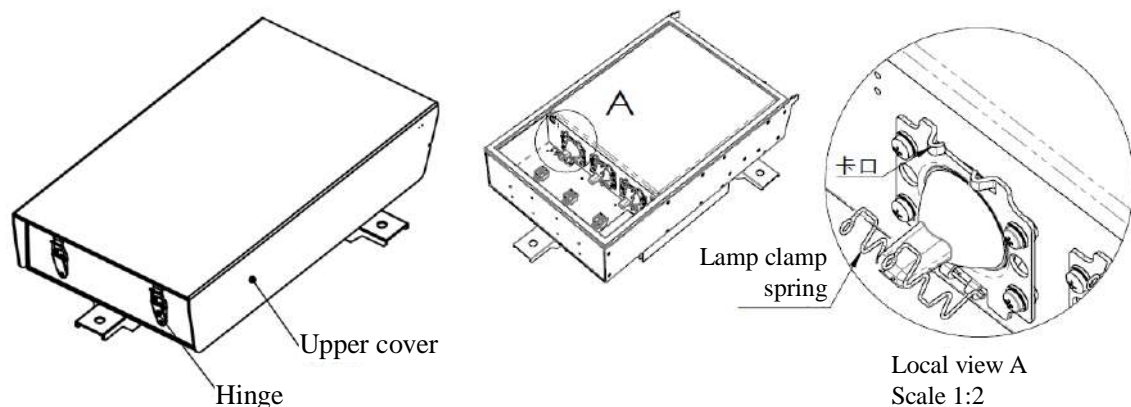
If one lamp in certain PAPI lighting fixture is found to be damaged during daily inspection and maintenance, the user shall immediately replace a new lamp. If the PAPI control panel monitors that two lamps in certain lighting fixture are damaged, this unit will enter “Error” and the remaining PAPI units of the system will turn off the light to switch this unit to “Calibrate Flight” and the faulty light box will be immediately found.

Before replacing the lamp, turn off the CCR power source of the relevant circuit. When replacing the lamp, please wear the cotton gloves, which shall be washed once at least.

Open the upper cover of the PAPI lighting fixtures, pull down the terminal block and release the lamp clamp ring from the interface to take out the lamp; when loading the lamp, place it at the reserved position, clamp the lamp clamp spring into the interface and plug in the lamp terminal block (see Figure below).

After lamp replacement, power one again. After powered on, the PAPI control panel will re-inspect the whole system and light up all light sources. Switch “Calibrate Flight” back to “Operation” and the system recovers its work.

If the service life of the lamp expires, the manufacturer suggests to replace 12 lamps on four units to ensure the reliability of the PAPI system.



- During installation, making sure that the power source is disconnected.
- ※ Otherwise it may cause electric leakage or shock.



- Touching the lamp directly with hands is strictly prohibited.
- ※ Otherwise it may burn the skin.



- Touching the lamp cup with hands is prohibited when replacing a new lamp.
- ※ Touching the lamp cup with hands is one of causes to cause its explosion.



- Switching SW1 or making the metal article close to it is strictly prohibited to avoid automatic trigger.
- ※ Otherwise it may automatically remove the data in the PAPI control panel, causing turnoff of the PAPI system.

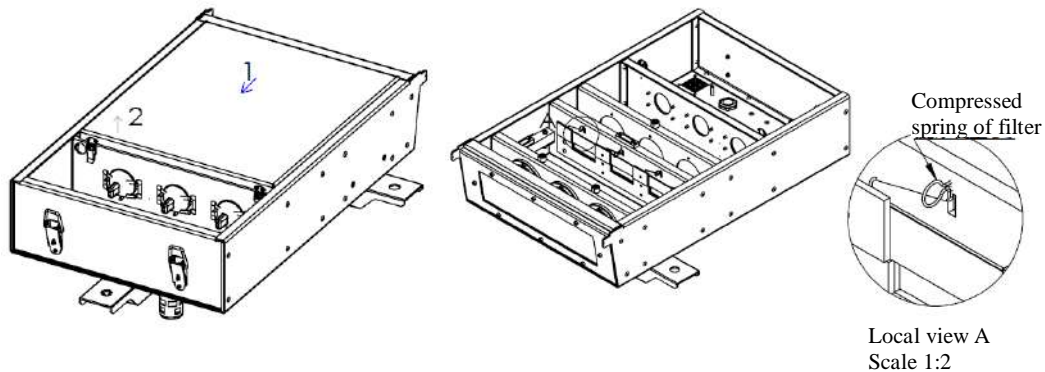
5.2 How to Replace Filter

Before replacing the filter, first turn off the CCR power source of the relevant circuit.

