

AIRPORT LIGHTING CONTROLLER UNIT

INSTALLATION AND MAINTENANCE MANUAL

**Pilot Activated Lighting Controller (PALC)
Aerodrome Frequency Response Unit (AFRU)**



Produced by: Airport Alliance Contracting
Registered office:
176 Wellington St. East Perth
Western Australia 6004

Enquiries: Telephone: 61 08 9276 3354
Fax: 61 08 9264 8276

Filename:

Revision: 20090521 | Sample Manual Only

TABLE OF CONTENTS

1	INTRODUCTION	4
1.1	SCOPE OF HANDBOOK	4
1.2	AFRU + PALC UNIT OVERVIEW	4
1.2.1	WHAT IS AN AFRU (AERODROME FREQUENCY RESPONSE UNIT)?	4
1.2.2	AFRU + PALC (PILOT ACTIVATED LIGHTING CONTROL)	4
1.2.3	AIRPORT ALLIANCE CONTRACTING AFRU + PALC UNIT	4
1.3	OPERATIONAL AND PHYSICAL FEATURES	6
1.4	STATEMENT OF DESIGN STANDARDS COMPLIANCE	8
2	DESCRIPTION OF OPERATION	10
2.1	AFRU OPERATION - GENERAL	10
2.2	PALC OPERATION - GENERAL	10
2.3	MANUAL KEYSWITCH OPERATION	11
2.4	OPERATION OF MODE CONTROL SWITCH	11
2.4.1	TWO-MINUTE TEST CYCLE	11
2.4.2	NORMAL POSITION OF MODE SWITCH	11
2.5	RESET PUSHBUTTON (FRONT PANEL)	11
2.6	DESCRIPTION OF VOICE MESSAGES	12
2.7	LIGHTING CYCLE OPERATION AFTER RESET OR COLD START	13
2.8	LIGHTING OPERATION AFTER MAINS POWER RESTORATION	13
2.9	CONFIGURING AFRU + PALC OPTIONS (DIP SWITCHES)	13
2.10	OPERATION OF REVERTIVE INPUTS (IF OPTIONAL REVERTIVE INPUTS AND “LIGHTING STATUS” IN USE)	13
2.11	USER TEST INSTRUMENTS REQUIREMENTS	13
2.12	DIP SWITCH FUNCTIONS	14
2.13	FRONT PANEL LED INDICATIONS	15
3	INSTALLATION AND TESTING	16
3.1	INSTALLATION LEGAL REQUIREMENTS	16
3.1.1	CASA MANUAL OF STANDARDS	16
3.1.2	AUSTRALIAN ELECTRICAL WIRING REGULATIONS	16
3.1.3	INSTALLATION PERSONNEL QUALIFICATIONS	16
3.1.4	RADIO TRANSMITTER LICENCE	16
3.2	PRE-INSTALLATION PROCEDURES	17
3.2.1	FACTORY CONFIGURATION OF AFRU + PALC UNITS	17
3.2.2	RECORDING OF MESSAGES	17
3.2.3	PHYSICAL MOUNTING OF UNIT	17
3.2.4	ADJUSTMENT OF VHF TRANSCEIVER	17
3.2.5	INTERNAL DIP SWITCH SETTINGS	17
3.2.6	LIGHT SENSOR	18
3.2.7	LIGHT SENSOR ADJUSTMENT	18
3.3	LOCATION AND DESIGNATION OF EXTERNAL I/O CONNECTIONS	18
3.4	ANTENNA INSTALLATION	21
3.4.1	ANTENNA ASSEMBLY AND TUNING	21
3.4.2	ANTENNA CONNECTION	21
3.4.3	ANTENNA MOUNTING	21



3.5	BATTERY	21
3.6	TESTING THE INSTALLATION	22
3.6.1	CASA - AFRU+PAL COMMISSIONING FLIGHT TEST REQUIREMENTS	22
4	MAINTENANCE AND FAULT-FINDING	23
4.1	ROUTINE MAINTENANCE	23
4.2	ROUTINE BATTERY REPLACEMENT	23
4.3	SAFETY INSPECTION	23
4.4	FAULT-FINDING	25
5	RECORDING OF NEW MESSAGES	27
5.1	RECORDING METHODS	27
6	LEGAL REQUIREMENTS	27
7	APPENDICES	28
7.1	TEXT OF MESSAGES	28
7.2	AFRU + PALC PACKING LIST	29
7.3	GLOSSARY	30

Revision History:

1. As at January, 2009. AAMB Version 021
2. 21 May, 2009 - Various minor wording changes



1 INTRODUCTION

1.1 Scope Of Handbook

This handbook describes the Airport Alliance Contracting

- PALC unit and/or
- AFRU + PALC unit

(“the Unit”) including all installation, operational and maintenance procedures. Portions of this manual may be applicable to AFRU operation only.

The Units are designed, constructed and supported in Western Australia, and comply with Australian CASA Manual of Standard (MOS) requirements.

1.2 AFRU + PALC Unit Overview

1.2.1 What is an AFRU (Aerodrome Frequency Response Unit)?

An AFRU is an electronic, ground based, aviation safety enhancement device, intended for use on the CTAF or MBZ frequency at uncontrolled aerodromes. It is essentially an internally controlled VHF transceiver with a pre-recorded message transmission capability. AFRU transmissions are triggered when the AFRU receiver detects aircraft transmissions on the correct aerodrome frequency.

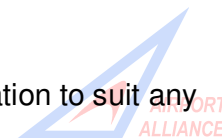
If the pilot is aware of the presence of an AFRU in a CTAF area, the AFRU will assist in alerting pilots to these situations by providing an automatic transmission on the aerodrome frequency to confirm the receipt of a transmission by an aircraft within radio range. The confirming transmission will be either a short recorded voice message (e.g. aerodrome name followed by CTAF, as appropriate), or a short (300 millisecond) tone burst, depending upon the radio transmission activity by aircraft operating on that frequency in the preceding 5 minutes.

