



Advanced Control Equipment (ACE2)

User Manual

96A0357, Rev. H, 2020/06/29



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 FAA Airfield regulations. The FAA directives that have been taken into consideration in the design are available on written request to ADB SAFEGATE.

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ADB SAFEGATE will correct by repair or replacement per the applicable guarantee above, 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.

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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.

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Standard Products Guarantee

Products of ADB SAFEGATE manufacture 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 sales order contract for a complete warranty description.

FAA Certified product installed in the United States and purchased or funded with monies through the Airport Improvement Program (AIP) installations guarantee

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 L858(L) Airfield Guidance Signs 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).

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Note

See your sales order contract for a complete warranty description.

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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.

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TABLE OF CONTENTS

1.0 Safety	1
1.1 Safety Messages	1
1.1.1 Introduction to Safety	2
1.1.2 Intended Use	2
2.0 Advanced Control Equipment	3
2.1 About this manual	3
2.2 How to work with the manual	3
3.0 Introduction	5
3.1 Advanced Control Equipment	5
3.2 Wall Mount	6
3.3 Internal-Mount	6
3.4 Combo Box-Mount	7
3.5 Main Circuit Board	7
3.6 ACE2 Lamps-Out Monitoring Board	9
4.0 Modes of Operation	11
4.1 Stand-Alone Configuration	11
4.2 Stand-Alone Push-button Description	14
4.3 I/O Status display	15
4.3.1 Lamps-Out Calibration for Stand-Alone Mode	16
5.0 Installation	17
5.1 Introduction	17
5.2 Wall-Mount Installation	17
5.2.1 ACE2 Cabling Entry	18
5.3 Internal-Mount Installation	21
5.4 Combo Box-Mount Installation	21
5.4.1 ACE2 Cable Entry	23
6.0 Troubleshooting	25
6.1 Troubleshooting Procedures	25
6.2 Error Messages	27
6.3 Wiring Schematics	28
6.3.1 Connectors	29
7.0 Parts	33
7.1 Parts List	33
A.0 SUPPORT	35
A.1 ADB SAFEGATE Website	35
A.2 Recycling	36
A.2.1 Local Authority Recycling	36
A.2.2 ADB SAFEGATE Recycling	36

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.

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.
- 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

2.0 Advanced Control Equipment

ACE2 Operations Manual

2.1 About this manual

The manual shows the information necessary to:

- Install
- Carry out maintenance
- Carry out troubleshooting on the Advanced Control Equipment.

2.2 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.

3.0 Introduction

This section describes the L-827/ L-829 Advanced Control Equipment (ACE2™).

Note
ACE and ACE2 are trademarks of ADB Airfield Solutions.

The ACE2 operates either as the remote interface between the L-890 ALCMS and any controlled element in the airfield lighting vault or as the stand-alone regulator/monitor performing all L-827/L-829 functions in accordance with FAA AC 150 / 5345-10F. The ACE2 is a universal device that can be used to control any type of CCR and/or controlled element regardless of the manufacturer.

L-827/L-829 ACE2

The ACE2 can be physically packaged as a Combo Box-Mount ([Figure 3](#)), a Wall-Mount ([Figure 1](#)), or a CCR Internal-Mount ([Figure 2](#)). The Combo Box Assembly is a wall-mount version, which houses the ACE2 controller board, the IRMS board, and the CVM. The Remote-Mount is typically placed on top of the CCR. The Wall-Mount is usually bolted to a wall or can be mounted on the front of a CCR. The internal-mount is mounted inside a ADB Airfield Solutions L-828 CCR. This combination is called an L-829 CCR.

3.1 Advanced Control Equipment

Compliance with Standards

FAA: Monitoring: Certified to AC 150/5345-10 (Current Edition). ETL Certified.
Insulation Resistance: AC 150/5340-26 Chapter 3, Section 2, para. 27.

Overview

The ACE2 can operate either as the remote interface between the L-890 ALCMS and any controlled element in the airfield lighting vault or as the stand-alone constant current regulator (CCR) monitor, performing all L-827/L-829 functions in accordance with FAA AC 150 /5345-10. The ACE2 is a universal device that can be used to control any type of CCR and/or controlled element regardless of the manufacturer.

The ACE2 can be packaged as a remote mount, wall mount, CCR internal mount, or Combo Box. A remote mount is typically placed on top of the CCR. The wall mount is typically bolted to a wall or can be mounted on the front of a CCR. The internal mount is mounted inside a ADB Safegate L-828 CCR (Also called a L-829 CCR). The Combo Box Assembly is a wall-mount version, which houses the ACE controller board. The Combo Box Assembly also houses the IRMS board and the CVM, which are normally mounted inside a ADB Safegate L-829 CCR.

Each CCR and controllable item is connected to an ACE2. The ACE2 is a microprocessor-based module that includes all of the communication, control commands, input/output inter-face, and fail-safe functionality for the controlled element.

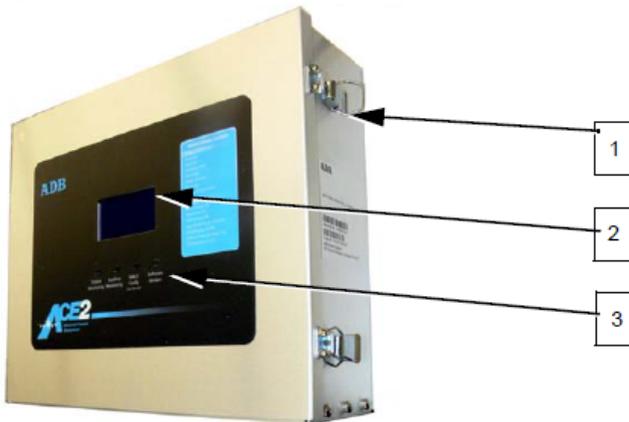
Note
For those applications that require:

- Connection with up to a four-circuit L-847
- Up to eight discrete input or outputs

Use ADB SAFEGATE's first generation ACE system. Request data sheet 2016 for more information.

