RELIANCE PAPI, Precision Approach Path Indicator

L-880(L)/PAPI and L-881(L)/APAPI

User Manual

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ADB SAFEGATE

A.0 Disclaimer / Standard Warranty

CE certification

The equipment listed as CE certified means that the product complies with the essential requirements concerning safety and hygiene. The European directives that have been taken into consideration in the design are available on written request to ADB SAFEGATE.

ETL certification

The equipment listed as ETL certified means that the product complies with the essential requirements concerning safety and C22.2 No.180:13 (R2018) regulations. The CSA directives that have been taken into consideration in the design are available on written request to ADB SAFEGATE.

All Products Guarantee

ADB SAFEGATE will correct by repair or replacement per the applicable guarantee below, at its option, equipment or parts which fail because of mechanical, electrical or physical defects, provided that the goods have been properly handled and stored prior to installation, properly installed and properly operated after installation, and provided further that Buyer gives ADB SAFEGATE written notice of such defects after delivery of the goods to Buyer. Refer to the Safety section for more information on Material Handling Precautions and Storage precautions that must be followed.

ADB SAFEGATE reserves the right to examine goods upon which a claim is made. Said goods must be presented in the same condition as when the defect therein was discovered. ADB SAFEGATE furthers reserves the right to require the return of such goods to establish any claim.

ADB SAFEGATE's obligation under this guarantee is limited to making repair or replacement within a reasonable time after receipt of such written notice and does not include any other costs such as the cost of removal of defective part, installation of repaired product, labor or consequential damages of any kind, the exclusive remedy being to require such new parts to be furnished.

ADB SAFEGATE's liability under no circumstances will exceed the contract price of goods claimed to be defective. Any returns under this guarantee are to be on a transportation charges prepaid basis. For products not manufactured by, but sold by ADB SAFEGATE, warranty is limited to that extended by the original manufacturer. This is ADB SAFEGATE's sole guarantee and warranty with respect to the goods; there are no express warranties or warranties of fitness for any particular purpose or any implied warranties of fitness for any particular purpose or any implied warranties other than those made expressly herein. All such warranties being expressly disclaimed.

Standard Products Guarantee

Products manufactured by ADB SAFEGATE are guaranteed against mechanical, electrical, and physical defects (excluding lamps) which may occur during proper and normal use for a period of two years from the date of ex-works delivery, and are guaranteed to be merchantable and fit for the ordinary purposes for which such products are made.

Note

See your applicable sales agreement for a complete warranty description.

Replaced or repaired equipment under warranty falls into the warranty of the original delivery. No new warranty period is started for these replaced or repaired products.

FAA Certified products manufactured by ADB SAFEGATE

ADB SAFEGATE L858 Airfield Guidance Signs are warranted against mechanical and physical defects in design or manufacture for a period of 2 years from date of installation, per FAA AC 150/5345-44 (applicable edition).

ADB SAFEGATE LED products (with the exception of obstruction lighting) are warranted against electrical defects in design or manufacture of the LED or LED specific circuitry for a period of 4 years from date of installation, per FAA EB67 (applicable edition). These FAA certified constant current (series) powered LED products must be installed, interfaced and powered with and through products certified under the FAA Airfield Lighting Equipment Program (ALECP) to be included in this 4 (four) year warranty. This includes, but is not limited to, interface with products such as Base Cans, Isolation Transformers, Connectors, Wiring, and Constant Current Regulators.

Note

See your sales order contract for a complete warranty description.

Replaced or repaired equipment under warranty falls into the warranty of the original delivery. No new warranty period is started for these replaced or repaired products.

Liability

WARNING

Use of the equipment in ways other than described in the catalog leaflet and the manual may result in personal injury, death, or property and equipment damage. Use this equipment only as described in the manual.

ADB SAFEGATE cannot be held responsible for injuries or damages resulting from non-standard, unintended uses of its equipment. The equipment is designed and intended only for the purpose described in the manual. Uses not described in the manual are considered unintended uses and may result in serious personal injury, death or property damage.

Unintended uses, includes the following actions:

- Making changes to equipment that have not been recommended or described in this manual or using parts that are not genuine ADB SAFEGATE replacement parts or accessories.
- Failing to make sure that auxiliary equipment complies with approval agency requirements, local codes, and all applicable safety standards if not in contradiction with the general rules.
- Using materials or auxiliary equipment that are inappropriate or incompatible with your ADB SAFEGATE equipment.
- Allowing unskilled personnel to perform any task on or with the equipment.

Copyright Statement

TABLE OF CONTENTS

List of Figures

List of Tables

1.0 Safety

Introduction to Safety

This section contains general safety instructions for installing and using ADB SAFEGATE equipment. Some safety instructions may not apply to the equipment in this manual. Task- and equipment-specific warnings are included in other sections of this manual where appropriate.

1.1 Safety Messages

HAZARD Icons used in the manual

For all HAZARD symbols in use, see the Safety section. All symbols must comply with ISO and ANSI standards.

Carefully read and observe all safety instructions in this manual, which alert you to safety hazards and conditions that may result in personal injury, death or property and equipment damage and are accompanied by the symbol shown below.

	WARNING Failure to observe a warning may result in personal injury, death or equipment damage.
	DANGER – Risk of electrical shock or ARC FLASH Disconnect equipment from line voltage. Failure to observe this warning may result in personal injury, death, or equipment damage. ARC Flash may cause blindness, severe burns or death.
	WARNING – Wear personal protective equipment Failure to observe may result in serious injury.
	WARNING – Do not touch Failure to observe this warning may result in personal injury, death, or equipment damage.
	CAUTION Failure to observe a caution may result in equipment damage.
	ELECTROSTATIC SENSITIVE DEVICES This equipment may contain electrostatic devices.

Qualified Personnel

	**Important Information** The term **qualified personnel** is defined here as individuals who thoroughly understand the equipment and its safe operation, maintenance and repair. Qualified personnel are physically capable of performing the required tasks, familiar with all relevant safety rules and regulations and have been trained to safely install, operate, maintain and repair the equipment. It is the responsibility of the company operating this equipment to ensure that its personnel meet these requirements. Always use required personal protective equipment (PPE) and follow safe electrical work practice.

1.1.1 Introduction to Safety

CAUTION

Unsafe Equipment Use
This equipment may contain electrostatic devices, hazardous voltages and sharp edges on components

- Read installation instructions in their entirety before starting installation.
- Become familiar with the general safety instructions in this section of the manual before installing, operating, maintaining or repairing this equipment.
- Read and carefully follow the instructions throughout this manual for performing specific tasks and working with specific equipment.
- Make this manual available to personnel installing, operating, maintaining or repairing this equipment.
- Follow all applicable safety procedures required by your company, industry standards and government or other regulatory agencies.
- Install all electrical connections to local code.
- Use only electrical wire of sufficient gauge and insulation to handle the rated current demand. All wiring must meet local codes.
- Route electrical wiring along a protected path. Make sure they will not be damaged by moving equipment.
- Protect components from damage, wear, and harsh environment conditions.
- Allow ample room for maintenance, panel accessibility, and cover removal.
- Protect equipment with safety devices as specified by applicable safety regulations
- If safety devices must be removed for installation, install them immediately after the work is completed and check them for proper functioning prior to returning power to the circuit.

Failure to follow this instruction can result in serious injury or equipment damage

Additional Reference Materials

Important Information

- IEC – International Standards and Conformity Assessment for all electrical, electronic and related technologies.
- IEC 60364 – Electrical Installations in Buildings.
- CSA – C22.2 No.180:13 (R2018), series isolating transformers for airport lighting.
- FAA Advisory: AC 150/5340-26 (current edition), Maintenance of Airport Visual Aid Facilities.
- Maintenance personnel must refer to the maintenance procedure described in the ICAO Airport Services Manual, Part 9.
- ANSI/NFPA 79, Electrical Standards for Metalworking Machine Tools.
- National and local electrical codes and standards.

1.1.2 Intended Use

CAUTION

Use this equipment as intended by the manufacturer
This equipment is designed to perform a specific function, do not use this equipment for other purposes

- Using this equipment in ways other than described in this manual may result in personal injury, death or property and equipment damage. Use this equipment only as described in this manual.

Failure to follow this instruction can result in serious injury or equipment damage

1.1.3 Material Handling Precautions: Storage

CAUTION

Improper Storage
Store this equipment properly

- If equipment is to be stored prior to installation, it must be protected from the weather and kept free of condensation and dust.

Failure to follow this instruction can result in equipment damage

1.1.4 Operation Safety

CAUTION

Improper Operation
Do Not Operate this equipment other than as specified by the manufacturer

- Only qualified personnel, physically capable of operating the equipment and with no impairments in their judgment or reaction times, should operate this equipment.
- Read all system component manuals before operating this equipment. A thorough understanding of system components and their operation will help you operate the system safely and efficiently.
- Before starting this equipment, check all safety interlocks, fire-detection systems, and protective devices such as panels and covers. Make sure all devices are fully functional. Do not operate the system if these devices are not working properly. Do not deactivate or bypass automatic safety interlocks or locked-out electrical disconnects or pneumatic valves.
- Protect equipment with safety devices as specified by applicable safety regulations.
- If safety devices must be removed for installation, install them immediately after the work is completed and check them for proper functioning.
- Route electrical wiring along a protected path. Make sure they will not be damaged by moving equipment.
- Never operate equipment with a known malfunction.
- Do not attempt to operate or service electrical equipment if standing water is present.
- Use this equipment only in the environments for which it is rated. Do not operate this equipment in humid, flammable, or explosive environments unless it has been rated for safe operation in these environments.
- Never touch exposed electrical connections on equipment while the power is ON.

Failure to follow these instructions can result in equipment damage

1.1.5 Maintenance Safety

DANGER

Electric Shock Hazard
This equipment may contain electrostatic devices

- Do not operate a system that contains malfunctioning components. If a component malfunctions, turn the system OFF immediately.
- Disconnect and lock out electrical power.
- Allow only qualified personnel to make repairs. Repair or replace the malfunctioning component according to instructions provided in its manual.

Failure to follow these instructions can result in death or equipment damage

1.1.6 Material Handling Precautions, ESD

CAUTION

Electrostatic Sensitive Devices
This equipment may contain electrostatic devices

- Protect from electrostatic discharge.
- Electronic modules and components should be touched only when this is unavoidable e.g. soldering, replacement.
- Before touching any component of the cabinet you shall bring your body to the same potential as the cabinet by touching a conductive earthed part of the cabinet.
- Electronic modules or components must not be brought in contact with highly insulating materials such as plastic sheets, synthetic fiber clothing. They must be laid down on conductive surfaces.
- The tip of the soldering iron must be grounded.
- Electronic modules and components must be stored and transported in conductive packing.

Failure to follow this instruction can result in equipment damage

2.0 About this manual

This document includes RELIANCE™ Precision Approach Path Indicator (PAPI), type LED L-880(L) and L-881(L), Style A [1] and Style B [2] system information with a focus on safety, installation and maintenance procedures.

For more information, see www.adbsafegate.com.

Note
It is very important to read this document before any work is started.

2.1 How to work with the manual

1. Become familiar with the structure and content.
2. Carry out the actions completely and in the given sequence.

[1] Voltage-powered
[2] Current-powered

3.0 RELIANCE PAPI Overview

This manual provides instructions for installation, operation and maintenance of the RELIANCE™ Precision Approach Path Indicator (PAPI) LED system.

The RELIANCE PAPI systems provide visual approach path guidance to pilots of landing aircraft.

3.1 LED PAPI / APAPI

Compliance with Standards

FAA:	L-880(L) / L-881(L) AC 150/5345-28 (Current Edition). ETL Certified.
ICAO:	PAPI / APAPI Annex 14, Volume 1 (Current Edition)
T/C:	API / APAPI Transport Canada TP 312 par. 5.3.16.12 and Appendix 5B, Figure B-19.
EASA:	CS ADR-DSN.M.645
MOS:	Part 139, para. 9.9.4.6
CE:	DIRECTIVE 2014/35/EU: LVD annex IV & with DIRECTIVE 2014/30/EU: EMC annex IV.
Rosaviation/IAC:	AP-170 (Aviation rules. Part 170).

Uses

The RELIANCE™ LED PAPI (Precision Approach Path Indicator) system uses a multi-LED array to form a single light channel on each light unit to provide the pilot precise visual information, enabling the approach procedure to be performed with the utmost accuracy and safety.

Type L-880(L) PAPI system consists of four light units located at the side of the runway adjacent to the origin of the glide path. The nominal glide slope angle is midway between the angular settings of the central pair of the four units. If an aircraft is on the correct approach path, the pilot will see two red and two white light indicators. If the aircraft approach is too high, an increased number of white light indicators will be seen. If the approach is too low, the pilot will note an increased number of red light indicators.

Type L-881(L) APAPI system is an abbreviated PAPI system. It is identical to the L-880(L) PAPI system, except it consists of only two light units (instead of four). The nominal glide slope is midway between the angular settings of the two units, and when the pilot is on or close to the correct approach path, the unit nearest the runway will be seen as red and the other unit as white.

Style A (voltage powered) system is for use with 120 VAC or 240 VAC, 50/60 Hz voltage input. Style B (current powered) system is for use with 6.6 A or 20 A, 50/60 Hz series current input from a CCR.

An electronic inclinometer assembly, which is a mercury-free device, is provided on each light unit to monitor the aiming angle of the light unit. FAA certified PAPIs are designed to de-energize all light units if the optical pattern of any light unit is raised between 0.5° and 1.0° or lowered between 0.25° and 0.5° with respect to the aiming angle of the light unit. For ICAO and TP312 compliant units, this feature is factory disabled, but can easily be enabled if desired.

Features

- LEDs greatly increase light source life and significantly reduce ongoing maintenance costs and periodic relamping expenses.
- Average LED life of 60.000 hours under high-intensity conditions and more than 150.000 hours under typical operating conditions.
- Each light unit uses a maximum 120 W when the heater is active.
- Depending on operating mode, light unit uses 62% to 80% less energy than traditional light units that use three 105 W lamps, two 200 W lamps or three 200 W lamps.
- Unique, sealed optical chamber is designed to prevent dew/frost on LED optical elements.
- Low-power design contributes to a lower life cycle cost and lower cost for CCRs and supporting equipment.
- Use of LED light source improves safety and pilot recognition by eliminating color shifts typical of incandescent light sources at lower intensity settings.
- Digitally controlled heated front glass ensures that the glass is clear of frost/dew within:
  - 3 minutes when ambient: -6 °F to +131 °F (-21 °C to +55 °C)
  - 4 minutes when ambient: -38 °F to -8 °F (-39 °C to -22 °C)
  - 5 minutes when ambient: -67 °F to -40 °F (-55 °C to -40 °C)
- Hardened front glass protects the optical lens from sandblast.
- Voltage powered systems do not require a separate controller cabinet. Controller functionality is incorporated into the Primary Light Unit. This minimizes installation costs and is compliant with FAA Safety Management System requirements to clear the Runway Safety Areas (RSA) and Runway Obstacle Free Areas (ROFA) of all unnecessary obstacles. Operates on an input voltage of 240 VAC +/-10%, 50-60 Hz and can easily be field configured to operate on 120 VAC +/-10%, 50/60 Hz.
- Current powered systems operate on either a 3 or 5-step CCR designed in compliance with IEC or FAA requirements
- A unique digital display indicating the vertical angle can be read from outside the light unit. This eliminates the need to use a manual aiming device during initial installation and for routine verification of vertical angle setting, minimizing maintenance time.
- In the event of a tilt, the digital display indicates which light unit has tilted along with status indicators and horizontal angle. This allows for quick troubleshooting, minimizing the maintenance effort needed to determine which light unit is tilted.
- Light units may be aimed at any vertical angle up to 10°
- Rugged lightning protection complies with ANSI/IEEE C62.41- 1991 Location Category C2 given in FAA Eng. Brief 67. Category C2 is defined as a 1.2/50µS – 8/20 µS combination wave, with a peak voltage of 10,000 V and a peak current of 5,000 A.
- For voltage powered systems, a photoelectric control on the primary light unit automatically provides full intensity during the day and a reduced intensity (5% or 20% of full intensity) at night. A circuit breaker is provided to permit the input power to be de-energized for field maintenance.
- Includes an integral deflection plate on the top front edge of the light unit cover to prevent the pilot from seeing reflected light from the top of the light unit during approach.
- Body is painted black. Top cover is painted aviation orange for FAA systems and aviation yellow for ICAO/TP 312 systems.
- A set of waterproof cables, connectors and connector boxes are provided to allow for a fast, reliable installation of each PAPI unit.

- Meets both FAA Class I and II temperature ranges:
  - Class I: -31 °F to +131 °F / -35 °C to +55 °C
  - Class II: -67 °F to +131 °F / -55 °C to +55 °C
- Protection class IP55.

Power Supply

For Style A (Voltage Powered) systems, power is supplied to the primary light unit. For Style B (Current Powered) systems, power is supplied individually to each light unit via a 6.6/6.6 A or 20/6.6 A, 200 W isolation transformer.

Style A (Voltage Powered)	
Input Voltage	240 VAC ±10%, 50/60 Hz or 120 VAC ±10%, 50/60 Hz [1]
L-880(L) PAPI (4 box):	528 VA max
L-881(L) APAPI (2-box):	264 VA max
Style B (Current Powered)	
Input Current	6.6 A or 20 A Series Circuit
L-880(L) PAPI (4-box) Total CCR Load:	630 VA max [2]
L-881(L) APAPI (2-box) Total CCR Load:	330 VA max [2]

Notes

1 Source power maximum 305 m (1000 ft) away using 6 mm^2 (AWG 10) wire.

2 Includes PAPI light units and isolation transformers.

Optional touchpad cover provides added protection for the LED display. See user manual for installation instructions.

3.2 Signal Display

3.2.1 Type L-880(L) PAPI (4 Light Unit) System

The L-880(L) PAPI system consists of four identical light units installed in a line perpendicular to the runway centerline. The units are usually installed on the left side of the runway viewed from the approach end.

The units should be aimed so that pilots during a landing approach will see the signal format shown below left in Figure 1:

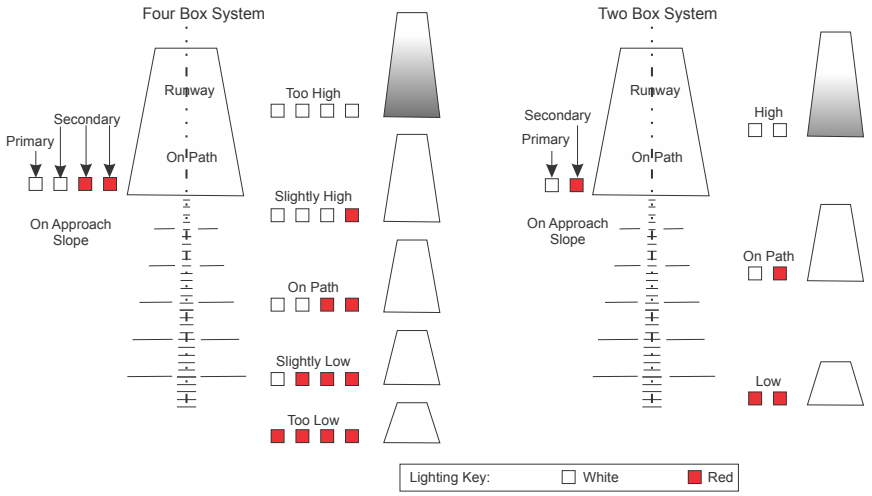
- If the aircraft is **too high above** the approach slope, **all four units are white**.
- If the aircraft is **slightly above** the approach slope, **three units are white** (farthest from the runway); the other is red.
- If the aircraft is **close to or on** the approach slope, **two units are red and two are white**.
- If the aircraft is **slightly below** the approach slope, **three units are red** (closest to the runway); the other is white.
- If the aircraft is **too far below** the approach slope, **all four units are red**.

3.2.2 Type L-881(L) APAPI (2 Light Unit) System

The L-881(L) APAPI system consists of two identical light units installed in a line perpendicular to the runway centerline. The units are usually installed on the left side of the runway viewed from the approach end. The units should be aimed so that pilots during a landing approach will see the signal format shown below right in Figure 1:

- If the aircraft is **too high above** the approach slope, **both units are white**.
- If the aircraft is **close to or on** the approach slope, **one unit is red and one is white**.
- If the aircraft is **too far below** the approach slope, **both units are red**.

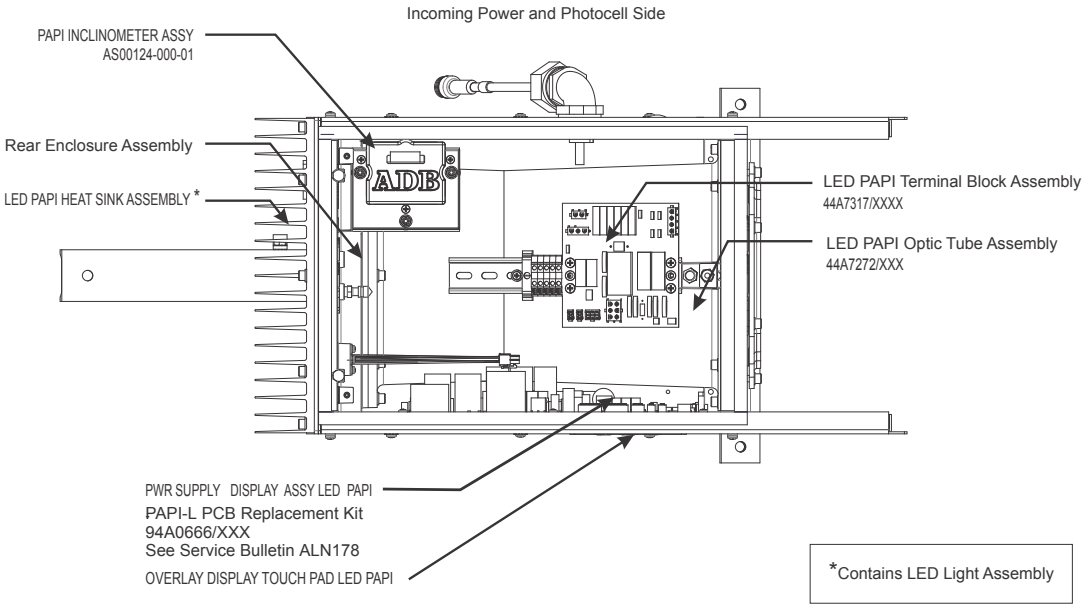
Figure 1: Signal Display - L-880(L) PAPI (4 Light Unit) and L-881(L) APAPI (2 Light Unit) Systems



3.3 RELIANCE PAPI Light Unit

A RELIANCE PAPI light unit contains one LED light assembly, optical unit, front glass, a Control PCB and an Inclinometer PCB. The PAPI unit is mounted on three adjustable legs. See Figure 8. Each component is discussed below. See Figure 2.

Figure 2: RELIANCE PAPI light unit



LED Light Assembly

An LED light assembly is located in the rear of the unit, aligns to pin located on the heat sink.

Optical Unit

A sealed optical unit that contains the optics and is designed to prevent dew, frost and dust from interfering with the light output and transition.

Front Glass

The heated front glass is designed to protect the optical unit and insure that the front glass is kept free of dew and frost.

Digital Display

A unique digital display indicating the vertical angle can be read from outside the light unit. This eliminates the need to manually use an aiming device during initial installation and for routine verification of vertical angle setting, minimizing maintenance time.

Tilt Detection Electronics

The tilt measurement/control electronics, built into the Control PCB and Inclinometer PCB, are designed to de-energize the LEDs if the optical pattern is raised more than ½ degree or lowered more than ¼ degree from the proper setting angle or if the optical pattern is tilted horizontally in either direction more than 1.75 degrees. If any Light Unit is moved from proper vertical or horizontal alignment, all PAPI light units will de-energize after about 25 seconds.

Note

For ICAO/TP312 PAPIs, the tilt/de-energizing LEDs function is optional.

3.4 Operation Overview - Voltage Powered Systems

This section provides an overview of operation for the Style A voltage powered RELIANCE PAPI system.

3.4.1 Primary Enclosure

Input voltage (Figure 49) is supplied to the Primary Enclosure at circuit breaker, Terminals 1 and 2 on the DIN rail. The Earth Ground connection attaches to the input power board on the DIN rail at J10 from the internal panel ground lug. The circuit breaker provides overcurrent protection. When the circuit breaker is turned on the voltage is fed to the input power board, which is used for lightning protection, then to the switch located on the front bulkhead, giving the user the ability to turn the system on and off externally. The switch feeds the input voltage back to the input power board which passes the voltage on to the secondary units and also fuses the voltage prior to feeding the power transformer. The power transformer steps the incoming voltage (120/240VAC) down to various internal operating voltages (0V, 24V, 48V). These voltages are fed to the Main control board via the input power board along with signals used for photocell control and remote operation control. The primary enclosure will turn the system on and off if any errors are detected on secondary units. This error detection is done through the use of CAN bus communications.

3.4.2 Local/Remote Operation

DIP switch (SW3-1 on PCU-1) on the control board in the primary unit enables remote or local mode operation. When set to LOCAL the system can be operated locally. When the switch is set to remote (REM) and the remote wires are connected to terminals 4 & 5 on the DIN rail, the PAPI system can be turned on or off from a remote location using a dry-switch contact closure across Terminals 4 & 5 of the DIN rail.

If the switch is in LOCAL, the PAPI system then turns ON to either the 100% level (if Daytime) or to the 5% or 20% level (if Nighttime) as controlled by the photocell.

If the switch is in REMOTE and there is a Remote ON command via a contact closure across Terminals 4 & 5 on the DIN rail. The PAPI system then turns ON to either the 100% level (if Daytime) or to the 5% or 20% level (if Nighttime) as controlled by the photocell.

3.4.3 Daytime Operation

The photocell is powered with 24VAC via the input power board feeding the main control board from the power transformer after is has been stepped down from 120VAC or 240VAC. The photocell connects to the input power board via connector J2. When illumination on the photocell rises to 50-60 foot-candles, the photocell is de-energized. A delay of 45-75 seconds is incorporated in the photocell circuit to prevent switching because of stray light or temporary shadows. Zero volts is then present on J2-2 on the input power board, which the control board interprets as a Daytime signal and will control the secondary units using CAN bus communication to all turn on to the 100% level.

3.4.4 Nighttime Operation

When the illumination drops to 25 to 35 foot-candles (270-377 lux), the photocell energizes. 24VAC is then present on J2-2 on the input power board. The control board interprets this signal as a Nighttime signal. A delay of 45-75 seconds is incorporated in the photocell circuit to prevent switching because of stray light or temporary shadows. If the photocell control circuitry fails, the system reverts to high intensity. Two night-intensity settings, 5% and 20% of full intensity, can be set by using DIP switch (SW3-2 PCU-2). This allows the user to select either of the two settings to accommodate local site conditions. The primary unit will control the secondary units using CAN bus communication to all turn on to the selected intensity level.

3.4.5 Output to LED Light Assembly

Each individual unit has a control board with LED drivers which control the light engine of each individual unit.

3.4.6 Optional Interlock Relay

This option provides ON/OFF control through current sensing of the runway series circuit during nighttime operations when operated by remote control.

Note

A 6.6 A secondary, 30/45W isolation transformer is typically used. However, a 10/15W or 20/25W isolation transformer may be used.

If DIP switch (SW3-1 PCU-1), is in LOCAL, the PAPI system then turns ON to either the 100% level (if Daytime) or to the 5% or 20% level (if Nighttime) as controlled by the photocell. Therefore, in this situation, the current sensing input has no effect on operation.

If DIP switch (SW3-1 PCU-1), is in REMOTE and there is a Remote ON command via a contact closure across Terminals 4 & 5 on the DIN rail and it is Daytime, the PAPI system then turns ON to 100% level as controlled by the photocell. Therefore, in this situation, the current sensing input has no effect on operation.

If DIP switch (SW3-1 PCU-1), is in REMOTE and it is Nighttime, and the current in the series circuit is greater than 2.8A (as provided by an external isolation transformer connected to Terminals 4 & 5 on the DIN rail, with a wire passing through CT1 on the control board that is attached to Terminals 4 & 5 on the DIN rail), the PAPI system then turns ON to either the 5% or 20% level. If current in the series circuit is less than 2.8A, the PAPI system turns off.

3.5 Operation Overview - Current Powered Systems

This section provides an overview of operation for the Style B current powered RELIANCE PAPI system.

3.5.1 Style B Power

The PAPI Style B is designed to operate from an L-828 Constant Current Regulator (CCR) with a maximum output current of 6.6 A. A single 200 W isolation transformer is connected to each Light Unit. Current from the secondary of the isolation transformer supplies power to the LED Light Assembly. When used on a 20 A series lighting circuit, a 20A/6.6A isolation transformer must be used to step the current down to 6.6 A. The CCR controls the brightness of the PAPI system. The CCR may have three or five brightness steps.

An ordering option is available for a current-powered style B LED PAPI with redundant series circuit input power capability. With this system there will be two independently fed circuits both simultaneously connected to the LED PAPI input power PCB [see wiring diagram Dual-Power Source]. Under normal operation the primary input power source will be the preferred source. If the primary input power source fails, the PAPI will automatically switch to the redundant input power source. If the primary input power source is re-energized then the PAPI will automatically switch back to the primary input power source.

Refer to one of the following wiring diagrams in Wiring Diagrams .

3.6 Operation Overview - RELIANCE PAPI Light Unit

Style A - Voltage Powered

The light units used in Style A systems contain the following components; Control Board, Inclinometer Board, Power Transformer, DIN rail with terminals and Input Power Board, Light Engine, Front Glass Defroster and Display Board. In Style A systems the Primary unit also contains a Photocell, Circuit Breaker and External ON/OFF switch.

Style B - Current Powered

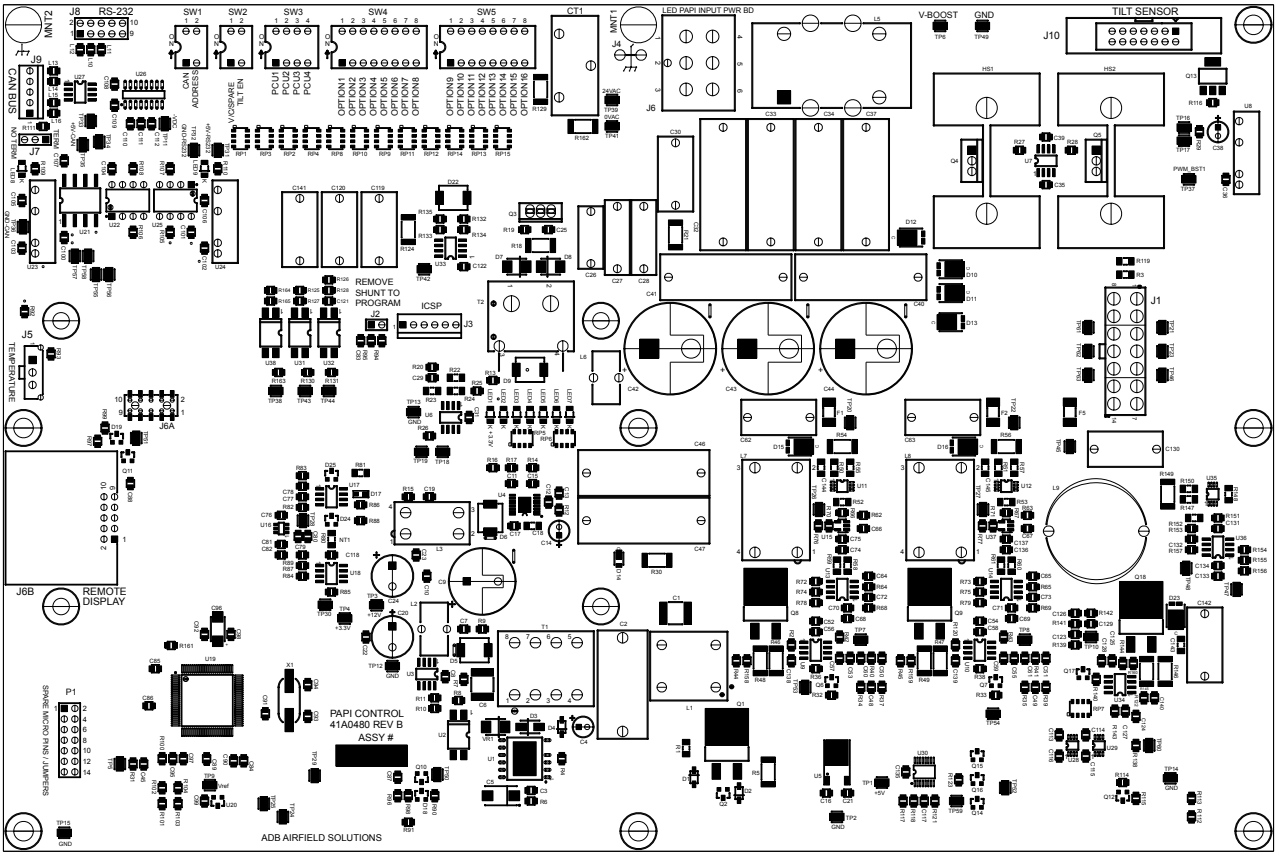
The light units used in Style B systems contain the following components; Control Board, Inclinometer Board, DIN rail with terminals and Input Power Board, Light Engine, Front Glass Defroster and Display Board.

If any PAPI light unit is tilted, the tilt electronics are activated, de-energizing all light units after about 25 seconds. The PAPI system cannot be re-energized until all the PAPI units are in proper alignment.

3.6.1 RELIANCE PAPI Control Board Overview

The Control Board has a micro controller that controls all operations of the PAPI Light Unit as follows:

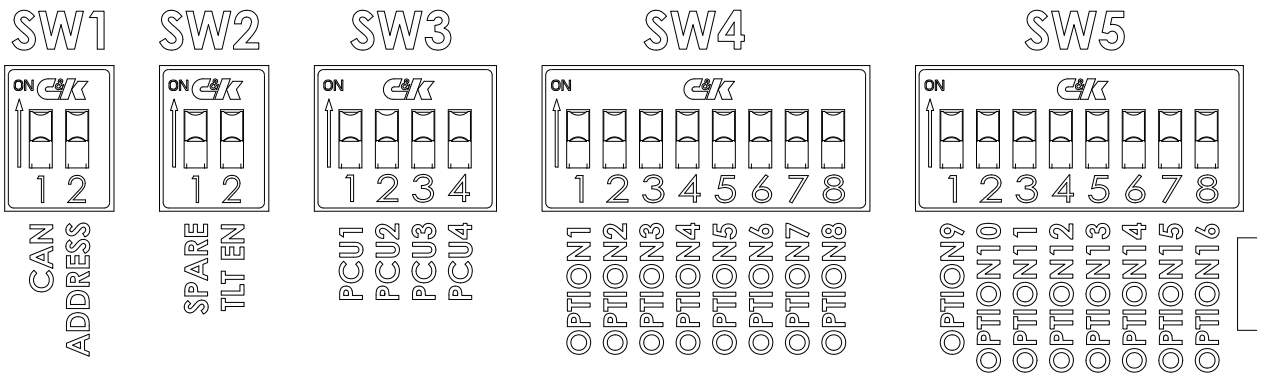
Figure 3: RELIANCE PAPI PCB



Dip Switches

The Control Board contains many DIP switches which are used for configuring each PAPI Unit.

Figure 4: LED PAPI Control PCB Dip Switches



The tables below outline the function of each DIP switch.

Table 1: Light Unit Position - Switch SW1

Dash Number	Light Unit	CAN / ADDRESS	
		SW1-1 (CAN)	SW1-2 (ADDRESS)
/XXXXXX1	Position 1	ON	ON
/XXXXXX2	Position 2	OFF	ON
/XXXXXX3	Position 3	ON	OFF
/XXXXXX4	Position 4	OFF	OFF

Table 2: Function of the DIP Switches

SW	PCB LABEL	ON Position	OFF Position	DEFAULT
2-1	SPARE	N/A	N/A	OFF
2-2	TLT EN	Tilt disabled (ICAO)	Tilt enabled (FAA)	Pre-Configured
3-1	PCU1	Local	Remote	Pre-Configured
3-2	PCU2	5% Night intensity	20% Night intensity	Pre-Configured
3-3	PCU3	PCU Interlock, 100% daytime Current Sense at night	Current Sense all the time	Pre-Configured
3-4	PCU4	2 box system	4 box system	Pre-Configured
4-1	OPTION1	When current powered, LEDs are OFF for B1 and B2	LEDs are ON for steps B1-B5	OFF
4-2	OPTION2	LEDs stay ON when heat failure is detected	LEDs turn OFF when heat failure is detected	OFF
4-3	OPTION3	LEDs turn OFF on all PAPI light units in the network when a heat failure is detected on one of the PAPI light units	All other PAPI light units in the network are unaffected by heat failure	OFF

Table 2: Function of the DIP Switches (Continued)

SW	PCB LABEL	ON Position	OFF Position	DEFAULT
4-4	OPTION4	LEDs turn OFF on all PAPI light units in the network when a LED failure is detected on one of the PAPI light units (has no effect in ICAO mode)	All other PAPI light units in the network are unaffected by LED failure	OFF
4-5	OPTION5	N/A	N/A	OFF
4-6	OPTION6	N/A	N/A	OFF
4-7	OPTION7	N/A	N/A	OFF
4-8	OPTION8	N/A	N/A	OFF
5-1	OPTION9	N/A	N/A	OFF
5-2	OPTION10	N/A	N/A	OFF
5-3	OPTION11	N/A	N/A	OFF
5-4	OPTION12	N/A	N/A	OFF
5-5	OPTION13	N/A	N/A	OFF
5-6	OPTION14	N/A	N/A	OFF
5-7	OPTION15	(Test Mode) - No error messages are displayed to the user interface	All error messages are displayed to the user interface	OFF
5-8	OPTION16	Defrost Timer disabled (instant ON)	Defrost timer enabled (180s)	OFF

Note

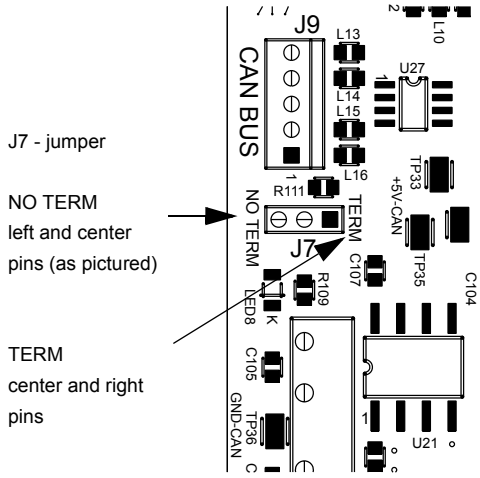
There is also a circuit on the control board to automatically detect if the Unit is Current Powered or Voltage Powered.

Note

When the switch is OFF it corresponds to a '1', when the switch is ON it corresponds to a '0'.

2-box and 4-box Termination Setup at J7

Figure 5: Light Unit Control/Display Board - J7 jumper setting



Light Unit Control/Display Board - J7 jumper setting

2-box setup: both the primary and secondary will be terminated (TERM).