1.2.2 AFRU + PALC (Pilot Activated Lighting Control)

Optional additional functionality is provided with the AFRU unit to provide for aircraft actuated operation of the aerodrome lights at the aerodrome at which the AFRU is located, during night hours or other times of low natural light levels. This option emulates the function of PALC circuitry, but permits operation on the CTAF (area) frequency.

1.2.3 Airport Alliance Contracting AFRU + PALC Unit

The Airport Alliance Unit has many features that enable configuration to suit any Australian airport.



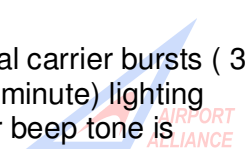
The Airport Alliance Unit can be factory-configured as a PALC only for use at airports where airport lighting needs to be remotely activated, or as a combination AFRU + PALC at airports where an AFRU facility deemed necessary by CASA regulations.

All necessary airport lighting can be activated by either configuration. Generally, runway/taxiway lighting is only activated during hours of darkness, while PAPI lighting is activated during day or night.



1.3 Operational and Physical Features

- **OPERATIONAL FACILITIES:**
Combined AFRU + PALC facilities or PALC only, in a 240-volt powered, rack-mounting enclosure, including an external light sensor. Solar power version is 12 volt operated.
- **SOUND FACILITIES**
Eight recorded voice messages are integrated to allow audio feedback announcements to aircraft.
- **HOUSING:**
Housed in a 3 rack-unit, rack-mounting chassis (overall dimensions 485mm W x 340mm D x 135mm H approx.) with internal VHF transceiver of the aircraft cockpit mounting class.
- **POWER REQUIREMENTS:**
Power requirement is 250volts, AC, 15 watts. Standby current drain is dependent on radio utilised. A 12-volt, 18AH battery is mandatory for AFRU backup and required for correct operation of both AFRU and PALC. Solar power operation can be supplied on request.
- **OUTPUT LINES.**
All output connections to unit are made to terminals at rear of unit. External wiring should be as per supplied drawing for correct operation and to comply with CASA fail-safe requirements.
The outputs are powered by 12V and supply 12V to external relay coils when active.
- **INPUT LINES.** Input lines are optically-isolated, PLC type inputs (powered internally at 12 volts) and are activated by earthing the terminals. All input connections to the unit are made to terminals at rear of unit.
- **AUDIO MESSAGES:**
Pre-recorded sound chip contains up to 90 seconds of quality speech, divided into 8 messages, each message can be up to ten seconds in length.
- **PALC OPERATION:**
Site and (optional) lighting status message transmitted if 3 sequential carrier bursts (eg 3 X 3 second PTT presses) received in 25 seconds. The main (30 minute) lighting timer is simultaneously started.
- **AFRU OPERATION:**
CTAF/MBZ Site/frequency message transmitted if 3 sequential carrier bursts (3 X one second PTT clicks) received in 5 seconds. The main (30 minute) lighting timer is simultaneously started. A Site/frequency message or beep tone is



transmitted after receipt of aircraft transmission longer than 2 seconds. The beep tone only transmitted after any 2-second or longer transmission received in the previous 5 minutes. A 1000 Hz beep tone is used for 300 milliseconds for AFRU beep-back facility.

- **FRONT PANEL CONTROLS**

The unit is fitted with a MODE CONTROL switch to over-ride lighting control. Lighting may be forced ON manually or placed into a short test cycle of two minutes duration.

A RESET BUTTON is fitted on the front panel to restart the Unit micro-controller. For correct resetting operation, the reset button should be switched OFF for 15 seconds and then switched back ON.

- **STATUS INDICATING LED's:**

The unit is fitted with LED's on the front panel to facilitate comprehensive visual assessment of operating conditions without the requirement for any test instruments.

- **ADVANCED MONITORING OF FIELD CIRCUITS (OPTIONAL)**

Inputs are available for true monitoring of field currents of circuits. Will be factory-configured on request.

- **USER / INSTALLER ADJUSTABLE OPTIONS:**

Many settings and features are user adjustable by means of eight internal DIP switches. These include:

[a] Main Lighting Timer can be set to 30, 45 or 2 minutes. As well as the default operation of 30 minutes, the timer can be set for 45minutes where extra long operation may be required. The two-minute option is used for testing only. This is designed for use during maintenance and testing where the timer cycle is shortened to allow quick re-triggering of the lighting, and for quick checking of the IWI flashing.

[b] All audio messages can be played back (transmitted) to ensure integrity of recordings.

[c] The selection of a mains-powered site or diesel genset site is done by a DIP switch setting. The selection of "Genset in use" mode will disable any mains sensing operation, (Loss of mains is not applicable at a genset site) and adjust the delay before the AFRU responds with a "Lights OK" or "Lights not available" message from 2 to 8 seconds This is the delay allowed to lapse before the unit reports back on the availability of the lighting. The shorter time is used at mains powered sites. The longer time is used where diesel gensets are fitted to allow for the cranking of the gensets.



1.4 Statement Of Design Standards Compliance

The AFRU/PALC is designed and installed in compliance with the requirements of CASA Manual Of Standards (MOS) Part 139, Section 9.3 and Chapter 14.