Take out the old filter: Open the upper cover of the PAPI lighting fixtures and internal dust cover plate as shown in Figures (in order shown in Figures 1 and 2);

Wear the cotton gloves, which shall be washed once at least. Gently press the compressed spring of the filter downward, take it out of the fixed groove, hold the lower filter edge, gently push it upward and the filter slips out of the locating groove in the filter pressing bracket.

Load a new filter: Place it along the locating groove of the filter pressing bracket and hold it with fingers, place the compressed spring of the filter on the filter and gently press it downward into the fixed groove.



- During installation, making sure that the power source is disconnected.
- ※ Otherwise it may cause electric leakage or shock.




- The lower edge shall not have any damage.
- ※ Otherwise it may cause unclear red and white beam boundary.



- Cleaning and maintenance of the filter by the laypeople is strictly prohibited.
- ※ Stain left after cleaning seriously impacts optical imaging.

5.3 How to Replace Control Panel

Before replacing the control panel, first confirm and record the current accurate angle. If it is impossible to read the “Memory Angle” on the control panel, it may be obtained from the longitudinal level indicator.

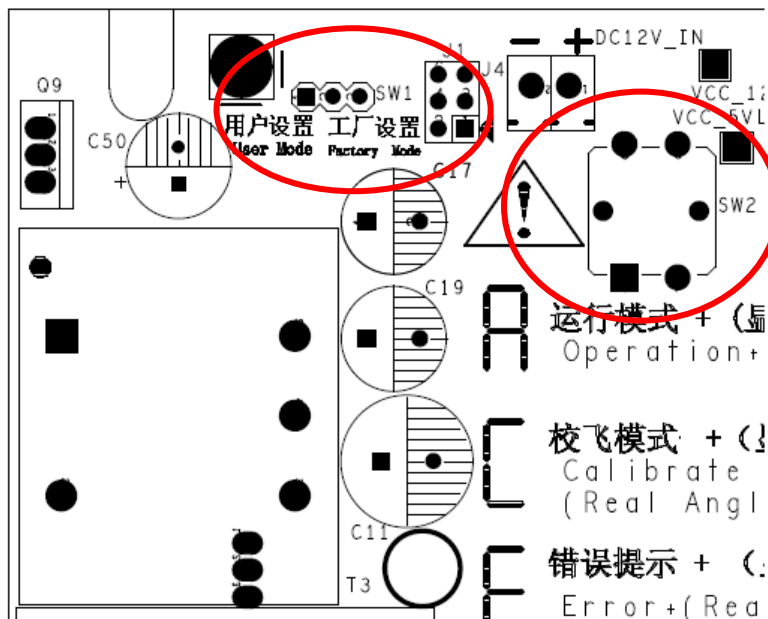


- Before replacing the control panel, first turn off the power source
- ※ The open circuit of the isolation transformer may cause electric shock.

Directly connect a new control circuit board at the original position, tighten the M3 screw and the following operations shall be performed:

1. Plug 10-digit connector and power on.
2. After display of the Nixie tube, switch the jumper cap on SW1 to “Factory Mode”.
3. After the Nixie tube displays “0.00”, continuously press the button SW2 and the angle will be increased by 0.01° per pressing.
4. Press the button SW2 for longer than one 1s and the angle will be increased at the speed of 0.4°/s.
5. When the angle is increased to the recorded angle approximately, release the button SW2 and increase the angle of the four-digit Nixie tube by clicking SW2.
6. When the angle reaches the value set, the jumper cap jumps back to “User Mode”.

The installation of the control circuit board is completed.



When the angle is adjusted, the force to pressing the button shall not be too great, otherwise it may cause the deformation of the control panel, so as to impact the angle inspection.

When the angle is set, if the set value is greater than the value recorded, continuously press the button and start to count from 0.00° after the angle is greater than 9.99°; in addition, re-plug “Factory Mode” after the jumper cap is removed and thus the angle may become zero.

When “Factory mode” is switched to “User Mode”, the angle set has been regarded to be stored. It is unnecessary to press SW2 for a while for storing it.

For SW1 position, see the top in the left Figure. For SW2 position, see left in Figure.