4-box setup: both the primary and box-4 will be terminated (TERM); boxes 2 and 3 will have the jumper set to NO TERM position.

Light Engine Control

LED driver circuitry is used in combination with the micro controller to control the brightness levels of the light engines in the RELIANCE PAPI. This circuitry will alter the brightness levels of the LEDs when attached to a CCR according the FAA Engineering Brief 67 (current rev).

Lamps Out

The micro controller monitors the voltage and current across each LED strand (white and red). If one of the LEDs in either of the strands goes out (open) the micro controller recognizes the abnormal voltage and will shut down the other LED string in the unit as well. The display on the unit will show a corresponding error, RED -> LED -> FAIL, on the unit that has the error. In order to fix this issue the light engine may have to be replaced.

Defroster Control

LED driver circuitry is used in combination with the micro controller to control the operation of the front glass defroster. The circuitry will change the amount of current passing through the front glass defroster. When initially turned on, the RELIANCE PAPI has a delay where the front glass is powered in order to properly clear the front glass before turning the light engines on. During normal operation, when the light engines are operating, the front glass defroster will be operating in the range between 0 - 50W, depending upon ambient temperature. The micro-controller monitors the power to the front glass defroster. If the micro- controller detects that the front glass defroster is opened or shorted the unit will shut down and display the following error on the display: HEAT -> FAIL.

Note

FAA systems will be shipped to activate lighting at the requested intensity within 5 seconds after the activation of power or current, per FAA AC 150/5345-28 (latest revision). This has been mandated by the testing authority for certification. Note that dew/frost on the lenses may obscure the well defined transition of the PAPI, as noted in FAA CertAlert 02-08 in the front of this manual. It is recommended at this time that PAPI light units on active runways be kept in at least a minimal light output to apply heat to the outer lens to keep it clear of dew/frost at all times, per the FAA CertAlert.

The preset configuration for the heater function can be overridden through switch SW 5-8 (OPTION16) on the Control PCB to prevent light output until the outer lens is clear, typically three-five minutes after power/current has been applied. Note that this is not an approved option for FAA installations, and applying this option will place the PAPI installation to be non-compliant with the FAA Advisory Circular.

Tilt Measurement

The micro controller reads the tilt sensor angle from the Inclinometer Board 20 times per second through a digital interface via the ribbon cable that connects the Control Board to the Inclinometer Board. The angle is displayed on the four-digit LED display and compared to the set angle from the last time the SET ANGLE button was pushed. A tilt situation can occur in two situations. First, if the measured vertical (Glide) angle either 0.25 degrees less than the desired glide angle or 0.50 degrees greater than the desired vertical (Glide) angle. Second, if the measured horizontal (Azimuth) angle is either less or greater than 1.75 degrees. The micro controller will then turn all the lamps off within the Light Unit and will also display the error, BOXx -> TILT, where x = 1, 2, 3 or 4, whichever unit is tilted. The remaining boxes in the system will all display the same error so the user knows which unit is titled.

CAN Bus Communications

Each RELIANCE PAPI unit communicates using CAN bus protocol. The individual units are set up to know which box position they are, 1, 2, 3 or 4. The Primary unit, box 1, sends a command to all secondary units that will respond to the primary unit. The CAN messaging allows the RELIANCE PAPI system to share information between each of the units.

- The voltage powered Style A intensity is controlled via CAN bus communication.
- Both Style A and Style B share fault conditions and tilt situations via CAN bus communications.

  Photocell (Primary Only)

  The Primary Unit in each voltage powered system has a photocell attached. The photocell input is read by the micro controller and will relay this signal to the secondary units using the CAN bus communication link. During daylight the intensity of the light output will be 100%. During nighttime operation the intensity of the light output will be 5% or 20% as selected on the DIP switches, shown previously.

  Circuit breaker & External ON/OFF switch (Voltage Powered Primary Only)

  The Primary unit in each voltage powered system has a circuit breaker and external ON/OFF switch. The circuit breaker protects the entire system from overload or short circuit. The external ON/OFF switch allows the user to turn the entire system ON or OFF from the primary unit. The circuit breaker is located next to the Input Power PCB, and the external ON/OFF switch is located on the front panel.

  Remote/Local Switch (Voltage Powered Primary Only)

  The local/remote switch (SW3-1) determines if external control signals will be used to remotely control the PAPI system. In local operation, only the photocell is active.

3.6.2 RELIANCE PAPI Display Board Overview

Startup

The PAPI display board at startup will show the following message; with XXX -> SEC repeated until the light output is activated, if the defrost timer (SW 5-8) is enabled.

ADB -> LED -> PAPI -> BOXn -> OFn -> COLD -> -> XXX -> SEC.

Errors

The following errors can be displayed by the four-digit LED display, if error messages are enabled;

Communications Lost

- COMM -> LOST

  Defroster Error

- HEAT -> FAIL

  Red LED Error

- RED -> LED -> FAIL

  White LED Error

- WHT -> LED -> FAIL

  Photocell Error

- PHOT ->FAIL

  Unit Tilt Error

- BOXn -> TILT

Normal Operation

Under Normal Operating conditions the four-digit LED display will show the following information:

When the GLIDE LED is on, the glide angle will be displayed or LOW if the glide angle is less than 0. If the readout shows **HI**, this indicates that the glide slope is greater than 9.99 degrees from horizon.

When the LEVEL LED is on, the level angle will be displayed.

When the SET LED is on, SAVE will be displayed if the SET button is pushed for more than five seconds to store the GLIDE angle.

3.6.3 RELIANCE PAPI Inclinometer Overview

The Inclinometer Board contains a dual axis inclinometer that provides instrumentation grade performance for leveling applications. It contains a silicon-based chip that measures the tilt angle and transmits it to the RELIANCE PAPI Control board over a digital interface.

4.0 Siting the RELIANCE PAPI System (FAA)

This section provides guidance on how to determine the physical location for each light unit for an FAA system. Refer to FAA AC 150/5340-30 (current edition) for additional information.

For guidance on how to determine the physical location for each light unit for an ICAO system, refer to Annex 14 (current edition) paragraphs 5.3.5.24 to 5.3.5.46 and in the Aerodrome Design Manual, Part 4 – Visual aids (current edition), section 8.3.

Only FAA siting guidance is explained here after.

4.1 Siting Considerations

When viewed from the approach end, the PAPI system should normally be located on the left-hand side of the runway as shown in Figure 6. The PAPI may be located on the right side of the runway if siting problems exist, such as conflicts with runways or taxiways. The PAPI must be sited and aimed so that it defines an approach path with adequate clearance over obstacles and a minimum threshold crossing height.

If the runway has an established ILS glideslope, refer to Siting a PAPI with an FAA ILS Glideslope . The PAPI must be installed so that the visual glideslope coincides (as much as possible) with the electronic glideslope. If there is no ILS on the runway, refer to Siting PAPI on FAA Runways Without ILS . The PAPI's glideslope must be chosen to ensure the on- course signal of the PAPI provides adequate clearance over obstacles.

4.1.1 Distance of the PAPI Light Units from the Runway Edge

See Figure 6. The light unit nearest the runway must be no closer than 50 feet (15.2 m) (+10, -0 feet) (+3, -0 m) from the runway edge or to other runways or taxiways. This distance may be reduced to 25 feet (7.62 m) for small general aviation runways used by non-jet aircraft. Heliports or military airports may require steeper angles. An optional elevation kit is available for glide angles greater than 5 degrees.

4.1.2 Lateral Spacing of the PAPI Light Units

The PAPI light units must have a spacing between the center of the light units of 20 to 30 feet (6.1 to 9.1 m). Regardless of the actual spacing chosen, the distance between light units must not vary by more than 1 foot (300 mm). Refer to FAA and ICAO document for further information.

4.2 Siting a PAPI with an FAA ILS Glideslope

When a runway has an established ILS electronic glideslope, the PAPI on-slope signal should coincide, as much as possible, with that for the ILS. To accomplish this, place the PAPI at the same distance (tolerance of ±30 feet or ±9.1 m) from the threshold as the virtual source of the ILS glideslope and aim at the same angle as the ILS glideslope.

Refer to Table 3. This procedure must be modified for runways that serve aircraft in height group 4 because of the eye-to-antenna distance. For these runways, the distance of the PAPI from the threshold must equal the distance to the virtual source of the ILS glideslope plus an additional 300 feet (91 m) (+50 feet, -0 feet) (+15.2 m, -0 m). Calculations should be performed to ensure that the site chosen provides adequate obstacle clearance and threshold crossing height. See also FAA AC 150-5340-30 diagram of the same name.

Figure 6: FAA PAPI Obstacle Clearance Surface

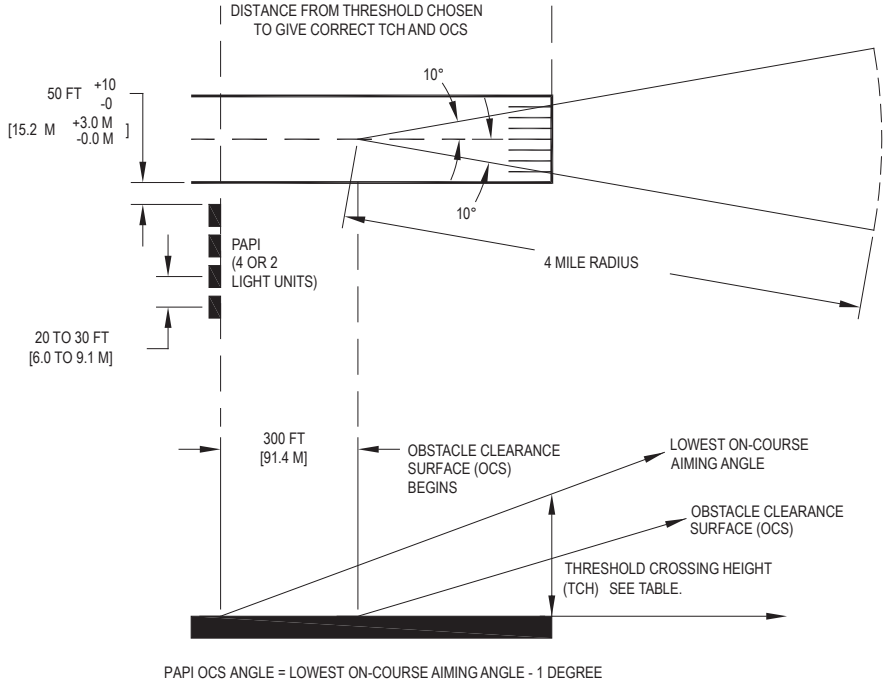


Table 3: FAA Threshold Crossing Height

Type of Aircraft	Cockpit-to-Wheel Height	Visual Threshold Crossing Height	Remarks
Height Group 1 (General aviation, small commuters, corporate turbojets)	10 feet (3.0 m) or less	40 feet (12 m) (+5 ft, -20 ft) (+1.5 m, -6.1 m)	Many runways less than 6,000 ft (1828.8 m) long with reduced widths and/or restricted weight bearing which would normally prohibit landings by larger aircraft
Height Group 2 (F-28, CV 340/440/580, B-737, DC 8/9)	15 feet (4.6 m)	45 feet (13.7 m) (+5 ft, -20 ft) (+1.5 m, -6.1 m)	Regional airport with limited air carrier service
Height Group 3 (B 707/720/727/757)	20 feet (6.1 m)	50 feet (15 m) (+5 ft, -15 ft) (+1.5 m, -4.6 m)	Primary runways not normally used by aircraft with ILS glideslope-to-wheel heights exceeding 20 ft (6.1 m)
Height Group 4 (B-747/767, L-1011, DC-10, A-300)	Over 25 feet (7.6 m)	75 feet (23 m) (+5 ft, -15 ft) (+1.5 m, -4.6 m)	Most primary runways at major airports.

4.3 Siting PAPI on FAA Runways Without ILS

When the runway does not have an ILS glideslope, the PAPI must be sited and aimed so that it defines an approach path which will produce the required threshold crossing height and clearance over any obstacles in the approach area.

4.3.1 Threshold Crossing Height (TCH)

See Figure 6. The TCH is the height of the lowest on-course signal at a point directly above the threshold and the runway centerline. The minimum allowable TCH depends on the height group of the aircraft using the runway, and is shown in Table 3. The glideslope of the PAPI must provide the proper TCH for the most demanding aircraft height group using the runway.

4.3.2 Glideslope Angle

The standard visual glideslope angle for the PAPI is 3 degrees. For non-jet runways, this may be raised to 4 degrees if required to provide obstacle clearance.

4.3.3 Distance of PAPI from Threshold

The following method can be used to determine the PAPI installation distance from the runway threshold provided there are no obstacles in the area from which the PAPI signals can be observed, no differences in elevation between the threshold and the installation zone of the PAPI or between the units, or reduced length of runway. The distance of the PAPI Light Units from the threshold (D1) can be calculated from the equation:

D1 = TCH x cotangent (angle of lowest on-course signal)

where the TCH is the threshold crossing height for the most demanding aircraft using the runway.

Refer to Table 3. The angle of the lowest on-course signal is determined as follows:

- For the L-880(L) PAPI system the angle of the lowest on-course signal will be the aiming angle of the third Light Unit from the runway minus 1.5 minutes or arc.

Note

The subtraction of 1.5 minutes of arc takes into account the width of the transition sector (3 minutes of arc) between the white and red part of the PAPI light beam. The lowest possible on-course signal is 3′/2 = 1.5′ lower than the aiming angle.

- For the L-881(L) APAPI system this angle will be the aiming angle of the outside Light Unit minus 1.5 minutes of arc.

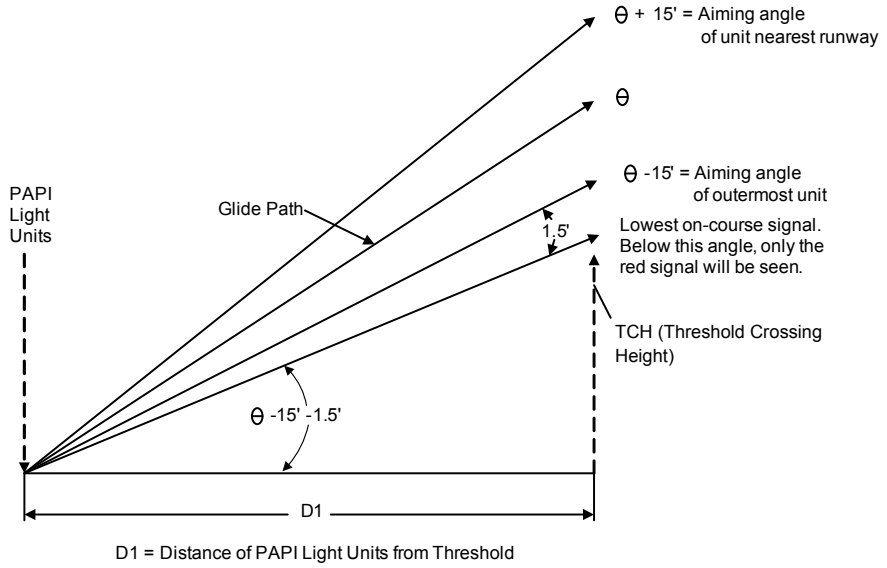
4.3.4 Obstacle Clearance Surface

Position and aim the PAPI so that no risk exists of an obstruction being located in an area where the PAPI signals can be observed. Make a survey of the site to determine if an obstacle is present in the area where you can observe the PAPI signals.

See Figure 6. This obstacle clearance surface begins 300 feet (91 m) in front of the PAPI Light Units (closer to the threshold) and proceeds outward into the approach area at an angle of 1 degree less than the lowest on-course signal. This surface extends 10 degrees on either side of the runway centerline to a distance of 4 miles (6 km) from the point of origin.

If an obstruction penetrates the obstacle clearance surface and cannot be removed, then the re-aim the glideslope angle or move the PAPI system further from the threshold. By moving or re-aiming the PAPI, re-position the obstacle clearance surface so that it will not be penetrated by an obstruction. See Figure 7.

Figure 7: Obstacle Clearance Surface



The 1.5′ is one-half the width of the transition sector of the light beam. The transition between the white to red part of the beam is 3 minutes of arc (3′). Hence the additional 1.5′ must be taken into account in calculating D1.

- For L-881(L): D1 = TCH x cotangent (Θ - 15′ - 1.5′).

Note

For the L-880(L) PAPI system, the lowest on-course signal will be the aiming angle of the third Light Unit from the runway minus 1.5′. For a standard L-880(L) installation the lowest on-course signal will be Θ -10′ - 1.5′. For Height Group 4 aircraft this angle will be Θ - 15′ - 1.5′.

- For L-880(L) (Standard Installation): D1 = TCH x cotangent (Θ - 10′ - 1.5′).
- For L-880(L) (Ht. Group 4 aircraft): D1 = TCH x cotangent (Θ - 15′ - 1.5′).

4.3.5 Reduction of Beam Coverage for Obstacle Avoidance

A PAPI system may require a reduction of the horizontal beam coverage because of an obstacle in the approach area. If this is the case, special consideration should be given to the following factors when determining the required system cutoff angle(s):

- Type and location of the obstacle with respect to the area where the PAPI signals can be observed.
- Wingspan of aircraft using the runway.
- Vertical pitch of the glideslope.
- Installation tolerances.
- Position of the PAPI system.
- Additional safety considerations.
- Origin of the cutoff angle should be either the outermost or innermost unit (whichever is closest in azimuth to the obstacle).
- Cutoff angles should be FAA approved.

If a reduction in the horizontal beam coverage is required, contact the ADB Safegate sales department for further details.

4.4 Siting Tolerances

Siting tolerances involve azimuth aiming, mounting height tolerance, PAPI tolerance along a line perpendicular to the runway, and correction for the runway longitudinal gradient.

4.4.1 Azimuth Aiming (Horizontal Alignment with Runway Centerline)

Each Light Unit shall be aimed outward into the approach zone on a line parallel to the runway centerline within a tolerance of ±0.5°. ADB Safegate recommends azimuth aiming to be within a tolerance of 0° to 0.5° towards centerline, if possible.

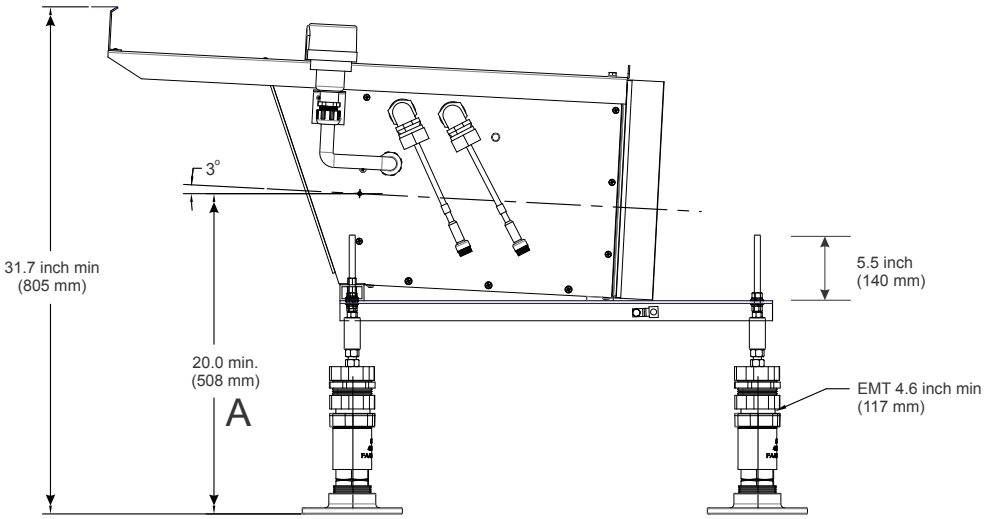
4.4.2 Mounting Height Tolerance

The beam centers of all Light Units shall be within ±1 inch (25 mm) of a horizontal plane. The beam center is located at the Beam Center Mark (+) as depicted on Figure 8. This plane shall be within ±1 foot (300 mm) of the elevation of the runway centerline at the intercept point of the visual approach angle with the runway except for additional siting considerations. Refer to Additional Siting Considerations . The Light Unit EMT leg length is chosen by the installer to ensure the proper mounting height is achieved. Refer to FAA AC 150/5340-30 (current edition) for additional information on installation requirements.

Figure 8: Light Unit Mounting Height

EMT LENGTH	DIM A MIN	DIM A MAX	MTG HT MIN	MTG HT MAX
4.6 (117)	20 (508)	25.5 (648)	31.7 (805)	37.2 (945)
10.1 (256)	25.5 (648)	31 (787)	37.2 (945)	42.7 (1085)

Inch (mm)



MINIMUM MOUNTING HEIGHT SHOWN (WITH 4.6 LONG EMT)

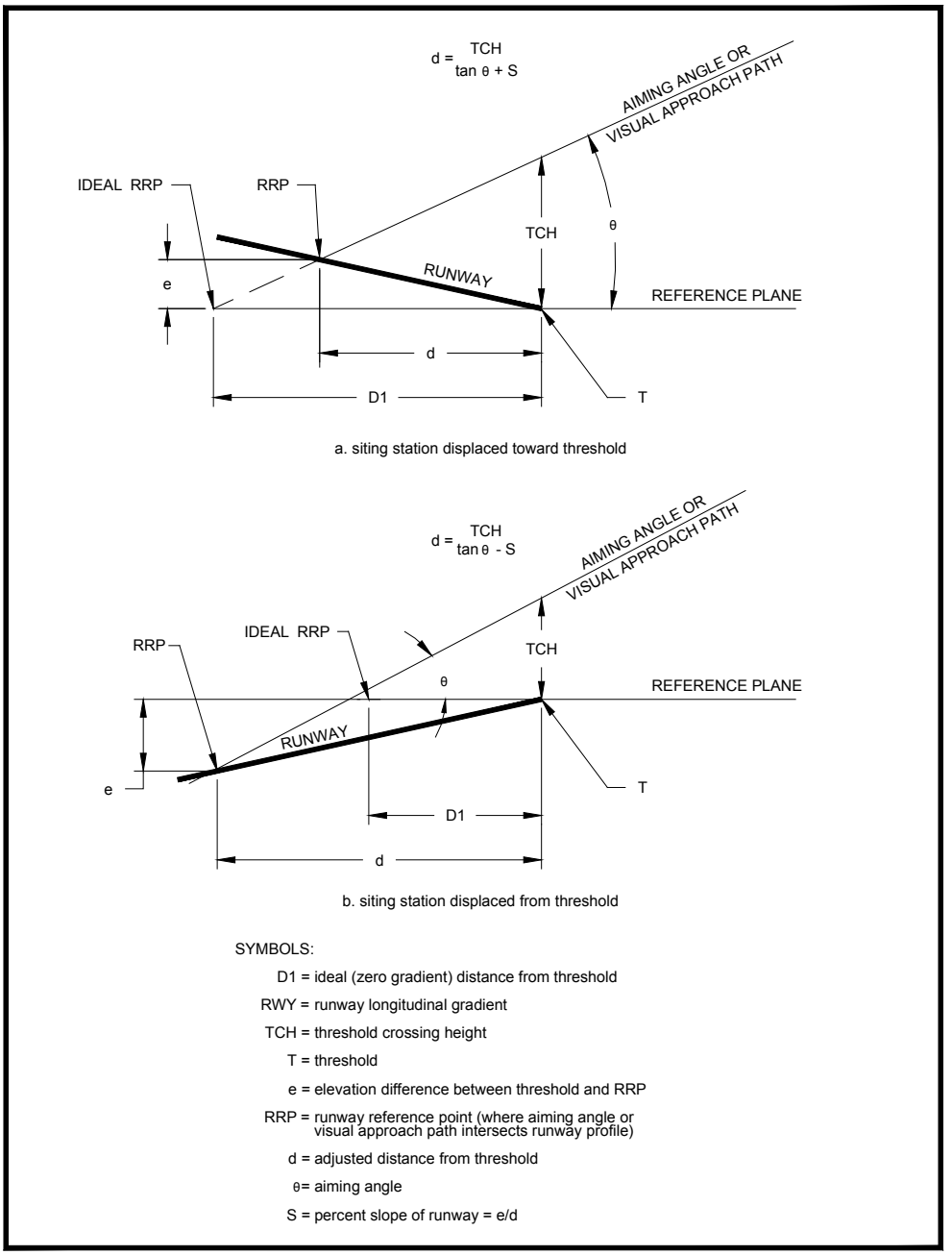
4.4.3 PAPI Tolerance Along Line Perpendicular to Runway

The front face of each Light Unit in a bar shall be located on a line perpendicular to the runway centerline within ±6 inches (150 mm).

4.4.4 Correction for Runway Longitudinal Gradient

See Figure 9. Refer to AC 150/5430-30 (current edition). On runways where a difference exists in elevation between the runway threshold and the elevation of the runway centerline adjacent to the PAPI, you may need to adjust the location of the Light Units with respect to the threshold to meet the required obstacle clearance and TCH.

Figure 9: Correction for Runway Longitudinal Gradient



If the condition exists, perform the following steps to compute the change in the distance from the threshold required to preserve the proper geometry:

1. Obtain the runway longitudinal gradient. This can be done by survey or obtained from airport obstruction charts or as-built drawings.
2. Determine the ideal (zero gradient) distance from the threshold in accordance with the preceding instructions.
3. Assume a level reference plane at the runway threshold elevation. Plot the location determined in Step 2.
4. Plot the runway longitudinal gradient.

5. Project the visual glideslope angle to its intersection with the runway longitudinal gradient. Then solve for the adjusted distance from the threshold either mathematically or graphically. Refer to Mounting Height Tolerance .
6. Verify the calculated location gives the desired threshold crossing height.

4.5 Additional Siting Considerations

Below are additional siting considerations.

- Where the terrain drops off rapidly near the approach threshold and severe turbulence is experienced, locate the PAPI farther from the threshold to keep the aircraft at the maximum possible threshold crossing height.
- On short runways, the PAPI should be as near the threshold as possible to provide the maximum amount of runway for braking after landing.
- Contact your ADB sales representative for additional guidance if the PAPI Light Units must be installed at locations where snow is likely to obscure the light beams.
- Since the effectiveness of the PAPI system is dependent on the optical red and/or white signal pattern from the Light Units, make sure that no other lights are close enough to confuse the pilot.

4.6 Baffle for Obstruction

Baffles may be required for EACH PAPI Light Box. Each set of baffles are to be the same cut-off range. If required, the PAPI Baffles must be installed at the factory. A baffle can narrow the horizontal light beam coverage from 0 to 5 degrees, as measured from the outer edge of the beam

Contact ADB SAFEGATE for more information or if you are not sure about the cut-offs required for your particular application.

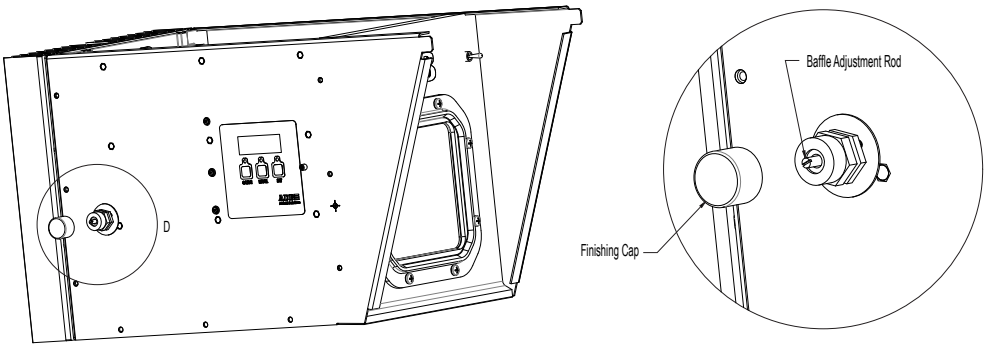
Note
The estimated time required is 60 minutes per PAPI Light Box.

To modify the horizontal light beam coverage of the PAPI unit, perform the following procedure:

Depending on the location of the obstruction in the approach area (right or left side), adjust the baffle rod on the opposite side bulkhead. If both sides are obstructed, adjust one side completely first, then do the other side.

Note
The baffle adjustment rod is mounted on either the left or right side on the bulkhead.

Figure 10: Baffle Adjustment Rod



IF the obstacle is on the LEFT side of the approach area, then adjust the baffle adjustment knob on the RIGHT side. -OR-
IF the obstacle is on the RIGHT side of the approach area, then adjust the baffle adjustment knob on the LEFT side. See Figure 10.

Baffling right or baffling left requires adjusting the baffle on the opposite side of the PAPI unit as the PAPI optics invert and flip the beam image. Each full rotation of the adjusting rod will change the amount of baffling by approximately 0.157 degree (9.4 minutes).

Note

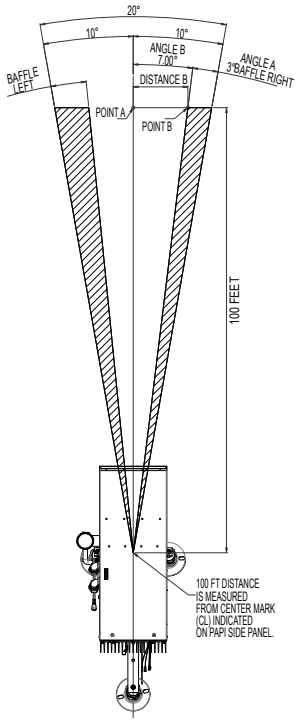
It may be necessary to lower the PAPI unit in elevation for the individual to see the light beam. If this is the case, jumper the tilt switch to restore power to the unit. Proceed as follows to jumper the tilt switch:

Position someone equipped with a walkie-talkie at the edge of the obstacle or as far out from the edge the beam where cutoff is desired. Move the baffle along the aperture of the baffle mounting plate until the light beam cut-off is seen by the individual who is standing in front of the obstacle. See Figure 10.

Note

To meet FAA specification requirements, the LED PAPI should be shipped with the baffle in the minimum baffle position. This can be verified by rotating the adjusting rod clockwise until resistance is felt. This indicates that the baffle is fully retracted. Movement of the baffle plate can be observed by looking through the front window of the PAPI.

4.6.1 For an Angle of 3 Degrees Baffle



For the amount of baffling desired (in this instance 3 degrees), calculate the distance B required to provide visual indication of the angle. Base the calculation on the 100 foot (30.5 m) distance measured from the PAPI beam CL. Angle B will be the difference between the full PAPI beam angle (10 degrees) and the angular amount that is desired to be cut off.

1. Establish Point A: Measure 100 feet (30.5 m) from the CL mark on the side of the PAPI. Sight along the edges of the PAPI to determine the CL of the horizontal beam.
2. Establish Point B: Starting at point A, measure perpendicular to beam the distance calculated for the desired baffle angle (in this case, 12.3 feet (3.7 m) for 3° baffle).

   The adjusting rod can now be rotated counterclockwise to baffle the PAPI. As the rod is rotated counterclockwise, the baffling will slowly increase. This can be observed directly by an observer on a ladder, or by vertically standing a painted pole at point B and watching for the beam edge to pass that point.

Note

If the terrain drops rapidly in front of the PAPI, the observer will require a ladder.

Note

Setting the baffle angle during the day will require the direct observation method (observer on a ladder). For a 3° elevation setting, the beam will rise a little over 5 feet (1.5m) in the 100 foot (30.5 m) distance.

Setting the baffle angle at night allows for the use of a white painted pole to determine where the edge of beam is located.

For an Angle of 3 Degrees Baffle, the Angle B will be 7 degrees and for an observation distance of 100 feet (30.5 m).

- Distance B = 100 ft (30.5 m)
- Angle B = 7°
- Distance B = 100 Tan 7° = 12.28 Feet (3.7m)

3. Remove finishing cap.

CAUTION

Failure to follow these warnings may result in equipment damage.
The adjusting rod should rotate with little torque required. There are hard stops at minimum baffle and maximum baffle. DO NOT attempt to force the adjustment beyond these stops.

- To rotate the baffle adjusting rod, it is not necessary to loosen the adjusting rod fitting.
- Do not loosen the adjusting rod fitting or actuator fitting as this can compromise the seal integrity of the system.

4. Using a flathead screwdriver, rotate the adjusting rod as follows:
   a. Counter-clockwise to increase amount of baffling.
   b. Clockwise to decrease the amount of baffling.
5. Replace the finishing cap.

5.0 Installation

This section provides instructions for installing the PAPI Light Units. Refer to airport project plans and specifications for specific installation instructions. The installation must conform to the applicable sections of the National Electric Code and local codes.

5.1 Safety Considerations

Read this installation section thoroughly before installing the equipment. A thorough understanding of system components and their requirements will promote safe and efficient installation. See FAA AC 150/5340-30 (current edition) and site plans and specifications for additional guidance on PAPI installation.

WARNING

INSTALLATION

- Allow only qualified personnel to install ADB Safegate and auxiliary equipment. Use only approved equipment. Using unapproved equipment in an approved system may void agency approvals. Observe the safety instructions in this document and all related documentation.
- Make sure all equipment is rated and approved for the environment where it is being used.
- Follow all instructions for installing components and accessories.
- Install all electrical connections in compliance with local and national codes and regulations.
- Use only electrical wire of sufficient gauge and insulation to handle the rated current demand. All wiring must meet local and national codes.
- Route electrical wiring along a protected path. Make sure it will not be damaged by moving equipment.
- Protect components from damage, wear and harsh environmental conditions.
- Allow ample clearance for maintenance, panel accessibility and cover removal.
- Protect equipment with safety devices as specified by applicable safety regulations.
- If safety devices must be removed for installation, reinstall them immediately after the work is completed and check them for proper functioning.
- The Light Unit cord set must be protected prior to installation.

Failure to follow these safety procedures can result in personal injury or death.

5.2 Inspect the Equipment

Upon receipt of the PAPI system and before unpacking it, verify that the labeled equipment matches the bill of lading. Inspect all items for damage. Report any damage immediately to the carrier and send a copy to ADB SAFEGATE.

5.2.1 What's Included

Table 4: Components Supplied by ADB Safegate

	L-880(L)/PAPI (4-box)			L-881(L)/APAPI (2-box)		
Component	**Style A (Voltage)**	**Style B (Current)**	**Style B (Redundant)**	**Style A (Voltage)**	**Style B (Current)**	**Style B (Redundant)**
Light Unit Assembly	4	4	4	2	2	2
Mounting Flange 62B0107-2	12	12	12	6	6	6
Frangible Coupling 44B0180	12	12	12	6	6	6
EMT Compression Coupling 77A0009	12	12	12	6	6	6

Table 4: Components Supplied by ADB Safegate (Continued)

	L-880(L)/PAPI (4-box)			L-881(L)/APAPI (2-box)		
Component	**Style A (Voltage)**	**Style B (Current)**	**Style B (Redundant)**	**Style A (Voltage)**	**Style B (Current)**	**Style B (Redundant)**
40 ft 6 Pin Inter-Box Cable 73A0178/40	3	3	3	1	1	1
Junction Box Assy 73A0179/X	2	4	4	-	2	2
8 ft 6 Pin Female Power Cord 73A0176	1	-	-	1	-	-
8 ft 6 Pin Male Power Cord 73A0180	4	4	4	2	2	2
8 ft 16/2 SOW Power Cord	-	-	4	-	-	2
Electrical Frangible Coupling 62A0711	5	4	8	3	2	4
Cable Clamp 63A0563	5	4	8	3	2	4

Note: 16-14 AWG butt splices and heat shrink provided for field circuit splicing for voltage powered light units, see Field Cabling Diagrams for details. Protective caps/plugs provided as required.

For Installations That Require A Longer Power Cord:

The standard power cord provided with each light unit is 8 ft long with 7 ft extending outside the enclosure. An optional 18 ft long power cord is available (Typically used for the ICAO and Canada markets). This power cord is typically cut to length during installation.

Note

The 94A0690/XX optional 18-ft cord kit must be ordered as a separate line item.

- 94A0690/A2 LED PAPI STYLE A 2-BOX 18-ft POWER CORD KIT.
- 94A0690/A4 LED PAPI STYLE A 4-BOX 18-ft POWER CORD KIT.
- 94A0690/B2 LED PAPI STYLE B 2-BOX 18-ft POWER CORD KIT.
- 94A0690/B4 LED PAPI STYLE B 4-BOX 18-ft POWER CORD KIT.
- 94A0690/B2/R LED PAPI STYLE B REDUNDANT 2-BOX 18-ft POWER CORD KIT.
- 94A0690/B4/R LED PAPI STYLE B REDUNDANT 4-BOX 18-ft POWER CORD KIT.

5.2.2 Required Materials Supplied by Others

Installing either the L-880(L)/APAPI or the L-881(L)/PAPI requires the following items, which must be supplied by others:

- 3/8-16 anchor bolts, 2 per leg; either expansion bolts and sleeves or J-bolts (M-12 is an expectable substitute)
- Aviation orange paint (used to paint the 2 in EMT legs); 12 oz. spray cans of orange paint are also available from ADB SAFEGATE (P/N 95A0008)
- Gray PTFE tape
- Rubber tape
- Electrical tape
- Contractor supplied items (See section Contractor Kit Items for details).

Base plates are available as optional sales order line item. Base plates are machined with 2-11.5 NPS threads to match the threads of the provided 62A0711 Frangible Couplings.

Contractor Kit Items

Items specified as "Contractor Supplied" are not included with the light unit. These items are typically provided by the contractor however, as a convenience these items are available from ADB Safegate as an optional Contractor Kit 94A0716/XX/XXX/X.

Table 5: Contractor Kit Items

	L-880(L)/PAPI (4-box)			L-881(L)/APAPI (2-box)		
Component	**Style A (Voltage)**	**Style B (Current)**	**Style B (Redundant)**	**Style A (Voltage)**	**Style B (Current)**	**Style B (Redundant)**
Contractor Kit	94A0716/A4	94A0716/B4	94A0716/B4/R	94A0716/A2	94A0716/B2	94A0716/B2/R
2 in x 13 in EMT Leg 60A4516	12	12	12	6	6	6
1-1/4 in x 8 ft Liquid-Tight Conduit 60A4620/8	5	4	8	3	2	4
1-1/4 in Liquid-Tight Fitting 77A0265	5	4	8	3	2	4
1-1/2 in x 1-1/4 in Bushing 77A0266	5	4	8	3	2	4

2-inch diameter EMT tubing (2-3/16 in OD) to be provided and installed by contractor. Length to be determined at installation to adjust for uneven terrain and to mount optical box at correct elevation above the runway. To ensure stable installation, the EMT tubing shall extend 3-1/4 inches into the frangible coupling and full insertion into compression coupling.

The EMT tubing must be painted international orange per FED-STD-595, color 12197 to provide corrosion protection.

For Installations That Require A Longer Power Cord:

Installations in ICAO and Canada markets typically require a longer length power cord. For these installations a version of the contractor kit is available 94A0716/XX/CAN/X.

Note

The items found in the contractor kit 94A0716/XX/CAN/X kit are identical to the standard contractor kit referenced above except it has an 18 ft conduit length to accommodate the longer 18 ft power cord typically used for the ICAO and Canada markets. This kit is intended for use with the 94A0690/XX 18 ft long power cord kit.