Figure 1 Functional Block Diagram of AFRU / PALC Unit

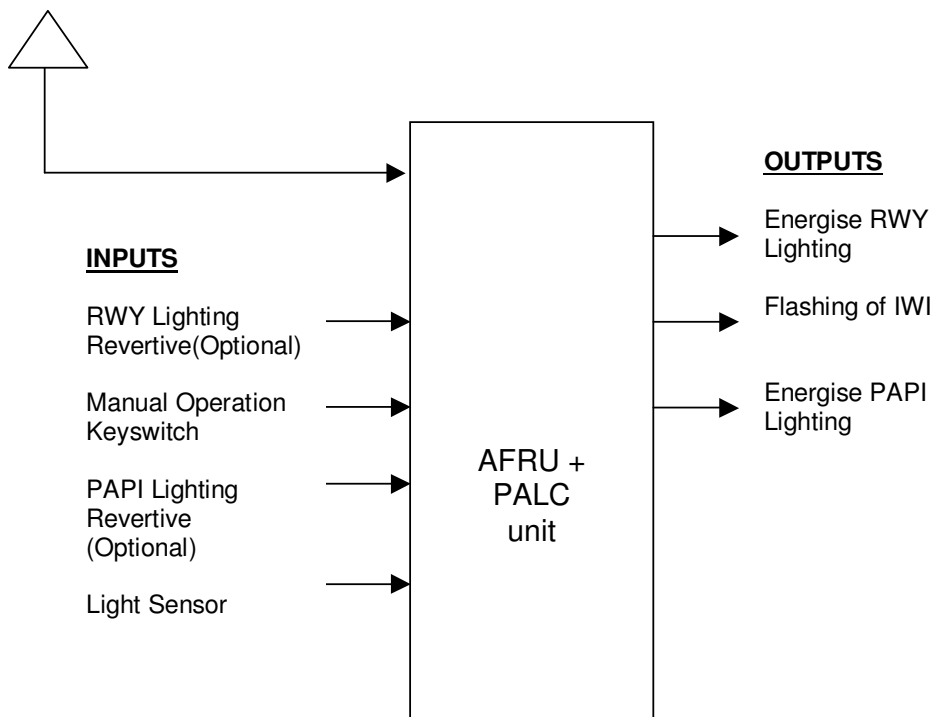
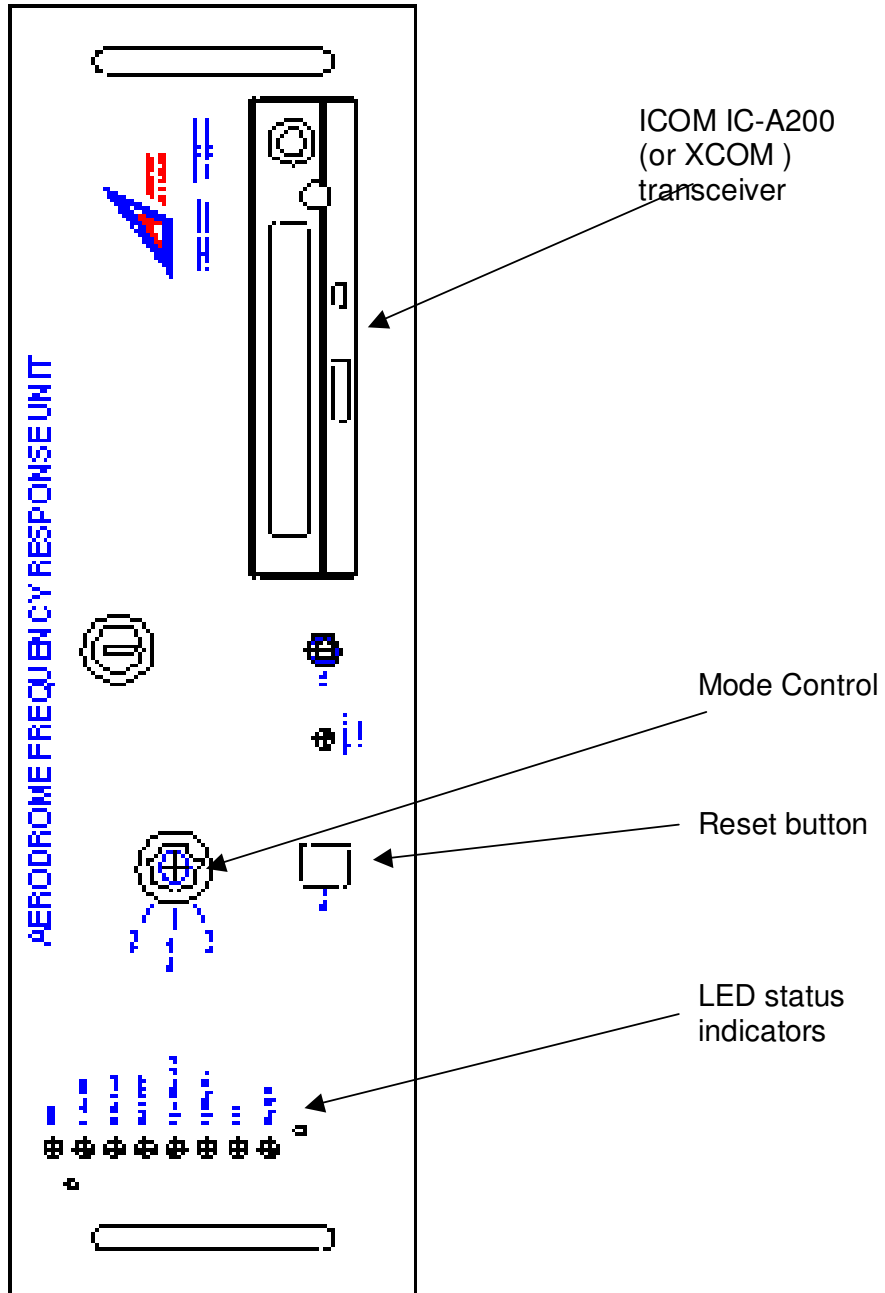


Figure 2 Airport Alliance Contracting AFRU/PALC Unit
(Front Panel View, 3 rack unit chassis)



2 DESCRIPTION OF OPERATION

2.1 AFRU Operation - General

The AFRU (Aerodrome Frequency Response Unit) facility allows pilot verification of the correct station frequency and general checking of aircraft radio communications equipment.

When a transmission of 2 seconds or greater is received, the Unit will respond by transmitting a recorded message (if not previously activated in the past 5 minutes). This message will confirm the airport site and frequency. If a previous transmission has been received in the last 5 minutes, the Unit will respond with a beep only. Any valid transmission received in the 5 minute window will reset the 5 minute timer.

The reception of either reply by the aircraft verifies the operation of the AFRU and aircraft radio communications systems.