- During installation, making sure that the power source is disconnected.
- ※ Otherwise it may cause electric leakage or shock.



- After calibration, all lighting fixtures must be switched to the “Operation”.
- ※ Otherwise the system will not turn of the light.



- Switching SW1 or making the metal article close to it is strictly prohibited to avoid automatic trigger
- ※ Otherwise it may automatically remove the data in the PAPI control panel, causing turnoff of the PAPI system.

6.0 Maintenance of Precision Approach Path Indicator

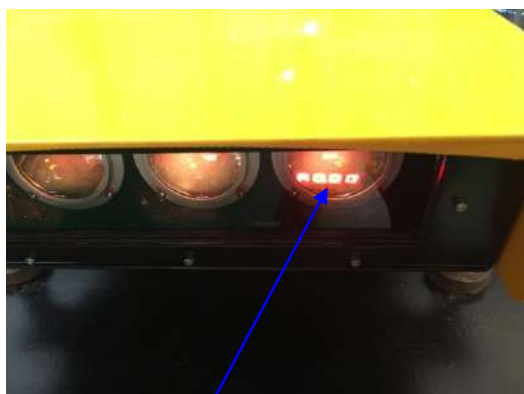
6.1 Daily Inspection and Maintenance

Maintenance of the lighting fixtures shall comply with the “Airport Maintenance Practice” of Section 9 of ICAO’s Airport Service Manual and FAA’s AC150/5345-26 Maintenance of Visual Nav aids at Airport. Because the PAPI system is a very precision optical system, the daily maintenance must be performed by the professional.

6.1.1 Daily Inspection and Maintenance Items

The daily inspection system established and correct maintenance method are very crucial to normal operation of the PAPI system. We suggest the follow items for the user for reference during actual maintenance. Except regular pre-tightening of 10-digit connector of the main control panel in PAPI, we do not provide the daily inspection and maintenance frequency and the user may decide the inspection frequency of all items according to the airport situation.

- I. Lamp inspection. Visually check whether three optical channels of PAPI give out light and do not deviate from the lamp;
- II. Luminous inspection: Visually check that each channel outputs the white and red light and the filter is not damaged;
- III. Elevation inspection. Facing PAPI, you may observe the “current angle” of the four-digit Nixie tube through the rightmost channel. If necessary, the upper cover of PPAI and internal optical box cover may be opened. Visually check whether the bubble of the horizontal and longitudinal level indicator is in the middle;



Angle display



Longitudinal level

Horizontal level



- Making sure that the light intensity of PAPI and the boundary between red and white is clear
- ※ Otherwise it may cause incorrect judgment of the pilot.

IV. Inspection of PAPI fixation. Check that all adjusting nuts on the landing leg are locked and the chassis connection is reliable. The PAPI box may be pushed with hands, without shaking;

V. Airtightness inspection. Visually check that there is no water spot, trace or sand in the box;

VI. Environmental inspection. Visually check that there is no weed or other barrier shading the light in the luminous direction of PAPI;

VII. Inspection of optical components. Visually check that the optical components are not damaged, the front glass is not eroded by the wind or sand and there is no burr. If necessary, clean such optical parts as front and rear lens;



- The lens and front glass, etc. shall be cleaned by the optical professional.
- ※ Stain on the optical device may reduce the light output, or even impact the red and white interface.

VIII. Regular pre-tightening of 10-digit connector of main control panel (once per three months)

6.6A current passes the 10-digit connector of the main control panel. During daily use, the tightening screw of 10-digit connector will be easily loosened, causing burnout of the control panel.



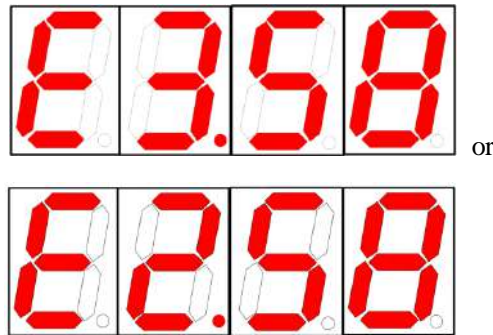
When the 10-digit connector screw is pre-tightened, a slot type screwdriver (head width: 4mm and rod length: 50mm (no overall length)) shall be used. Too wide screwdriver may damage the connector and screw and too small screwdriver may make it impossible to tighten the screw (notes: The torque is 0.5N.m).



- 10-digit connector must be regularly pre-tightened.
- ※ Screw looseness may cause PAPI failure.