3.2 Wall Mount

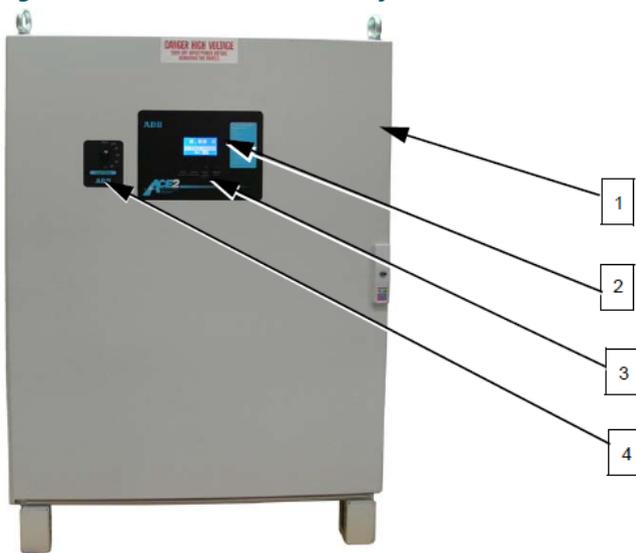
Figure 1: ACE2 Wall-Mount Assembly



1. Enclosure
2. ACE2 Front Display
3. ACE Control Keys

3.3 Internal-Mount

Figure 2: Internal-Mount Assembly



1. Constant Current Regulator
2. ACE2 Display
3. ACE2 Control Keys
4. Rotary Step Switch

Refer to [Figure 2](#). The ACE2 is a universal device that is used to control most types of CCRs and/or controlled elements regardless of the manufacturer. The ACE2 printed circuit boards are mounted inside a small and rugged environmental enclosure that can be wall-mounted, placed on a CCR, or enclosed in the CCR itself. The ACE2 consists of microprocessor-based module(s) that process communication, control commands, input/ output interface, and failsafe functionality for controlled elements in the airfield lighting vault.

3.4 Combo Box-Mount

Figure 3: ACE2 Combo Box-Mount Assembly



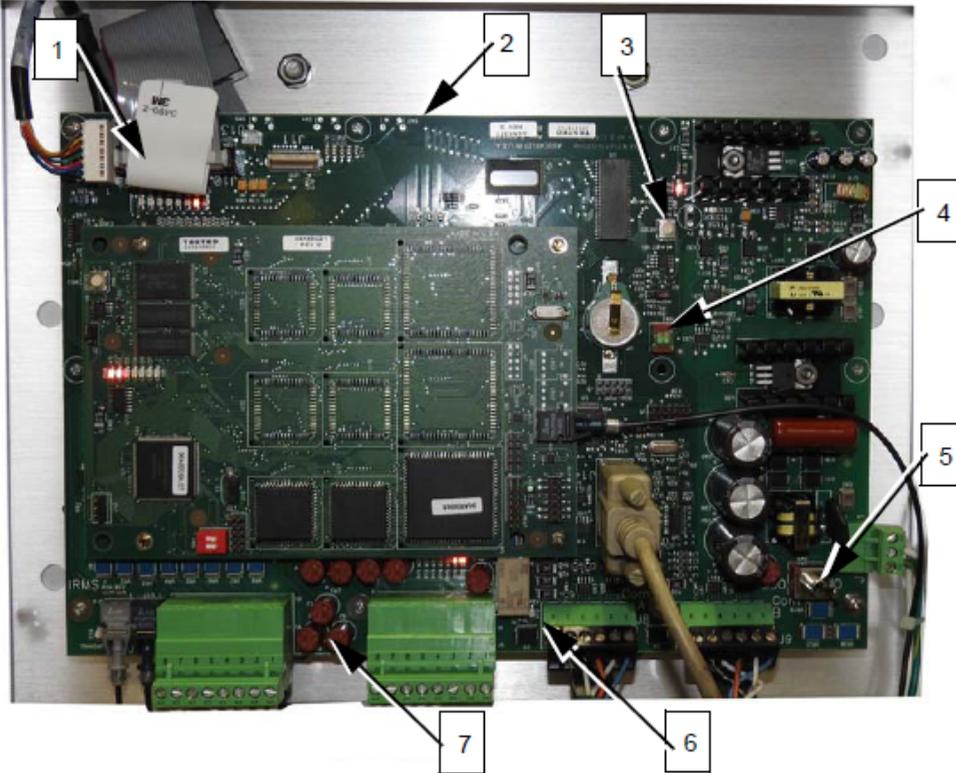
1. Enclosure
2. ACE2 Front Display
3. ACE2 Control Keys

3.5 Main Circuit Board

The Main Printed Circuit Board ([Figure 4](#)) is the central part of the design. It includes a micro-controller core that implements main logic and provides calculating functions. A communication circuit provides the interface for the redundant communication network (RCN), which is how ACE2 receives and transmits data to the ALCMS vault computer. It contains a fiber optic interface connection for the Current Voltage Monitor (CVM), optional Insulation Resistance Monitoring System (IRMS), and an RS-232 local configuration interface. The watchdog jumper (J2) is used to select whether the watchdog timer is On or Off. Connecting pins 1 and 2 enables the watchdog timer. Connecting pins 2 and 3 disables watchdog timer, and removing the jumper also disables watchdog timer. The normal setting for the watchdog timer is On. The watchdog timer should only be set by qualified ADB Airfield Solutions personnel. The reset switch (SW1) is used during the design and test phase, and has no application for the user. The keypad switches and an LCD connector provides a Graphic User Interface (GUI) for local control and monitoring for all controllable functions. The display is connected to the main board by a ribbon cable. The two-position DIP switch (SW2), is not currently used, but allows for future upgrades. The DIP switch must remain with both selectors in the On position for proper operation. The Power Supply circuitry provides all ACE2 equipment with a regulated and isolated power source.

The Power Supply circuitry can be turned On and Off via the main power switch in the lower right corner of [Figure 4](#).

Figure 4: ACE2 Main Circuit Board



1. Ribbon connector to display board	3. SW1	5. SW7	7. Relay Fuses
2. Main PCB	4. SW2	6. RY7	

Table 1: Main Board Description

Feature	Function Description
Ribbon connector to display board	
Main PCB	
SW1	Reset switch - Press to reset the processor
SW2	Two-position DIP switch <ul style="list-style-type: none"> • Not used • Keep in On position
SW7	On/Off power switch to ACE2
RY7	RY7 general fault relay
Relay Fuse	

ACE2 Power Supply Circuit

The ACE2 Power Supply circuitry is integrated into the Main Circuit Board (shown in [Figure 5](#)). It provides the internal system with a regulated and isolated power source.

ACE2 Input/Output

The Discrete Input/Output circuitry provides an interface for all control and monitoring connections. It contains seven latching relay outputs and, one proper operation, mono-stable relay output normally used for the Fault Alarm indication. The I/O circuit contains eight Optically-isolated input lines.