2.2 PALC Operation - General

The PALC (Pilot-Activated Lighting Control) facility allows the remote operation of the airport lighting.

AFRU:

When the Unit is operated as an AFRU/PALC on the CTAF frequency, PAL lighting is activated by 3 consecutive PTT pulses in a five second period. The pulses must be more than 0.25 second and less than 1.2 seconds.

PALC:

When the Unit is operated as a PALC Unit on the PAL frequency, it is activated by 3 pulses in a 25 second period. The pulses must be more than 1 second and less than 5 seconds.

A valid set of three pulses will energise all applicable airport lighting for 30 minutes, by starting the main lighting timer. Subsequent valid sets of pulses will reset the timer to 30 minutes.

The "Lighting Activated" response is broadcast on receipt of the valid set of pulses. If the optional true monitoring function using revertive inputs is implemented, then the status of the lighting is checked several seconds after the lighting request and either a "Lights Not Available" or a "Lights ON" message is also transmitted in response.

PAPI lighting can be requested day or night, but other lighting will not operate if ambient light level is too high.



2.3 Manual Keyswitch Operation

The airport lighting can also be energised by a key-operated switch. The lights will remain energised as long as the keyswitch is ON. Returning the keyswitch to Remote (auto) will commence the countdown of the airport lighting timer. A voice message is transmitted on return to Remote (auto) mode, as a normal lighting cycle is started.

This method is used by departing pilots and authorised staff. The keyswitch overrides remote pilot-activated lighting (radio) requests.

2.4 Operation of Mode Control Switch

The airport lighting can be energised by a front panel control. This switch enables simple operation of airport lighting and can be for the full lighting cycle or a shortened two-minute test period, depending on switch position.

The “Local” and “Remote” positions are the same as the manual keyswitch operation. When in “Local”, the lighting is held ON permanently. When the switch is moved back to “Remote”, the airport lighting cycle (30 minute timer) is commenced.

2.4.1 Two-Minute Test Cycle

To use the two-minute lighting test cycle, place the switch into the “Test” position and press the “Reset” button. The Unit immediately commences a two-minute cycle. At the end of the cycle, the Unit can be re-activated for further short cycles remotely. This feature is useful for flight testing the installation. The IWI output line flashes during the last 1/3 of the two minute period. All the usual voice messages are transmitted during the two-minute cycle. The Mode switch must be left in the “Test” position for the entire duration of the test.

2.4.2 Normal Position of MODE Switch

This switch MUST be left in “Remote” position to enable normal remote activation of the Unit.

2.5 Reset Pushbutton (Front Panel)

This control restarts the Unit micro-controller. When fault-finding, this control may restore normal operation and should be used as a first resort. To reset the unit, press button in and wait for 15 seconds. COP LED should be extinguished. Then restart the unit by pressing switch again.



2.6 Description of Voice Messages

The table below describes the messages used in PALC and AFRU, and when they are transmitted.

	Event	Message
AFRU	First call received longer than 2 seconds, within five minute window	Site and frequency information
	Subsequent call longer than 2 seconds, within five minute window	300ms BEEP
	Start of Lighting Cycle (three PTT pulses)	“PAL activated” message
PALC	Start of Lighting Cycle (three PTT pulses)	“PAL activated” message The above message means that lighting has been selected by the unit, but should not be taken as a guarantee that lighting is actually available in the field.
BOTH PALC and AFRU	When there is ten minutes of light remaining	“Lighting has ten minutes remaining”
	If minimum set current is detected in the field circuits (by optional revertive inputs)	“Lighting is ON”
	If minimum set current is NOT detected in the field circuits (by optional revertive inputs)	“Lighting is not available”



2.7 Lighting Cycle Operation after Reset or Cold Start

When the Unit is reset, the lighting cycle will be started and “PAL activated” message shall be transmitted.

NB The Unit takes several seconds to initialise itself, during which time the front panel LED’s are lit for a one-second test period.

2.8 Lighting Operation After Mains Power Restoration

When mains are restored after an interruption and mains power has been stable for a short period (a few seconds), the lighting cycle is also restarted as per section 2.7 above.

This feature is not applicable to diesel genset powered sites.

2.9 Configuring AFRU + PALC Options (DIP switches)

The Unit contains eight DIP switches to allow the user/installer to configure the Unit to the site conditions and many user requirements.

2.10 Operation of Revertive Inputs (If optional revertive inputs and “Lighting Status” in use)

A revertive indication is a feedback from current-sensing equipment on the field circuit, indicating that there is the required minimum current flowing in the field circuit and therefore the lighting appears to be operating normally. The Unit requires external revertive circuitry that provides closed contacts connected to input 1 (RWY) and input 3 (PAPI), when the lighting is OK, for correct operation. Refer also to external circuits wiring schematic.

The use of revertive indications allows the Unit to provide “Lights ON” and “Lights not available” radio messages. Without the use of revertive indications, no lighting status messages will be transmitted.

“Revertives in use” mode is selected by DIP switch 7.

2.11 User Test Instruments Requirements

A hand-held VHF transceiver is highly recommended for testing of the unit. Successful triggering of the lighting, followed by correct transmitted responses indicate PALC is serviceable.



2.12 DIP Switch Functions

Table 1 DIP Switch Functions

DIP SWITCH DESIGNATIONS	
DIP switch number	Function
1	Selects 45minutes for main lighting timer when ON. Timer default is 30 minutes.
2	Not used
3	<u>Genset in use.</u> This switch should be selected ON at genset sites.
4	Enables the playback (transmission) of all recorded messages. Plays all messages in a continuous loop, until reset. To avoid unnecessary radio transmissions, this function should be used sparingly.
5	Not used
6	<u>PAPI in use.</u> If OFF, PAPI routines (any daytime lighting routines) are ignored.
7	<u>Revertive Indications in use.</u> (Optional "Lighting Status")
8	AFRU + PALC mode, if ON, else PALC mode only. [factory use only]



2.13 Front Panel LED Indications

The UNIT front panel is fitted with 8 LED indicators will allow a full assessment of operating status. To assist in fault-finding and general operation of the Unit, the table below contains interpretations of the LED indicators.