6.1.2 Troubleshooting of Common Error of Control Panel

Under “Operation”, when the elevation of any unit in the PAPI system is greater than the set limit or all lamps are damaged, this unit will enter “Error” and the Nixie tube may display the “E+ decimal system value of the current elevation”, as shown in Figure below:



Displays under two “error reporting states”

PAPI unit control panel will have “Error” in the following two cases and the determination methods and solutions are as follows.

(1) The elevation deviation is beyond the set limit.

After 20s, the control panel will turn off the light of the unit with over-deviation and transmit the signal to other PAPI units through the bus, making the whole PAPI system turn off the light and causing CCR to give out an undervoltage alarm.

Determination method: For the PAPI unit with “error state” in the system, if the longitudinal bubble observed is not in the middle and there is a big difference between the memory angle and real angle, it may be determined that the cause of light turnoff is that “the elevation deviation is beyond the set limit”. When the abnormal unit is switched to “Calibrate Flight”, all system lights may light up, such cause may be further determined.

Solution: Make the faulty unit enter “Calibrate Flight” and reset its elevation according to the operation requirements in 3.3.4.

(2) Two lamps in the unit are damaged.

Under “Operation”, when two lamps in any unit of the PAPI system are damaged, the Nixie tube of the unit with damaged lamps also has “anomaly prompt” and transmits the signal to other PAPI units through the bus, making the whole PAPI system turn off the light and causing CCR to give out an undervoltage alarm.

Determination method: For the PAPI unit with “Error” in the system, if the longitudinal bubble observed is in the middle and there is no big difference between the memory angle and real angle, it may be determined that the cause of light turnoff is that “two lamps are damaged”.

Solution: Switch this unit to “Calibrate Flight” and lamps of this unit damaged do not light up. After powering off, replace the damaged lamps according to the operation requirements in Section 5.1 “How to Replace Lamp”.



- During installation, making sure that the power source is disconnected.
- ※ Otherwise it may cause electric leakage or shock.



- After maintenance, PAPI shall be switched to “Operation”.
- ※ Otherwise the system may not work normally.

6.1.3 Inspection Method of Elevation

Visually inspect the angle displayed by the Nixie tube on the control panel to confirm that it falls into the allowable deviation range of the elevation of this lighting fixture. At this moment, bubbles of the horizontal and vertical level indicator systems are in the middle. If the end decimal of the digitally displayed angle has subtle change due to season change or temperature difference between day and night, it is normal, which may be neglected and not impact the normal work of the systems. If the elevation deviation exceeds the allowable value, the elevation of this lighting fixture shall be reset according to the operation requirements in Section 3.3.4 “Elevation Settings”.



- In case of big change of the evaluation of the lighting fixtures, please report it immediately, rather than unauthorized adjustment.
- ※ Otherwise it may cause loss of standard of the PAPI elevation.



- The PAPA elevation must be adjusted by a professional.
- ※ Otherwise it may cause loss of standard of the PAPI elevation.

6.2 Troubleshooting of Common Faults

SN	Common Faults	Fault Causes	Troubleshooting Methods
1	The lamp does not light up.	<p>Check whether the lamp is burnt out;</p> <p>Check the connection between the lamp and its feet;</p> <p>Check whether the circuit is correctly connected;</p> <p>Check the connection of the isolation transformer;</p> <p>Check the current elevation of the lighting fixtures.</p>	<p>Replace the lamp;</p> <p>Correctly and reliably connect the circuit;</p> <p>Recover the elevation value of the lighting fixtures.</p>
2	The light is dim.	<p>Check whether the lamp reaches its expected life;</p> <p>Check whether the lamp is burnt out;</p> <p>Check whether the optical path is dirty.</p>	<p>Replace the lamp;</p> <p>Replace the lamp;</p> <p>Clean the optical components.</p>
3	Unclear red and white boundary	<p>Check whether the fixation position of the filter disc is correct;</p> <p>Check whether the lower plane of the filter disc is bumped.</p>	<p>Correctly install the filter disc;</p> <p>Replace the filter disc.</p>
4	Burnout of wire holder	The wire connecting with the wire holder has no crimping terminal.	<p>Add a crimping terminal for the wire;</p> <p>Replace the wire holder.</p>
5	Damage of 10-digit wire holder	Screw loosened due to failure of inspection	Replace it

7.0 List of Components and Ordering of Spare Parts and Accessories

The list of parts of this product and relevant ordering information of the spare parts and accessories are shown in the Table of this Chapter. The manufacturer accepts to order in a manner of component or separate ordering of the parts. When ordering, please contact the manufacturer or deal according to the ordering No. listed in the Table. The manufacturer recommends to purchase some key parts from the original manufacturer to ensures all indexes of the lighting fixtures.