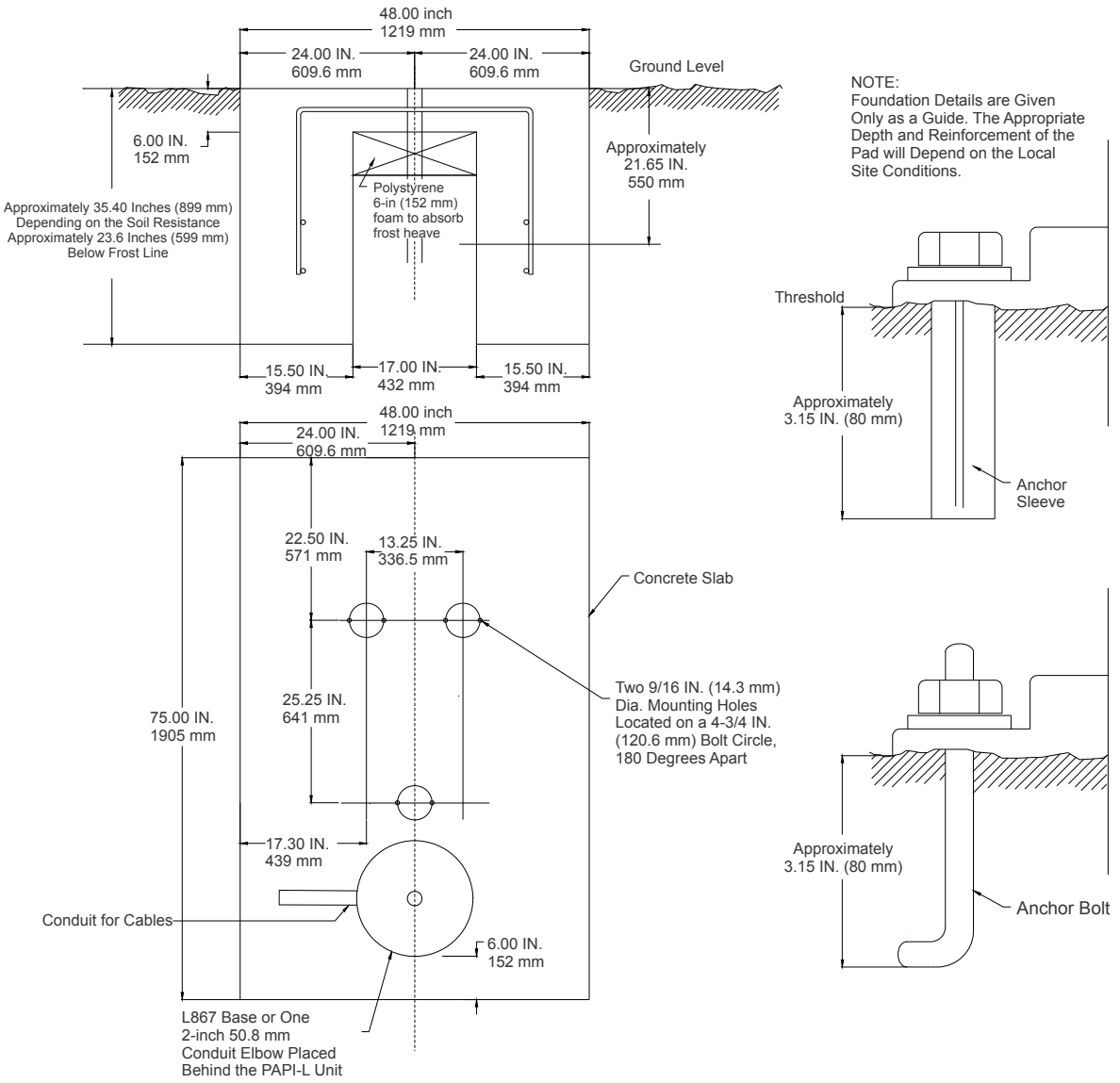
- 94A0716/A2/CAN LED PAPI STYLE A 2-BOX contractor supplied items.
- 94A0716/A4/CAN LED PAPI STYLE A 4-BOX contractor supplied items.
- 94A0716/B2/CAN LED PAPI STYLE B 2-BOX contractor supplied items.
- 94A0716/B4/CAN LED PAPI STYLE B 4-BOX contractor supplied items.
- 94A0716/B2/CAN/R LED PAPI STYLE B REDUNDANT 2-BOX contractor supplied items.
- 94A0716/B4/CAN/R LED PAPI STYLE B REDUNDANT 4-BOX contractor supplied items.

5.3 PAPI Foundations

The PAPI units shall be installed on concrete pads at ground level with frangible couplings. The foundation should extend at least 12 inches (300 mm) below the frost line and at least 1 foot (300 mm) beyond the light unit to minimize damage from mowers. Figure 11 through Figure 12 show dimensions that are generally acceptable for the concrete pad for the LED PAPI.

For series circuit (STYLE B) applications, high voltage field cables and low voltage communication cables must have separate conduit runs. See Figure 62.

Figure 11: Installation on Concrete Pad



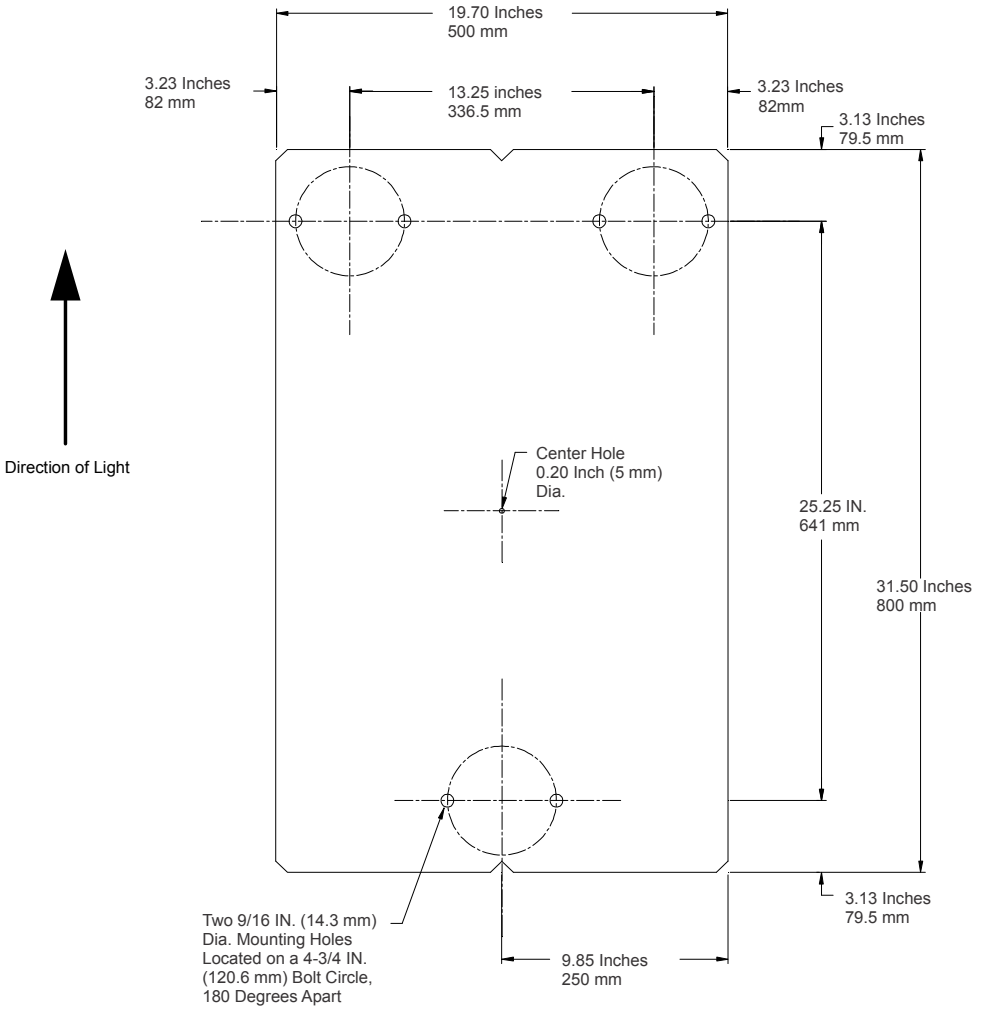
Installation on Concrete Pad (LED, Three-Leg PAPI-L)

To cast the concrete pad and anchor the support fixtures, perform the following procedure:

1. Stake out the longitudinal axis of the light units parallel to the runway centerline.
2. Dig the foundation hole per Figure 11.
3. Place polystyrene foam in pit to absorb frost heave below the central part of the slab. Place L-867 light base/conduit elbows or pipes for cables. Place bars for reinforcement of concrete.
4. Pour in concrete and allow it to harden for at least one day.
5. After concrete sets up, using chalk draw a longitudinal axis (in accordance with the axis staked out on the ground) on the upper surface of the pad. Draw a transverse axis perpendicular to the other axis.
6. See Figure 12. Lay a positioning plate on the pad; center it by positioning the central hole at the intersection of both axes; align the plate along the longitudinal axis using the V-notches in the plate.
7. Mark the six locations of the screws on the slab; drill the six holes to the diameter and depth required for the expansion sleeves and insert the sleeves.

8. See Figure 12 to locate flanges using mounting templates. Place and fasten the flanges with two screws.

Figure 12: Positioning Plate



Positioning Plate (Three Legs)

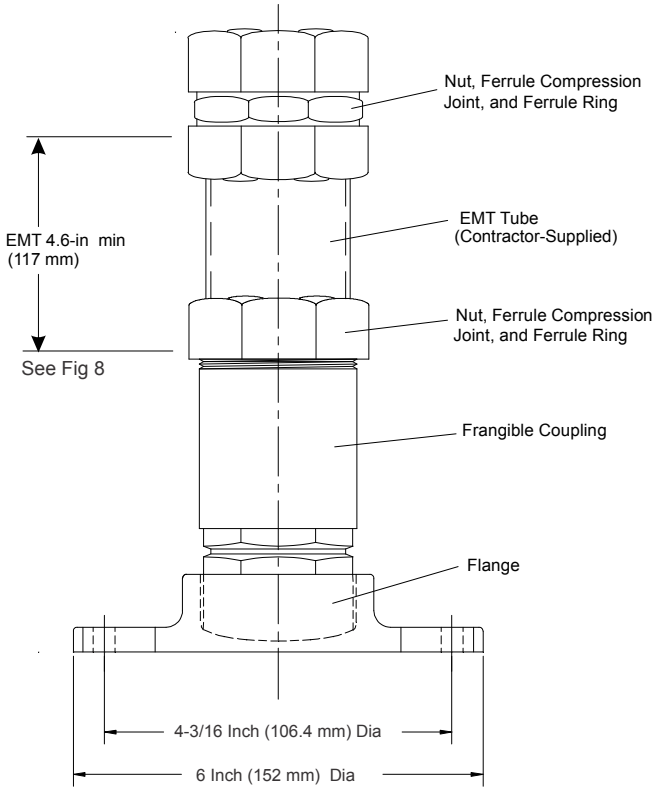
9. Install the frangible couplings. Make sure to place the second nut, ferrule compression joint, and ferrule ring on the bottom of the EMT tube first before screwing the tube with nuts, joints, and rings onto the frangible coupling. See Figure 13 .

Note

The contractor supplies and installs the 2-inch (50.8 mm) diameter (2-3/16 in OD) EMT tube. Determine length at installation to adjust for uneven elevation above the runway. See Figure 8. The 2-inch EMT tube (2 3/16 in OD) extends into the frangible coupling (Figure 13) 3.25 in (82.55 mm) and 1-1/2 in (38.1 mm) into the nut and ferrule compression joint to ensure stable installation. Paint the tube according to Federal standard 595A, color #12197, international orange, to reduce corrosion.

Instead of expansion sleeves, cast 3/8-16 x 6-inch anchor j-bolts into the concrete at the proper locations on a 4-3/16 in. (106.36 mm) diameter bolt circle, in two places.

Figure 13: Frangible Coupling

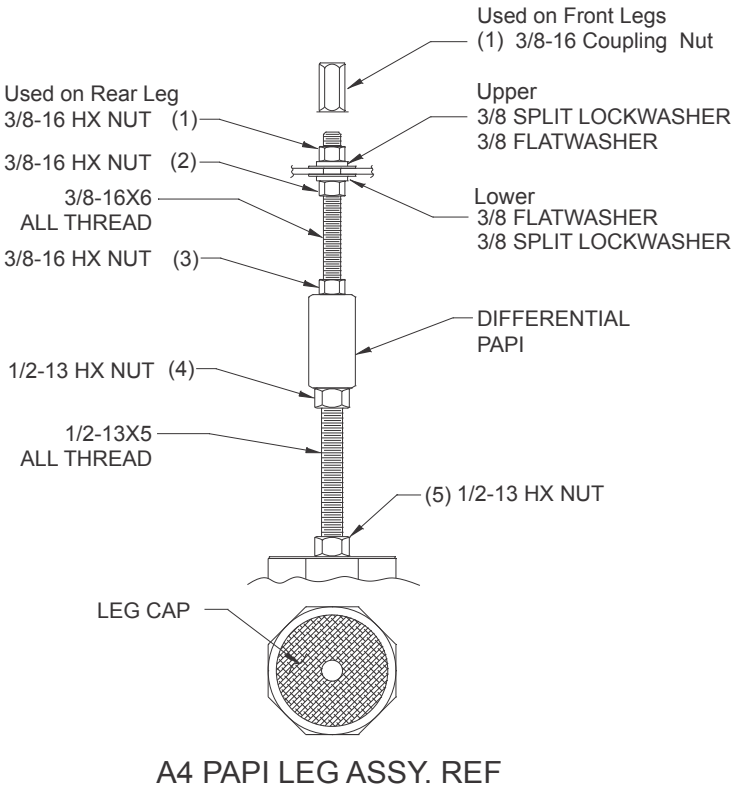


5.3.1 Adjustable Mounting Legs

See Figure 14. The three adjustable mounting legs are each made up of two screw rods connected by a differential sleeve. The upper (smaller diameter) rod is fitted with nuts and locking nuts designed for coarse height setting of the unit.

The differential sleeve is used for the fine adjustment setting of the unit. The lower (larger diameter) rod is inserted into a conduit column with frangible coupling held in place by a flange bolted on a concrete pad.

Figure 14: Adjustable Mounting Legs



5.3.2 Assembling Adjustable Legs

Assemble the legs for each PAPI unit as follows:

1. See Figure 14. Screw threaded rods into differentials and assemble each leg.

Note

Do not assemble upper hex nut (1), upper split lockwasher, and upper flatwasher. These items will be installed after the PAPI unit is mounted on the legs.

The threaded rods should only be threaded in ¼ of the length of the differential so there will be room for adjustment.

2. Screw front and rear leg assemblies into the frangible couplings installed on concrete pad.

5.3.3 Mounting Unit

To mount the unit, perform the following procedure:

1. See Figure 14. Gently mount PAPI unit on the three legs so that the unit rests on the top of the lower flatwasher, lockwasher, and hex nut (2).

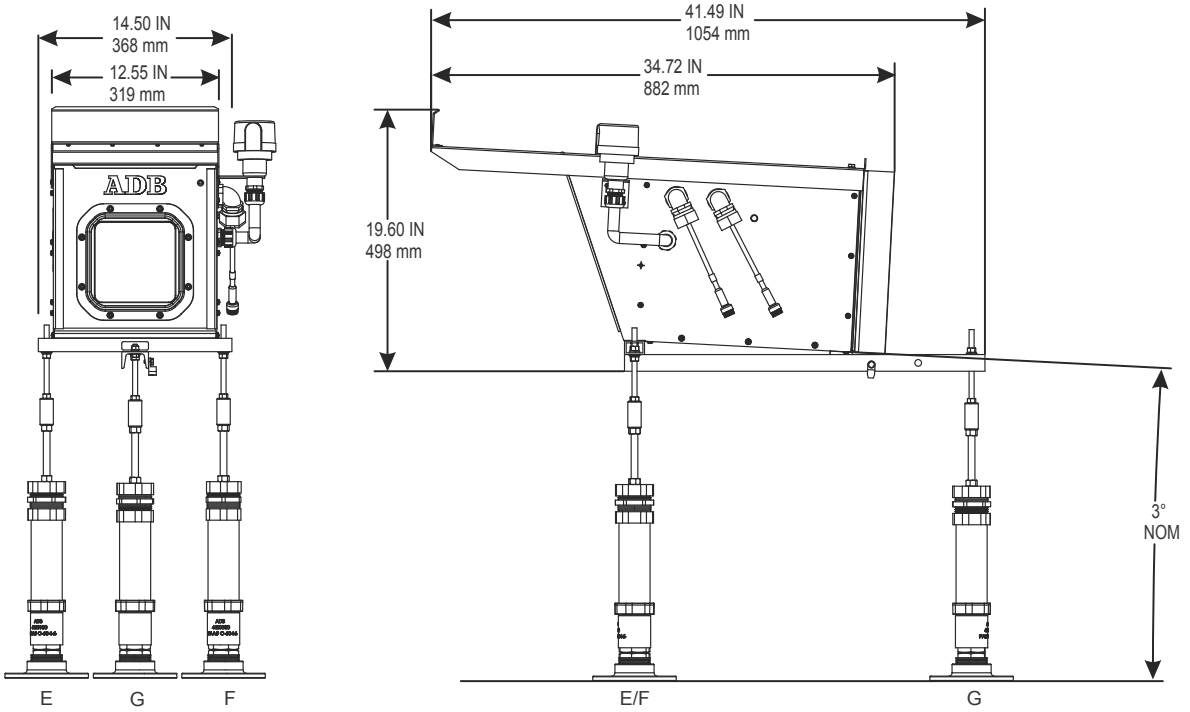
Note

Assemble the upper end of the center rear leg as shown in Figure 15. Make further adjustment of the leg height by using the PAPI differential.

Note

See also Figure 15 while mounting unit.

Figure 15: Mounting the PAPI-L Assembly to the Leg Assembly



2. Install the upper flatwasher, lockwasher, and hex nut (rear leg) (1) (coupling Nut for front legs) on the threaded rod. Do not tighten nuts.
3. Make sure the bottom of the unit is resting on the top of the lower flatwasher of the right front leg F.
4. Make sure all locking nuts on the frangible couplings are tightened.

5.4 System Wiring Connections

WARNING

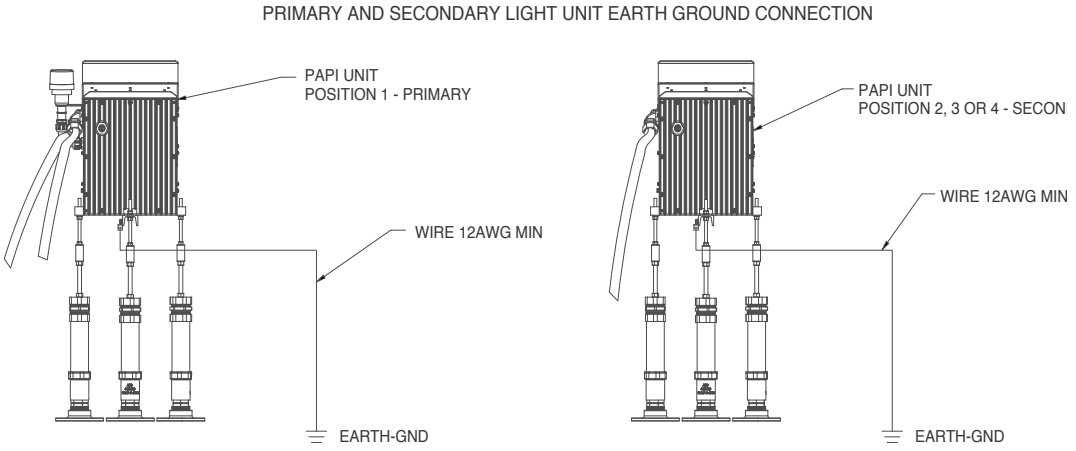
Before making any wire connections, make sure that you turn off all incoming power sources. Failure to observe this warning may result in personal injury, death, or equipment damage.

5.4.1 System External Wiring Connections Between Light Units

External Grounding Connection for Each Light Unit

Each PAPI unit must be grounded. To ground each unit, attach a minimum 12 AWG (4 mm^2) ground wire to the ground lug located on the rear bottom side of each light unit. Connect ground wire to appropriate earth ground.

Figure 16: External Grounding Diagram



System Field Cabling Connections Between Light Units

All installation wiring should conform to the applicable sections of the National Electric Code (US), other national and local codes.

Reference Field Cabling Diagrams.

Field splice kit(s) are for use with attaching interconnection wiring and provided as a separate line item than the PAPI system.

Note

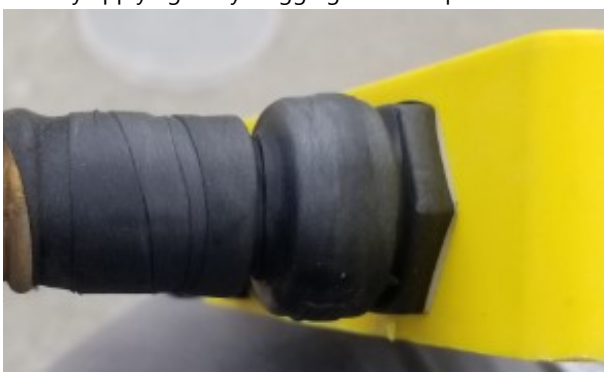
All external wiring must be a minimum 16 AWG (15 mm^2) 600 V wire.

Procedure for Sealing Electrical Connections - Field Cabling Connections

Base cans often contain some water and occasionally become flooded causing electrical connections to be submerged. Perform the following procedure to seal electrical connections and reduce potential system failures caused by water ingress.

1. If possible, remove water from within the base can.
2. Ensure the electrical connections are clean and free of contaminants such as moisture, dirt, sand, debris, etc. Use a can of compressed air on threads and pins to remove any contaminants before making connections.
3. Apply gray PTFE tape (thicker than white PTFE tape) onto the threads of the male connector and connect to the mating female receptacle. Hand tighten electrical connections only; excessive tightening can damage the electrical connectors increasing the potential for water ingress.

4. Cover the entire electrical connection by applying body-hugging rubber tape from bottom to top.

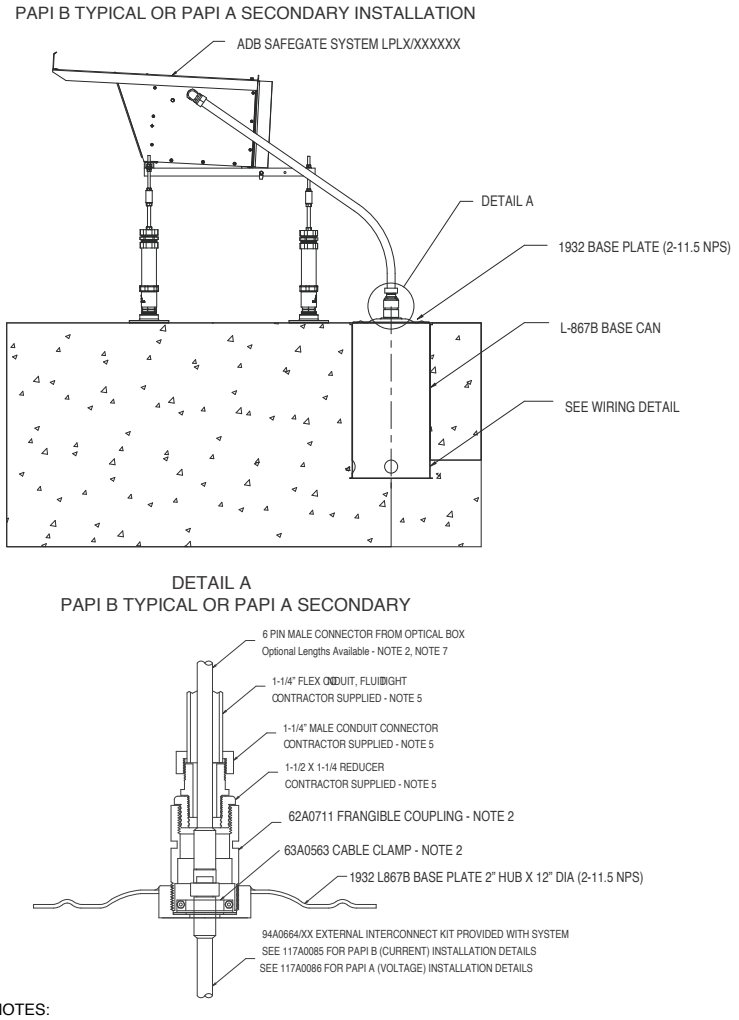


5. Cover the entire rubber-tape covered electrical connection by applying body-hugging vinyl electrical tape from bottom to top.

Electrical Frangible Coupling Installation

Each electrical connection to the light box must have frangibility. Frangible couplings are provided with the light unit. See Figure 17 and Figure 18 for details.

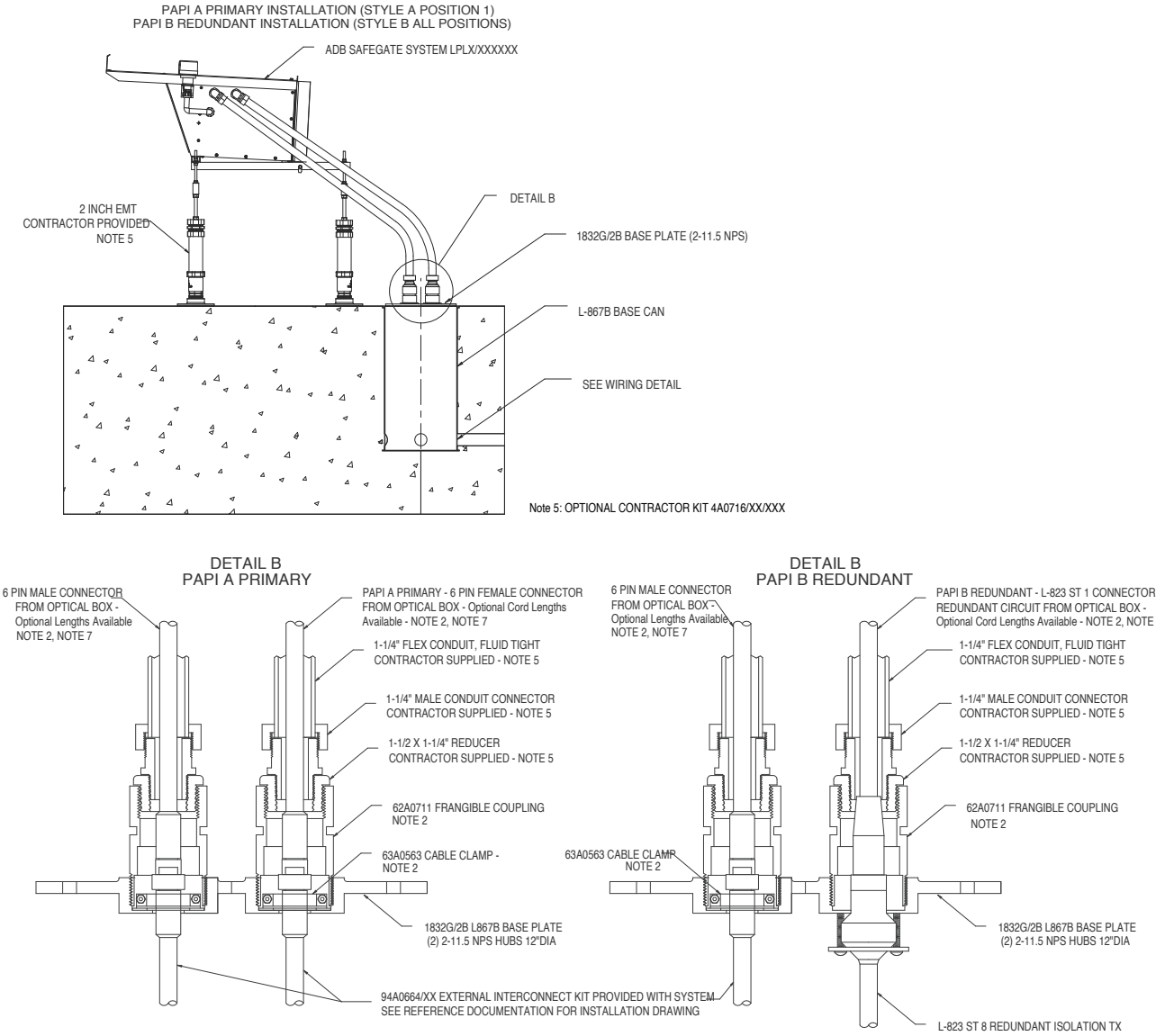
Figure 17: Installation for Single-Entry Light Units



NOTES:

1. 2 IN DIA EMT TUBING (2-3/16 OD) TO BE PROVIDED AND INSTALLED BY CONTRACTOR. LENGTH TO BE DETERMINED AT INSTALLATION TO ADJUST FOR UNEV MOUNT OPTICAL BOX AT CORRECT ELEVATION ABOVE THE RUNWAY. 2 IN EMT TUBE TO EXTEND 3-1/4 IN INTO FRANGIBLE COUPLING AND FULL INSERTION COUPLING TO ENSURE STABLE INSTALLATION. TUBE MUST BE PAINTED INTERNATIONAL ORANGE PER FED-STD-595, COLOR 12197 TO PROVIDE CORROSIO
2. ITEMS PROVIDED WITH OPTICAL ENCLOSURE.
3. FOR SERIES CIRCUIT (TYPE B) APPLICATIONS, HIGH VOLTAGE FIELD CABLES AND LOW VOLTAGE COMMUNICATION CABLES MUST HAVE SEPARATE CONDU FOR LED PAPI STYLE B EXTERNAL WIRING DIAGRAM.
4. FOR VOLTAGE POWERED (TYPE A) APPLICATIONS, A SEPARATE HIGH VOLTAGE CONDUIT IS NOT REQUIRED.
5. ITEMS SPECIFIED AS CONTRACTOR PROVIDED ARE AVAILABLE AS AN OPTIONAL KIT 94A0716/XX.
   94A0716/A2 LED PAPI STYLE A 2 BOX CONTRACTOR PROVIDED ITEMS
   94A0716/A4 LED PAPI STYLE A 4 BOX CONTRACTOR PROVIDED ITEMS
   94A0716/B2 LED PAPI STYLE B 2 BOX CONTRACTOR PROVIDED ITEMS
   94A0716/B4 LED PAPI STYLE B 4 BOX CONTRACTOR PROVIDED ITEMS
   94A0716/XX/CAN IS AN IDENTICAL KIT EXCEPT FOR LONGER CONDUIT LENGTH TO ACCOMMODATE THE LONGER CANADIAN POWER CORDS.
   94A0716/BX/XXX/R ARE KITS TO ACCOMMODATE THE REDUNDANT PAPI CONFIGURATIONS.
6. BASE PLATES ARE AVAILABLE AS OPTIONAL SALES ORDER LINE ITEM. BOTH BASE PLATES ARE MACHINED 2-11.5 NPS TO MATCH THE THREADS OF THE PR FRANGIBLE COUPLING.
7. THE STANDARD CORD LENGTH IS 8 FT LONG WITH 7 FT EXTENDING OUTSIDE THE ENCLOSURE. FOR THE CANADIAN MARKET, OPTIONAL (18 FT) CORDS ARE
   94A0690/A2 LED PAPI A 2 BOX 18 FT POWER CORD KIT
   94A0690/A4 LED PAPI A 4 BOX 18 FT POWER CORD KIT
   94A0690/B2 LED PAPI B 2 BOX 18 FT POWER CORD KIT
   94A0690/B4 LED PAPI B 4 BOX 18 FT POWER CORD KIT
   94A0690/XX/X OPTIONAL CORD LENGTH KIT MUST BE ORDERED AS A SEPARATE LINE ITEM WHEN ORDERING THE LPLX/XXXXXX SYSTEM.
   94A0690/BX/R ARE KITS TO ACCOMMODATE THE REDUNDANT PAPI B CONFIGURATIONS.

Figure 18: Installation for Double-Entry Light Units



NOTES:

1. 2 IN DIA EMT TUBING (2-3/16 OD) TO BE PROVIDED AND INSTALLED BY CONTRACTOR. LENGTH TO BE DETERMINED AT INSTALLATION TO ADJUST FOR UNEVE MOUNT OPTICAL BOX AT CORRECT ELEVATION ABOVE THE RUNWAY. 2 IN EMT TUBE TO EXTEND 3-1/4 IN INTO FRANGIBLE COUPLING AND FULL INSERTION I COUPLING TO ENSURE STABLE INSTALLATION. TUBE MUST BE PAINTED INTERNATIONAL ORANGE PER FED-STD-595, COLOR 12197 TO PROVIDE CORROSION
2. ITEMS PROVIDED WITH OPTICAL ENCLOSURE.
3. FOR SERIES CIRCUIT (TYPE B) APPLICATIONS, HIGH VOLTAGE FIELD CABLES AND LOW VOLTAGE COMMUNICATION CABLES MUST HAVE SEPARATE CONDUI FOR LED PAPI STYLE B EXTERNAL WIRING DIAGRAM.
4. FOR VOLTAGE POWERED (TYPE A) APPLICATIONS, A SEPARATE HIGH VOLTAGE CONDUIT IS NOT REQUIRED.
5. ITEMS SPECIFIED AS CONTRACTOR PROVIDED ARE AVAILABLE AS AN OPTIONAL KIT 94A0716/XX.
   94A0716/A2 LED PAPI STYLE A 2 BOX CONTRACTOR PROVIDED ITEMS
   94A0716/A4 LED PAPI STYLE A 4 BOX CONTRACTOR PROVIDED ITEMS
   94A0716/B2 LED PAPI STYLE B 2 BOX CONTRACTOR PROVIDED ITEMS
   94A0716/B4 LED PAPI STYLE B 4 BOX CONTRACTOR PROVIDED ITEMS
   94A0716/XX/CAN IS AN IDENTICAL KIT EXCEPT FOR LONGER CONDUIT LENGTH TO ACCOMMODATE THE LONGER CANADIAN POWER CORDS.
   94A0716/BX/XXX/R ARE KITS TO ACCOMMODATE THE REDUNDANT PAPI CONFIGURATIONS.
6. BASE PLATES ARE AVAILABLE AS OPTIONAL SALES ORDER LINE ITEM. BOTH BASE PLATES ARE MACHINED 2-11.5 NPS TO MATCH THE THREADS OF THE PRO FRANGIBLE COUPLING.
7. THE STANDARD CORD LENGTH IS 8 FT LONG WITH 7 FT EXTENDING OUTSIDE THE ENCLOSURE. FOR THE CANADIAN MARKET, OPTIONAL (18 FT) CORDS ARE
   94A0690/A2 LED PAPI A 2 BOX 18 FT POWER CORD KIT
   94A0690/A4 LED PAPI A 4 BOX 18 FT POWER CORD KIT
   94A0690/B2 LED PAPI B 2 BOX 18 FT POWER CORD KIT
   94A0690/B4 LED PAPI B 4 BOX 18 FT POWER CORD KIT
   94A0690/XX/X OPTIONAL CORD LENGTH KIT MUST BE ORDERED AS A SEPARATE LINE ITEM WHEN ORDERING THE LPLX/XXXXXX SYSTEM.:
   94A0690/BX/R ARE KITS TO ACCOMMODATE THE REDUNDANT PAPI CONFIGURATIONS.

Flexible Conduit Installation

Each PAPI light unit is shipped with multi-conductor cable connected to the unit. For installation this cable must be disconnected from the light unit and cut to length and enclosed within liquid-tight conduit (contractor supplied). Follow the procedure to install the flexible conduit.

1. Disconnect the multi-conductor cable from inside of the light unit enclosure.
2. Slide the multi-conductor cable through the liquid tight flexible conduit and the elbow on the Light Unit until the proper length is achieved.
3. Check the flexible conduit to the Light Unit, tightening the fittings securely, if necessary.
4. Cut the multi-conductor cable to the desired length. Remove 8 inches (200 mm) of insulation from the end of the cable. Strip the end of each wire 0.3 inches (8 mm).
5. Re-secure the multi-conductor cable internally with strain-relief ties.
6. Reattach the multi-conductor cable wires to the respective terminal blocks from which they were removed.

5.4.2 Input Power Connections

WARNING

Electric Shock
Before making any wire connections, make sure that you turn off the Constant Current Regulator. Failure to observe this warning may result in personal injury, death, or equipment damage.

Voltage Powered Connections

The RELIANCE LED PAPI will accept both input voltages 240 VAC and 120 VAC ±10%. Voltage is supplied to the primary light unit through a dedicated multi-conductor cable.

See External Wiring Diagrams section for connecting the source power supply to the multi-conductor cable.

See Internal Wiring Diagrams section for connecting the multi-conductor cable to the input power board.

Current Powered Connections

One 200 W L-830 (60 Hz) or L-831 (50 Hz) isolation transformer is required to connect the series lighting circuit to each light unit.

See External Wiring Diagrams section for connecting the source power supply to the multi-conductor cable.

See Internal Wiring Diagrams section for connecting the multi-conductor cable to the input power board.

5.5 Aligning and Aiming the LED PAPI

Before aligning or aiming the LED PAPI light units, please thoroughly read Operation of this manual to familiarize yourself with the digital display and push buttons operation.

On the side of each LED PAPI Light Unit there is digital LED readout display. This display is used to observe and set the horizontal level and vertical glide angle of each Light Unit. See Understanding the LED Readout for additional details. The glide angle varies by location, always refer to site-specific documents to determine the correct glide angle to aim each light unit. For standard installation aiming angles refer to Table 6 for L-880(L) PAPI and Table 7 for L-881(L) APAPI.

Table 6: Aiming Angles for L-880(L) PAPI Light Units

L-880(L) PAPI (4 box)	Aiming Angle (Minutes of Arc) (Standard Installation)	Aiming Angle (Minutes of Arc) (Height Group 4 Aircraft* on Runway with ILS)
Unit nearest runway	30' (0.50°) above glide path	35' (0.58°) above glide path
Next adjacent unit	10' (0.17°) above glide path	15' (0.25°) above glide path
Next adjacent unit	10' (0.17°) below glide path	15' (0.25°) below glide path
Unit farthest from runway	30' (0.50°) below glide path	35' (0.58°) below glide path

Table 7: Aiming Angles for L-881(L) APAPI Units

L-881(L) APAPI (2 box)	Aiming Angle (Minutes of Arc) (Standard Installation)
Unit nearest runway	15' (0.25°) above glide path
Unit farthest from runway	15' (0.25°) below glide path

Note
60 minutes of arc = 1 degree (60' = 1°)

The PAPI's LED display shows the angle in decimal degrees with one hundredth of a degree resolution (x.xx).

The conversion from minutes to decimal and decimal to minutes is calculated by the following formulas:

DECIMAL = MINUTES / 60

MINUTES = DECIMAL x 60

Refer to Table 8 to help convert decimal degrees to minutes.

Examples:

If a glide angle of 3°10′ is desired, adjust the Light Unit's glide angle to 3.17 on the digital readout.