3.6 ACE2 Lamps-Out Monitoring Board

The ACE2 lamps-out monitoring (LOM) board ([Figure 5](#)) consists of a processor communicating over a fiber optic serial communications link, with up to three Current and Voltage Modules (CVM). In addition to RMS voltage, RMS current, apparent power (VA), and true power (WATTS), the LOM Board also calculates the number of lamps burned out at each brightness level. The Lamps-out function can detect up to 16 burned out lamps.

If the CCR is controlling multiple circuits through circuit selectors, each of the circuits may have a CVM monitoring voltage, current, watts, VA, and the number of lamps out on the circuit.

The setting of the two-position DIP switch (SW1) depends on the number of circuits monitored and the number of Lamps-Out boards used. If the ACE2 contains only one Lamps- Out board, the settings are:

- Switch 1 - Off
- Switch 2 - Off

If the ACE2 contains a second Lamps-Out board, the SW1 settings on the second board are:

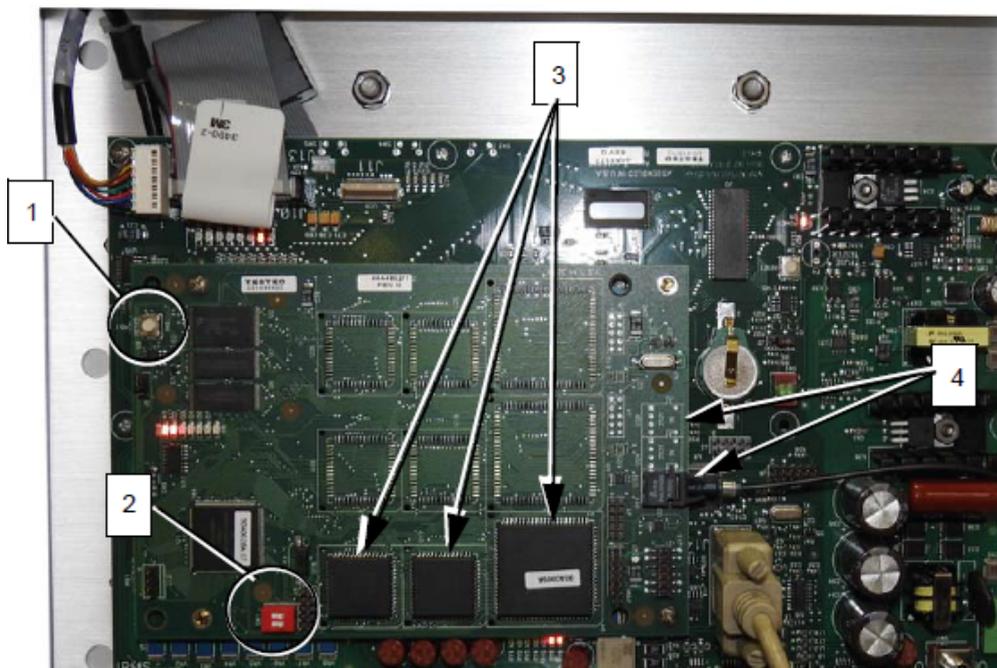
- Switch 1 - Off
- Switch 2 - On

If the ACE2 contains a third Lamps-Out board, the SW1 settings on the third board are

- Switch 1 - Off
- Switch 2 - On

The third Lamps-Out board also has a 4-port jumper with a jumper on pins 1 and 2.

Figure 5: Lamps-Out Monitoring Module



1. Switch (SW2)
2. SW1 Switch Positions for Monitoring Additional Lamps-Out Boards
3. IC Chip Sets
4. Fiber Optic Sockets (one shown installed)

4.0 Modes of Operation

Only qualified ADB Safegate personnel select modes of operations. There are 3 ways to handle the ACE2 operation:

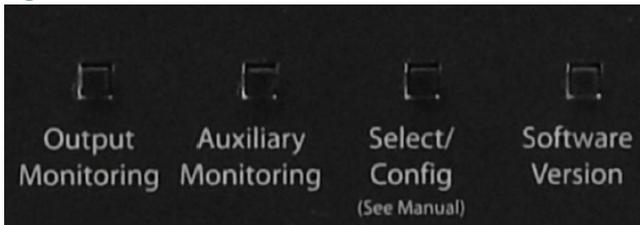
1. L-827 stand-alone (external to the CCR).
2. L829 stand-alone (integrated with the CCR).
3. L-890 ALCMS.

4.1 Stand-Alone Configuration

The ACE2 is only set up for stand-alone operation by qualified ADB Safegate personnel. In this mode, configuration of the ACE2 is performed through the local menu and alternative functions of the buttons listed in [Figure 7](#):

1. Modify, execute (Output Monitoring button).
2. Go to the next item (Auxiliary Monitoring button).
3. Enter, exit (Select/Config button).
4. No Function (Software Version button).

Figure 6: Functional Buttons



The stand-alone mode configuration menu is presented in [Table 2](#) and [Figure 7](#) below.

Table 2: ACE2 Stand-Alone Configuration Short Reference

		Button Action	
Menu Item	Parameter	Possible value	Description
2 ↓, 3	2 ↓, 3 ←, 1 modify		
CCR Config Menu	CCR Type	Generic, Heavy Duty	Heavy Duty is an older brand name, which requires an additional output line (B1, B10) to turn on and off the regulator. If this regulator is not in use adjust setting to Generic.
	CCR Class	6.6A, 20A	ADB Safegate sells two regulator output types. 6.6A and 20A output. Based on the regulator choose the correct current output.
	CCR Style	3 steps, 5 steps	ADB Safegate sells two regulator step types, 5 step and 3 step. Based on the regulator choose the correct Step Configuration.
	Line Frequency	50Hz, 60Hz	Depending on the location, the input voltage frequency may be 50Hz or 60Hz. Set the ACE2 to the correct frequency for the area.
	Ramp Interval	0.5s, 1s, 2s, 5s	When adjusting the steps of a regulator it is necessary to have a slight delay between steps. The Ramp Interval sets the amount of time the regulator stays at a step before moving on to the next step.