List of components and spare articles:

Structure No.	Component Name	Order No.	Remarks
1	Upper cover plate assy	61160	
2	Dust cover plate	46602	
3	Seal cover plate	46601	
4	Front glass (assy)	961122	Front glass +gasket sleeve
5	Box	961130	
6	Temperature controlled switch	48511	
7	Transformer	979127	Heating transformer
8	Longitudinal level module	946315	
9	Front glass set	931163	Aluminum ring + double isolation glass
10	Filter disc	61175	
11	Compressed spring	61127	
12	Rear glass set	961185	Aluminum ring + double spherical lens
13	Circuit board	6119B	Lightning protection board
14	Thermal insulation box	46619	
15	Lamp mounting plate	942134	
16	Wire holder	941201	
17	Lamp	105W	KLS 105W
18	Drive assy	961199	Control panel
19	Hose connector	48408	
20	Electric wire set	71802	
21	Junction box	71803	

List of components and spare parts of landing leg assy:

Structure No.	Component Name	Order No.	Remarks
1	Flange	27641	
2	Landing leg	46322	
3	Front cover of landing leg	46317	
4	Tapping screw ST5.5	GB/T845	ST5.5×19
5	Spring washer 16	GB/T7244	
6	Screw	61101	
7	Hex nut M16	GB/T41	
8	Hex thin nut M16	GB/T6142	
9	Lower spherical washer	61103	
10	Upper spherical washer	61104	
11	Wave spring washer 16	GB/T7246	

List of spare articles for normal operation:

Structure No.	Component Name	Order No.	Remarks	Qty
1	Filter	61175		3
2	Lamp	105W	KLS reflection cup 105W	12
3	Circuit board	6119B	Lightning protection board	2
4	Drive assy	961199	Control panel	1



- Making sure that the annual necessary spare parts are in stock
- ※ Making sure that the system works normally

List of supporting accessories of this product is as follows (needing additional order):

Serial No.	Order No.	Description
1	TJB-12-L867	L867 deep base
2	ITF-300-066	300W isolation transformer
3	6119A-01	PAPI-CAN adapter plate

8.0 ° - " Conversion Table

$$1^{\circ} = 60 "$$

$$1 " = 0.016^{\circ}$$

Decimal system degree	Minute
0.017	1
0.033	2
0.050	3
0.067	4
0.083	5
0.100	6
0.117	7
0.133	8
0.150	9
0.167	10
0.183	11
0.200	12
0.217	13
0.233	14
0.250	15
0.267	16
0.283	17
0.300	18
0.317	19
0.333	20

Decimal system degree	Minute
0.350	21
0.367	22
0.383	23
0.400	24
0.417	25
0.433	26
0.450	27
0.467	28
0.483	29
0.500	30
0.517	31
0.533	32
0.550	33
0.567	34
0.583	35
0.600	36
0.617	37
0.633	38
0.650	39
0.667	40

Decimal system degree	Minute
0.683	41
0.700	42
0.717	43
0.733	44
0.750	45
0.767	46
0.783	47
0.800	48
0.817	49
0.833	50
0.850	51
0.867	52
0.883	53
0.900	54
0.917	55
0.933	56
0.950	57
0.967	58
0.983	59
1.000	60

9.0 Packaging, Transportation and Storage

9.1 Packaging and Weight

Packaging of upper box: 1 pc / box

Gross weight of upper box: 19 KG / box

Volume of upper box: 840×550×270

Packaging of landing leg: 12 pcs / box (including flange)

Gross weight of landing leg: 40KG/ box (including flange)

Volume of landing leg: 835×540×290

9.2 Transportation Mode

Well packed products may be transported in three modes- railway, highway and air according to factors such as transportation distance, quantity of lights and delivery cycle.

9.3 Storage

This product shall be stored in a place which is dry, well ventilated and far away from heat source and has no caustic gas. Custody should be checked on a regular basis.

The final right to interpret this manual is reserved by Airsafe Airport Equipment Co., Ltd.

Thanks for your purchasing and using AIRSAFE product!

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