If a glide angle of 3°15′ is desired, adjust the Light Unit's glide angle to 3.25 on the digital readout.

Note
If the readout shows **LOW**, this indicates that the glide slope is negative (PAPI aimed toward the ground).If the readout shows **HI**, this indicates that the glide slope is greater than 9.99 degrees from horizon.

Table 8: Conversion Table for Decimal Degrees to Minutes

Decimal Degrees	Minutes		Decimal Degrees	Minutes
0.02	1		0.52	31
0.03	2		0.53	32
0.05	3		0.55	33
0.07	4		0.57	34
0.08	5		0.58	35
0.10	6		0.60	36
0.12	7		0.62	37
0.13	8		0.63	38
0.15	9		0.65	39

Table 8: Conversion Table for Decimal Degrees to Minutes (Continued)

Decimal Degrees	Minutes		Decimal Degrees	Minutes
0.17	10		0.67	40
0.18	11		0.68	41
0.20	12		0.70	42
0.22	13		0.72	43
0.23	14		0.73	44
0.25	15		0.75	45
0.27	16		0.77	46
0.28	17		0.78	47
0.30	18		0.80	48
0.32	19		0.82	49
0.33	20		0.83	50
0.35	21		0.85	51
0.37	22		0.87	52
0.38	23		0.88	53
0.40	24		0.90	54
0.42	25		0.92	55
0.43	26		0.93	56
0.45	27		0.95	57
0.47	28		0.97	58
0.48	29		0.98	59
0.50	30		1.00	60

5.5.1 Adjusting Azimuth Aim (Horizontal Alignment with Runway Centerline)

Make sure that the rod at 164 feet (50 m) from the light unit is still properly aligned with the side of the PAPI-L light unit. If not, loosen the fasteners securing the flanges to the concrete foundation and make adjustments as necessary to align the light unit.

Each Light Unit shall be aimed outward into the approach zone on a line parallel to the runway centerline within a tolerance of ±0.5°. ADB Safegate recommends azimuth aiming to be within a tolerance of 0° to 0.5° towards centerline.

Note

It is not necessary for the alignment to be absolutely perfect. An error of 20 inches (500 mm) at 164 feet (50 m) yields an error of 0.5°, which is within FAA required tolerance.

5.5.2 Adjusting the Horizontal Level and Setting Rough Elevation Glide Slope Angle

The following instructions require the Light Unit's circuit board to be powered by the system input power. When the PAPI is initially powered on there will be a delay in which the display will show the following sequence;

ADB -> LED -> PAPI -> BOX X -> OF X -> COLD -> -> XXX -> SEC

After the initial delay the light engines may come on and then go off and the display will show an error explaining why the unit is in an alarm state.

Referring to Figure 14 and Figure 15 perform the following procedure:

1. Loosen the hex nuts (1) and (2) on all three legs (E), (F), and (G). Hex nuts (3), (4) and (5) should be finger tight.
2. With the unit powered, press the LEVEL button on the display pad to display the horizontal level angle.

3. Level the light unit by adjusting the hex nuts (1) and (2) on the left front leg. The LEVEL angle on the display pad should read 0.00° ±0.07°.
4. Tighten hex nuts (1) and (2) simultaneously.
5. Press the GLIDE button on the display pad to display the elevation level angle (glide slope).
6. Set glide slope by adjusting hex nut (5) of the rear leg (G).
7. Position upper hex nut (1) on leg (G) against the upper flat washer. Simultaneously tighten the hex nuts on leg (G).
8. Tighten lower hex nut (4) on leg (F).

5.5.3 Adjusting Fine Elevation Glide Slope Angle

To adjust the fine elevation settings using the differential for the LED PAPI-L, perform the following procedure:

Figure 19: Elevation Setting Sequence

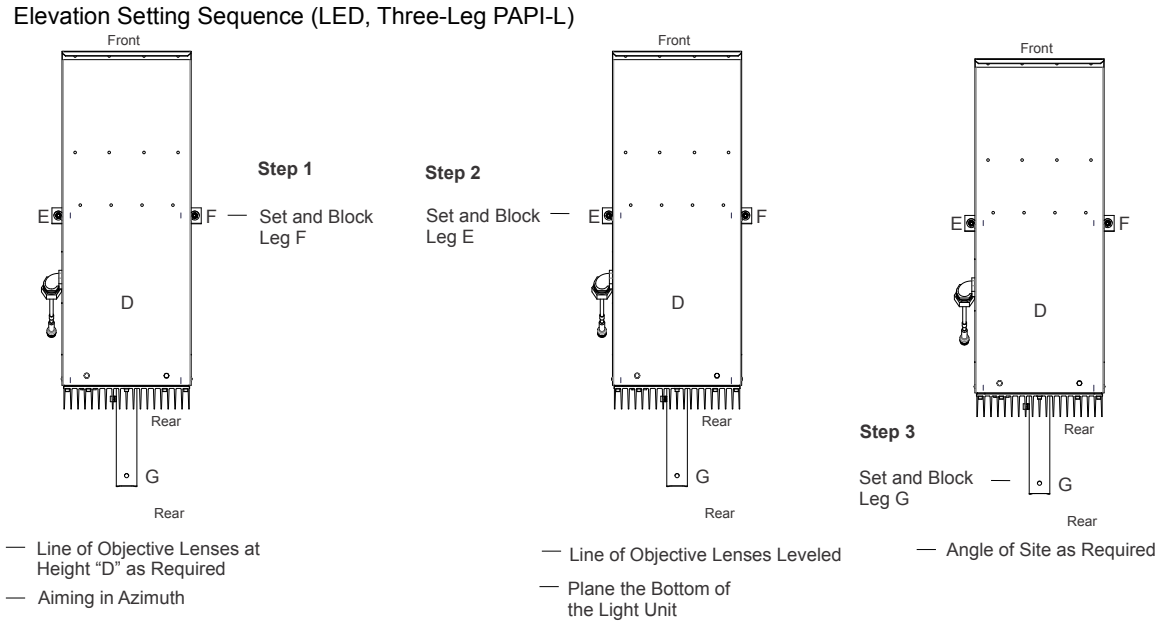
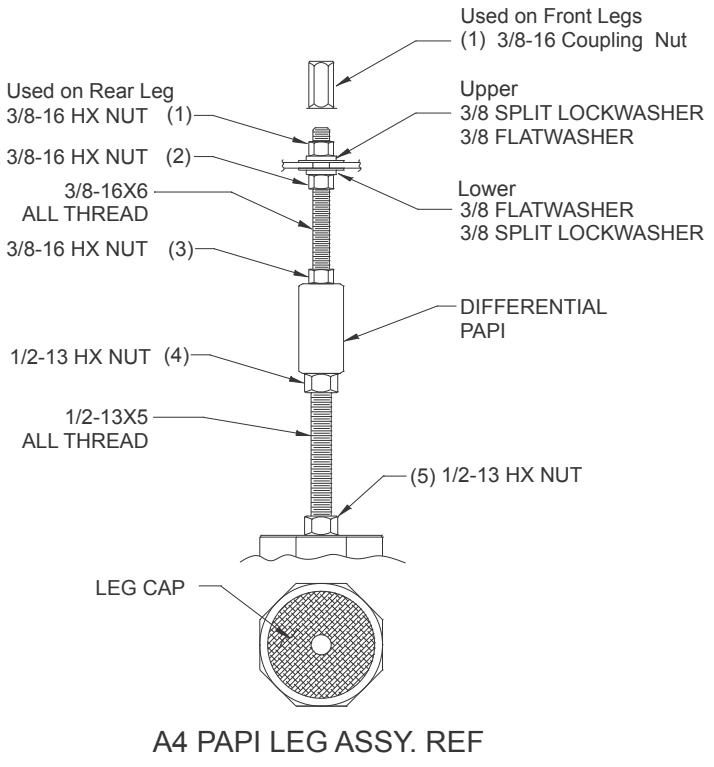


Figure 20: Adjustable Mounting Legs



1. Press the LEVEL button on the display pad to display the horizontal level angle.
2. Refer to Figure 19 STEP 1. Make sure the locking hex nuts (3) and (4) for the differential on the right front leg (F) are tightened. The locking hex nuts (3) and (4) for the differentials on the other legs should remain loose.

3. Refer to Figure 19 STEP 2. While watching the displayed LEVEL angle on the display pad, level the front of the PAPI by turning the differential left front leg (E) in the proper direction. Tighten locking hex nuts (3) and (4) on the differential on left front leg (E) when leveled.
4. Press the GLIDE button on the display pad to display the longitudinal angle (glide slope).
5. Refer to Figure 19 STEP 3. While watching the displayed GLIDE angle on the display pad, adjust the differential on the rear leg (G). When leveling is complete, tighten the locking hex nuts (3) and (4) on legs (E), (G), and (F) and the differential of leg (G). Tighten the hex nuts to a torque of 132 in-lb. (15 n·m) and the GLIDE angle is displayed within ±0.03 degrees.
6. Check the settings by pressing the LEVEL button to display the horizontal level angle.

   If it is incorrect, repeat steps 1 to 5 of this section.
7. When all the readings are correct, continue installation.

5.5.4 Saving the Glide Angle to Memory

1. After all adjustments are complete, press the **SET** push-button for five seconds until **SAVE** is displayed. This stores the current glide angle in memory so that if a Light Unit becomes vertically misaligned, the inclinometer circuitry will disable the Light Unit. The horizontal (Azimuth) angle is hard coded to disable the Light Unit if the unit is tilted more than 1.75 degrees in either direction.
2. Repeat the alignment procedure for each of the Light Units.

5.6 RELIANCE PAPI Ground Check Procedure

This procedure describes the steps to ground-check the light beam angles of the RELIANCE PAPI.

The RELIANCE PAPI incorporates an advanced optics system to create a crisp transition sector at the required evaluation distance of 300 m. However, because of the advanced optics system, the RELIANCE PAPI displays a non-linear wave-shaped pattern at the ground verification distance than that of conventional incandescent-lamp PAPI. The reason for this difference is attributed to the optical effects not producing a fully developed beam until after a distance of about 200 m. The concept of near-field vs. far-field optical effects is important to understand as this complicates the ground alignment procedure and introduces variables in the measurement of the elevation aiming process.

The three largest sources of variability are the measurement of the 18 m distance to target, accuracy of the placement of the laser level line to the cross-hairs of the side of the PAPI, and determine the precise center of the beam between the non-linear areas of the red and white boundaries. All of these introduce uncertainty that must be accounted for. These are the uncertainties that have lead to the acceptance criteria of +/- 6 minutes of arc given in Standards and Tolerances of the LED PAPI manual. This translates to a maximum allowable difference between "H" and "H1" of 31.4 mm during operational ground checks.

5.6.1 Equipment Needed to Perform a Ground Check

The following equipment is used to perform the ground check (list does not include LED PAPI adjustment tools):

1. Self-Leveling Line Laser, Accuracy +/-0.2 minutes. Ref: Spectra Precision LL300S.
2. Camera Tripod with bubble level and vertical adjustment mechanism
3. Measuring Tape – 20m
4. Steel rule – 30cm
5. Marker, Dry-erase Black.
6. Carpenter’s Level (2)
7. Bright Spray Paint (or other method) for marking line in grass.
8. Projection screen or marker board. Recommend dry erase board (0.9m x 1.5m) mounted on a post (50mm x 100mm). See Figure 21.

5.6.2 Prior to Performing A Ground Check

Set up and aim PAPI units as described in the section Aligning and Aiming the LED PAPI to the Site Specific elevation angles required by the Airport.

1. Mark the specified observation distance.
   a. Measure 18m from the centerline mark on the PAPI side panel along the light path. Note: the centerline mark is 12mm behind the PAPI leg centerline. Mark the 18m distance with a spray paint line. Optional to install a mounting stake at the CL of the beam on the 18m line.
   b. This is the location at which the projection screen will be located. The dry erase board can be permanently attached to the support pole by placing the pole at this location and making sure that the beam transition and the laser level indicator are both visible on the dry erase board. This step is necessary due to variations in PAPI mounting height and the slope of the terrain directly in front of the PAPI units.

Figure 21: Projection Screen

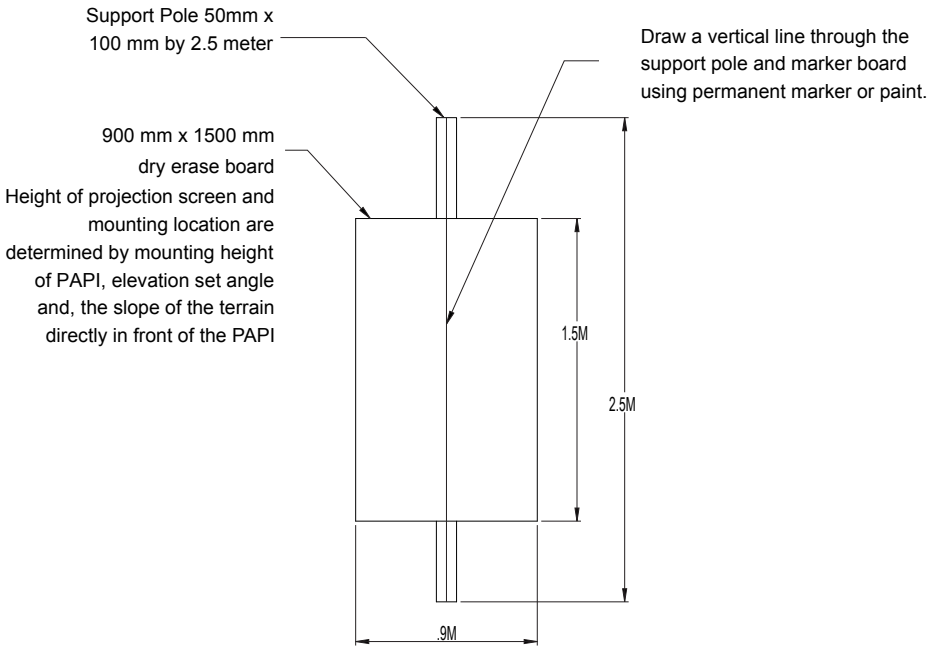


Table 9: Blank Table: Record of PAPI Changes to Elevation from "H1" to "H"

Light Unit (1)	Required Elevation Angle in Minutes (2)	Required Elevation Angle in Degrees (3)	Dimension "H" Calculated Millimeters (4)	Dimension "H1" Measured Millimeters (5)	Difference Between H and H1 Millimeters (6)	Adjust Angle (7)	Adjust Up/Down (8)
A							
B							
C							
D							

2. Prepare and fill out columns (2), (3), and (4) of Table 9 (Blank Record of PAPI Changes to Elevation from "H1" to "H"), which will be used throughout this procedure. Rows A and B are populated for 2-box systems and rows A, B, C, and D will be populated for 4-box systems.
   a. Fill out the required elevation angles in degrees and minutes in column (2) for the installed units.
   b. Calculate the conversion and fill out the required elevation angles in decimal degrees in column (3) for the installed units.
   c. Calculate and record dimension "H" in column (4) by using the formula: H = [distance of observation in mm] x tan[angle in column 3].

Note

Example: 18 m observation distance and an aiming angle of 2.50 degrees, H = 18000 x tan[2.50] = 786 mm.

Table 10: Sample Table: Record of PAPI Changes to Elevation from "H1" to "H"

Light Unit (1)	Required Elevation Angle in Minutes (2)	Required Elevation Angle in Degrees (3)	Dimension "H" Calculated Millimeters (4)	Dimension "H1" Measured Millimeters (5)	Difference Between H and H1 Millimeters (6)	Adjust Angle (7)	Adjust Up/Down (8)
A	2° 30′	2.50	786				
B	2° 50′	2.83	890				
C	3° 10′	3.17	997				
D	3° 30′	3.50	1101				

Note

Sample values shown are an example of for a nominal 3 degree approach glide slope. Actual site specific elevation angles required by the airport must be used.

5.6.3 Setup and Ground Check Procedure

Setup and Ground Check procedures are to be performed at night.

Figure 22: Ground Check Setup

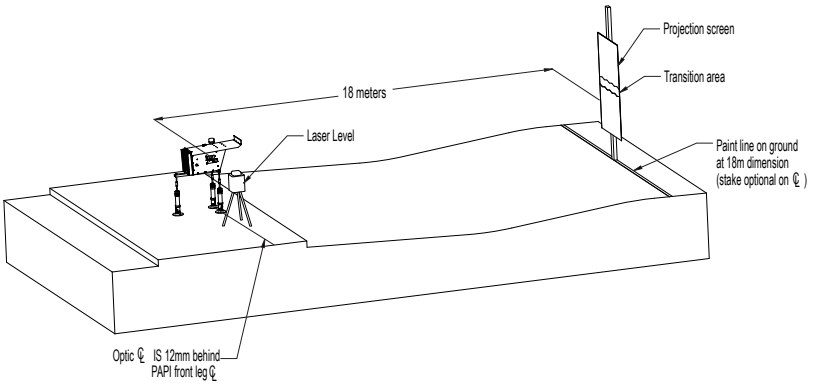


Figure 23: LED PAPI Light Beam Centerline Mark

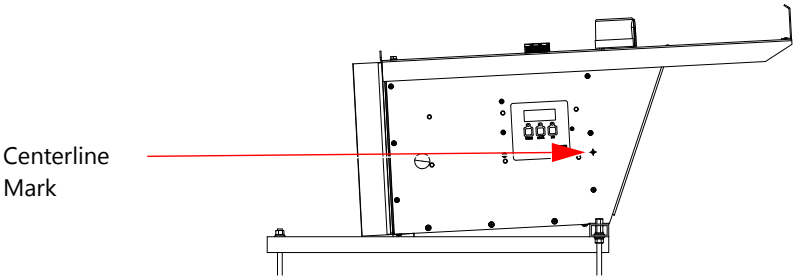


Figure 24: Laser Level

1. Place the laser level adjacent to the touchpad side of the PAPI unit.
2. Turn on and adjust height of the laser level so the beam intersects the LED PAPI Light Beam Centerline Mark. See Figure 23.

Note

Mount the Self-Leveling Line on the tripod as close to level as possible. Note that a tripod with a bubble level will assist with leveling the laser. The Self-Leveling Laser needs to be mounted within +/- 5 degrees of level for the self-leveling feature to function.

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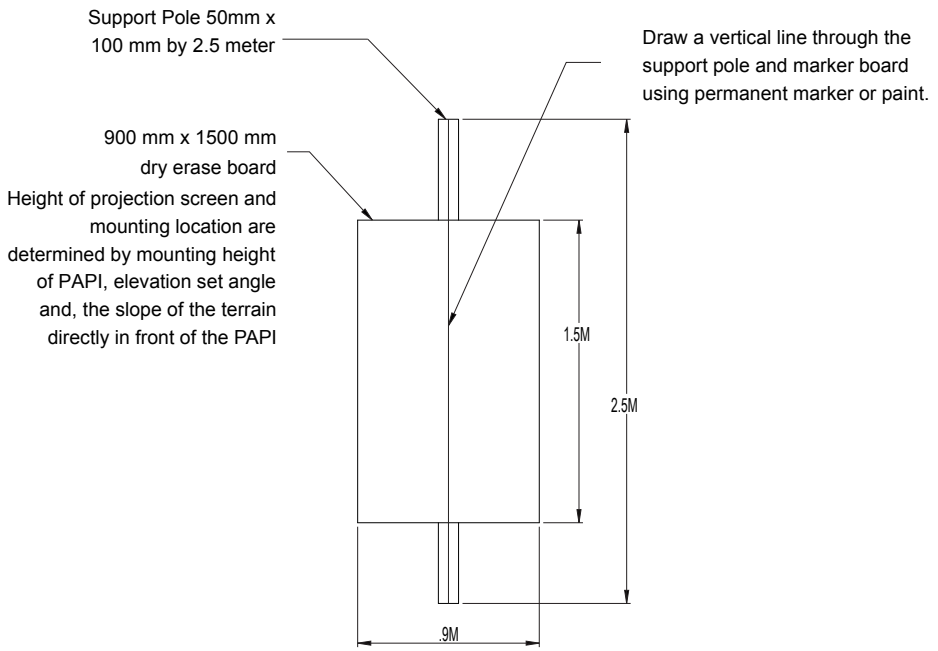
3. Mark the specified observation distance.
   a. Measure 18 m from the centerline mark on the PAPI side panel along the light path. Note: the centerline mark is 12 mm behind the PAPI leg centerline. Mark the 18m distance with a spray paint line. Optional to install a mounting stake at the CL of the beam on the 18m line.
   b. This is the location at which the projection screen will be located. The dry erase board can be permanently attached to the support pole by placing the pole at this location and making sure that the beam transition and the laser level

indicator are both visible on the dry erase board. This step is necessary due to variations in PAPI mounting height and the slope of the terrain directly in front of the PAPI units.

Figure 25: Projection Screen



4. Place the projection screen on the paint line 18 m in front of the PAPI. Sight along the side of the PAPI as shown in Figure 22.
5. Lock the vertical movement of the tripod holding the laser level. With the PAPI turned off, mark the projection screen at the location where the laser level crosses the permanent vertical line on the projection screen. See Transition Boundary Figure 26. This will be used as the baseline from which to measure distance "H1".

Note

It is important not to move the marker board once this mark has been made. It is also important that the marker board remain within 3° of and vertical during this process.

Note

Use a carpenter's level to help maintain the vertical position.

Figure 26: Transition Boundary

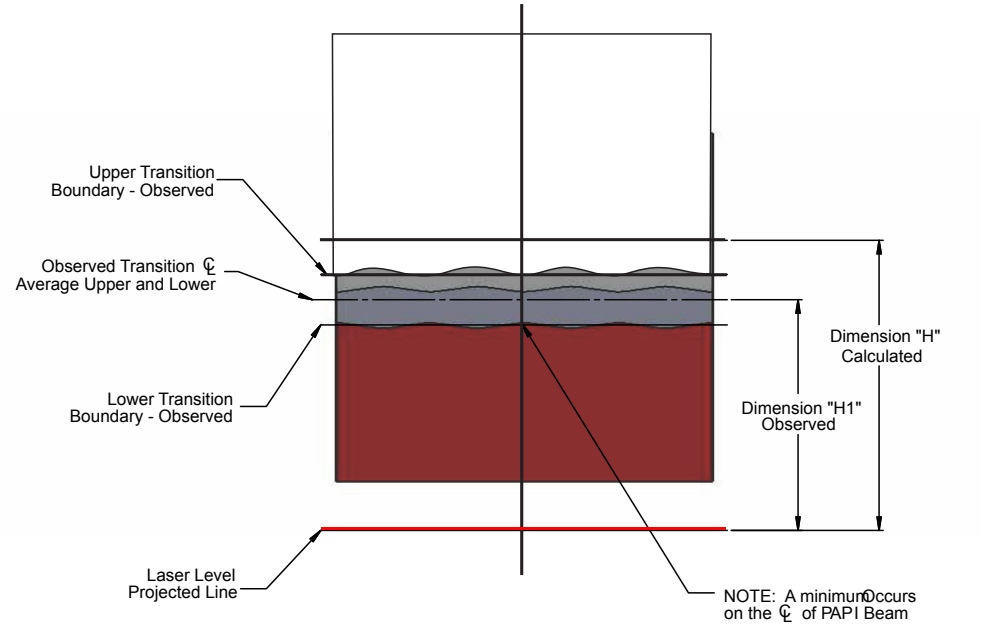
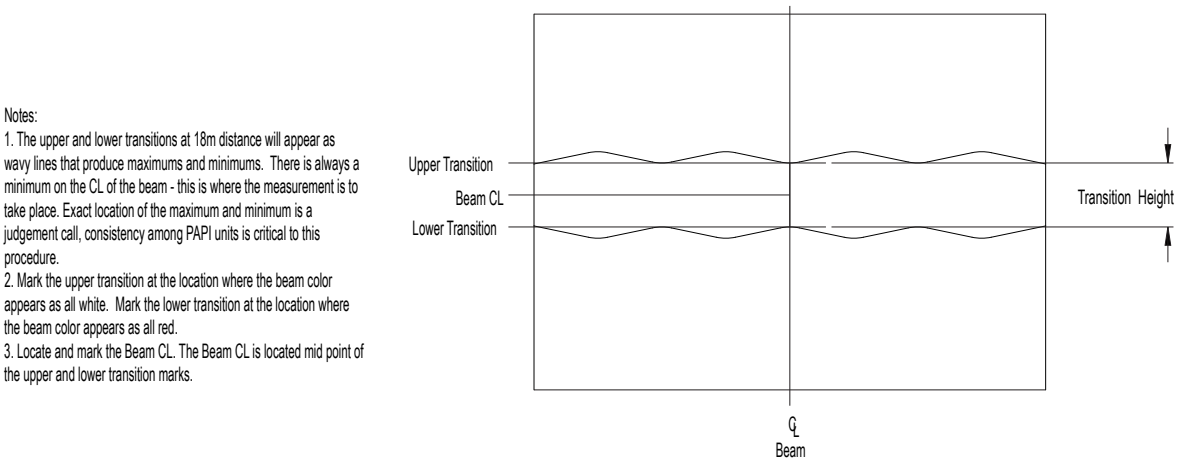


Figure 27: Transition Boundary Explanation



6. Turn on the LED PAPI and adjust the brightness in order to provide the greatest contrast between the red colored area and the dark transition sector. Regulator Step 5 is recommended for the 18 m distance.
7. Determine the upper and lower transition lines and mark these with dry erase markers on the board.

Note

There are peaks and valleys to the transition area – see Figure 27 for additional detail. Center the minimum area found at 0 degrees azimuth. See Figure 26.

8. Mark the observed transition centerline. It is located mid-way between the upper and lower transition boundaries. See Figure 26.
9. Complete Table 9 by performing the following measurements and calculations.
   a. Measure the distance between the laser level projected line and the marked beam centerline. Record this value in the "Dimension "H1" Measured" column in [5].
   b. If "H" and "H1" are not equal, subtract the smaller from the larger value and record this difference in “Difference between H and H1” column [6].

c. If H1 is greater than H the PAPI is aimed too high, record "Down" in column (8). Then using the formula ADJUSTMENT ANGLE = ARCTAN [(H1-H)/18000], calculate the adjustment angle in decimal format and record it in column (7).

d. If H1 is less than H the PAPI is aimed too low, record "Up" in column (8). Then using the formula ADJUSTMENT ANGLE = ARCTAN [(H-H1)/18000], calculate adjustment angle in decimal format and record it in column (7).

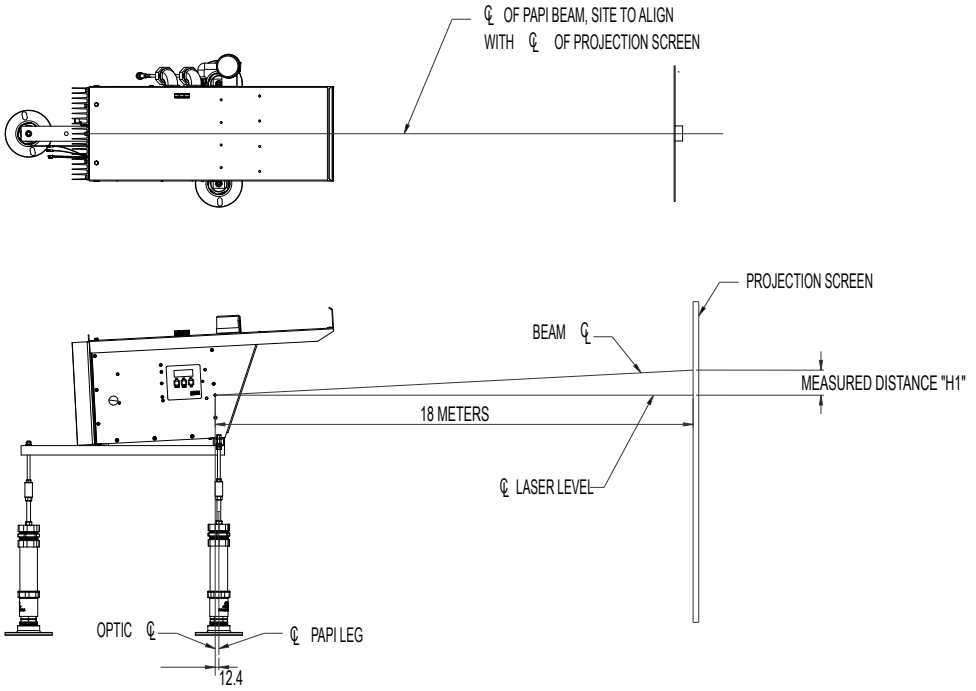
10. Using the inclinometer display, adjust each PAPI up or down by the amount recorded in column (7) of Table 9.

11. Check PAPI observed transition centerline again to verify that the transition area is now centered at the laser level reference.

Note

There is no adjustment necessary if the calculated difference between H and H1 is less than 10 mm. An adjustment of 10 mm results in an angular change of less than 2 minutes of arc.

Figure 28: Calculate adjustment in the PAPI inclinometer elevation setting



6.0 Operation

This section provides operating information for the PAPI system, including important guidelines for normal operation, preparation for heavy snowfall and criteria for system deactivation.

- For **voltage powered** PAPI units, follow the steps for initial startup using local control, remote control operation and optional interlock relay in Initial Startup Using Local Control - Voltage Powered through Set Up and Test Optional Interlock Relay .
- For **current powered** PAPI units, follow the steps for initial startup discussed in Section Initial Startup Using Local Control - Voltage Powered .

6.1 Operation Safety Considerations

CAUTION

Improper Operation

- Only qualified personnel, physically capable of operating the equipment and with no impairments in their judgment or reaction times, should operate this equipment.
- Read this manual completely before operating the equipment. A thorough understanding of system components and their operation will help you operate the system safely and efficiently.
- Before starting this equipment, check all safety interlocks, fire-detection systems and protective devices such as panels and covers. Make sure all devices are fully functional. Do not operate the system if these devices are not working properly. Do not deactivate or bypass automatic safety interlocks or locked-out electrical disconnects.
- Never operate equipment with a known malfunction.
- Do not attempt to operate or service electrical equipment if standing water is present.
- Use this equipment only in the environments for which it is rated. Do not operate this equipment in humid, flammable or explosive environments unless it has been rated for safe operation in these environments.
- Never touch exposed electrical connections on equipment while the power is ON.

6.1.1 Normal Operation

The PAPI system must operate continuously as long as the runway is in service.

- The **voltage powered** system is controlled by a photocell that automatically sets the system to 100% intensity during daytime and either 5% or 20% intensity at night.
- The **current powered** system operates at any intensity selected by the CCR. It is recommended that a five-step CCR be used to power the Style B PAPI system.

6.1.2 Preparation for Heavy Snowfall

The LED PAPI should operate continuously at normal standby brightness even when the runway is not in use, permitting any snow, ice or condensation to melt and drain off.

If snowfall is expected to bury the Light Units, mark the location of the Light Units with sticks or flags — approximately 7 ft. (2.1m) high — to prevent damage by snow removal equipment.

Should the system show more serious defects, it must be taken out of service.

6.2 Understanding the LED Readout

Figure 29: LED Display

6.2.1 Four-Segment LED

The four-digit LED display indicates the azimuth (horizontal level), the glide slope (vertical) angle measured from the horizon and additional information regarding unit and system errors. The messages are displayed on the four-digit LED display as follows:

0.00 to 9.99: Displays degrees of glide slope if GLIDE button is pushed. Displays degrees of azimuth (horizontal level) if LEVEL button is pushed.

SAVE: Displays after the SET button is held in order to set a new glide angle.

ADB -> LED -> PAPI -> BOX X -> OF X -> COLD -> ___ -> XXX -> SEC: Displayed during the delay at startup.

COMM -> LOST: Indicates there is a comm error within the box displaying the error.

HEAT -> FAIL: Indicates there is an error with the defrost heater within the box displaying the error.

RED -> LED -> FAIL: Indicates there is an error with the red LED string within the box displaying the error.

WHT -> LED -> FAIL: Indicates there is an error with the white LED string within the box displaying the error.

PHOT -> FAIL: Indicates there is an error with the photocell (will only be displayed on the voltage powered primary unit).

BOX X -> TILT: Indicates the particularly box in the system that has the tilt error.

Note

(__ -> XXX) = A pause then the time in seconds remaining in the initial power sequence - the delay time where the front glass is being cleared of frost before the PAPI lights up.

It takes 15 seconds for the display to warm up in cold weather.

ICAO PAPI systems do not require tilt/detection shutdown, but may optionally be enabled if desired.

6.2.2 Push Button Functions

The GLIDE, LEVEL and SET push buttons determine the display as follows:

GLIDE

- When the GLIDE push button is pressed the four-digit LED display will show the current glide angle or LOW is the tilt angle is less than 0.00.

LEVEL

- When the level push button is pressed the four-digit LED display shows the azimuth (horizontal level) angle.

SET

- The SET push button stores the **glide angle** that defines proper vertical alignment for the PAPI Light Unit. If any PAPI Light Unit is raised more than ½ degree or lowered more than ¼ degree from this angle, the inclinometer circuitry will de-energize all PAPI Light Unit lamps, if TILT is enabled.
- Push and hold the SET push button for about 5 seconds until SAVE is displayed on the four-digit LED display for the Control Board to memorize the glide angle.

6.3 Initial Startup Using Local Control - Voltage Powered

To turn ON the voltage powered RELIANCE PAPI system using local control:

1. Turn the external ON/OFF switch on the primary unit to the OFF position and circuit breaker CB1 to OFF and set DIP SW3-1 to ON, the unit will read this input and translate it to mean it is in local mode operation.
2. Select the desired intensity for nighttime operation by switching DIP SW3-2 ON for 5% and OFF for 20%.
3. Ensure that all light units are aligned properly and that the glide angle settings are memorized in each unit. See Aligning and Aiming the LED PAPI for the Light Unit setting procedure.
4. Turn CB1 to on in the primary Unit.
5. Switch the external ON/OFF switch on the primary unit to the ON position. The system should energize and all lamps should turn on after the initial countdown.

6.4 Set Up and Test Remote Control Operation

To set up and test remote control operation:

1. Turn the external ON/OFF switch on the primary unit to the OFF position and circuit breaker CB1 to OFF.
2. Set DIP SW3-1 to OFF for remote operation and connect remote control wiring to Terminals 4 and 5 on the DIN rail (The remote control should be shorted for initial testing). Disconnect the photocell.
3. Turn CB1 to on in the primary Unit.
4. Switch the external ON/OFF switch on the primary unit to the ON position. The system should energize and all lamps should turn on after the initial countdown.
5. Open the remote control connection that is connected to terminals 4 and 5 on the DIN rail. The light output should go OFF.
6. Short the remote control connection that is connected to terminals 4 and 5 on the DIN rail. The light output should come back ON.
7. The PAPI system is now ready for operation, the lights are turned on and off via the remote switch that was wired in.

6.5 Set Up and Test Optional Interlock Relay

To set up and test the operation of the interlock relay:

Note

Before verifying this operation insure the unit is wired for the optional interlock relay as described in Optional Interlock Relay .

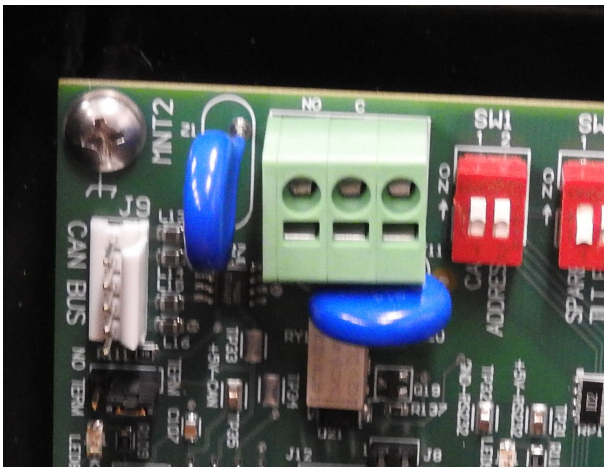
1. Turn the external ON/OFF switch on the primary unit to the OFF position and circuit breaker CB1 to OFF.
2. Ensure that the primary of a low-wattage isolation transformer is connected to the series circuit. Ensure that the secondary is connected to Terminals 4 and 5 on the DIN rail. A 6.6A secondary, 30/45W isolation transformer is typically used. However, a 10/15W or 20/25W isolation transformer may be used.
3. Set DIP SW3-1 to OFF for remote operation.
4. Cover the photocell to force the nighttime operation.
5. Turn CB1 to on in the primary Unit.
6. Switch the external ON/OFF switch on the primary unit to the ON position. The unit should remain OFF.
7. Turn on the CCR that controls the interlock relay. The unit should turn on and all PAPI Light Unit lamps should illuminate to the 5% or 20% intensity level as selected using DIP SW3-2.
8. Turn off the CCR. All light units should turn off.
9. Turn the external ON/OFF switch on the primary unit to the OFF position and circuit breaker CB1 to OFF.

6.6 Set Up the Alarm Contact on the Main PCB

To set up the Alarm contact, follow these steps:

Note

Add a remote monitoring point to a LED PAPI (ICAO, current powered) light unit (one per unit). The contacts are normally open (N.O.) and will be closed during normal operation when the PAPI-L is on.



1. Disconnect power from the PAPI-L.
2. Connect the wires to the Alarm Contacts 1 (NO) and 2 (C). If connecting all the units, the circuit will be in series.
3. Inset a small flathead screwdriver into the rectangular slot to open the circular opening to inset the wire into. Check that the wires hold when lightly tugged on.

CAUTION

Do not connect the incoming alarm wire directly to the PCB. Anchor a connector or terminal strip to the frame or side of the PAPI-L to allow wire separation if the external wire gets caught on something and pulled out of the PAPI-L unit.

PAPI-L unit operation is normal, the contact is closed.

A heater failure will cause an open contact which equals and alarm state.

A red LED failure will cause an open contact which equals and alarm state.

A white LED failure will cause an open contact which equals and alarm state.

Note

A failure will open the circuit and all PAPI-L units in the circuit will show an alarm. To isolate the alarm cause, close the circuit inside each PAPI-L unit until the alarms clear on the other units.

6.7 Initial Startup of the Current Powered System

Each Light Unit is energized following an initial delay to clear the front glass when the constant current regulator (CCR) is activated, assuming that no Light Unit is in a tilt situation.

6.7.1 Check Light Unit Alignment

Ensure that all Light Units are aligned properly and that the glide angle settings are memorized in each Light Unit. See Aligning and Aiming the LED PAPI for the Light Unit setting procedure.

6.7.2 Verify Correct Input Current in Each Light Unit

Verify that the input current from the series circuit is correct in each of the Light Units.

To check this, perform these steps for each Light Unit:

- Turn the CCR OFF.
- Remove the lid from the Light Unit closest to the input side of the series circuit.
- Connect a true RMS amp meter current clamp around one of the wires connected to terminal 1 or 2 on the DIN rail.
- Turn the CCR ON to the lowest step (2.8A for a five-step CCR or 4.8A for a three-step CCR).

  Verify that the current is correct.
- Verify that the current is correct in each of the remaining current steps.

  Troubleshoot or repair the external wiring if the current is incorrect.

6.8 Commissioning the PAPI System

After the PAPI system setup is complete, perform a flight check prior to commissioning the system, if required.