LED designation	Colour	Explanation	LED Status during normal operation
COP	Green	Computer Operating Properly. This LED flashes once per second when UNIT micro-controller is operating properly. Battery voltage is present.	Flashing
Mains OK	Green	This LED is normally ON. If this LED is OFF, no 250 volt power is available.	Steady ON
Radio PTT	Red	This LED is lit by transmissions taking place from the radio.	ON during transmissions from unit
Signal Received	Amber	This LED indicates an incoming signal from an aircraft or other transmitter.	ON while receiving radio transmissions.
Lighting ON	Amber	This LED indicates the lighting cycle has been activated and lighting should be ON.	Steady ON when lighting is ON.
Daylight	Green	This LED indicates that the light sensor has detected day light levels	ON when light sensor has sensed day time conditions



3 INSTALLATION AND TESTING

3.1 Installation Legal Requirements

3.1.1 CASA Manual Of Standards

The Unit shall be installed as per the requirements of the CASA Manual Of Standards (MOS) Part 139, Section 9.3 and Chapter 14.

Some MOS requirements are summarised below:

- Adequate operational coverage of the airport local surroundings, including all aircraft movement areas
- Antenna shall be installed vertically at height greater than 4.5 metres. The installed antenna shall give coverage to all aircraft in the usual approach paths
- De-sensitised VHF receiver operation to avoid unwanted, spurious triggering of the lighting.
- The Unit shall service the design airport only. Only aircraft within 15NM shall be able to trigger the Unit, so as not to interfere with other airport PALC systems.
- After any power failure the Unit shall re-commence it's lighting sequence.
- ALL PALC AND AFRU INSTALLATIONS IN LICENSED AIRPORTS MUST BE FLIGHT-TESTED BY A CASA APPROVED PILOT, BEFORE COMMISSIONING BY CASA.

3.1.2 Australian Electrical Wiring Regulations

The Unit shall be installed by a licensed electrical installer, as per the AS3000 Australian Wiring Rules.

3.1.3 Installation Personnel Qualifications

IT IS HIGHLY RECOMMENDED THAT ALL INSTALLATIONS BE CARRIED OUT BY PERSONNEL WITH PREVIOUS EXPERIENCE IN THIS WORK.

3.1.4 Radio Transmitter Licence

The voice response facility of this Unit requires a radio transmitting licence. Licenses are issued by Australian Communications and Media Authority (ACMA). It is the responsibility of the owner of the airport to acquire the appropriate licence before the Unit is placed into service, by applying for a frequency allocation from Airservices Australia and then for the licence from ACMA.



3.2 Pre-Installation Procedures

NB: AFRU and PALC Units will be supplied pre-configured to the maximum extent possible. Generally, internal adjustments or radio transceiver adjustments will be not required. Installation generally only consists of making external connections to the Unit (or to the cubicle, if Unit supplied already fitted to a control cubicle).

The installation procedures below may not be required and are provided only for completeness.

3.2.1 Factory Configuration of AFRU + PALC Units

All Units shall be delivered preset to each individual site. The following features will be preset in the factory testing:

- Recording of correct voice messages for each site
- All DIP switch settings
- VHF radio controls preset, including correct frequency of operation

3.2.2 Recording Of Messages

The Unit should be pre-recorded with the correct messages for the airport site.

3.2.3 Physical Mounting Of Unit

The Unit shall be mounted in a location protected from the weather, usually in a lighting control cubicle or equipment rack. The PALC and AFRU + PALC units require 3 rack units.

3.2.4 Adjustment of VHF Transceiver

The VHF transceiver shall be prepared by setting the main and standby frequencies to site frequency.

3.2.5 Internal DIP Switch Settings

The PALC is fitted with an 8-way DIP switch on the CPU circuit board.

Verify that all DIP switches are in correct position. If any settings are changed, a reset (restart) of the Unit will be required.

Refer to section 2.13 for designated functions of each switch.



3.2.6 Light Sensor

A Light-dependent resistor (LDR) sensor assembly is supplied and should be connected as per schematic diagram. The status (daylight or night) of the LDR are shown by the "Daylight" front panel LED.

3.2.7 Light Sensor Adjustment

The Light Sensor operation can be adjusted by varying the vertical multi-turn trimmer resistor on the rear "External Interface" PCB.

3.3 Location and Designation of External I/O Connections

All connections to the Unit are via terminal blocks at the rear of the Unit. VHF transceiver is connected via a BNC antenna connector to an Omni-directional antenna. Refer to tables below for terminal identification

Figure 3 Identification of Rear Connectors (Rear View)

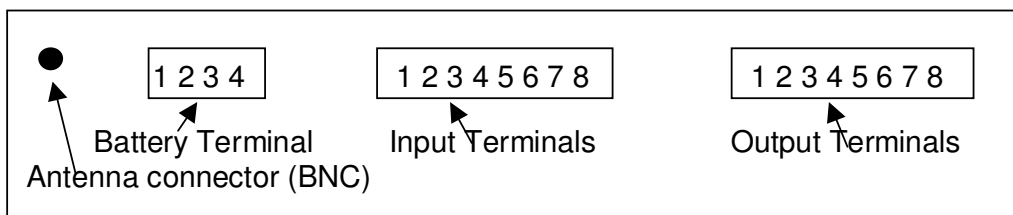


Table 2 OUTPUT TERMINAL IDENTIFICATION

OUTPUT TERMINAL DESIGNATIONS	
Output terminal number	Description
1	Runway Lighting Control (12 volts)
2	NC
3	IWI Lighting Control to Main (flashing) IWI (12 volts)
4	NC
5	PAPI Lighting Control (12 volts)
6	NC
7	+12 volts (output circuits switching supply)
8	0 volts (output circuits switching supply)