Table 2: ACE2 Stand-Alone Configuration Short Reference (continued)

		Button Action	
2 ↓, 3	2 ↓, 3 ←, 1 modify		
Menu Item	Parameter	Possible value	Description
IRMS Config Menu	Meg Voltage	Disabled, 50V, 500V, 1000V	Select the Meg Voltage based on the regulator. The smaller regulators voltage protection triggers if higher Meg Voltages are used, but the higher the Meg Voltage, the more accurate the reading.
	Meg Period	5min, Hourly, Daily, Weekly	Set how often to Meg the field circuit
	Resistance Warning	Disabled, 100K, 300K,1M, 3M, 10M, 30M, 100M	Select a resistance value to be notified at depending on the field circuit, it may vary.
	Resistance Alarm	Disabled, 100K, 300K,1M, 3M, 10M, 30M, 100M	Select a resistance value to be notified at depending on the field circuit, it may vary.
LOM Config Menu	LO Warning	Disabled, 1-15	Select a Lamp out value to be notified at depending on the field circuit, it may vary.
	LO Alarm	Disabled, 1-15	Select a Lamp out value to be notified at depending on the field circuit, it may vary
Command Menu	Meg Now	N/A	Perform a Meg right now
	Meg Timer Reset	N/A	Reset the current Meg timer to start over with the count.
	LO Calibration	N/A	See Lamps-Out Calibration for Stand-Alone Mode for instructions.
Exit	N/A	N/A	

 **Note**

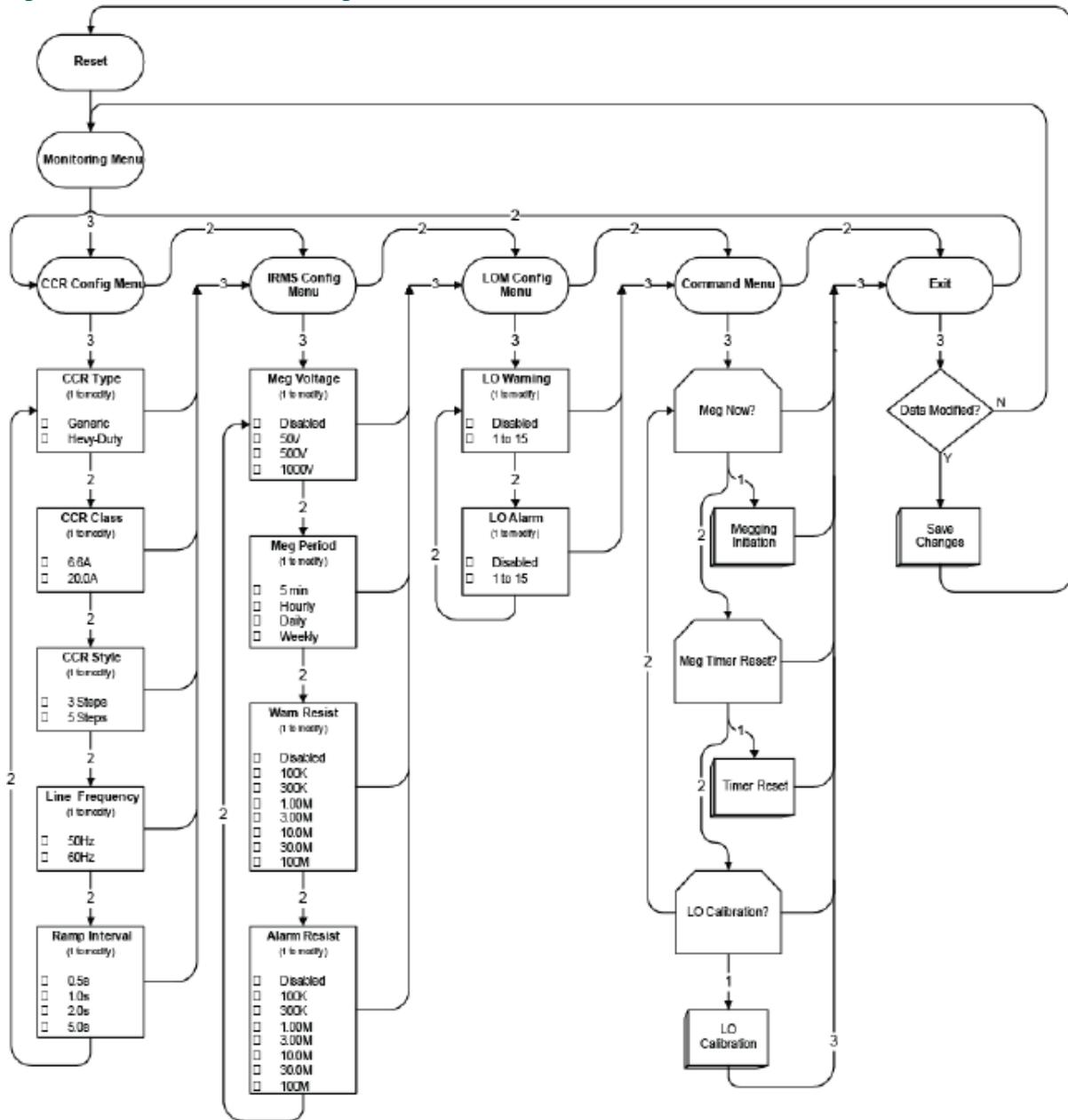
VA refers to the Volt-Amps in an airfield load and is measured by reading the RMS voltage, measuring the RMS current, and multiplying these two numbers together.

Watts corresponds to the amount of power actually consumed by an airfield load. These two numbers are only equal in the case of a purely resistive load. In systems with reactance (capacitance or inductance), power from the source enters the reactive portions of the load, and returns to the source, un-used. This additional unused energy is the difference between the VA and Watts delivered to a system. The power factor of a load is the ratio of the power (watts) used by a load, to the volts and amps (VA) that are delivered to the load. This is always less than or equal to 1.

It is important to remember that all electrical components in a power system are designed to deliver the necessary VA the system needs in order for it to consume the watts it needs.

CCR sizes are actually designed to deliver a kVA value because it is impossible to account for the different power factors in airfield loads. If an airfield load has open-circuited transformers, signs, etc. it requires more VA to deliver the watts needed. For instance, if a 30kW CCR delivered 30kVA into a load with a power factor of 0.5 the resultant watts would be 15kW.

Figure 7: ACE2 Stand-Alone Configuration Flowchart



Most of the parameters are self explanatory. The “Meg Now” command initiates an immediate insulation resistance measurement regardless of the schedule. The “Meg Timer Reset” restarts the megging schedule. The next megging shall occur at the end of the “Meg Period” and periodically after that.

4.2 Stand-Alone Push-button Description

Figure 8 shows the Monitoring Legend and the Pushbutton Functions.

Figure 8: ACE2 Legend and Button Enlargement



Note

The buttons and the monitoring legend are the same for all ACE2 units.