7.0 Maintenance

This section provides maintenance information and procedures for L-880(L)/PAPI (4-box) and L-881(L)/APAPI (2-box) systems.

7.1 Maintenance and Repair Safety Considerations

CAUTION

Electric Shock

- Allow only qualified personnel to perform maintenance, troubleshooting and repair tasks. Only persons who are properly trained and familiar with
- ADB SAFEGATE equipment are permitted to service this equipment.
- Always use safety devices when working on this equipment.
- Follow the maintenance procedures recommended in equipment manuals.
- Do not service or adjust any equipment unless another person trained in First Aid and CPR is present.
- Connect all disconnected equipment ground cables and wires after servicing equipment. Ground all conductive equipment.
- Use only approved ADB SAFEGATE replacement parts. Using unapproved parts or making unapproved modifications to equipment may void agency approvals and create safety hazards.
- Check CCR interlock systems periodically to ensure their effectiveness.
- Do not attempt to service electrical equipment if standing water is present. Use caution when servicing electrical equipment in a high-humidity environment.
- Use tools with insulated handles when working with electrical equipment.
- Also review and follow safety guidelines in FAA AC 150/5340-26 (current edition), Maintenance of Airport Visual Aid Facilities.

7.2 Maintenance Schedule

To keep the PAPI unit operating efficiently, follow the preventive maintenance schedule in Table 11.

Table 11: LED PAPI Periodic Maintenance Schedule

Interval	Maintenance Task	Action
After installation and before operational use	Make flight check of system.	Readjust if needed.
After installation (first few weeks)	Check elevation angle of Light Units using the on board inclinometer.	Readjust if needed. Refer to Additional Siting Considerations for Light Unit alignment. To independently check the elevation aiming angle, refer to Siting Considerations
Daily	If Light Units are not operated continuously, check for frost or dew on the outer lens.	Remove frost or dew and check airport lighting circuitry per CertAlert 02-08
	Visually check for any apparent evidence of damage to any Light Unit.	Repair or replace any damaged components.

Table 11: LED PAPI Periodic Maintenance Schedule (Continued)

Interval	Maintenance Task	Action
Monthly	Check all control equipment -including photocell (voltage powered systems) - for proper operation.	Repair or replace any damaged components.
	Clean the outer surface of the front glass.	Use a soft cotton cloth moistened with alcohol.
	Check the glide slope and azimuth angle of each Light Unit.	Use the onboard Light Unit digital readout. Readjust if necessary.
	Inspect housing, LEDs, electrical connections, filters and front glass for damage, breakage or a warped shape.	Repair or replace any damaged parts.
	Clean the interior of the housing.	Remove any foreign matter. Also check for water damage, insect infestation and presence of rodents.
	Make sure mounting is rigid.	Tighten any loose hardware—nuts, screws, etc. Realign the Light Unit if hardware has loosened.
	Make sure no vegetation obscures the light beams.	Remove vegetation. Use weed killer to prevent any regrowth
	Check whether the lightning arresters and/or surge suppressors are scorched or show other signs of failure. Also check after electrical storms.	Replace as necessary.
	Record input voltage to each of the voltage powered light units.	Repair or replace equipment if input is abnormal.
	Check Humidity Indicating Plug.	If humidity plug indicates 20% or more, a seal may be compromised. Inspect the front glass seal and the rear LED heat-sink assembly seal for damage. Replace components as necessary.
Quarterly	Check the obstacle-free approach plane for clearance from tree growth, new towers, pole lines or other obstacles. The obstacle-free plane is four miles long and extends 10 degrees on either side of the runway centerline.	Remove obstacles as necessary.
Semiannually	Check the insulation resistance of underground cables and record the results.	Remove obstacles as necessary.
	Check the resistance of the grounding system and record the results.	Remove obstacles as necessary.

7.3 Standards and Tolerances

These standards and tolerances are specified by FAA Advisory Circular 150/5340-26C. Current revisions of AC 150/5340-26 and/or applicable local standards and tolerances should always be observed.

Table 12: FAA Standards and Tolerances for Precision Approach Path Indicator (PAPI)

Parameter	Standard	Tolerance / Limit	
		Initial [1] [2]	Operating [2] [3]
Vertical aiming [4]			
• Unit closest to runway	3° 30′	±2 ′ (0.03°)	±6 ′ (0.1°)
• Unit second from runway	3° 10′	±2 ′ (0.03°)	±6 ′ (0.1°)
• Unit third from runway	2° 50′	±2 ′ (0.03°)	±6 ′ (0.1°)
• Unit farthest from runway	2° 30′	±2 ′ (0.03°)	±6 ′ (0.1°)
Horizontal alignment	Parallel to runway centerline	±30 ′ (0.50°)	±30 ′ (0.50°)
Tilt Detection	0.25° below to 0.50° above established Light Unit angle	Same as standard	
Obstructions due to vegetation, etc.	No obstruction	Same as standard	

Notes

1 Initial tolerances should be considered during installation.

2 ICAO ADM, Part 4, Para 8.3.18: Errors in excess of one minute of arc should be corrected.

3 Operating tolerances should be considered during Preventive Maintenance Inspections, Scheduled Maintenance, and Unscheduled Maintenance.

4 Unless a different standard is established locally, angles shown are for a 3-degree glide path.

8.0 Troubleshooting

WARNING

Electric Shock
Allow only qualified personnel to perform the following tasks. Observe and follow the safety instructions in this document and all related documentation.

- Before attempting to service the fixture, de-energize the circuit and lock out the circuit or regulator so that the circuit cannot be energized by remote means.

8.1 Troubleshooting Tips

Refer to Wiring Diagrams for general troubleshooting procedures. This guide covers only the most common problems. The following paragraphs provide specific details on troubleshooting and repair of PAPI subsystem components. For additional help, contact your local ADB SAFEGATE representative.

8.2 Troubleshooting the Field Circuit First

To identify a faulty section, follow the guidelines given below, along with a drawing and a meter:

- Check the incoming supply power first.
- Check for voltages at the specific test points in circuit.
- While the circuit is OFF test, check for continuity of circuits, as intended, and check for insulation resistance.
- If it's not possible to perform a power OFF test, connect the supply to the circuit and do a live test of circuit.

Generally, any electrical circuit can be differentiated in two sections:

- Power circuit (voltage of current).
- Control circuit.

It is always advisable to first check the power circuit. So, if the power circuit works, as it should, then troubleshoot the control circuit.

Power circuit check list:

- Incoming power to circuit and its integrity
- Check for correct functioning of protection devices
- Check visual cable continuity
- Check for any signs of flash or burning smell of devices.

Control circuit check list:

- Control circuit power first
- Check for proper functioning of relays, timers, and switches
- Check visual cable continuity
- Check for wire interconnections and terminal connections of circuit
- Check logical operational sequence of contactor switching
- Check for timer duration settings.

If the above criteria are checked and the ADB product is still not working, then go to Table 13.

Table 13: General PAPI System Troubleshooting Guide

Problem	Possible Cause	Solution
Voltage Powered: Current Sensing not operating	Control Board Issue	Continue to Repair
	Bad Isolation Transformer	Change the Isolation transformer to a known good transformer.
	Regulator Outputting incorrect current	Low input current from series circuit. Repair CCR or series circuit wiring (if an open circuit is present on the series circuit).
LEDs Dim	Dirt on Outer Glass	Clean with a soft cotton cloth moistened with alcohol.
	Current Powered: Current Level too low	Low input current from series circuit. Repair CCR or series circuit wiring (if an open circuit is present on the series circuit).
	Light Unit improperly aligned	Realign and recalibrate light unit.
LEDs out	PAPI Light unit tilts	Realign PAPI Light Unit(s) that have tilted
	LEDs Failed	Check the local display on the PAPI where the Light Engine has failed and continue to Repair
	No power input	**Voltage Powered:** Measure the voltage between fuses F3 and F4 on the input power board 44A7392, if either fuse is blown replace the fuse, if it does not measure what the desired input voltage should be verify the system wiring or the power source is working properly (Style A Primary unit, verify the operation of the local ON/OFF switch). If the desired power is measured, replace the step down transformer. **Current Powered:** Measure the input current using a current clamp in either the conductor going to TB-1 or TB-2. If the desired output current is not present verify the Isolation transformer is good, the series circuit is properly connected and the Regulator is properly calibrated.
	Bad Inclinometer	See Troubleshooting the Inclinometer PCB
	Communications lost	Determine which box has the communication error but looking at the display on the side of each PAPI, then continue to Repair
Display Reported Error: COMM -> LOST	CAN communication lost on the unit	See Troubleshooting COMM LOST error.
Display Reported Error: HEAT -> FAIL	Front glass defroster error	See Troubleshooting HEAT FAIL error.
Display Reported Error: RED -> LED -> FAIL	Red LED string error	See Troubleshooting RED LED FAIL error.
Display Reported Error: WHT -> LED -> FAIL	White LED string error	See Troubleshooting WHT LED FAIL error.
Display Reported Error: PHOT -> FAIL	Photocell failure, only displayed on the Style A Primary unit.	See Troubleshooting PHOT FAIL error.
Display Reported Error: BOX **?** -> TILT	PAPI Light unit tilts	Realign PAPI Light Unit(s) that have tilted
	Bad Inclinometer	See Troubleshooting the Inclinometer PCB
Voltage Powered: Remote mode operation not working	Bad switch	Replace the remote switch and all wiring to the LED PAPI system
	Blown fuse	Check Fuse F2 on the power board, if it is blown, replace the fuse.
	Bad Step Down Transformer	Measure the voltage between pin 2 on J7 and pin 1 on J2 of the power board, verify it is 48VAC (±15%). If it is not measuring the correct voltage, replace the step down transformer
	Control Board Issue	Continue to Repair

8.3 Detailed Troubleshooting and Repair Procedures

This section describes procedure for troubleshooting or repairing parts in the RELIANCE PAPI enclosure

8.3.1 Troubleshoot and repair the RELIANCE PAPI

Follow these steps to troubleshoot and repair the RELIANCE PAPI:

- Visually examine all areas of the RELIANCE PAPI
- Check for burnt or loose connections and parts.
- Check all fuses and the circuit breaker (where applicable). See Fuses .

If the RELIANCE PAPI does not energize at all:

- **Voltage Powered:** Measure the voltage between fuses F3 and F4 on the input power board 44A7392, if either fuse is blown replace the fuse, if it does not measure what the desired input voltage should be verify the system wiring or the power source is working properly (Style A Primary unit, verify the operation of the local ON/OFF switch). If the desired power is measured, replace the step down transformer.
- **Current Powered:** Measure the input current using a current clamp in either the conductor going to TB-1 or TB-2. If the desired output current is not present verify the Isolation transformer is good, the series circuit is properly connected and the Regulator is properly calibrated.

  Verify the indication LEDs on the Control PCB.

Table 14: Indication LEDs on the Control PCB

	ON (GREEN)	OFF
LED1	+3.3V OK	+3.3V ERROR
LED2	HEARTBEAT (blinking)	ERROR (fast blinking)
LED3		
LED4	Current Powered	Voltage Powered
LED5	CAN OK	CAN ERROR
LED6	+12V OK	+12V ERROR
LED7	BOOST OK	BOOST ERROR
LED8	+5V CAN OK	+5V CAN ERROR
LED9	+5V SERIAL OK	+5V SERIAL ERROR

If any of the indicator LEDs, show an error with the Control PCB, replace the control PCB.

8.3.2 Troubleshooting COMM LOST error

1. Follow Table 13
2. If no error is found in the unit or on the control PCB then there is faulty wiring between boxes. Replace the connections between PAPI units.

8.3.3 Troubleshooting HEAT FAIL error

1. Follow Table 13
2. Turn the LED PAPI unit off, and disconnect the J1 connector from the control PCB and using a multimeter measure the resistance between pins 12 & 5, verify the resistance reads between 12Ω and 15Ω. If the measurement is outside this

range there is a problem with the heater. If the heater measurement is within tolerance the error is with the control PCB and it needs replaced.

3. Verify fuse F5 on the control board. See Fuses and Figure 67.

8.3.4 Troubleshooting RED LED FAIL error

1. Follow Table 13.
2. Turn the RELIANCE PAPI unit off and disconnect the J1 connector from the control PCB. Using a DC voltage supply limited to 65VDC and 300mA apply the output to pins 3(+) and 10(-) on the J1 connector. If the Red LEDs do not come on there is an error with the Light engine and it needs replaced. If the Red LEDs came on in the previous step there is an error with the control PCB and it needs replaced.

8.3.5 Troubleshooting WHT LED FAIL error

1. Follow Table 13.
2. Turn the RELIANCE PAPI unit off and disconnect the J1 connector from the control PCB. Using a DC voltage supply limited to 65VDC and 300mA apply the output to pins 4(+) and 11(-) on the J1 connector. If the White LEDs do not come on there is an error with the Light engine and it needs replaced. If the White LEDs came on in the previous step there is an error with the control PCB and it needs replaced.

8.3.6 Troubleshooting PHOT FAIL error

1. Follow Table 13
2. Check to see if Fuse F1 on the power board is blown. Replace fuse F1 if it is blown. Measure the voltage between pins 1 and 3 on J2 of the power board, verify it is 24VAC. If 24VAC is not measured, the step down transformer needs replaced. If 24VAC is measured, replace the photocell. After replacing the photocell if the problem persists then the problem is with the control PCB and it needs replaced.

8.3.7 Troubleshooting the Inclinometer PCB

1. Measure the voltage between TP1 and TP2, verify it is +5VDC ±5%.
2. Verify resistors R9, R10 and R11 are all 20Ω. The inclinometer board is precision-mounted on the Light Unit. If this board needs to be replaced, contact the ADB sales department for details.

8.3.8 Troubleshooting the Main PCB

If a problem is suspected with the Light Unit Control board, refer to drawings in Figure 30 and check the following indicators and test points.

1. Remove the eight screws and washers holding the top cover.
2. Set the top cover aside.
3. Verify operation of Control Board LEDs.
   see Table 14.

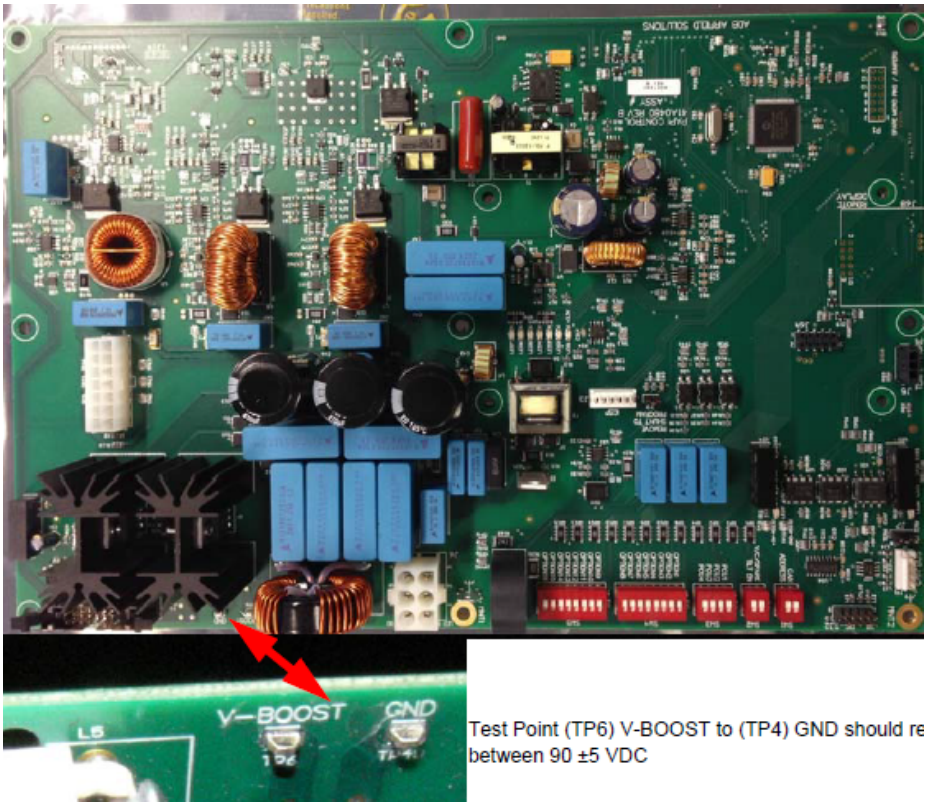
> **Note**
> Use a non conductive inspection mirror to perform the LED checks.

4. DC Power Supply Measurements

Measure the following power supply voltage:

a. TP6, referenced to TP4, 90 VDC ±5%.

Figure 30: PAPI-L PCB



Test Point (TP6) V-BOOST to (TP4) GND should re
between 90 ±5 VDC

5. Check for loose wires and disconnected Molex plugs for the board and power supply.
6. If the main control board is found to be faulty, power down the PAPI.
7. Go to Control Board Replacement to make certain you get the correct replacement kits to proceed.

   Read all of the following replacement procedures before performing any other steps.
8. Re-attach plugs to new LED PAPI control board. Reference the Wiring Diagrams .

Note

With each control board assembly, the corresponding input PCB (44A7392/X) is provided and must be replaced.

9. Disconnect wiring from the 44A7392/X input power assembly.
10. Remove 44A7392/X input power assembly by lifting the Din Rail mount tabs to release it from the Din Rail.
11. Replace with 44A7392/X input power assembly provided with the kit. Install by snapping the mounting tabs onto the Din Rail.
12. Re-connect wiring to 44A7392/X Input power assembly. Ref to Wiring Diagrams .
13. Replace the top cover gasket if necessary. Attach the top cover.
14. Go to Understanding the LED Readout and complete the setup and alignment procedures.

9.0 Repair

To troubleshoot and repair a PAPI Light Unit, follow these steps:

1. Check the display on each Light Unit and see if any errors are displayed. The following errors are displayed on the specific unit that is having an issue:

Display	Error
COMM -> LOST	CAN communication lost on the unit
HEAT -> FAIL	Front Glass defroster error
RED -> LED -> FAIL	Red LED string error
WHT -> LED -> FAIL	White LED string error
PHOT -> FAIL	Photocell failure, only displayed on the voltage powered Primary Unit.

2. If one of the units is tilted all units in the system will display which box is tilted: BOX X -> TILT (Where X is the number of the tilted box).

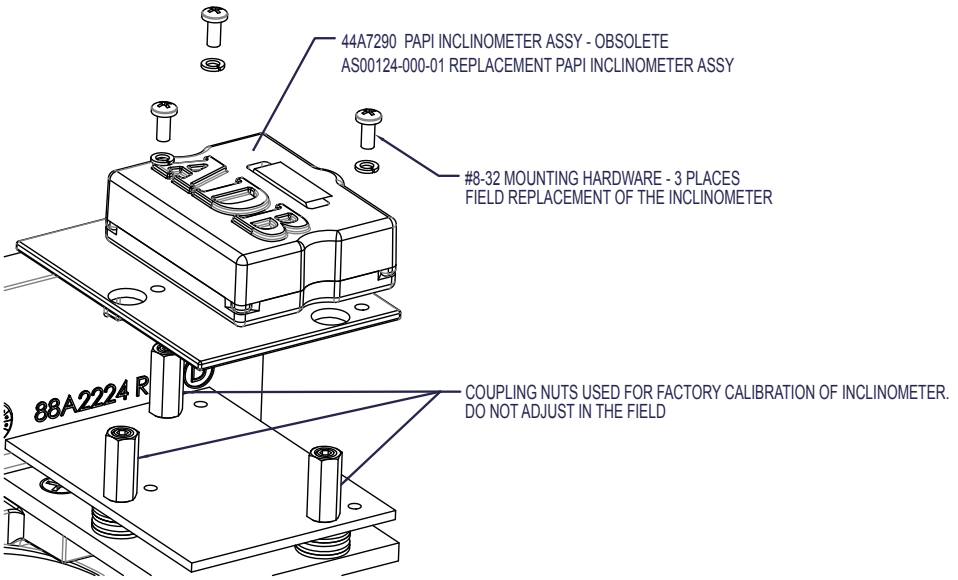
   Depending on the information read on the Display, take corrective actions to repair the Light Unit. Details on further troubleshooting/repair are detailed in the paragraphs below.

9.1 Inclinometer Assembly Replacement

If a problem is suspected with the inclinometer board, first verify the following voltage is present on the board. Refer to Troubleshooting the Inclinometer PCB

If the inclinometer needs to be replaced, install new inclinometer assembly AS00124-000-01.

Figure 31: Top Inside View



Procedure for replacing the inclinometer assembly AS00124-000-01

1. Remove the (2) top cover screws, washers and the top cover and set them aside for later reuse.
2. Disconnect the inclinometer connectors from the main PCB assembly.
3. Remove the (3) mounting screws while insuring the coupling nuts DO NOT MOVE.
4. Replace the inclinometer and replace the (3) screws, (torque to 10 to 12 in-lbs) again insuring the coupling nuts DO NOT MOVE.
5. Reconnect the ribbon cable to the main PCB.

6. Replace the top cover gasket if necessary.
7. Reinstall the top cover, screws and washers.

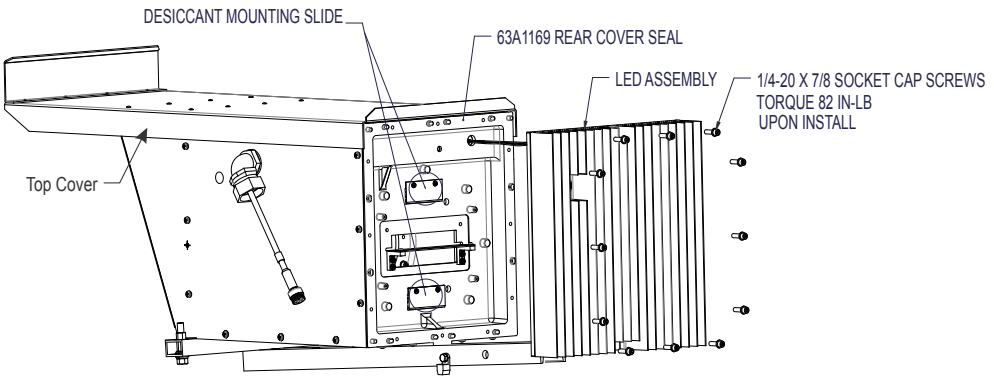
9.2 LED Light Engine Replacement

If there is a problem with the LED Assembly and it needs to be replaced.

Kit AK00030-200-01, RELIANCE PAPI LED Light Engine Replacement Kit.

Note
When replacing the LED Light Engine, the desiccant packs must also be replaced. The required desiccant packs and mounting hardware are included in the LED Light Engine replacement kit AK00030-200-01.

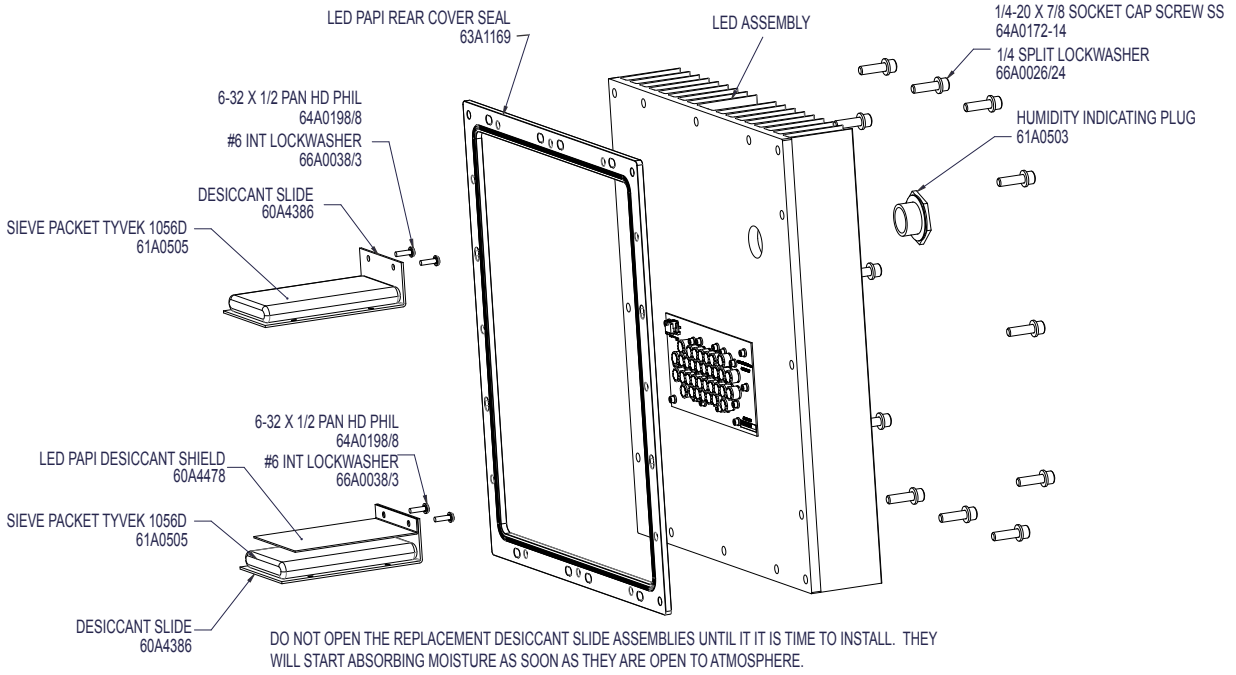
Figure 32: Replace the LED Assembly



1. Remove the (12) 1/4-20 SHCS from the rear of the LED assembly. Remove the LED assembly.
2. Disconnect the wire connector from the LED assembly and discard the non-working LED assembly.
3. Remove and discard the rear cover seal gasket.
4. Replace the (2) desiccant packs. (only in dry conditions and not until ready to reassemble). See Replace the Two Desiccant Packs.
5. Replace the rear cover seal gasket.
6. Connect the wire connector to the replacement LED assembly.

7. Mount the LED assembly onto the PAPI unit.
8. Replace the (12) 1/4-20 SHCS and washers to the rear of the LED assembly, torque to 82 in-lb.

Figure 33: Desiccant Packs and Rear Seal



9.3 Control Board Replacement

Kit 94A0666/XXX, RELIANCE PAPI Control Board Replacement Kit.

Note
Read the following sections prior to performing any tasks.
Follow these procedures carefully and call ADB SAFEGATE for assistance, if required.

Use the following matrix to identify the compatible kit for your LED PAPI.

Ordering Code 94A0666/□□□

Power
1 = Voltage-Powered Primary PAPI
2 = Voltage-Powered Secondary PAPI
3 = Current-Powered PAPI

Series Option
0 = LPL Series PAPI (PN begins with LPL)
2 = RP Series PAPI (PN begins with RP)

Input Power PCB Option
0 = Input Power PCB Not Included
= Input Power PCB Included

9.3.1 Replacing the Control/Display Side Panel Assembly (w/Control Board)

1. Identify the configuration of your RELIANCE PAPI enclosure.

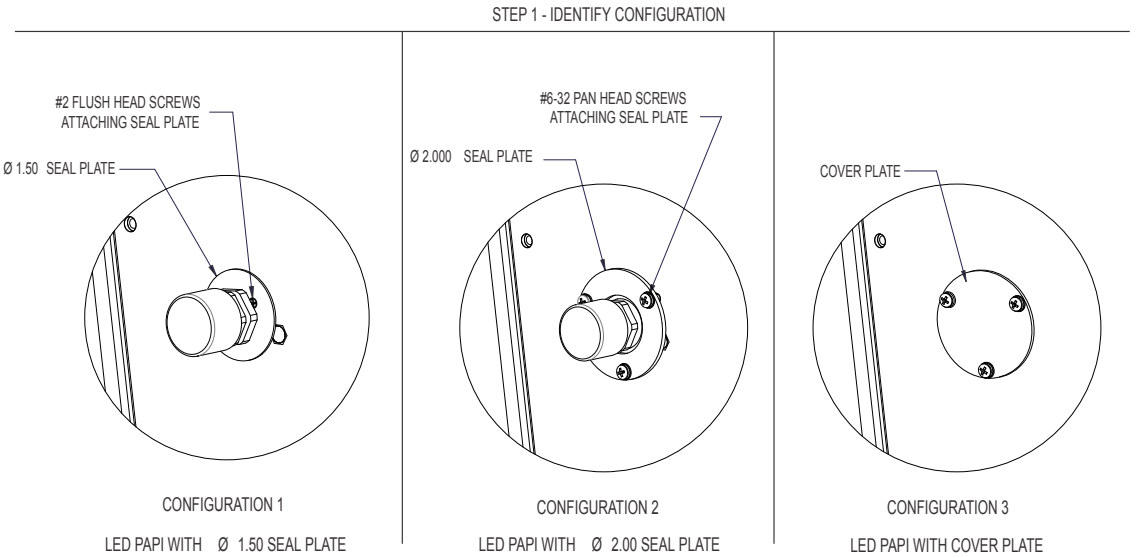
   a. If the enclosure is not equipped with a baffle, proceed to step 4.

   b. If the enclosure is identified as Configuration 1, proceed to step 2.

   c. If the enclosure is identified as Configuration 2, proceed to step 3.

   d. If the enclosure is identified as Configuration 3, proceed to step 4.

Figure 34: Identify the Side Panel Configuration



2. Configuration 1 Baffle Plate removal instructions.

   RELIANCE PAPI WITH Ø 1.5-in SEAL PLATE.

   a. Slightly loosen the sealing gland nut on the 77A0263 cord grip. Do not allow the Actuator fitting to rotate as this will break the seal.

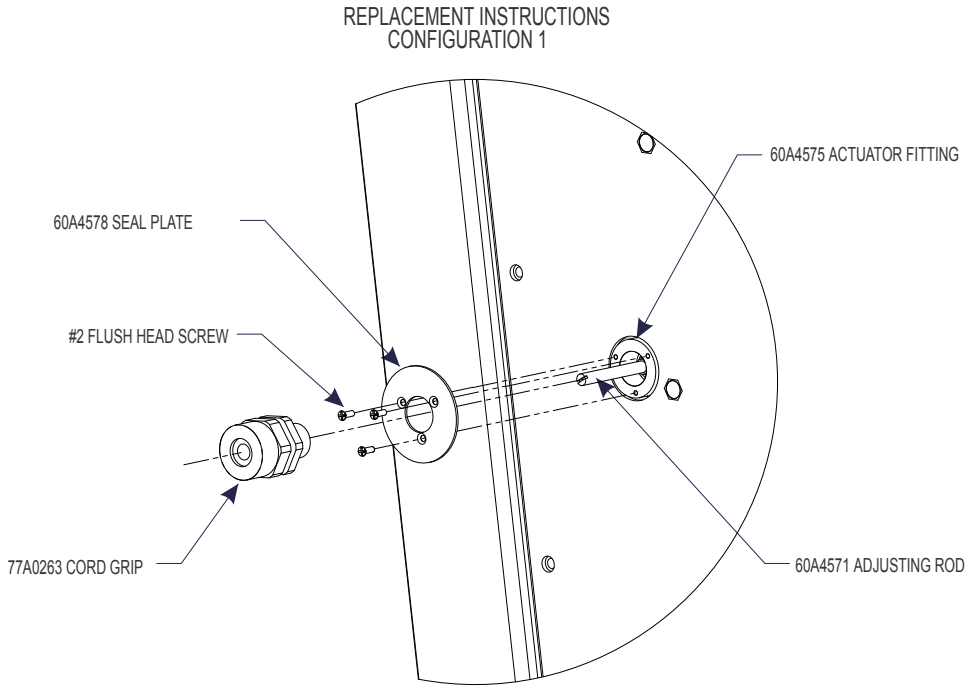
   b. Remove the 77A0263 cord grip from the 60A4575 actuator fitting. It is necessary to secure the 60A4575 actuator fitting to prevent rotation.

> **Note**
> Do not allow the 60A4571 adjusting rod to rotate as this will change the baffle setting.

c. Remove the three #2 flush screws and 60A4578 seal plate - discard.

d. Proceed to step 4

Figure 35: Remove the baffle closeout (configuration 1)



3. Configuration 2 Baffle Plate removal instructions.

   a. Remove the #6 hardware attaching the 60A4719 closeout plate.

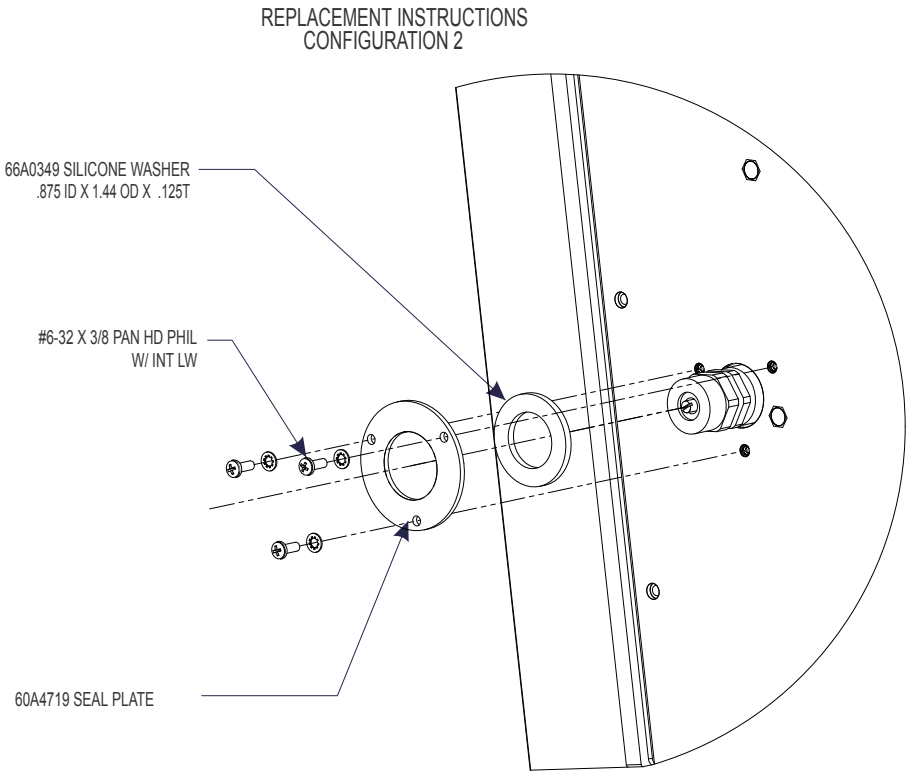
   b. Remove the 66A0349 silicone washer.

   c. Proceed to step 4, Side Panel Removal.

Note

Do NOT loosen the Gland Nut (77A0263), or threaded connection to the Actuator Fitting (60A4575).

Figure 36: Remove the baffle closeout (configuration 2)



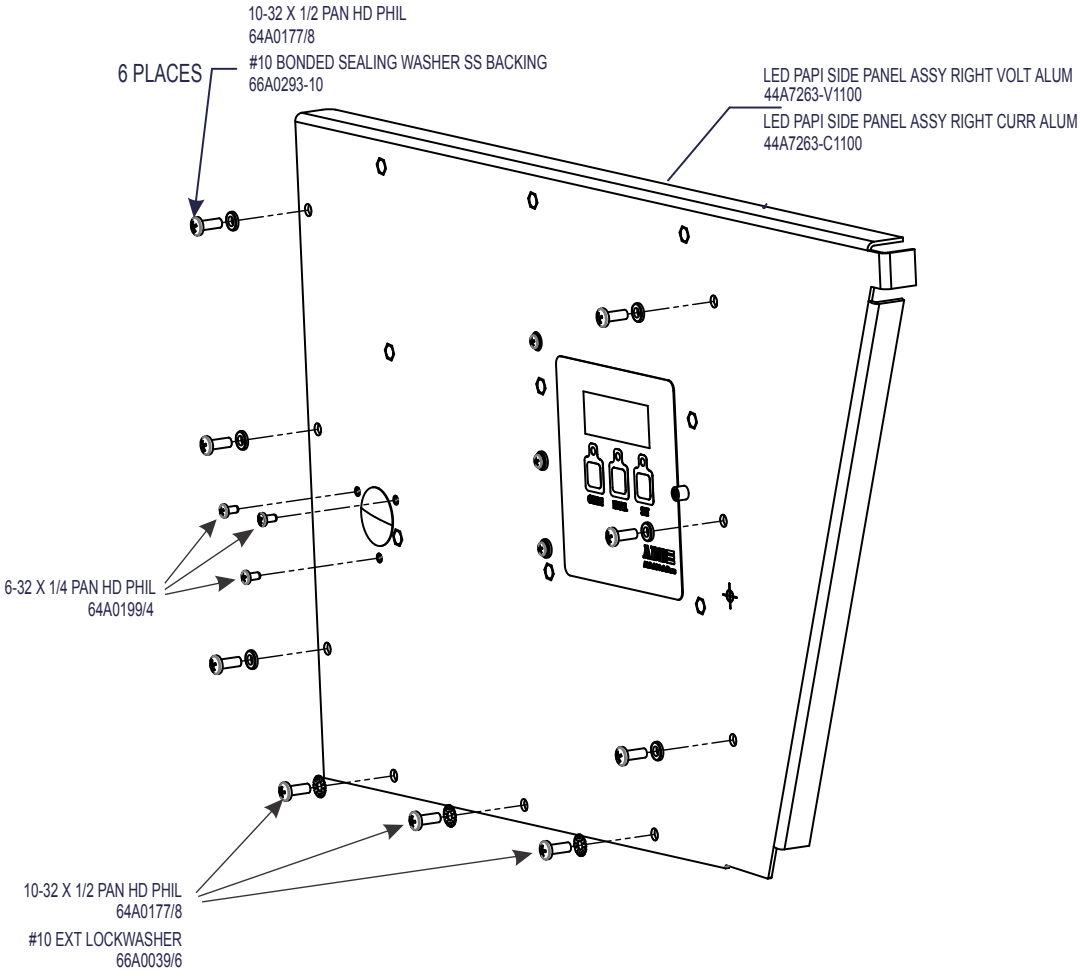
4. Side Panel Removal - all configurations.

   a. Disconnect all of the plug-in attachments to the 44A7265 Side Panel Assembly.

   b. Remove (9) #10-3 screws attaching the 44A7263 Side Panel Assembly.

   c. Set DIP switches on the replacement 44A7263 Side Panel Assembly to match the DIP switches on the removed Side Panel Assembly. Reference the user manual 96A0446 for the LP series PAPI and DM00012-000-01 for the RP series PAPI for applicable wiring diagrams.