Table 3 INPUT TERMINAL IDENTIFICATION

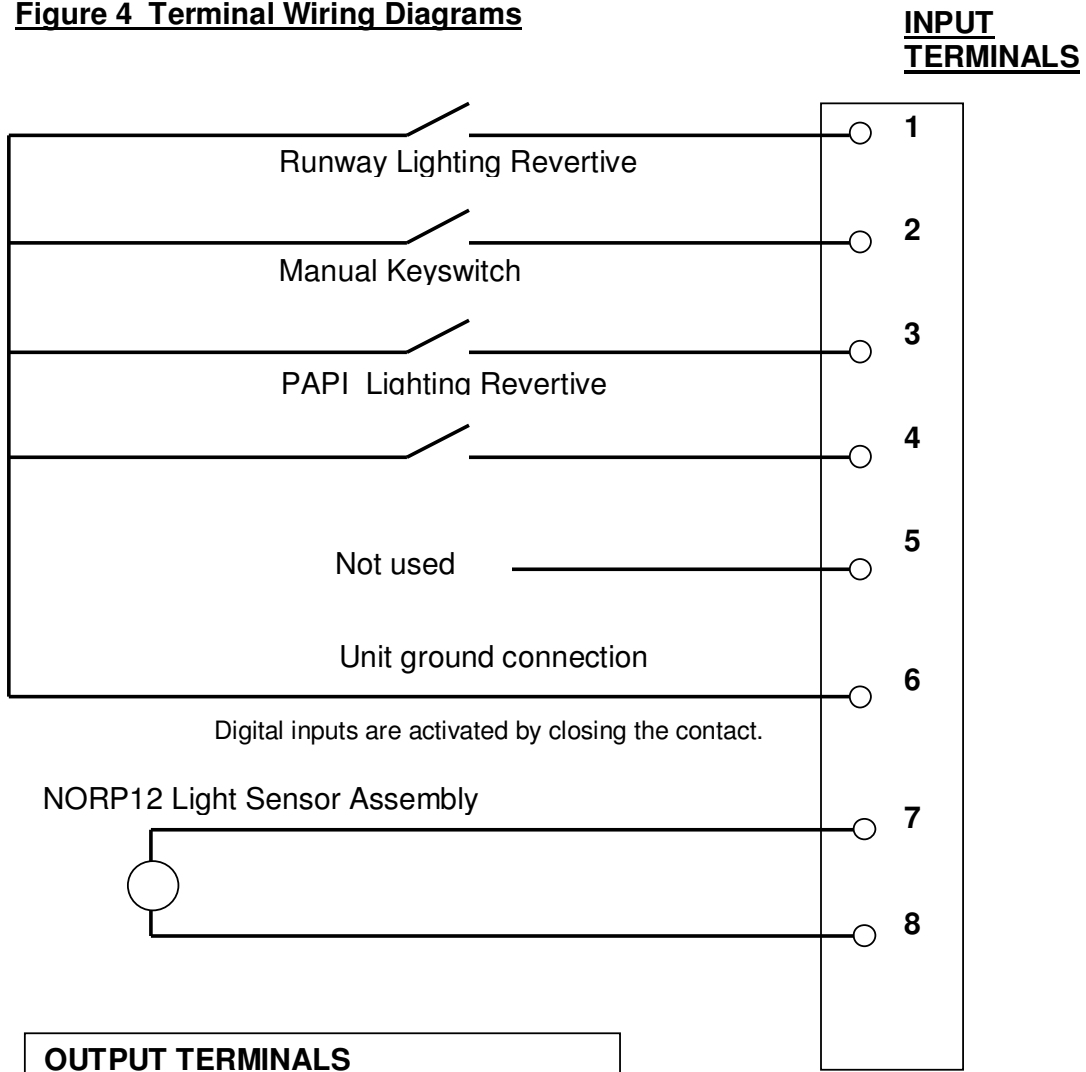
INPUT TERMINAL DESIGNATIONS	
Output terminal number	Description
1	Runway Lighting Revertive
2	Manual Keyswitch
3	PAPI Lighting Revertive
4	Not used
5	Not used
6	Input Ground (-ve, 0V, GND)
7	Light Sensor Assembly +12V
8	Light Sensor Assembly -12V

Table 4 BATTERY TERMINAL IDENTIFICATION

BATTERY TERMINAL DESIGNATIONS	
Output terminal number	Description
1	Battery (+12 volts)
2	Battery -ve
3	N.C.
4	Do not connect (Voltage test point for charger regulator)



Figure 4 Terminal Wiring Diagrams



OUTPUT TERMINALS

**Refer to separately supplied drawing
for connection details.**



3.4 Antenna Installation

The antenna supplied with the unit is a ground-plane, omni-directional device which requires simple tuning prior to use. It is suitable for mounting on a mast (not supplied), which may be free-standing or fixed to a building.

The antenna should be 4.5 metres high as a minimum, and at least 1.5 metres above a building. It should also have a (generally) obstacle-free line-of-sight coverage of the airfield. This coverage includes approaching/departing aircraft and those on the aircraft movement areas.

3.4.1 Antenna Assembly and Tuning

Assemble the antenna as per the supplied manufacturer's instruction.

3.4.2 Antenna Connection

The antenna is fed with the supplied 50 ohm coaxial cable terminated in a N-type connector which mates with a female N-type fitting mounted on the base of the antenna. Any excess antenna cable should be looped at a convenient location. The mounting support tube will need to be removed for the connection.

3.4.3 Antenna Mounting

Mount antenna on existing mast by clamping mount-support tube U-bolt clamps.

3.5 Battery

A 12-volt battery is essential for correct operation. The battery is kept charged by the Unit power supply, except in solar power installations.

A suitable battery is the Jaycar Cat No. SB-2490 (12 volt, 18AH sealed lead-acid) or similar, for mains powered installations. A larger battery will be required for solar-powered installations.



3.6 Testing The Installation

Verify that the Unit operates as described by section 2 of this manual.

Verify that the Unit operates as described by CASA requirements, Manual Of Standards (MOS) Part 139, Section 9.3 and Chapter 14, a portion of which relating to flight testing is reprinted is below in section 3.6.1. A flight test is mandatory for all new installations at licensed aerodromes.