Refer to Figure 9. The push-buttons are described left to right as 1 through 4, and their functions are as follows:

Push button 1, Output Monitoring, provides selection of the LCD top string from the following list of the monitored parameters:

- "Amps": Output CCR current (A).
- "Volts": Output CCR voltage (V).
- "VA": Output CCR VA (VA).
- "Watts": Output CCR watts (W).
- "LO": Number of lamps out on the lamp circuit (optional).
- "Ohms": The last insulation resistance reading for the lamp circuit (Ω) (optional).
- "Cycle": Above list cycled.

Pushbutton 2, Auxiliary Monitor (optional), if the function is enabled, provides access to the CCR input power parameters:

- Input Current "iAmps" (A).
- Input Voltage "iVolts" (V).
- Input Power "iWatts" (W).
- Input Power Factor "iPwrFtr" decimal fraction.
- CCR Efficiency "Effcncy"(%).

A second CVM is connected to the input of the CCR to measure these parameters. If these functions are enabled, the display shows the following hour-meter parameters:

- Total time the CCR has been ON xHT.
- Time the CCR has been on Step B1 xH1.
- Time the CCR has been on Step B2 xH2.
- Time the CCR has been on Step 3 xH3.
- Time the CCR has been on Step 4 xH4.
- Time the CCR has been on Step 5 xH5.
- Total number of the CCR OFF-ON switching cycles xC.



Note

Small x = time in hours.

Push-button 3, Select/Config, becomes active and is used only in a stand-alone L-827 or L-829 mode of operation, described above in Push-button 2.

Push-button 4, Software Version, initiates the automatic sequence displaying the following system parameters:

- Main Control Board Firmware Version.
- Lamps-Out Monitor Firmware Version.
- IRMS Firmware Version.
- RS422 channel A network address.
- RS422 channel A baud rate.
- RS422 channel B network address
- RS422 channel B baud rate.

Appearance of question marks instead of the firmware version number means the firmware is not loaded for that function.

4.3 I/O Status display

Pressing and holding push-button 4 during the Software Version sequence displays the status of the Input/Output Interface. In this mode, read all the input and output lines. The format appears like this:

Out 87654321	or	Out	-----
Inp 87654321		Inp	-----

Or a combination of the two.

Each number is linked to a different pair of pins on the input or on the output connector. If the number is displayed, the corresponding pair of input pins has voltage on them and the corresponding relay is closed.



Note

Out ?????? means there is nothing written to the outputs since power-up and the latching relay status is unknown.

The input and output display has numbers 1 through 8 and correspond to the pins as shown in [Table 3](#):

Table 3: LCD's corresponding Pins

Output Display Number	Output Pin Number	Input Display Number	Input Pin Number
8	1	8	1
7	2	7	2
6	3	6	3
5	4	5	4
4	5	4	5
3	6	3	6
2	7	2	7
1	8	1	8

To exit this mode, press push-button 1.

4.3.1 Lamps-Out Calibration for Stand-Alone Mode

In order for the ACE2 to correctly calculate the number of lamps burned-out it has to be calibrated. For best accuracy, the lamps-out calibration is done only when CCRs are loaded to 75% or more of their specified rating. For best accuracy, all lamps on the lamp circuit being calibrated have the same wattage rating, otherwise the lamps-out detection is not as accurate on lamp wattages not used in the calibration process. Some devices on a series circuit such as but not limited to power adapters, L-858 sign electronics, and L-858 sign fluorescent lamps cause inaccurate lamp-out detection.

In all modes of operation, the calibration is performed in this order;

1. The number of initially present lamps-out is entered in the ACE2
2. The ACE2 steps through all brightness steps and takes measurements.
3. One Lamp is removed from the circuit.
4. The ACE2 steps through all brightness steps again and takes measurements.
5. At this time, it records the Current and Voltage values for each step. If the regulator's VA drops to 90% of the recorded value for that step, LOW VA is displayed.
6. Calibration results are confirmed by the operator and stored in the ACE2's non-volatile memory.

In the stand-alone mode of operation, the lamps-out calibration is performed using the LO Calibration local menu command. In the L-829 mode, the ACE2 controls the CCR through the brightness steps. For an L-827 application, the operator manually changes steps using the CCR local controls of brightness setting lines.

When connected to an ADB Airfield Solutions L-890 ALCMS the lamps-out calibration is performed using the vault computer.

5.0 Installation



WARNING

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

5.1 Introduction

This section provides instructions for installing the L-827/L-829 CCR with Advanced Control Equipment (ACE2). Refer to airport project plans and specifications for specific installation instructions. The installation conforms to the applicable sections of the National Electric Code and local codes.

The ACE2 is mounted either as a Remote-mount, a Wall-mount, a Combo Box-mount, or an Internal-mount. The following subsections describe each of these mounting options.

5.2 Wall-Mount Installation

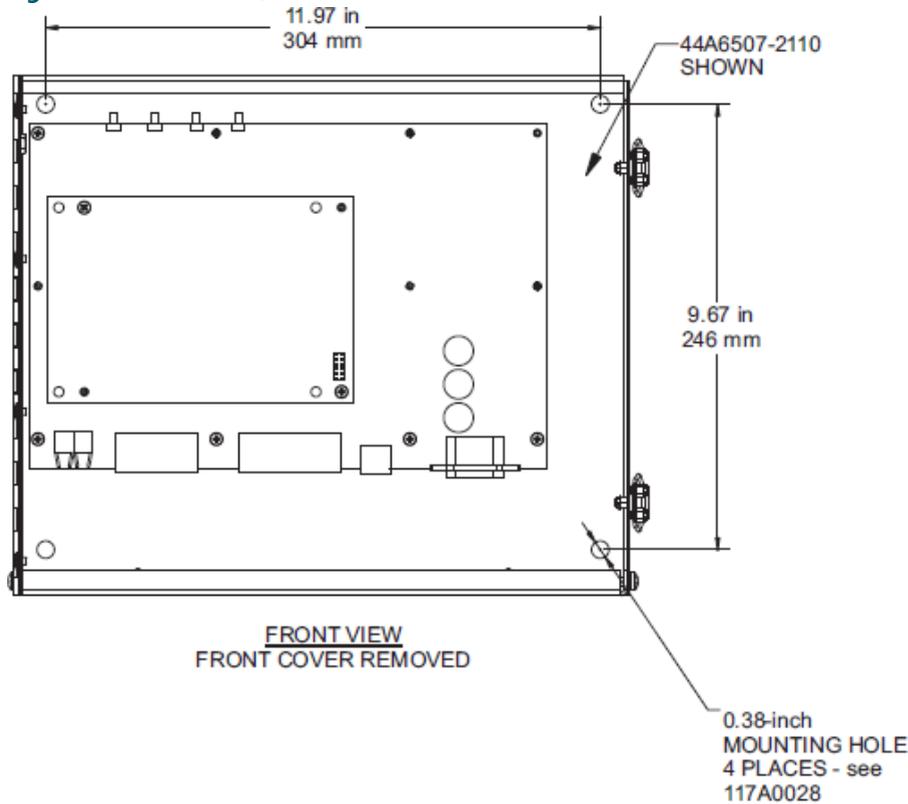
Figure 9 shows the exterior of the ACE2 wall-mount.