Figure 37: Side Panel Removal/Replacement

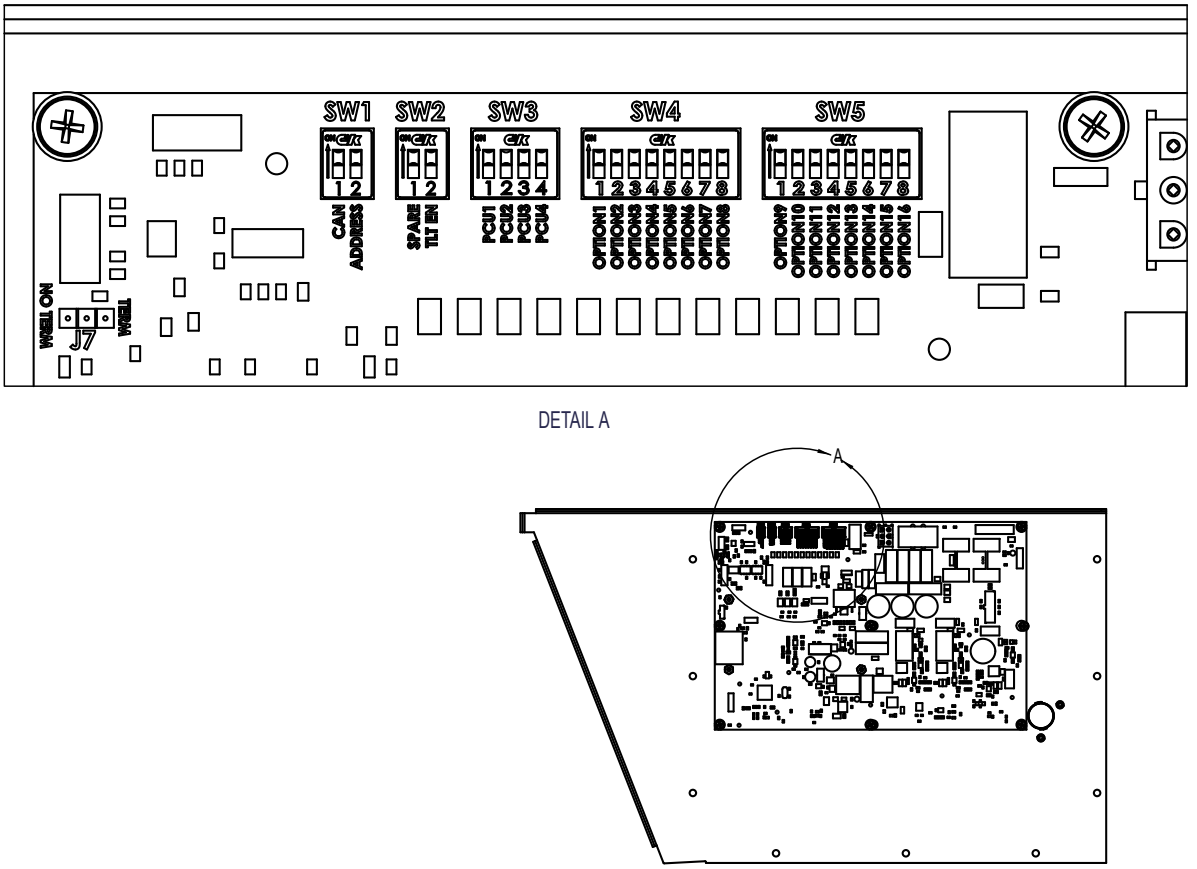


Note

Prior to Side Panel Replacement, set the Dip Switches per user manual 96A0446 for the LPL series PAPI and DM00012-000-01 for the RP series PAPI and Figure 6.

5. Set DIP switches on the replacement Control Board assembly to match the DIP switches on the removed Control Board assembly. Refer to Figure for DIP switch location.

Figure 38: Control Board DIP Switch Location



6. Reassembly of Baffle Actuator Assembly - if present.

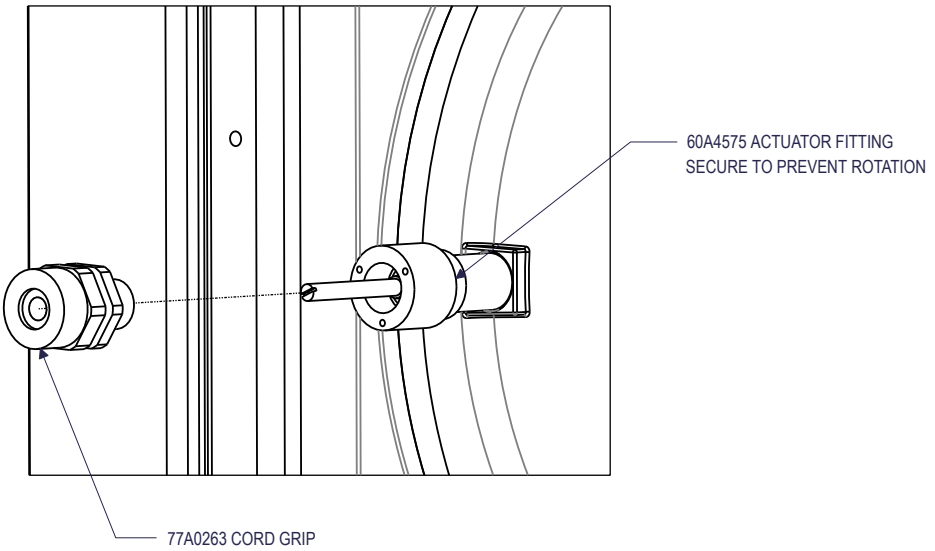
a. Enclosure without a baffle and configuration 3 Side Panel Replacement.

- Install the replacement side panel using the provided hardware - (9) # 10-32 screws.
- Re-attach cable-plugs to new RELIANCE PAPI control board. Reference the user manual 96A0446 for the LP series PAPI and DM00012-000-01 for the RP series PAPI for applicable wiring diagrams.

b. Configuration 1 Side Panel Replacement instructions.

- Apply a light coating of lubricant to the protruding 60A4571 adjusting rod.
- Install the 77A0263 cord grip using pipe thread sealant. It is necessary to secure the 60A4575 Actuator Fitting to prevent rotation. Do not allow the 60A4571 Adjusting Rod to rotate as this will change the baffle setting.

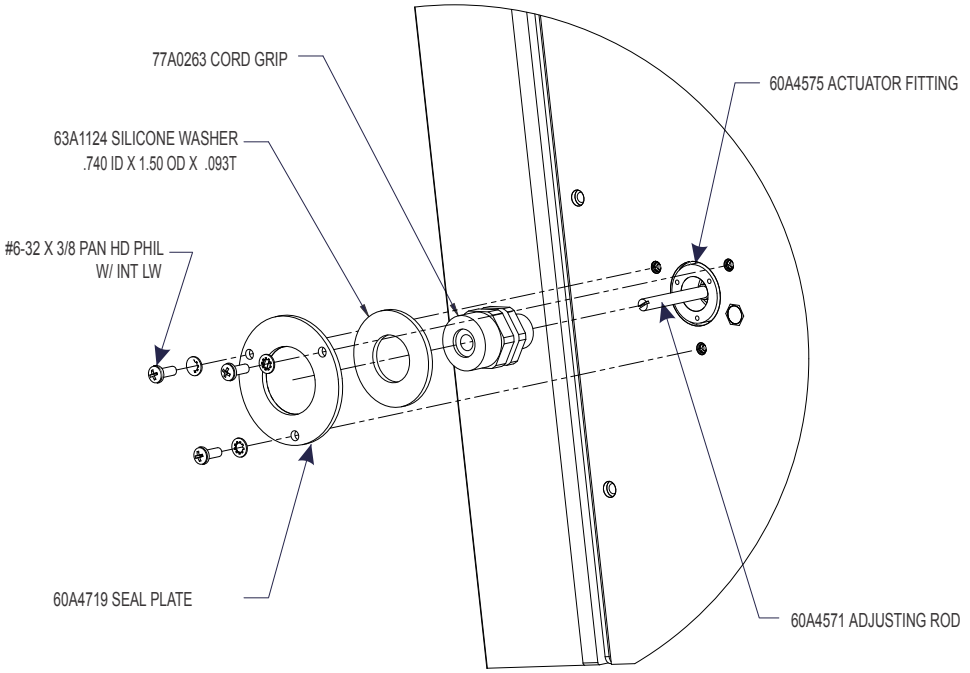
Figure 39: Reassembly of the Baffle Actuator Fitting (configuration 1)



- Install replacement side panel using provided hardware - (9) #10-32 screws.

- Stretch the 63A1124 Seal Washer over the cord grip fitting and install the 60A4719 Closeout Plate using the #6 hardware provided.
- Re-attach plugs to new RELIANCE PAPI control board. Reference the user manual 96A0446 for the LPL series PAPI and DM00012-000-01 for the RP series PAPI for applicable wiring diagrams.

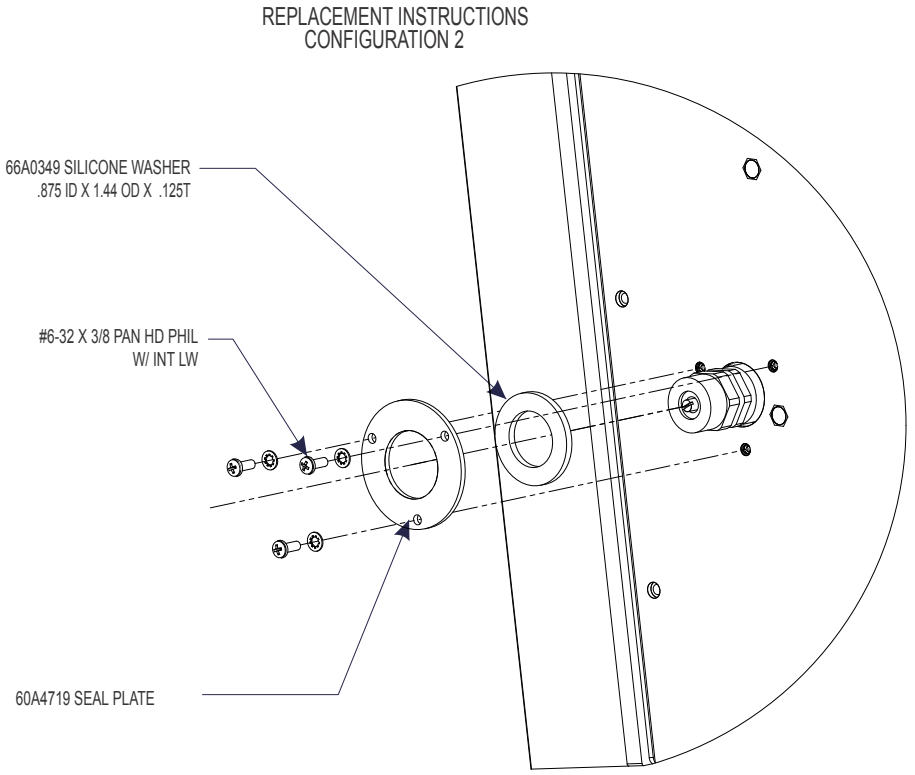
Figure 40: Reassembly of the Baffle Seal Washer and Seal Plate (configuration 1)



c. Configuration 2 Side Panel Replacement instructions.

- Install the replacement side panel using provided hardware - (9) #10-32 screws.
- Install the 66A0349 Seal Washer over the cord grip fitting and install the 60A4719 Seal Plate using the #6 hardware provided.
- Re-attach plugs to new RELIANCE PAPI Control Board. Reference the user manual 96A0446 for the LP series PAPI and DM00012-000-01 for the RP series PAPI for applicable wiring diagrams.

Figure 41: Reassembly of the Baffle (configuration 2)



7. Replace the Input Power Board as necessary. If Input Power Board is not replaced, proceed to step 8.

> **Note**
> With each control board assembly, the corresponding input Power Board (44A7392/X) is provided and must be replaced.

   a. Disconnect wiring from the 44A7392/X input power board.
   b. Remove 44A7392/X input power assembly by lifting the Din Rail mount tabs to release it from the Din Rail.
   c. Replace with 44A7392/X input power assembly provided with the kit. Install by snapping the mounting tabs onto the Din Rail.
   d. Re-connect wiring to 44A7392/X Input power assembly. Reference manual for applicable internal wiring diagram.

8. On Control Board change dip switch 4-6 to the "ON" position.
9. Turn Regulator on to step B5.
10. Observe the digital display, the display will present the firmware version. If the digital display reads firmware version 1.33, skip to step 12. If the firmware version is newer (or higher) than 1.33, continue with the next step.
11. Allow time for PAPI to execute calibration process. When finished light output from PAPI will blink every second.
12. Turn regulator off.
13. Change dip switch 4-6 to the "OFF" position.
14. Turn regulator on and verify PAPI changes light intensity at all steps.
15. Turn regulator off.
16. Replace the top cover gasket if necessary. Attach the top cover.
17. Go to Reference manual for Understanding the LED Readout and complete the setup and alignment procedures.

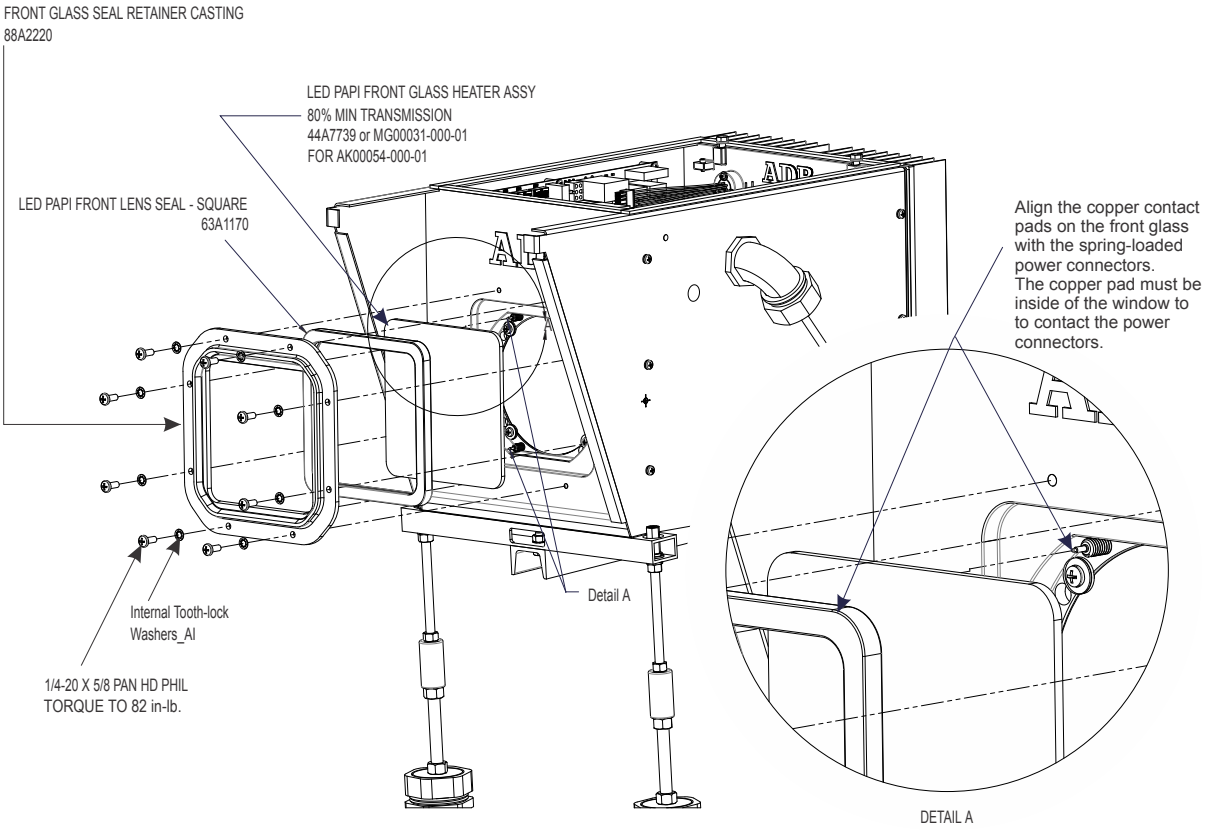
9.4 Front Glass Replacement

Kit 94A0674/1, RELIANCE PAPI front glass replacement kit.

Note

When replacing the LED PAPI front glass, the desiccant packs must also be replaced. The required desiccant packs and mounting hardware are included in the front glass replacement kit 94A0674/1.

Figure 42: Front Glass Replacement



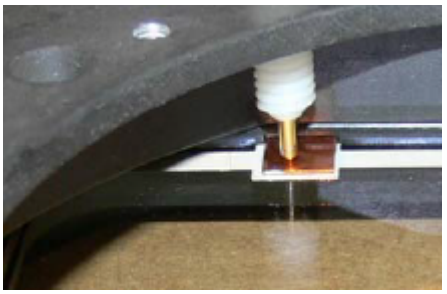
9.4.1 Replace the PAPI-L front glass.

Kit 94A0674/1, RELIANCE PAPI Front Glass Replacement Kit (GL-01).

1. Remove and discard the (8) 1/4-20 fasteners and washers attaching the 88A2220 seal retainer.
2. Remove and discard the defective front glass and seal.
3. Install the new 63A1170 front lens seal by wrapping around the new 44A7739 front glass.

4. Align the copper contact pads on the 44A7739 front glass with the spring loaded power connectors. The copper pad must be on inside of window (facing the PAPI) to contact the spring loaded power connectors.

Figure 43: Copper Tab and Spring Loaded Power Connector



Note

Align the copper contact pads on the front glass with the spring-loaded power connectors.
The copper pad must be inside of the window (facing the PAPI) to contact the power connectors.

5. Install 88A2220 seal retainer with new (8) 1/4-20 fasteners and washers, torque to 82 IN-LB.
6. Replace the desiccant packs. See Replace the Two Desiccant Packs.
7. Verify fuse F5 on the control board.

9.4.2 Replace the Two Desiccant Packs

1. Remove and discard the (12) 1/4-20 SHCS and washers from the rear of the LED assembly heat sink.
2. Disconnect the wire connector from the LED assembly.
3. Discard the rear cover seal gasket.
4. Replace the two desiccant packs. (only in dry conditions and not until ready to reassemble)
   a. Remove and discard the two screws holding each desiccant slides.
   b. Remove and discard the desiccants, slides and shield.
   c. Insert the (2) new pre-assembled desiccant packs with slides and attach each with the two fasteners and washers. Ensure the new desiccant shield is installed with the lower slide only.

Figure 44: LED Assembly

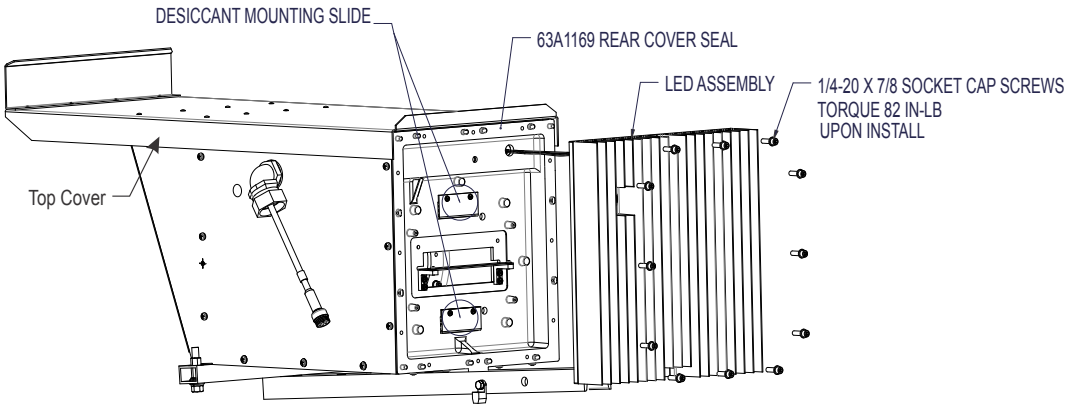


Figure 45: Desiccant Packs and Rear Seal

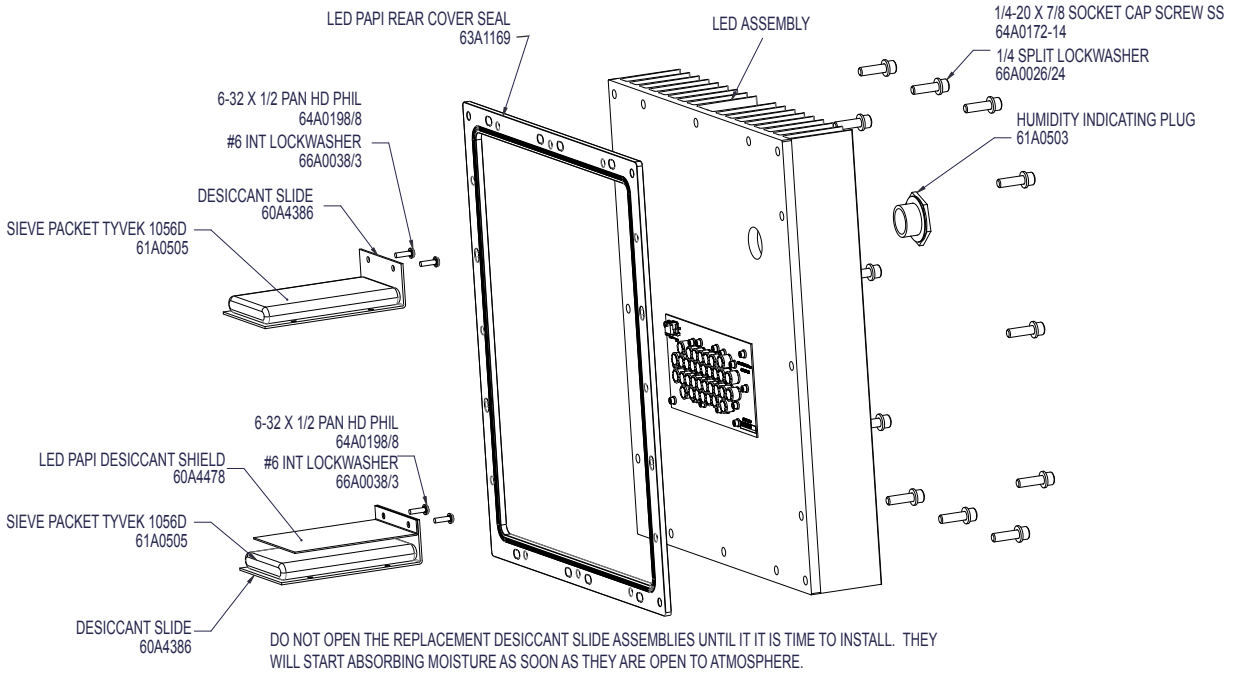
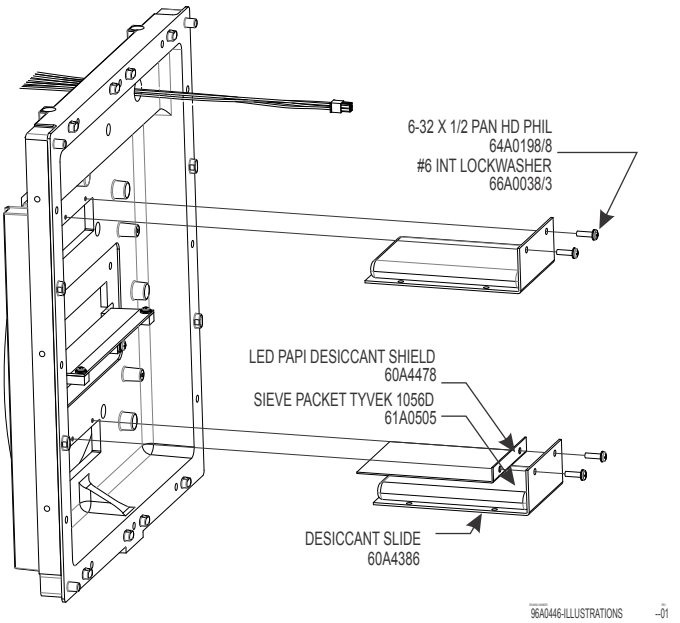


Figure 46: Desiccant Packs

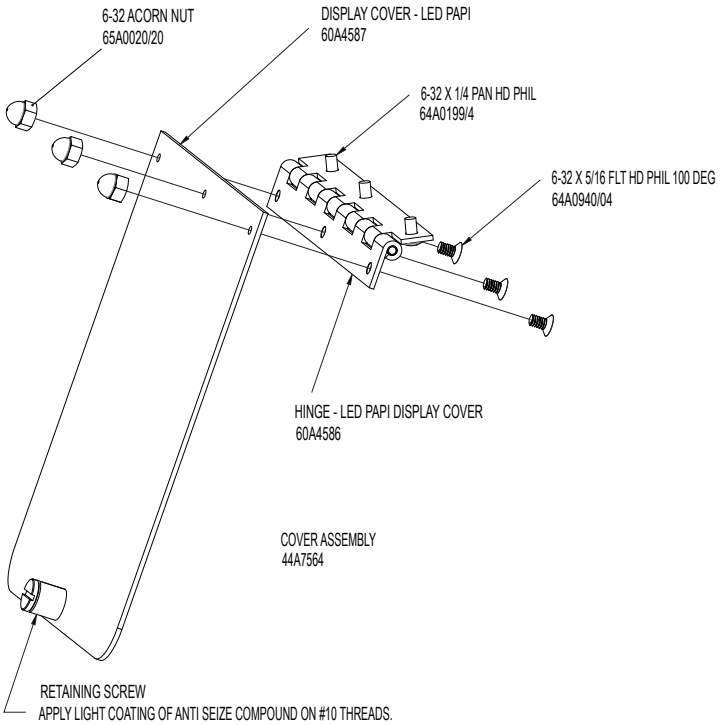


5. Replace the rear cover seal gasket.
6. Connect the wire connector to the LED assembly.
7. Replace the (12) 1/4-20 SHCS to the rear of the LED assembly, torque to 82 in-lb.

9.5 Optional Display Cover

Unpack the optional cover assembly. Insure all components are in the package.

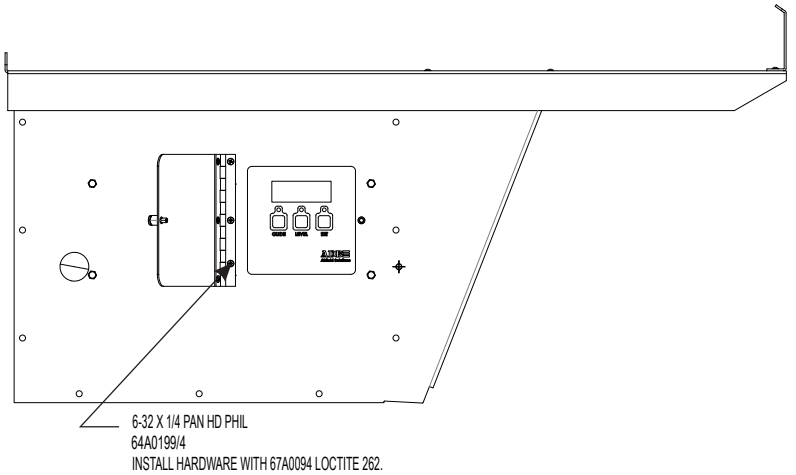
Figure 47: Cover Assembly 44A7564



Install the optional cover assembly using the three holes to the left of the display.

1. Apply a drop of Locktite to the supplied screws.
2. Line up the cover assembly with the holes and attach with the supplied 6-32 screws.
3. Close the cover and lock closed with the retaining screw.

Figure 48: Cover Assembly Installed



10.0 Wiring Diagrams

10.1 Internal Wiring Diagrams

Figure 49: Input Power Wiring Diagram - Voltage Powered (Primary Light Unit)

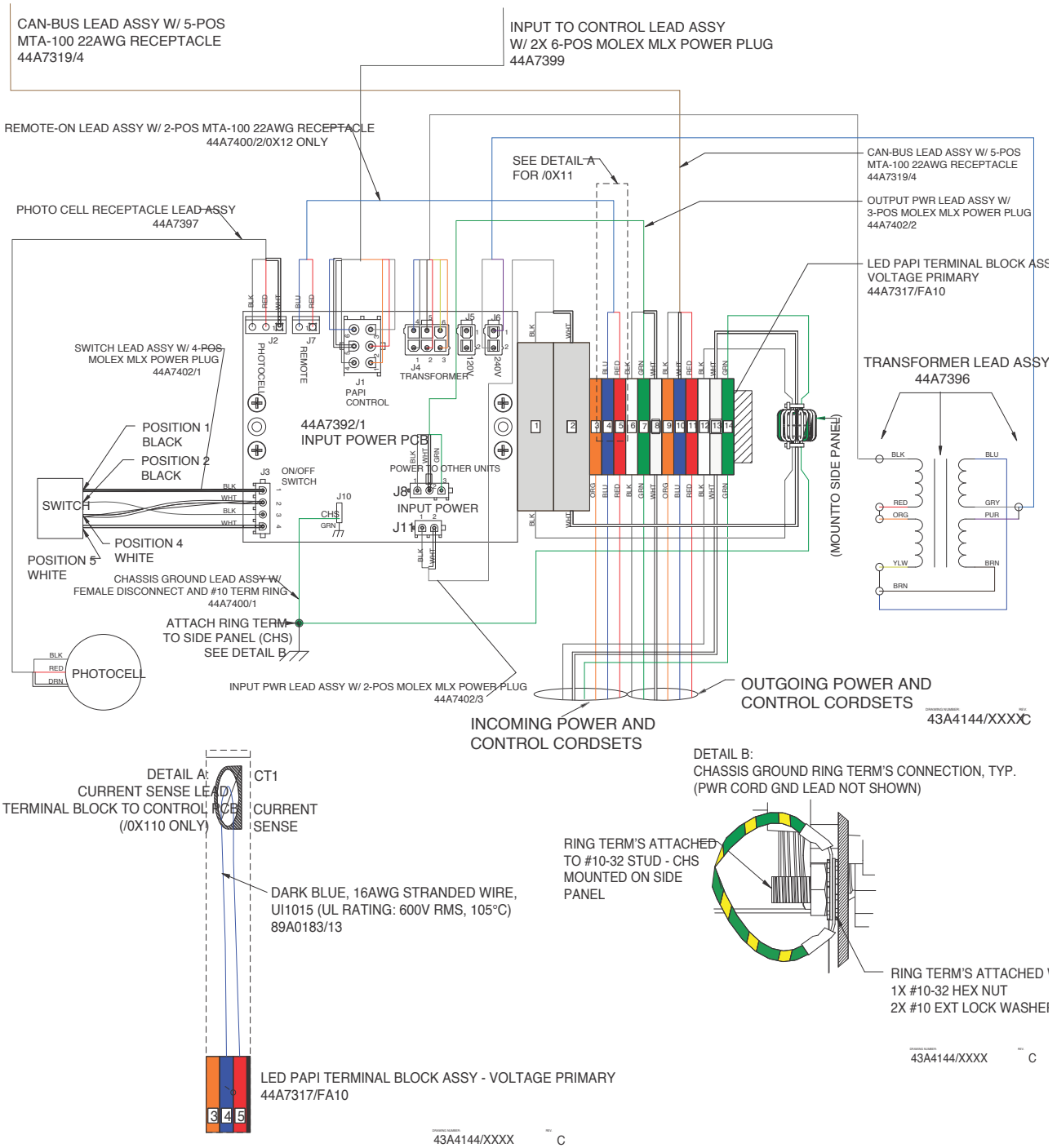


Figure 50: Input Power Wiring Diagram - Voltage Powered (Secondary Light Unit)

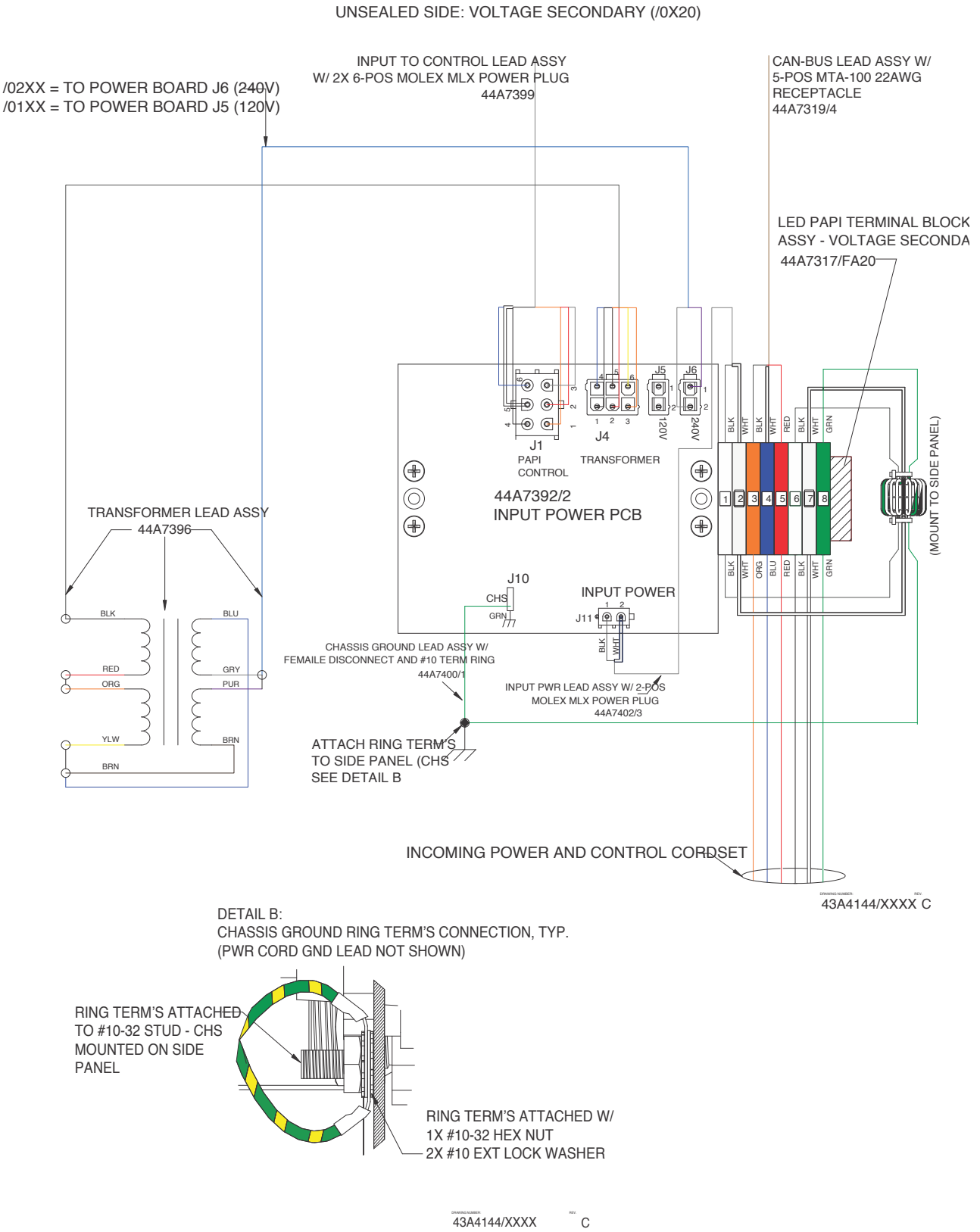
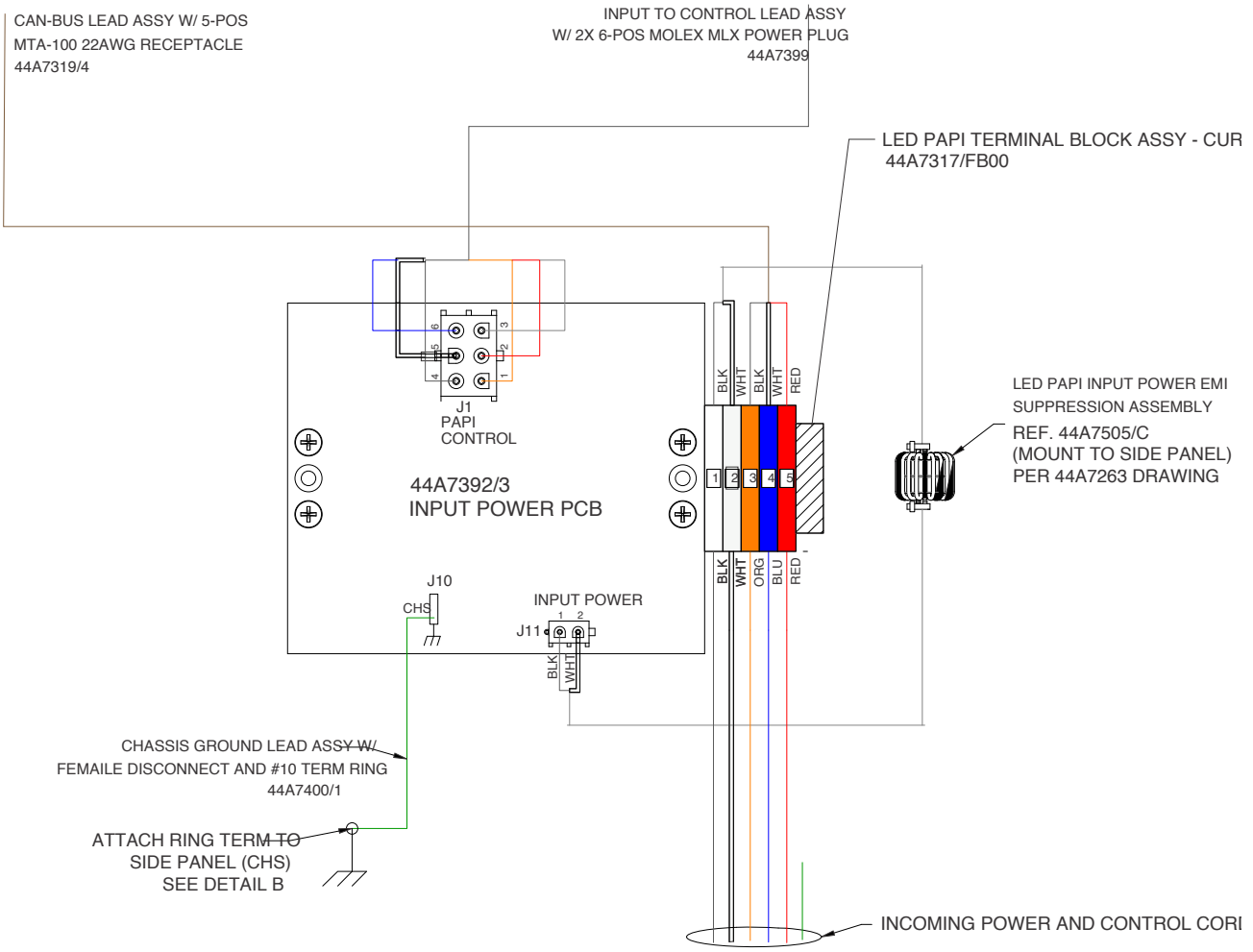
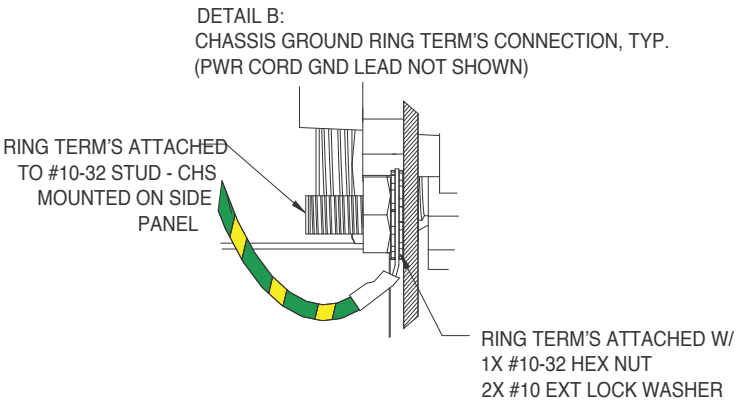