3.6.1 CASA - AFRU+PAL Commissioning Flight Test Requirements

A flight check of the AFRU / PAL Activation function shall be to the satisfaction of a CASA inspector. The flight test will ensure the functionality of the AFRU and optional PAL at appropriate points on the aerodrome and out to the limits of the relevant CTAF area.

ON THE GROUND:

- (a) Check activation of AFRU and PAL from the parking apron(s) of the aerodrome.
- (b) Check all specified functionality of the AFRU and PAL option.

IN THE AIR:

- (a) Check proper performance of AFRU at line of sight distances out to 15NM radius of the aerodrome at altitudes to 3000 feet AGL.
- (b) Check that AFRU Receiver sensitivity and Transmitter power levels are adjusted to ensure that the AFRU does not activate, and does not transmit, beyond approx. 30NM radius.
- (c) Check that voice and tone responses are clear and legible. Check that three microphone clicks will activate voice response.
- (d) Ensure that the AFRU does not trigger falsely during aircraft transmissions. Ensure that no interruptions occur to aircraft transmissions by false triggering of the AFRU during the aircraft transmission.
- (e) Check and ensure proper operation of the PAL option as follows:
- (f) Ensure lights are activated by three microphone clicks at a radius of 15NM in line-of-sight from the aerodrome, to altitudes of 3000 feet AGL.
 - (i) Ensure that lights remain activated for 30-minute period after activation.
 - (ii) Ensure receipt of correct recorded voice responses after activation.
 - (iii) Ensure that illuminated wind indicator flashes after 20 minutes.
 - (iv) Ensure that lights are reset for 30 minutes following an aircraft transmission of three microphone clicks at anytime within the 30 minutes period.



4 MAINTENANCE AND FAULT-FINDING

This section describes the requirements for maintenance and fault-finding for the Airport Alliance AFRU / PALC Unit.

4.1 Routine Maintenance

Routine maintenance should include:

- Battery and voltage checks.
- Safety inspections to verify correct and safe operation. These may be done monthly.
- Ensure light sensor is not obstructed by debris or vermin.
- Six-monthly cleaning to remove dust.
- SWR check on transceiver antenna every two years. This will reveal any degradation due to antenna corrosion. If the SWR degrades, the antenna and antenna cable may need to be replaced.

4.2 Routine Battery Replacement

The battery MUST be replaced every two years.

4.3 Safety Inspection

A Safety Inspection should be performed regularly to verify operation. This is a basic overall check of the entire AFRU+PALC Unit. If the Safety Inspection is carried out successfully, it can be assumed that no significant faults exist.

The suggested Safety Inspection is detailed below:

Item	Purpose
1. Verify Correct power supply to unit	Mains power should be available and is indicated by >17 volts at Battery Terminals 4 and 2. Correct battery charging is indicated by 13.6 volts at Battery Terminals 1 and 2.
2. Verify correct LED indications on front panel.	The green "Mains OK" and "COP" LED's should be lit. The steady "Mains OK" LED indicates 250-volt power is available to the Unit. The flashing "COP" LED indicates the main CPU (micro-controller) is functioning normally. The Daylight LED will be lit if the light sensor detects daylight.
3. Verify correct overall operation of AFRU facility [AFRU only]	Using a handheld transceiver, at the correct site frequency, at some distance from the antenna, press the PTT for more than two seconds. The AFRU Unit should reply with a site/frequency message.
4. Verify "Radio PTT" and "Signal Received" LED's [AFRU only]	While observing front panel of the Unit, repeat above test and a "beep" response should be received on the handheld. NB A beep reply will only be received if less than 5 minutes has elapsed between steps 3 and 4.

	The “Signal Received” LED should illuminate when a transmission is being received. The “Radio PTT” LED will illuminate when the radio is transmitting.
5. Verify correct overall operation of PALC lighting control	<ul style="list-style-type: none"> • Select “Test” position on front panel, press reset button • Using a handheld transceiver at some distance from the antenna, press the PTT to give 3 valid pulses in 5 seconds. The AFRU Unit should reply with a site/frequency message and switch on the runway and IWI lighting. • The IWI should be flashing. • Wait for two minutes for the timer to elapse • Repeat 3 pulses, if required, for another test • Return to “Remote” position (Normal) on front panel
6 Leave Unit in ready mode	Ensure “Remote” position is selected on front panel and radio is on correct frequency.



4.4 Fault-Finding

The table below is to assist in diagnosing and rectifying faults with the Airport Alliance AFRU + PALC Unit. The Unit is assumed to be in service and all external connections including antenna and battery, are made.

Generally, faults may be rectified by:

- Restarting the CPU, by pressing the “Reset” pushbutton for 15 seconds or by briefly disconnecting all power (battery and mains).
- Verifying the correct triggering of the Unit as per the Safety Inspection. Many faults are the result of incorrect timing (by the aircraft) of the three pulses required to activate the Unit
- Replacing the VHF Transceiver
- Replacing the entire Unit

Fault Symptoms	Cause and Remedial Procedure
1. No front panel LED indicators lit. No internal LED's lit. or no display on radio.	Both mains power supply and battery supply are U/S. Restore either for further checking. NB: unit must have battery for correct operation. Mains power should be available and is indicated by >17 volts at Battery Terminals 4 and 2. Correct battery charging is indicated by 13.6 volts across Battery Terminals 1 and 2
2. “Mains OK” front panel LED indicator lit. COP LED not flashing	Controller has stopped. CPU circuit board may be faulty. <ul style="list-style-type: none"> • Press “Reset” pushbutton to attempt CPU restart • Replace CPU circuit board.
3. No front panel LED indicators lit. Internal COP LED flashing.	Front panel circuit board faulty or unplugged from CPU circuit board. <ul style="list-style-type: none"> • Verify that lead from front panel LED's is plugged into J2 on CPU circuit board.
4. “Signal Received” LED does not illuminate when transceiver is receiving a radio signal	Interface circuit board may be faulty. <ul style="list-style-type: none"> • Verify that transceiver is set to correct frequency for site and appears operational • Test Interface circuit board by replaying all messages (Section 5.2.6)
5. Unit ignores radio signals from (distant)aircraft	<ul style="list-style-type: none"> • Aircraft may be outside of AFRU range. This is normal operation. AFRU is designed to service airport vicinity only. • Verify that transceiver is set to correct frequency for site. • Verify the timing of the three PTT pulses to activate the Unit.
6. “Radio PTT”	Transceiver or Interface circuit board may be faulty.