Figure 9: Wall-Mount, Exterior View



See Figure 11 for a drawing of the interior.

Figure 10: Wall-Mount, Interior View



Locate each ACE2 unit as close as possible to the controllable elements, the Regulator, the Generator etc. Mount the CVM and the IRM board (if present) separately from the ACE2.

Mount the Wall-mount ACE2 flush against a wall or on U-channels that support all four corners of the enclosure.

5.2.1 ACE2 Cabling Entry

Note The ACE2 enclosure is designed to be replaced easily without having to remove the mounting hardware. Follow these instructions:

1. Position the enclosure flush on its mounting surface.
Level the enclosure and open the lid. Mark or transfer punch the location of the 3/8" diameter holes in each corner of the enclosure shown in [Figure 14](#).
2. Remove the ACE2 unit and drill the marked holes.
Insert anchor hardware as required. **DO NOT DRILL THROUGH THE BOX.** Drilling chips and debris can not fall into the enclosure.
3. **Carefully open the lid of the enclosure.**
Use 1/4-20 x 1.0-inch long screws, flat washers, and lock washers to fasten the enclosure to the wall or to rails.
4. Mount the enclosure using the top two holes then install the hardware for the bottom two holes.
5. Attach all conduits to the bottom or to the top access plate **ONLY**.
6. Protect all equipment inside the ACE2 enclosure while installing conduit.

Note All conduit and wiring must only enter the ACE2 enclosure through the bottom or the top access plate. This facilitates quick maintenance and replacement of the ACE2 unit.

There are four knockouts in both the top and bottom of the enclosure walls for one inch EMT metal conduit fittings for wires and fiber optic cables, see [Figure 12 Wall-Mount Bottom View](#) and [Figure 13 Wall-Mount Top View](#) for dimensions. and the Conduit Drawing, [Figure 14](#), for routing. Power and ACE-to-ACE communication wiring must be in separate conduits. Attach all conduits as required to the bottom or to the top access plate ONLY as seen in [Figure 14](#). Protect ALL electronic equipment in the ACE2 enclosure while installing conduit.

Figure 11: Wall-Mount, Bottom View

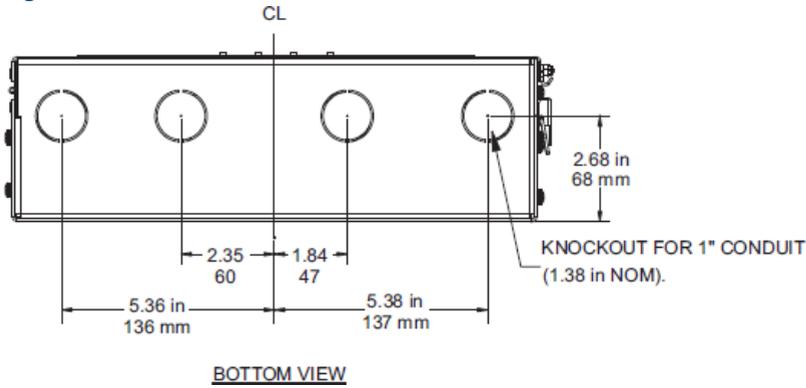


Figure 12: Wall-Mount, Top View

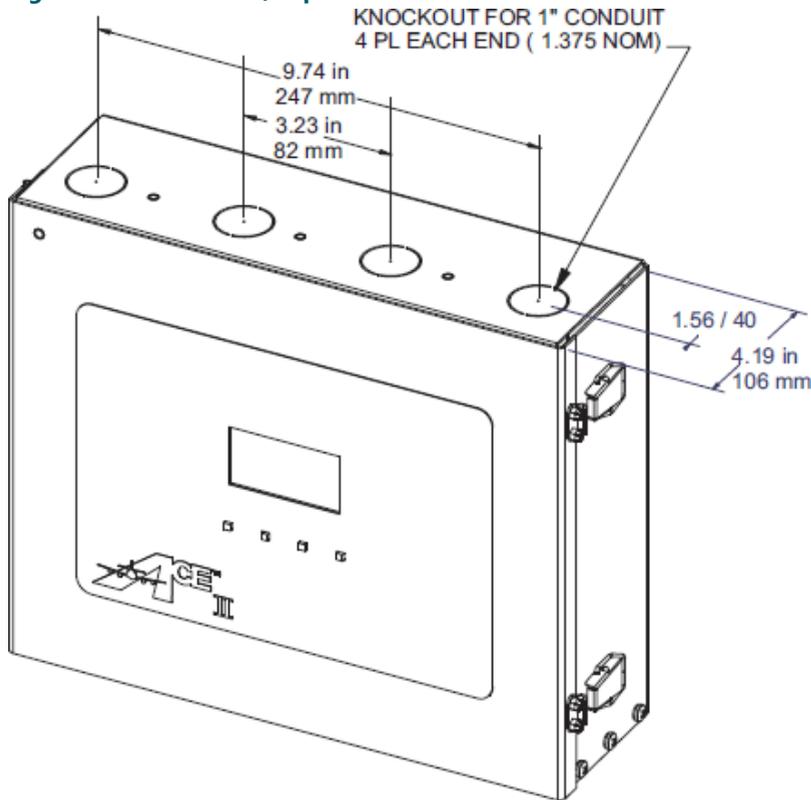
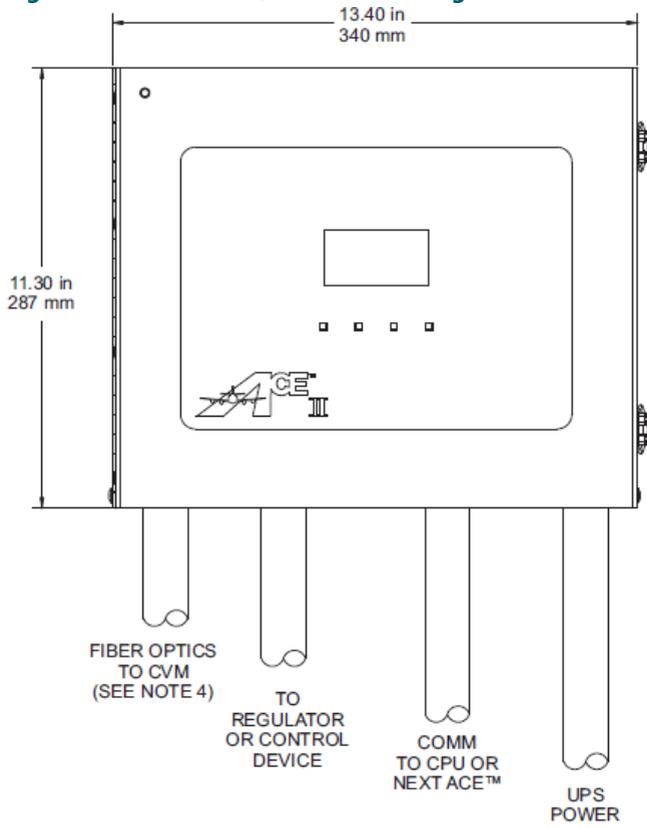