Figure 51: Input Power Wiring Diagram - Current Powered (Primary and Secondary Light Unit)





43A4165/XXXX G

Figure 52: Input Power Wiring Diagram - Current Powered with Redundant Circuit (Primary and Secondary Light Unit)

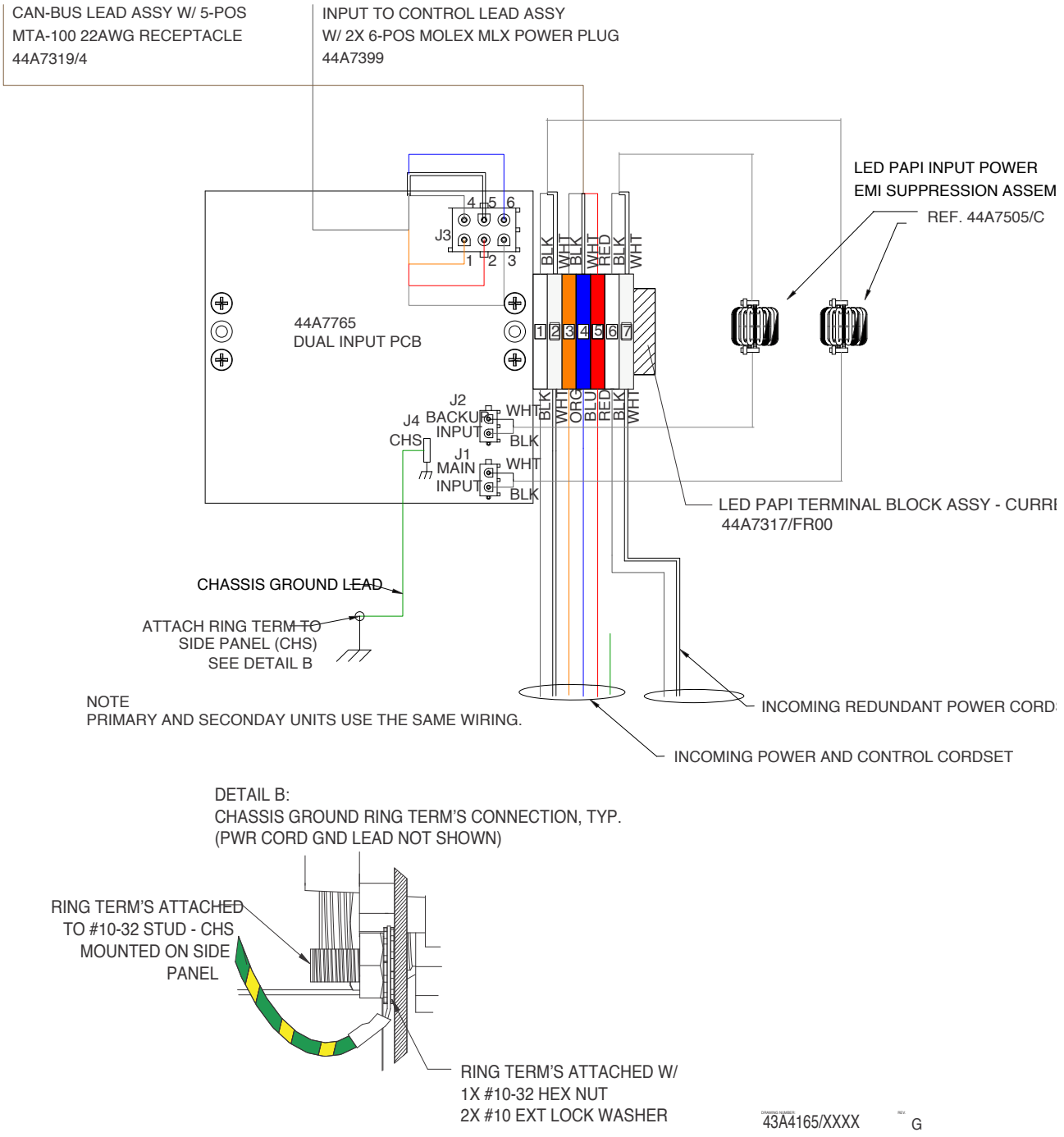


Figure 53: Main Control PCB Wiring Diagram

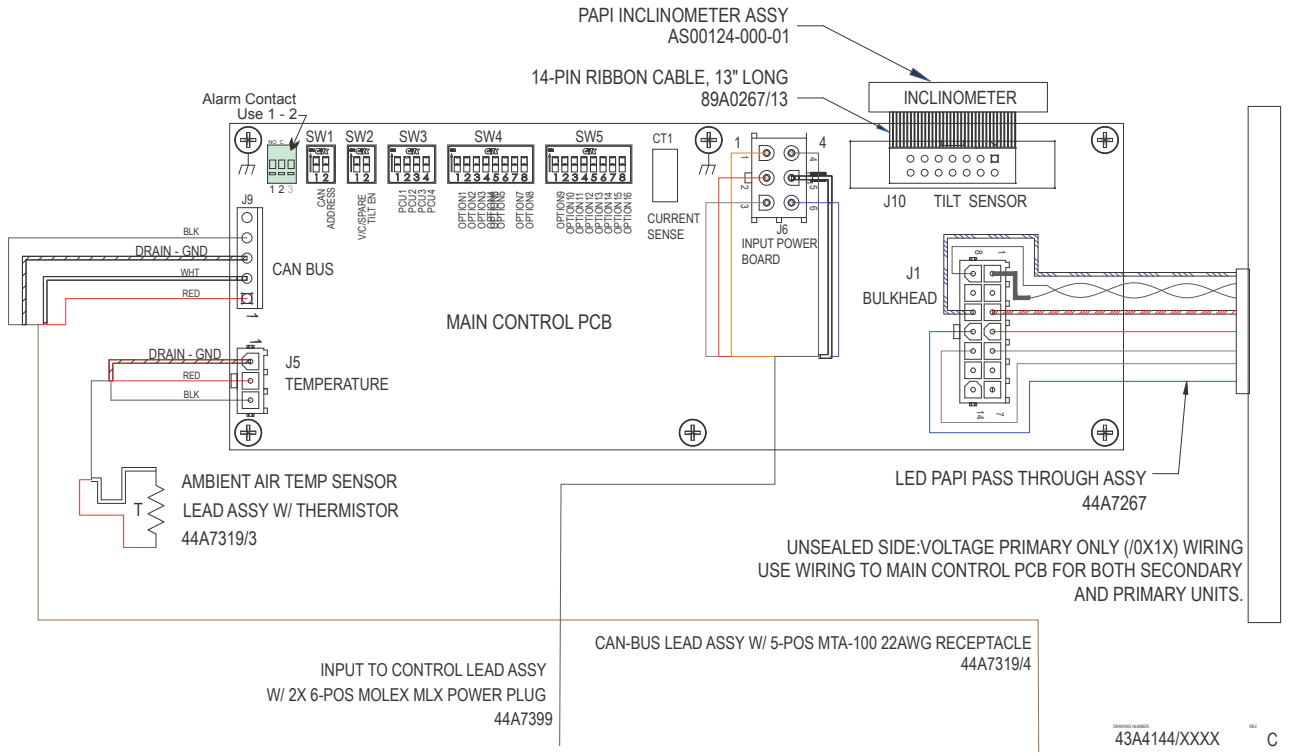
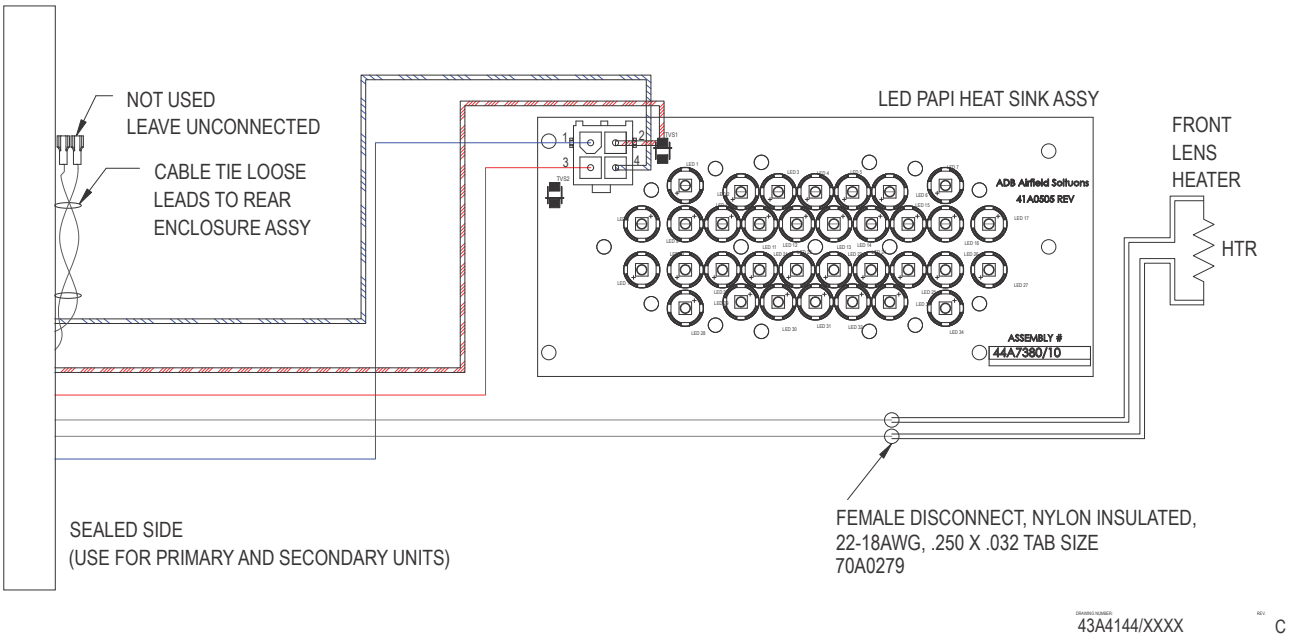


Figure 54: LED Assembly and Front Lens Heater Wiring Diagram



10.2 External Wiring Diagrams

Figure 55: External Wiring Diagram - Voltage Powered (2 Box)

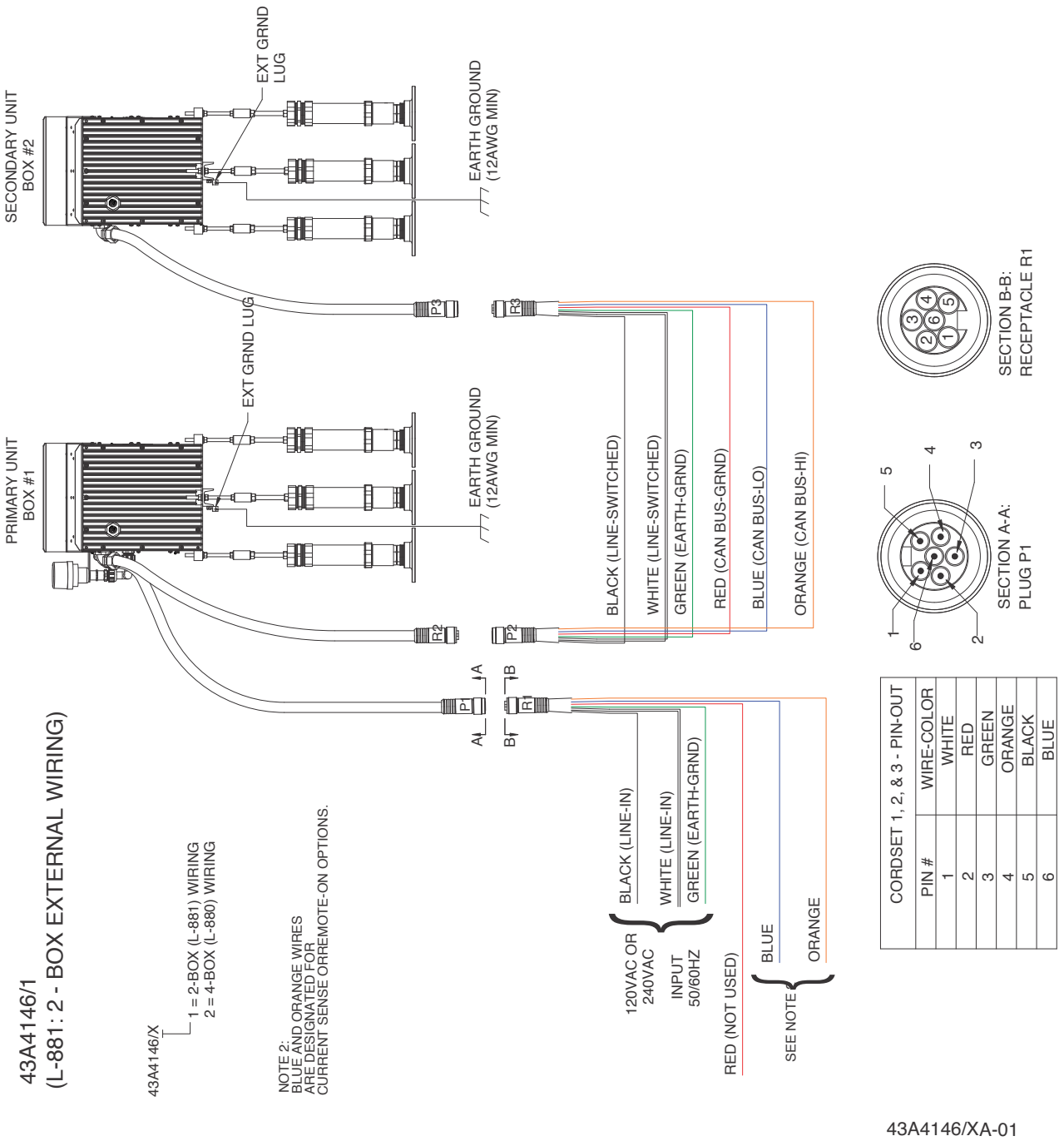


Figure 56: External Wiring Diagram - Voltage Powered (4 Box)

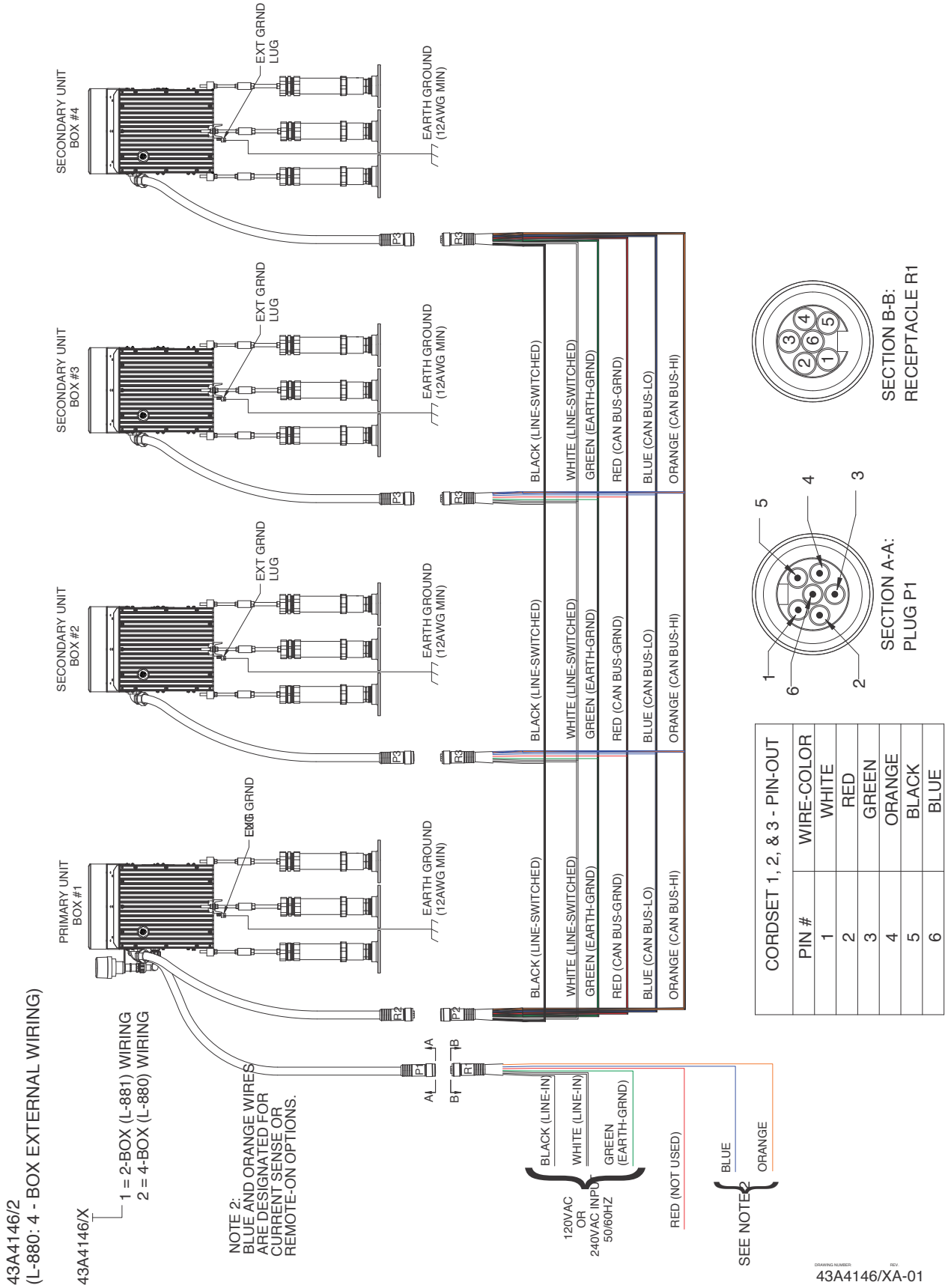


Figure 57: External Wiring Diagram - Current Powered (2 Box)

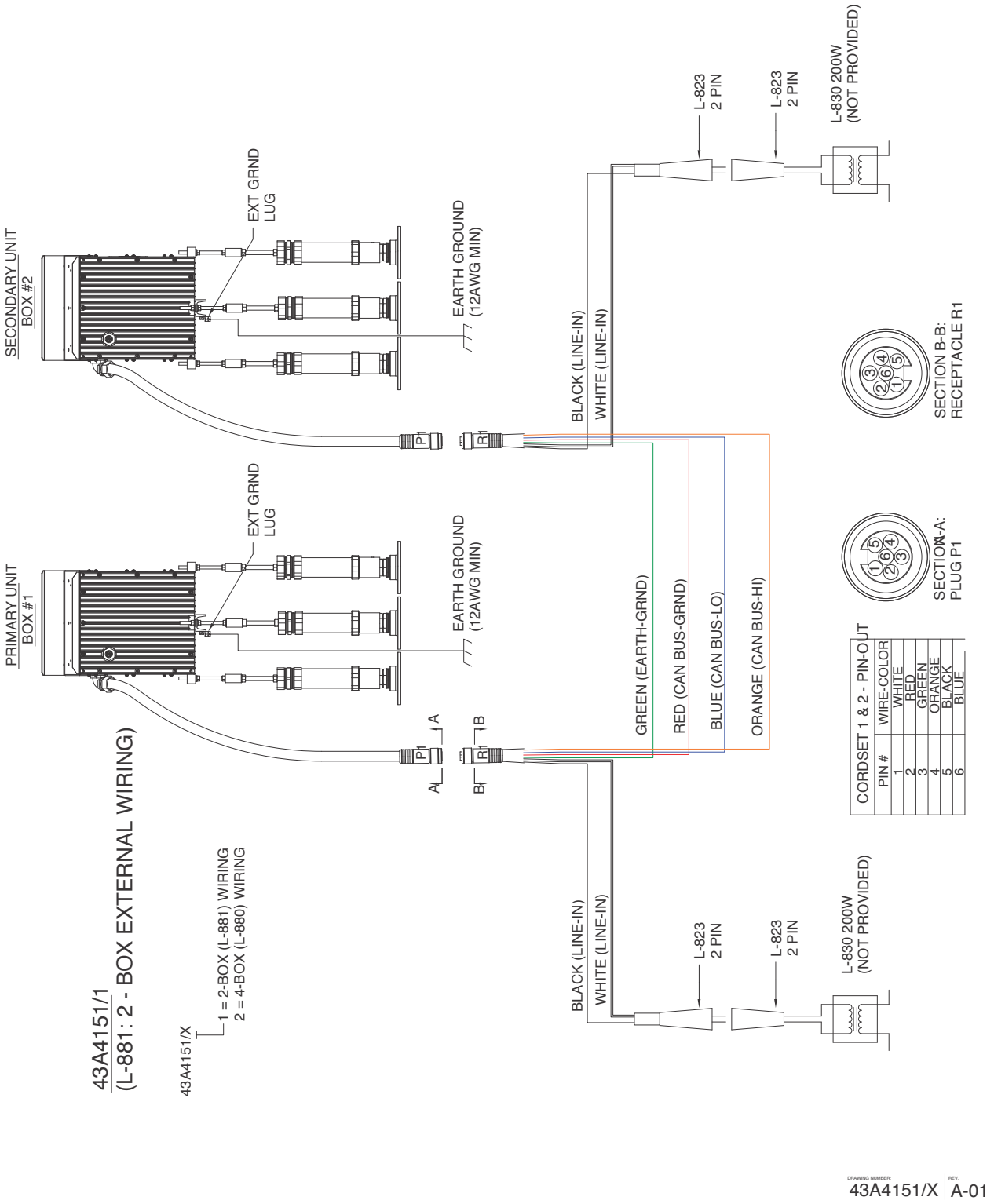
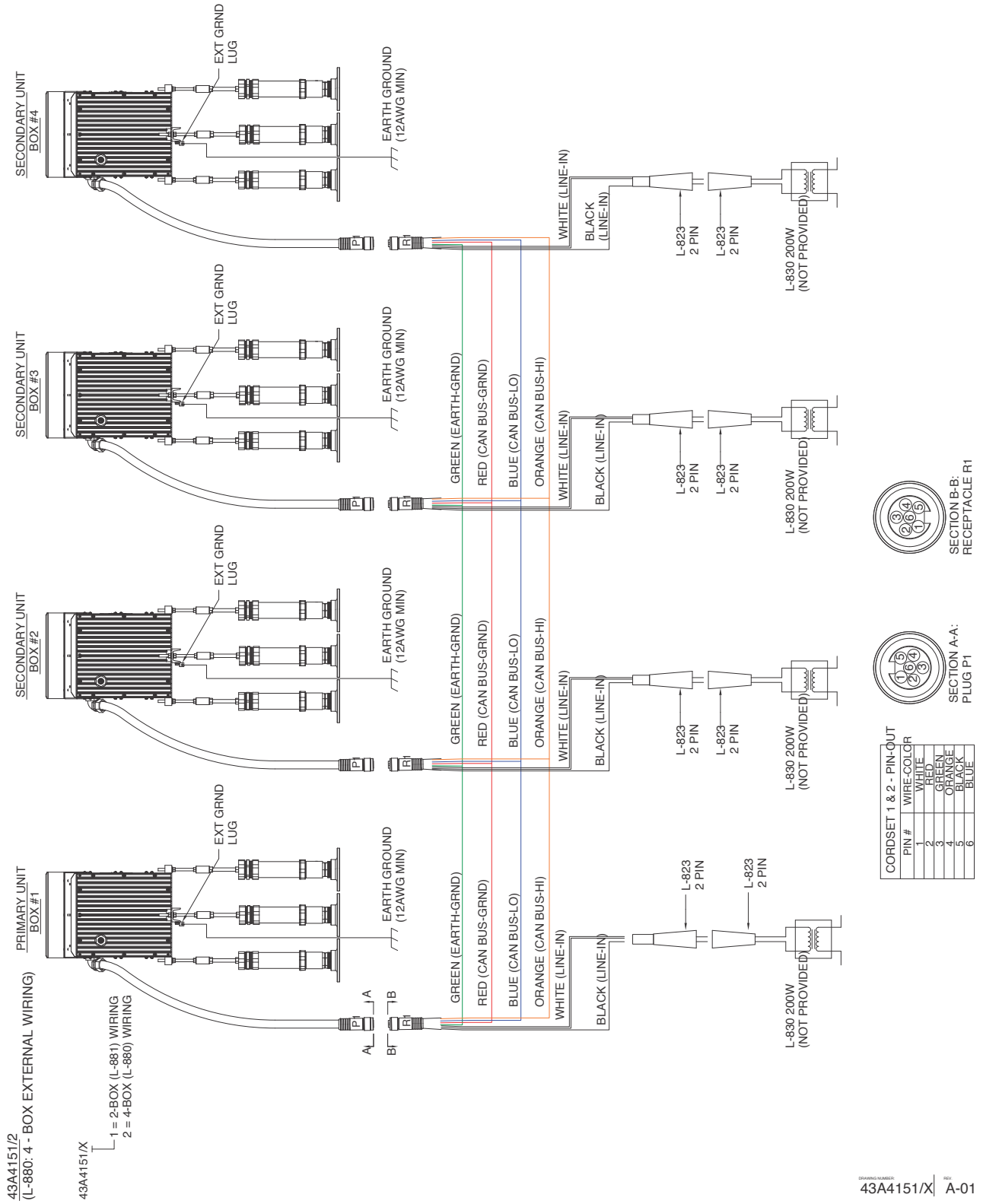


Figure 58: External Wiring Diagram - Current Powered (4 Box)



10.3 Field Cabling Diagrams

Figure 59: Field Cabling Diagram - Voltage Powered (2 Box)

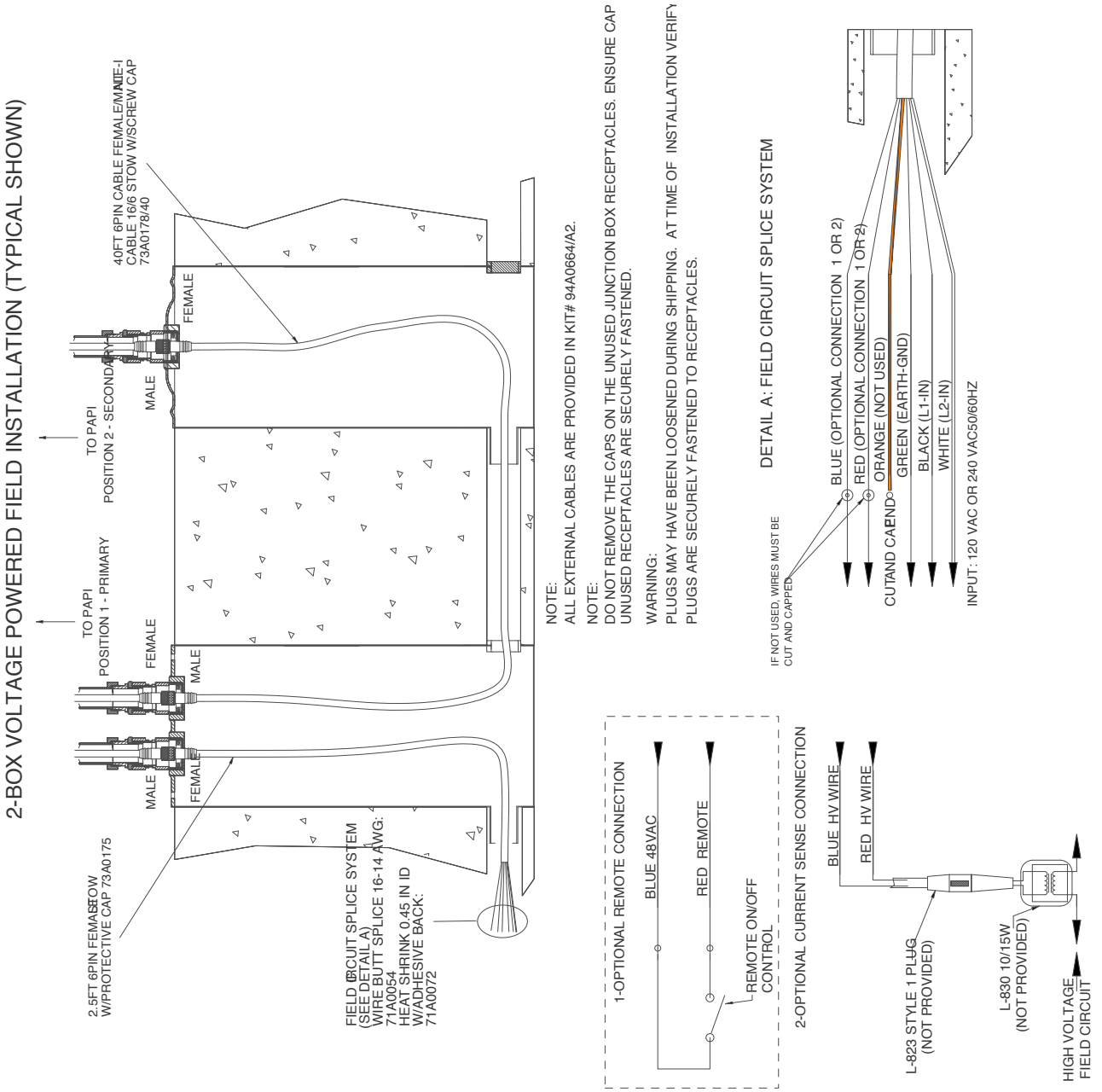


Figure 60: Field Cabling Diagram - Voltage Powered (4 Box)

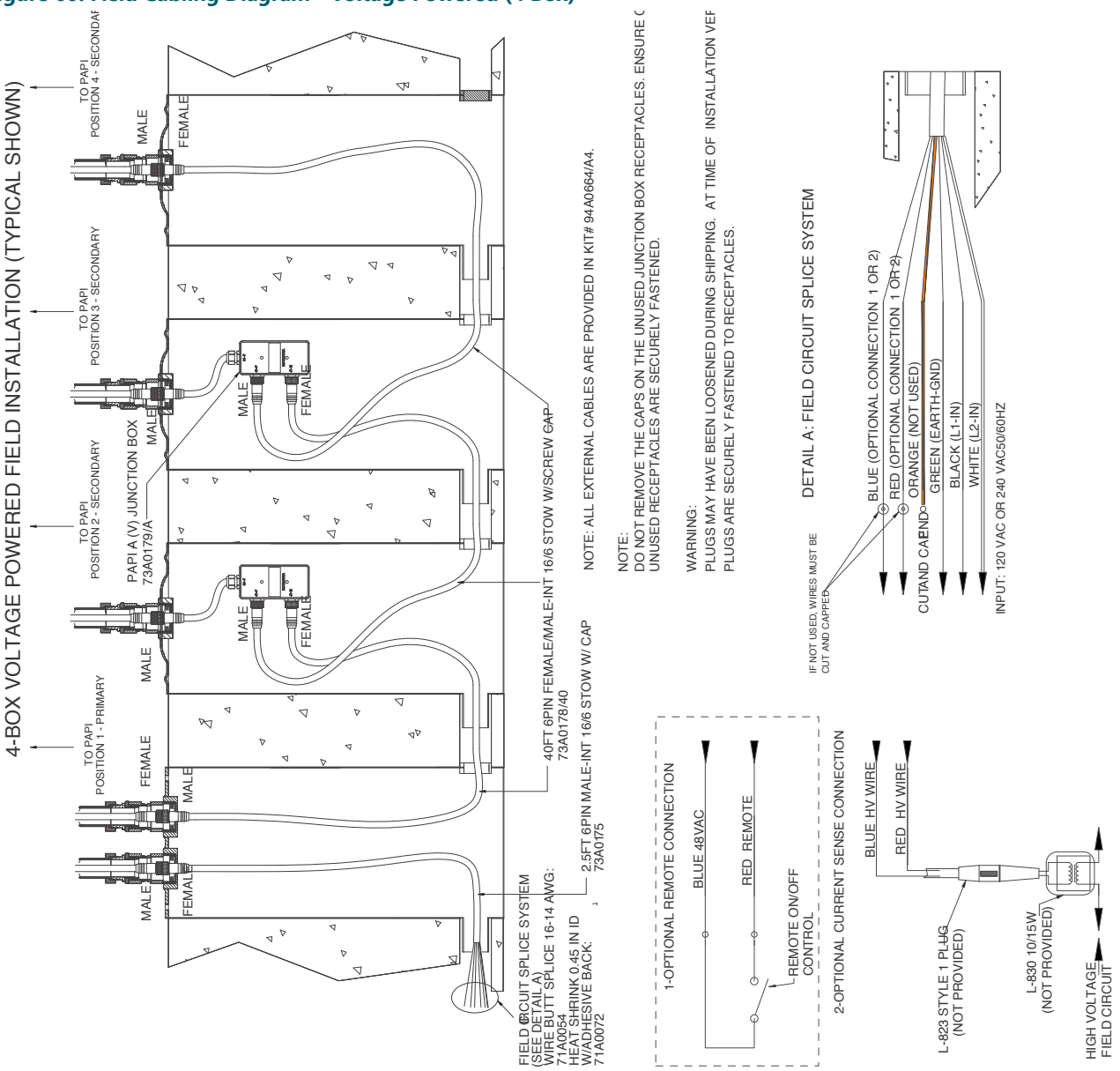


Figure 61: Field Cabling Diagram - Voltage Powered Junction Box (4 Box)

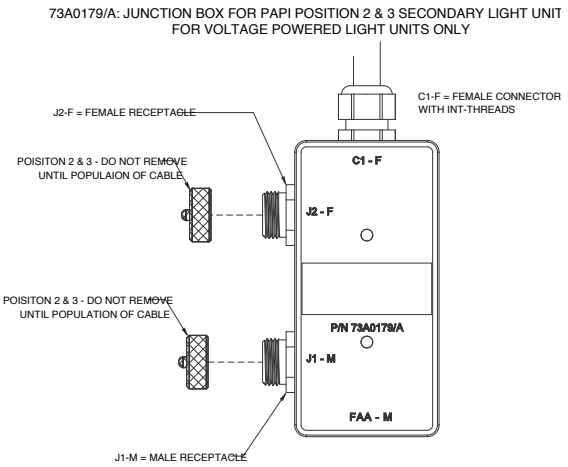


Figure 62: Field Cabling Diagram - Current Powered (2 Box)

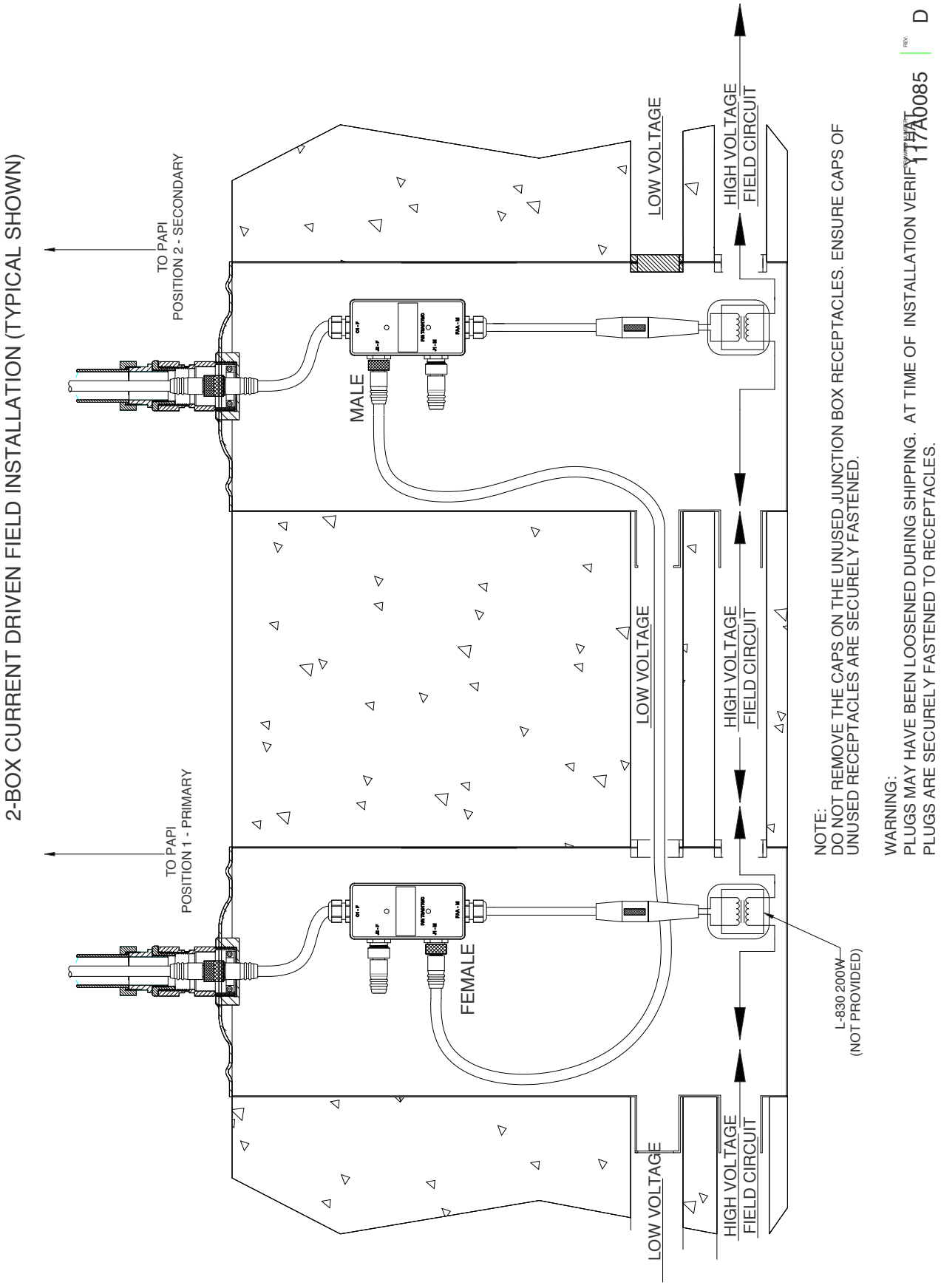


Figure 63: Field Cabling Diagram - Current Powered with Redundant Circuit (2 Box)