LED illuminated but transceiver is not transmitting	<ul style="list-style-type: none"> • Check / replace transceiver. • Test Interface circuit board by replaying all messages (Section 5.2.6)
7. "Radio Fault" and "Radio PTT" LED's are lit.	<p>Transceiver has been transmitting continuous carrier (signal) and has been shutdown to avoid interference to other radio signals.</p> <ul style="list-style-type: none"> • Press "Reset" pushbutton to attempt further normal operation. • If still faulty, transceiver should be returned to supplier for repairs.
8. Radio transmission appears garbled	<p>Ensure that battery is serviceable. The battery is required to provide sufficient current for radio transmissions.</p>
9. Keyswitch does not switch ON lighting. Internal COP LED flashing.	<p>Input or output lines may be faulty.</p> <ul style="list-style-type: none"> • Trace Keyswitch input to J7 pin 2, verify earth is applied at this point, when keyswitch turned ON. • Trace runway lighting output to pin 1 of output plug. • Trace IWI lighting output to pin 2 of output plug.



5 RECORDING OF NEW MESSAGES

5.1 Recording Methods

Airport Alliance Contracting (Perth, Western Australia) will supply an exchange or replacement sound chip on request.

6 LEGAL REQUIREMENTS

RADIO TRANSMITTING LICENCE

This AFRU/PALC unit includes a radio transmitter, which must be licensed by the Australian Communication and Media Authority (ACMA)

The licensing of the transmitter consists of two procedures, the allocation of a radio frequency by AirServices Australia :

Email: (SPECTRUM.MANAGER@AirservicesAustralia.com)

and the issue of the licence by ACMA at <http://www.acma.gov.au>

It is the responsibility of the owner of the transmitter to obtain and renew this licence as necessary.

FLIGHT TESTING AND COMMISSIONING

Generally, AFRU/PALC installations must be flight-tested and commissioned by Civil Aviation Safety Authority (CASA) approved personnel prior to use. This generally applies to regulated airports used for commercial purposes. CASA should be contacted for further information prior to any new AFRU/PALC installations.

CASA Building
Cnr Northbourne Ave & Barry Dr
Canberra ACT 2600 GPO Box 2005
Canberra ACT 2601

Ph: 131 757 (local call cost within Australia)
Ph: + 61 131 757 (from outside Australia)
Fax: 02 6217 1209

Email: info@casa.gov.au



7 APPENDICES

7.1 Text of Messages

The table below shows the text of the recorded messages in the sound chip. The chip is a 90-second recording capacity, divided into 8 equal areas.

Sample messages are also shown, but can be customised for each site.

Table 5 Sample Messages

Message Text
Message 1 “ <u>Airport Site</u> PAL Lighting activated”
Message 2 Airport lighting is activated “ <u>Airport Site</u> Lighting is ON”
Message 3 Airport Lighting is <u>not</u> available “ <u>Airport Site</u> Lighting NOT available”
Message 4 Airport lighting has 10 minutes remaining “ <u>Airport Site</u> Lighting (pause) ten minutes remaining”
Message 5 The BEEP. 300ms of 1000Khz tone DO NOT RECORD A VOICE MESSAGE AT THIS LOCATION
Message 6 PAPI lighting is activated “ <u>Airport Site</u> PAPI is ON”
Message 7 PAPI Lighting is <u>not</u> available “ <u>Airport Site</u> PAPI is NOT available”
Message 8 The airport name and CTAF or MBZ frequency “ <u>Airport Site</u> MBZ One-Two-Zero decimal One” AFRU ONLY



7.2 AFRU + PALC Packing List

This is a list of items to be shipped with each Unit:

Item No	Description	Qty
1	AFRU / PALC Control Unit – Rack Mounted	
2	Omni-Directional Antenna	
3	Antenna cable with terminations (BNC plug to N-Type plug)	
4	VHF Transceiver Modified for CASA requirements.	
5	VHF Transceiver manual	
6	AFRU + PALC installation and operating manual (hardcopy)	
7	Light Sensor Assembly	
8	External connections schematic drawing	
9	Description of legal requirements regarding radio transmitting licence and CASA flight check / commissioning. Refer printout of following page.	
10	Airport Alliance Contracting Warranty Statement	
	Installation Location:	Transceiver serial number

Received

Date

_____ / ____ / _____



7.3 Glossary

ACMA	Australian Communications and Media Authority. Responsible for issuing radio transmitting licences.
APL	Airport Lighting (includes Runway and Taxiway)
AFRU	Aerodrome Frequency Response Unit
CASA	Civil Aviation Safety Authority
CPU	Central Processing Unit. The microcontroller used in the system
COP	C ontroller O perating P roperly. LED indication of healthy Central Processing Unit
CTAF	Common Traffic Advisory Frequency
IWI	Illuminated Wind Indicator, “ the windsock”
Main lighting timer	The timer that controls the duration of the airport lighting. Usually set at 30 minutes, but can be set to 45minutes or 2 minutes (testing purposes)
MOS, Part 139	M anual O f S tandards, produced by Civil Aviation Safety Authority to regulate aerodromes
PALC or PAL	Pilot Activated Lighting Control
PAPI	Precision Approach Path Indicator
PTT	Press-To-Talk on VHF radio transceiver
revertive	Feedback taken from the controlled circuit, as indication of correct operation.
Safety Inspection	A basic inspection of the AFRU + PALC Unit to verify safe and correct operation.