Figure 13: Wall-Mount, Conduit Drawing



Note

DO NOT blow out enclosures because metal shavings can damage the electronics.

5.3 Internal-Mount Installation

The Internal-mount ACE2 is installed into the door of the L-829 CCR, see [Figure 15](#). The CVM and IRMS board (if present) are already wired inside the CCR. Only running and connecting external ACE2 communications wiring among other ACE, ACE2, and the Vault computer is required. The ACE2 is located on the interior, attached to the hinged door. To gain access to the ACE2, open the CCR door, unlatch and open the ACE2 enclosure door. See [Figure 14](#).

Figure 14: Internal-Mount, External View



Figure 15: Internal-Mount, Interior View



5.4 Combo Box-Mount Installation

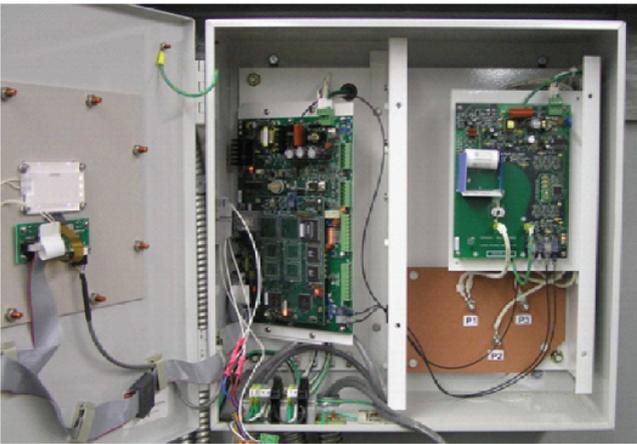
Locate each ACE2 Combo Box unit as close as possible to each of the controllable elements like the Regulator, the Generator, etc.

The Combo Box-Mount must be flush against a wall as in [Figure 16](#) and [Figure 17](#), or on U-channels supporting all four corners of the enclosure. See [Figure 18](#).

Figure 16: Combo Box-Mount, External View



Figure 17: Combo Box-Mount, Internal View



i Note

The ACE2 enclosure is designed to be replaced easily without having to remove any of the mounting hardware. Follow these instructions:

1. Position the enclosure flush on its mounting surface.
Level the enclosure and then open the lid and mark or transfer punch the location of the 3/8" diameter holes in each of the corners of the enclosure. Refer to [Figure 18](#).
2. Remove the ACE2 unit, drill out the marked holes, and insert anchor hardware as required.
DO NOT DRILL THROUGH THE BOX to keep drilling chips and debris from falling into the enclosure.
3. Carefully open the lid of the enclosure.
Use 3/4-20 x 1.0-inch long screws, flat washers, and lock washers to fasten the enclosure to the wall or to rails.
4. Mount the enclosure using the top two holes then install the hardware for the bottom two holes.
5. Attach all conduits to the bottom or to the top access plate ONLY as seen in [Figure 21](#).
6. Protect ALL electronic equipment in the ACE2 enclosure while installing conduit to the BOTTOM or to the TOP access plate.

5.4.1 ACE2 Cable Entry

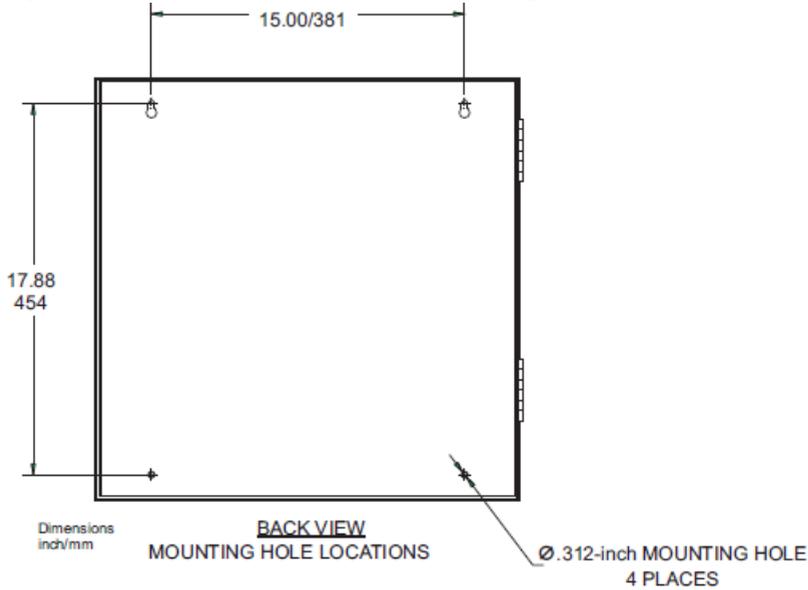


Note

All conduit and wiring must only enter the ACE2 enclosure through the bottom or through the top access plate. This facilitates quick maintenance and replacement of the ACE2 unit.

DO NOT blow out enclosures because metal shavings can damage the electronics.