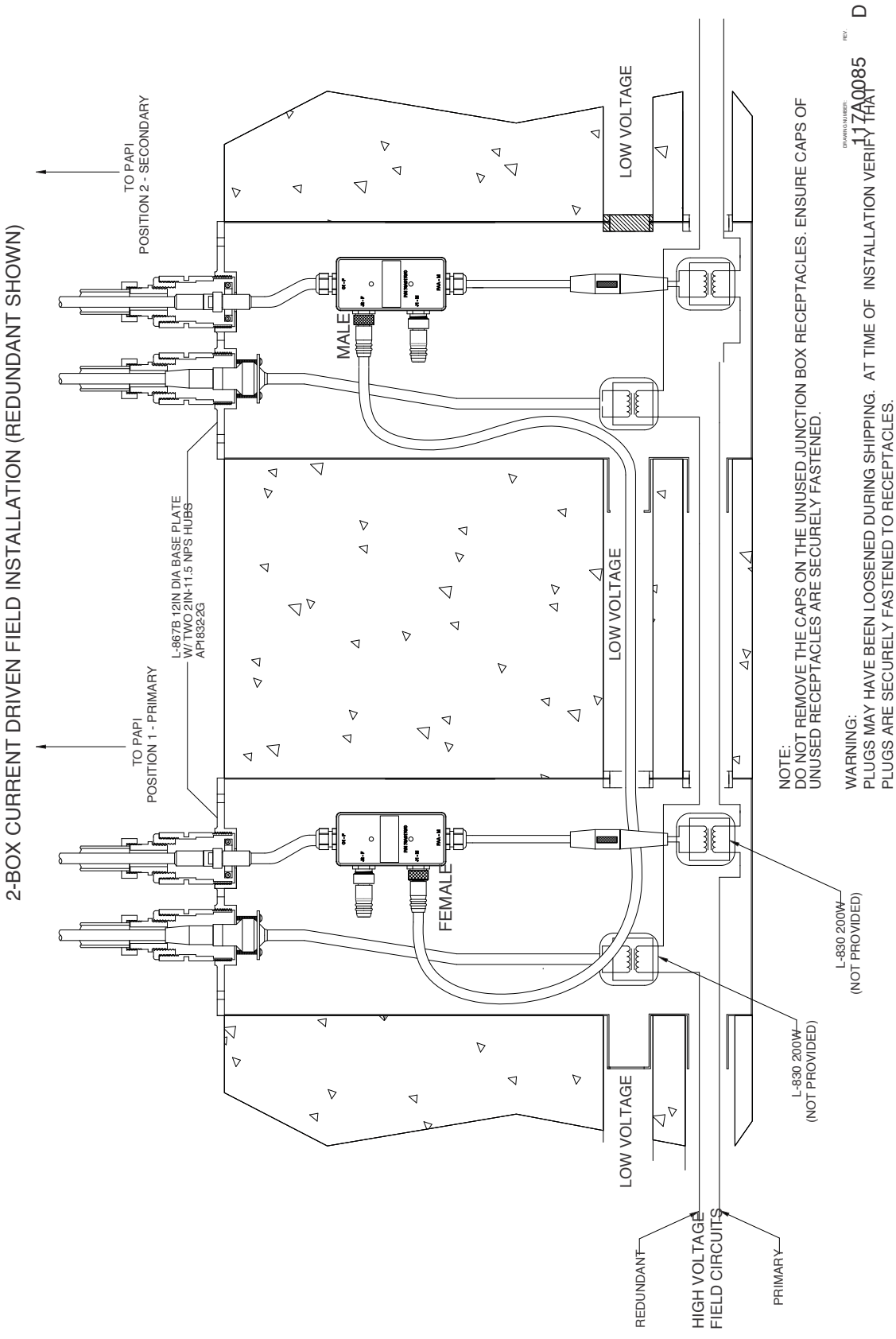


Figure 64: Field Cabling Diagram - Current Powered (4 Box)

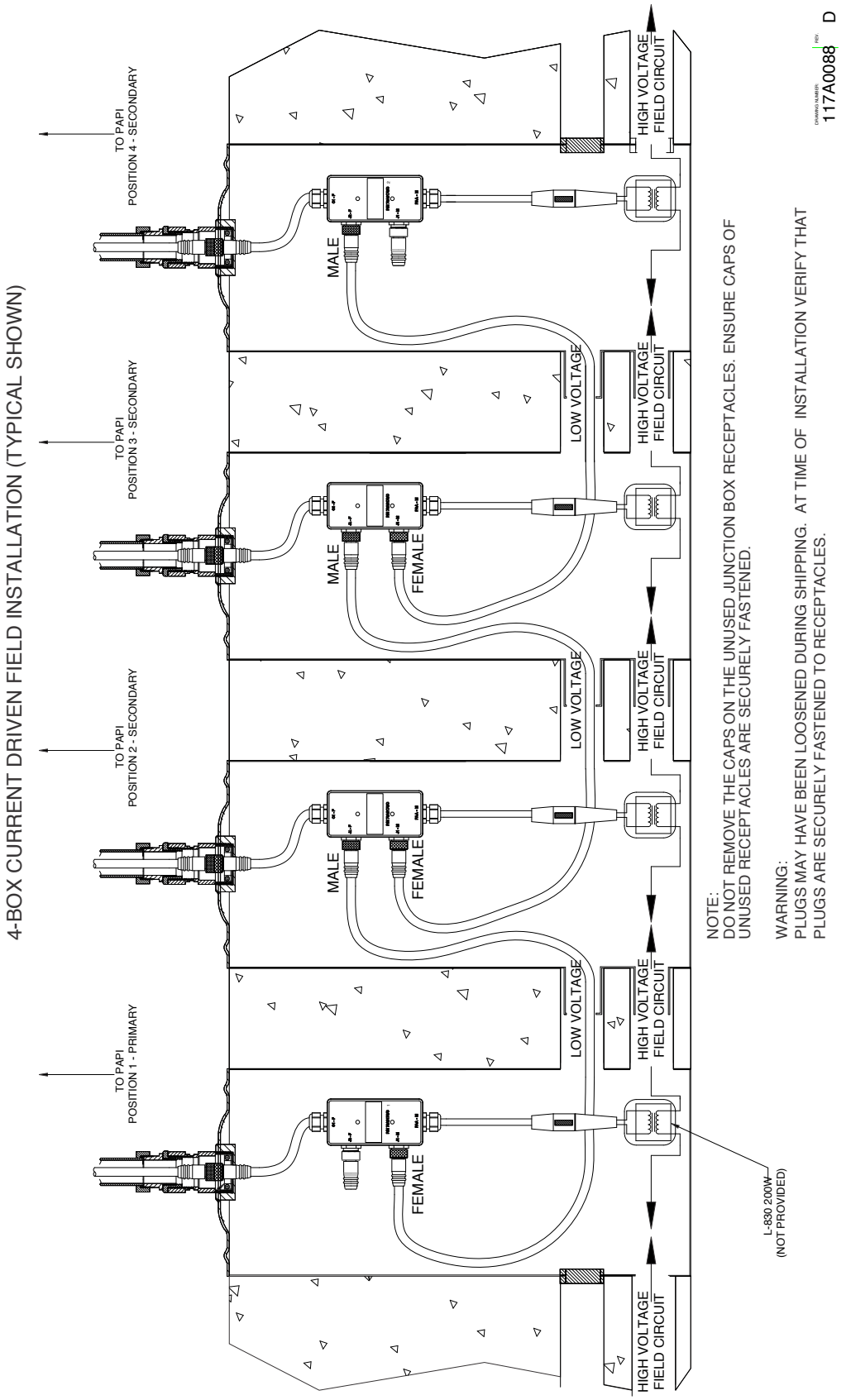


Figure 65: Field Cabling Diagram - Current Powered with Redundant Circuit (4 Box)

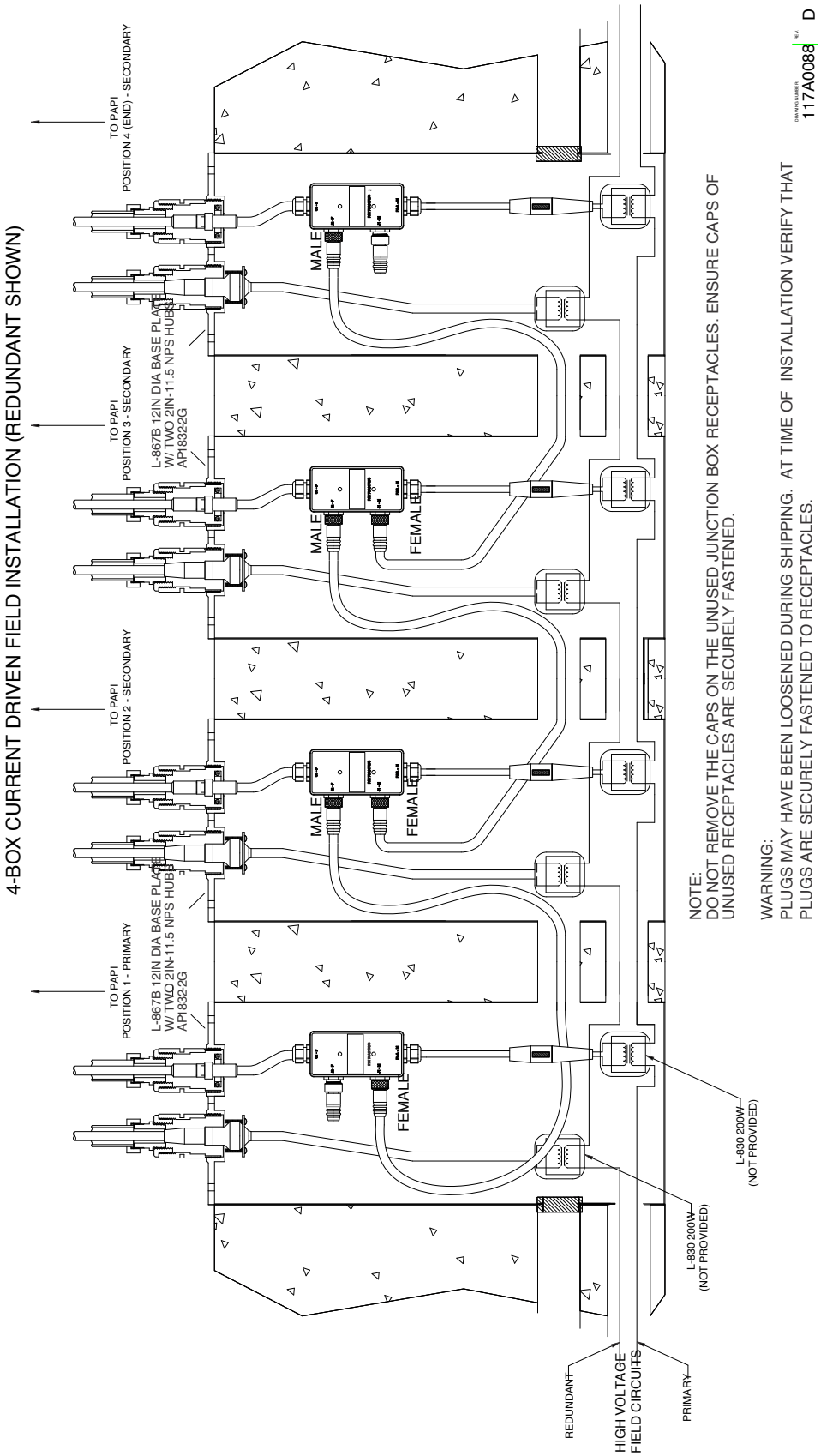
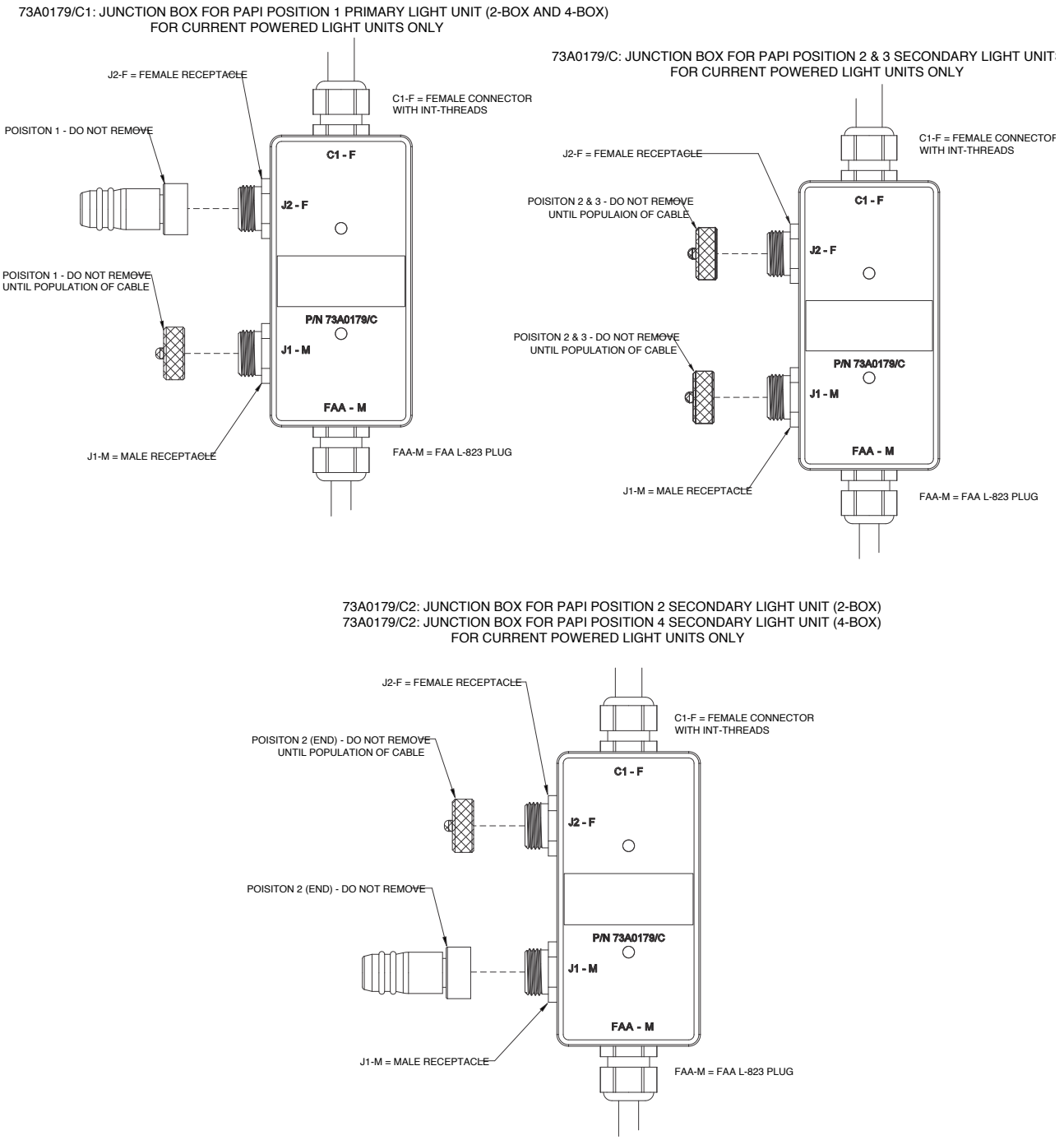


Figure 66: Field Cabling Diagram - Current Powered Junction Box (2 & 4 Box)



11.0 RELIANCE PAPI Parts

To order parts, call ADB SAFEGATE Customer Service or your local representative. This section provides schematic drawings, along with part numbers. Refer to the Wiring Diagrams .

Note

Contractor Kits: See Field Cabling Diagrams.

Ordering Code

LPL□ /□□□□00

Specification
F = FAA
I = ICAO/TP312[1]

Power
A = PAPI A, 240 VAC or 120 VAC, 50/60 Hz (voltage)[2]
B = PAPI B, 2.8-6.6 A, 50/60 Hz (current)
R = PAPI B, 2.8-6.6 A, 50/60 Hz (current) redundant

Type
2 = 2 Light Units, L-881(L) APAPI
4 = 4 Light Units L-880(L) PAPI

Housing
0 = Aluminum (Standard)
1 = 316 Stainless Steel

Operation/Control Mode[3]
0 = Style B (Current) Operation
1 = Style A (Voltage) Operation, Current Sensing Night Control Mode
2 = Style A (Voltage) Operation, Current Sensing Day/Night Control Mode
3 = Style A (Voltage) Operation, External On/Off Control Mode

Notes

1 ICAO/TP312 PAPI units are provided with the tilt switch function disabled. This can easily be enabled in the field.
2 All Style A units are factory preset to operate from a voltage range of 240 VAC ±10%. The system can be easily modified in the field for 120 VAC ±10%.
3 See Operation/Control Mode table for details.

Optional Touchpad Cover

44A7564

Optional touchpad cover provides added protection for the LED display. See user manual for installation instructions.

Baffle Kits

94A0701/□□0

Type
2 = 2 Light Units L-881(L) APAPI
4 = 4 Light Units L-880(L) PAPI

Baffle Location
L = Baffle on left side
R = Baffle on right side
B = Baffle on both sides*

Notes

- Provides a 0 to 5 degree cut-off angle to modify the horizontal light beam coverage for obstacle avoidance in the approach area. See manual for field adjustment.
- The PAPI baffle can only be installed at the factory. It cannot be installed in the field.

Longer Length Power Cord

94A0690/□□

Power
A = Style A (Voltage)
B = Style B (Current)

Type
2 = 2 Light Units L-881(L) APAPI
4 = 4 Light Units L-880(L) PAPI

Notes

- Standard power cord length is 8 ft (2.4 m) with 7 ft (2.1 m) extending outside the enclosure. This kit provides a longer 18 ft (5.5 m) power cord that can be cut-to-length on site.
- Use 94A0690/XX/R for Style B Redundant Circuit systems.

Contractor Kit

94A0716/□□

Power
A = Style A (Voltage)
B = Style B (Current)

Type
2 = 2 Light Units L-881(L) APAPI
4 = 4 Light Units L-880(L) PAPI

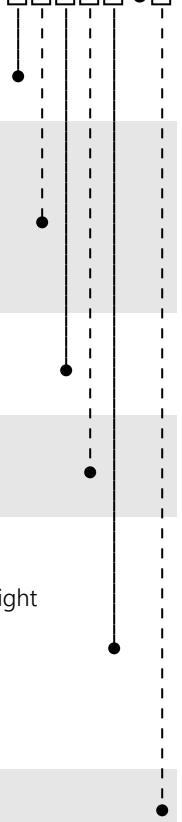
Notes

- Kit provides the following materials typically contractor supplied: 2 in EMT, flexible conduit, and fittings for installation.
- Use 94A0716/XX/CAN for contractor kits used with longer length 18 ft (5.5 m) Power Cord Kit 94A0690/XX.
- Use 94A0716/XX/R for contractor kits used with Style B Redundant Circuit systems.
- Use 94A0716/XX/CAN/R for contractor kits used with Style B Redundant Circuit systems and longer length 18 ft (5.5 m) Power Cord Kit 94A0690/XX/R.

11.1 Spare Parts

Spare Light Unit

94A0707/□□□□□0□



Specification
F = FAA
I = ICAO/TP312

Power
A = PAPI A, 240 VAC or 120 VAC, 50/60 Hz (voltage)
B = PAPI B, 2.8-6.6 A, 50/60 Hz (current)
R = PAPI B, 2.8-6.6 A, 50/60 Hz (current) redundant

Type
2 = 2 Light Units, L-881(L) APAPI
4 = 4 Light Units L-880(L) PAPI

Housing
0 = Aluminum (Standard)
1 = 316 Stainless Steel

Operation/Control Mode[3]
0 = Style B (Current) Operation
1 = Style A (Voltage) Operation, Current Sensing Night Control Mode
2 = Style A (Voltage) Operation, Current Sensing Day/Night Control Mode
3 = Style A (Voltage) Operation, External On/Off Control Mode

Light Unit Position
1 = Position 1[1]

Notes

1 Only position 1 is available as spare. The light unit position is configurable by DIP switch.

Table 15: Spare Parts

Description	Part No.
Mounting Flange	62B0107-2
Frangible Coupling	44B0180
LED Light Engine Replacement Kit (See Table 16)	AK00030-200-01[1]
Complete PAPI Light Box Assembly	94A0707-XXXXXX1[2]
Front Heated Glass Replacement Kit	94A0674/1
Inclinometer Assembly	AS00124-000-01
LED PAPI Rear Cover Seal	63A1169
6-Pin Input Power Cord (8 ft) Standard	73A0180
6-Pin Input Power Cord (18 ft) Optional - Typically used with Transport Canada TP312 Installation	73A0180/18

Notes

1 See LED Light Engine Replacement Kit AK00030-200-01 parts.

Table 15: Spare Parts (Continued)

Description	Part No.

[2] Only position 1 is available as spare. The light unit position is configurable by DIP switch. See Spare Light Unit Codification for complete part code.

Table 16: LED Light Engine Replacement Kit AK00030-200-01 Parts

Description	Qty
LED Engine/Heat Sink Assembly (FAA/ICAO)	1
LED Desiccant Mounting Slide	2
LED PAPI Desiccant Heat Shield	1
Humidity Indicating Plug	1
56 G Molecular Sieve Packet TYVEK 1056D	2
LED PAPI Rear Cover Seal	1
1/4-20 X 7/8 Socket Head Cap Screw (SHCS) Stainless Steel (SS)	12
6-32 X 1/2 PAN HD PHIL	4
1/4 SPLIT LOCKWASHER	12
#6 INT LOCKWASHER	4
Wire Tie 0.13x8.5 inch Black UV Resistant	4

11.1.1 Voltage Powered Style A Only

Description	Part No.
Photocell (24 VAC/VDC)	31A0022
Photocell Receptacle	44A7397
Input Power Board (Voltage Powered) (Primary)	44A7392-1
Input Power Board (Voltage Powered) (Secondary)	44A7392-2
Control Board Replacement Kit (primary)	94A0666/10
Control Board Replacement Kit (secondary)	94A0666/20
External Cable Junction Box 3-way	73A0179-A
External Cable Junction Box 4-way	73A0179-C
Low Voltage Mini-Link cable 40 FT	73A0178-40

11.1.2 Current Powered Style B Only

Description	Part No.
Input Power Board (Current Powered) (6)	44A7392-3
Control Board Replacement Kit	94A0666/30
External Cable Junction Box 3-way	73A0179-A
External Cable Junction Box 4-way	73A0179-C
Low Voltage Mini-Link cable 40 FT	73A0178-40

11.1.3 Fuses

Table 17: Control Board Fuse

Description	Part No.
F1, F2 Fuse .750A 125V Fast	47A0243
F5 Fuse 2A 125V Fast	47A0244

Table 18: Input Power Board Fuses (Voltage Powered ONLY)

Description	Part No.
(F3, F4) FUSE 250V SLO-BLO 3AG 0.5A	47A0233
(F1, F2) FUSE 250V UL SLO 5X20MM, 3A	47A0234

11.1.4 Desiccant Pack Replacement

Description	Part No.
Desiccant Pack Replacement (includes QTY (2) desiccant packs, mounting hardware and seal)	61A0505S

Note

The 94A0674/1 Front Glass Replacement Kit and the AK00030-200-01 LED Light Engine Replacement Kit both include the desiccant pack assemblies required for installation. The only reason to replace the desiccant pack only would be if the sealed area is compromised.

11.2 Spare Part Drawings

Figure 67: RELIANCE PAPI Exploded View - Parts

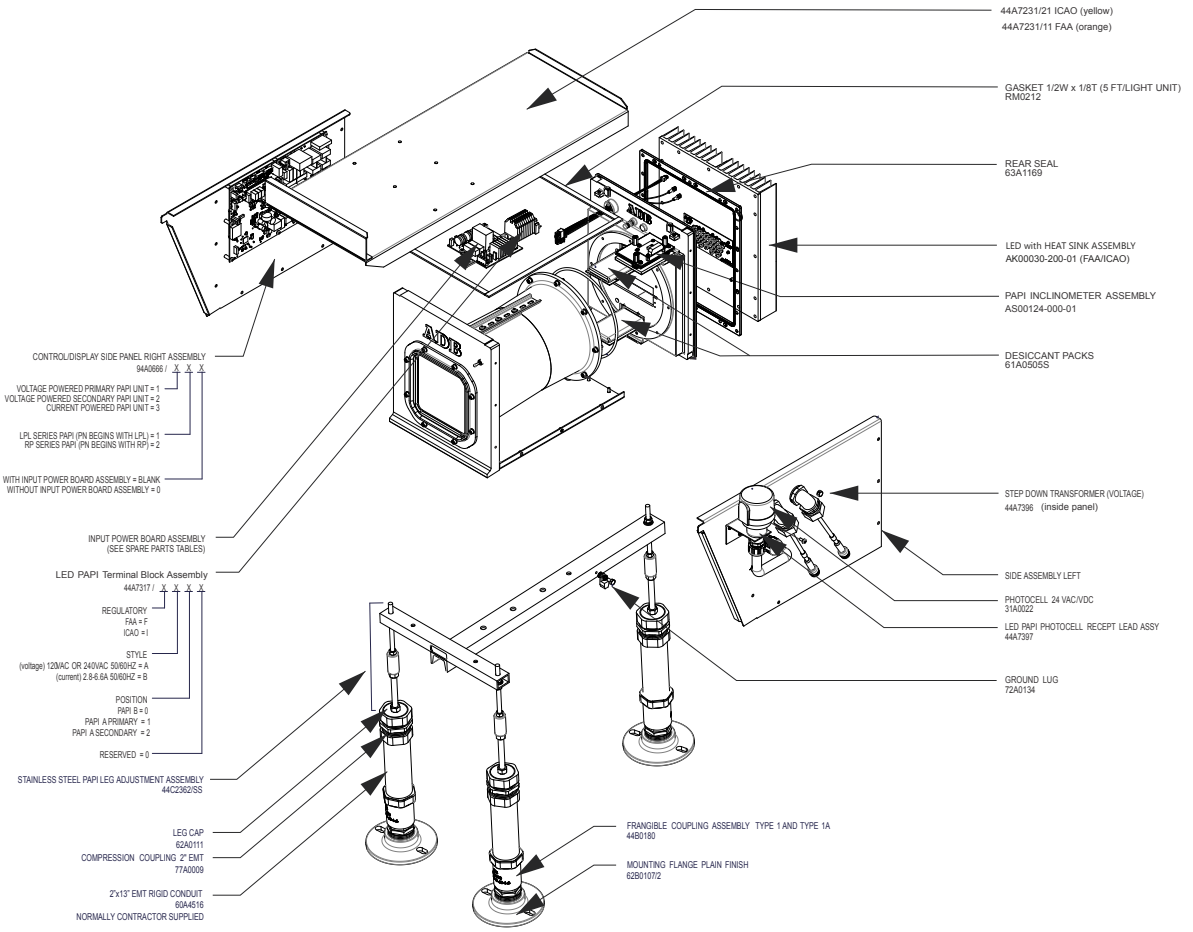


Figure 68: RELIANCE PAPI Exploded View - Hardware

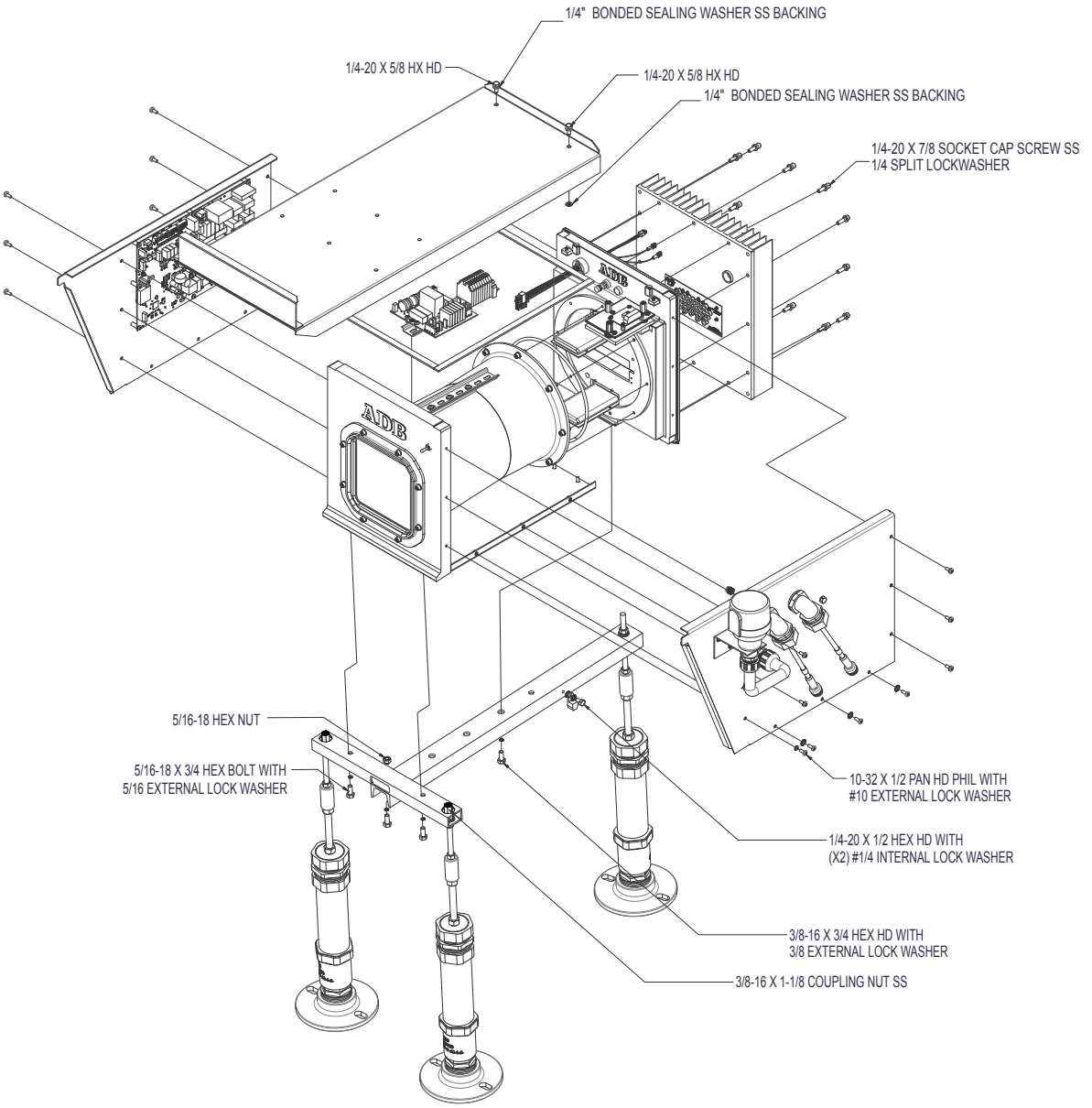


Figure 69: RELIANCE PAPI Side View Assembly

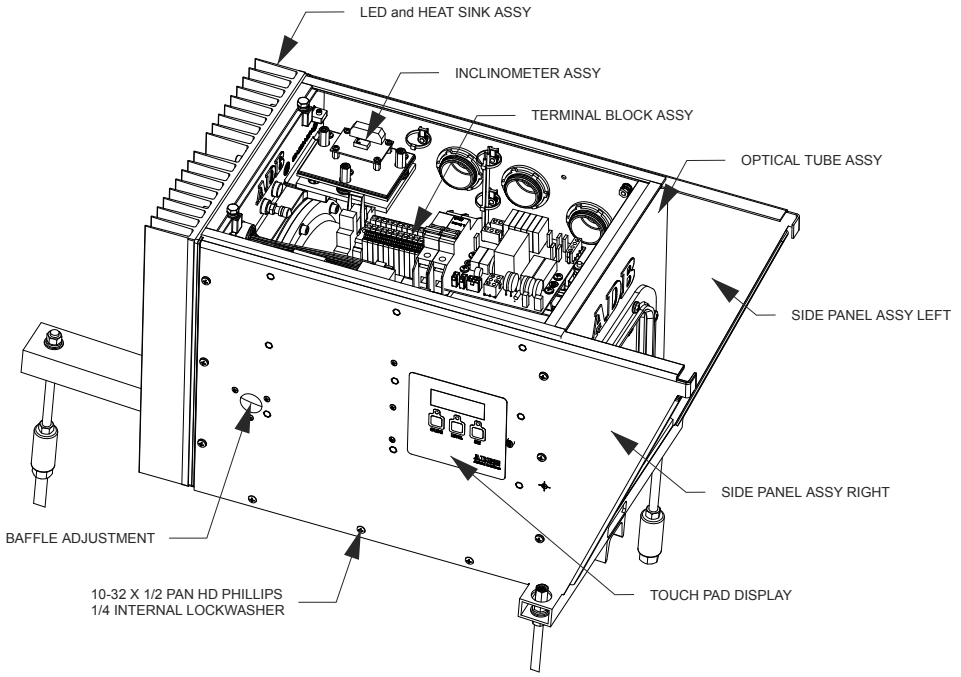
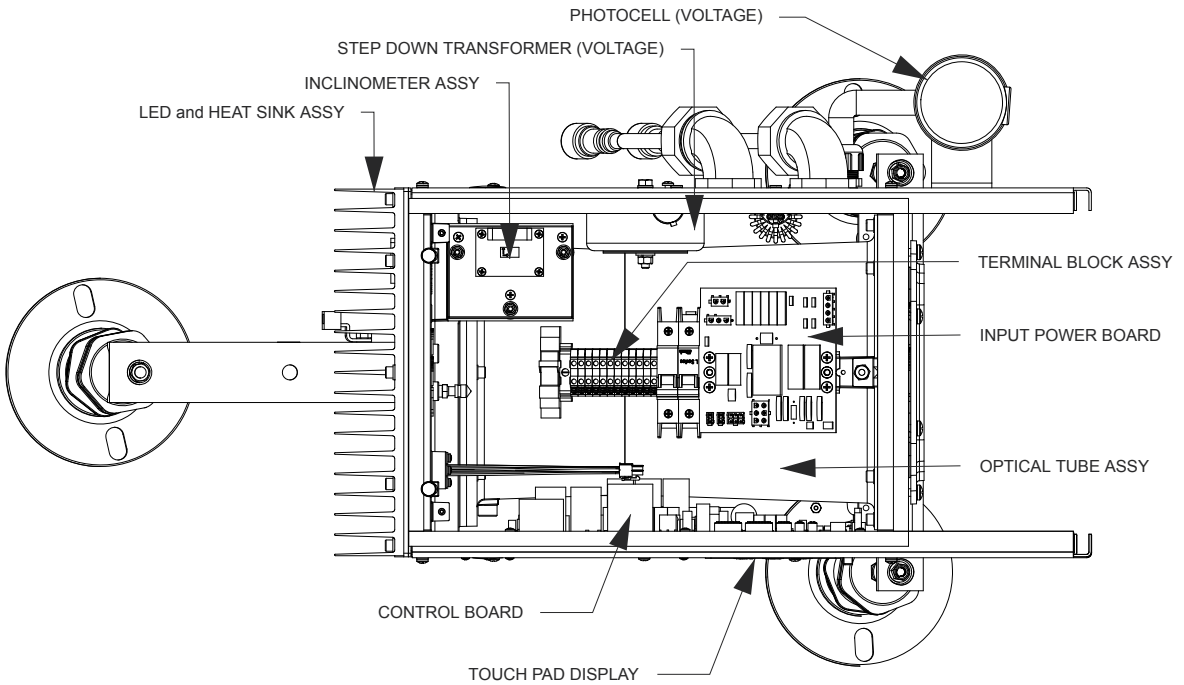


Figure 70: RELIANCE PAPI Assembly Top View



Appendix A: SUPPORT

Our experienced engineers are available for support and service at all times, 24 hour/7 days a week. They are part of a dynamic organization making sure the entire ADB SAFEGATE is committed to minimal disturbance for airport operations.

ADB SAFEGATE Support

Technical Support – Global
Customers in Europe, the Middle East, Africa or Asia Pacific are more than welcome to our portal for technical support. Trained in all areas of system issues, troubleshooting, quality control and technical assistance, our highly experienced Technical support specialists are available 24 hours a day, seven days a week to provide assistance over the phone. In the Americas, we also offer live technical support.

Live Technical Support – Americas
If at any time you have a question or concern about your product, contact ADB SAFEGATE's US-based technical support specialists, available 24 hours a day, seven days a week, to assist you via phone.
ADB SAFEGATE Americas Technical Service & Support (US & Canada) :**+1-800-545-4157**
ADB SAFEGATE Americas Technical Service & Support (Canada): **+1-905-631-1597**
ADB SAFEGATE Americas Technical Service & Support (International): **+1-614-861-1304**

We can also be reached via email during regular business hours:
Airfield and Gate: **techservice.us@adbsafegate.com**
Gate: **gateservice.us@adbsafegate.com**

We look forward to working with you!

Before You Call
When you have an airfield lighting or system control system problem, prior to calling, please ensure the following:

- Review the product's manual and troubleshooting guide.
- Be located with the product ready to troubleshoot.
- Have all necessary information available: airport code/company name, customer id number, contact phone number/email address, product/part number.
- Have a *True RMS* meter available and any other necessary tools.

When calling about an issue with Safedock A-VDGS, we can serve you better if you collect the following information before you call:

- Relevant information regarding the issue you are calling about, such as gate number, flight number, aircraft type and time of the event.
- What, if any, actions have been taken to resolve the issue prior to the call.
- If available, provide a CCTV recording of the incident to aid in aligning the information from the Safedock log file.

Note

For more information, see www.adbsafegate.com, contact ADB SAFEGATE Support via email at support@adbsafegate.com or
Europe: +32 2 722 17 11
Americas: +1 614 861 1304. Press 3 for technical service or press 4 for sales support.
China: +86 (10) 8476 0106
Middle East and Africa: +971 4 452 7575

A.1 ADB SAFEGATE Website

The ADB SAFEGATE website, www.adbsafegate.com, offers information regarding our airport solutions, products, company, news, links, downloads, references, contacts and more.

A.2 Recycling

A.2.1 Local Authority Recycling

The disposal of ADB SAFEGATE products is to be made at an applicable collection point for the recycling of electrical and electronic equipment. The correct disposal of equipment prevents any potential negative consequences for the environment and human health, which could otherwise be caused by inappropriate waste handling. The recycling of materials helps to conserve natural resources. For more detailed information about recycling of products, contact your local authority city office.

A.2.2 ADB SAFEGATE Recycling

ADB SAFEGATE is fully committed to environmentally-conscious manufacturing with strict monitoring of our own processes as well as supplier components and sub-contractor operations. ADB SAFEGATE offers a recycling program for our products to all customers worldwide, whether or not the products were sold within the EU.

ADB SAFEGATE products and/or specific electrical and electronic component parts which are fully removed/separated from any customer equipment and returned will be accepted for our recycling program.

All items returned must be clearly labeled as follows:

- For *RoHS/WEEE* Recycling
- Sender contact information (Name, Business Address, Phone number).
- Main Unit Serial Number.

ADB SAFEGATE will continue to monitor and update according for any future requirements for *EU directives* as and when *EU member states* implement new *regulations* and or *amendments*. It is our aim to maintain our *compliance plan* and assist our customers.

Company Addresses

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ADB SAFEGATE, Americas	ADB SAFEGATE Americas, LLC 700 Science Blvd Gahanna, OH 43230 USA
Contact: Tel.: +1 (614) 861 1304 Fax: +1 (614) 864 2069	 Email: sales.us@adbsafegate.com Internet: www.adbsafegate.com

ADB SAFEGATE, Sweden	ADB SAFEGATE Sweden AB Djurhagegatan 19 SE-213 76 Malmö Sweden
Contact: Tel.: +46 (0)40 699 17 00 Fax: +46 (0)40 699 17 30	 Email: marketing@adbsafegate.com Internet: www.adbsafegate.com

ADB SAFEGATE, China	ADB SAFEGATE Airfield Technologies Ltd. China Unit 603, D Block, CAMIC International Convention Center, No 3, Hua Jia Di East road, ChaoYang district, Beijing 100102 P.R. China
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