Figure 18: Combo Box-Mount, Interior Drawing



There are six knockouts each in the top and in the bottom of the enclosure walls for one inch EMT metal conduit fittings for wires and fiber optic cables. See Figure 18 and Figure 19 for dimensions in inches, and see Figure 21 for routing. Power and ACE-to-ACE communication wiring must be in separate conduits.

Figure 19: Combo Box-Mount, Bottom View

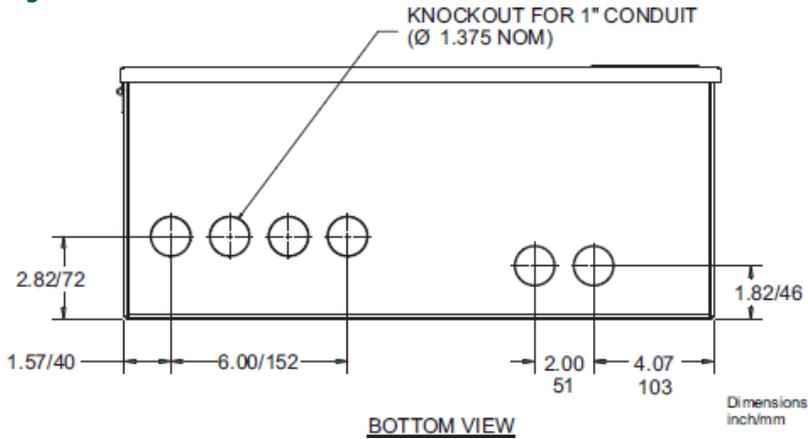


Figure 20: Combo Box-Mount, Top Detail

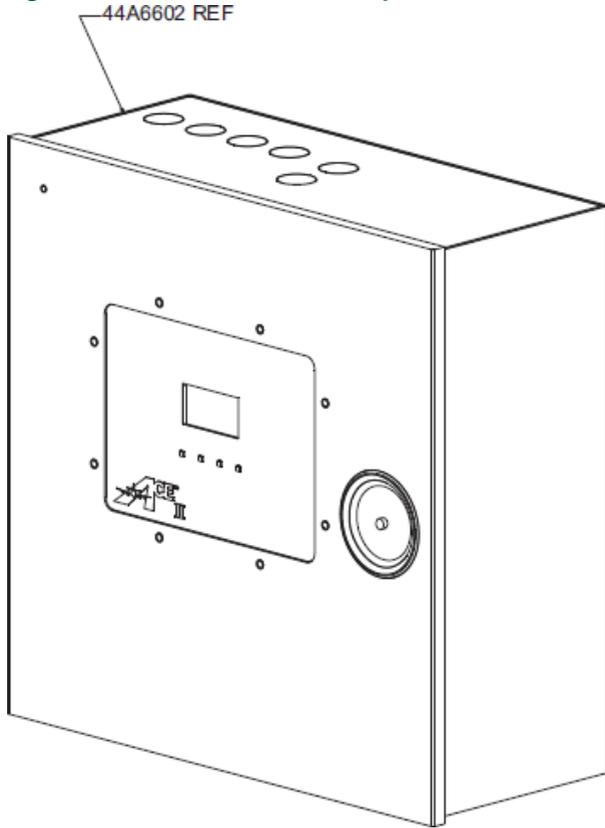
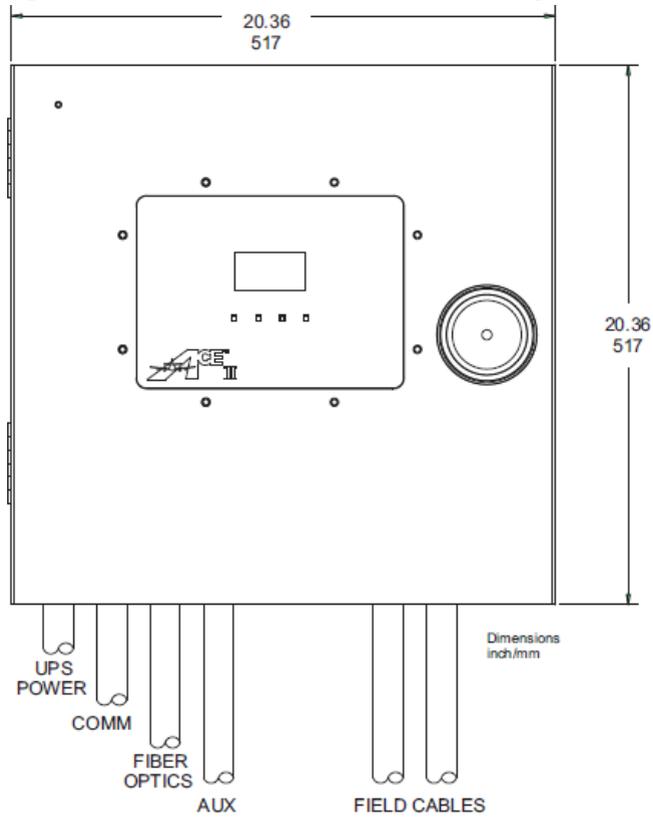


Figure 21: Combo Box-Mount, Conduit Drawing



6.0 Troubleshooting

This section contains troubleshooting information. The information covers only the most common problems. If a solution to the problem is not found with the information given here, contact the local ADB Safegate representative for help.

6.1 Troubleshooting Procedures

Troubleshooting procedures for the Advanced Control Equipment (ACE2) are in this section.



Note

Before beginning, remember that improper or incorrect wiring is the cause of most problems. Check all the wiring for loose connections or possible electrical shorts/opens.

Table 4: Troubleshooting Chart

Problem	Possible Cause	Corrective Action
1. ACE2 Front Panel Status LCD is not illuminated.	No power ACE2 ribbon cable not secure Backlight Power not correctly hooked up.	Make sure the main power LED on the main printed circuit board is illuminated. If this LED is not illuminated then power to the ACE2 is not being supplied. Make sure the ACE2 Main printed circuit board (refer to Figure 4) is receiving 120 VAC at the main power, quick disconnect, terminal block. Make sure all wire connections are secure. Make sure the ACE2 Main Printed circuit board On/Off switch is On. If the main power LED on the input/output printed circuit board is illuminated, make sure the ribbon cable that connects the front panel display to the ACE2 processor board is secure. Make sure the connection for the LCD backlight power is connected. (refer to Figure 22)
2. Either of the Internal Processor Board Diagnostic LEDs is frozen On or Off.	Board not seating properly No power	Reseat the PC board. Cycle the power to the ACE2. If the problem still persists, contact the ADB Airfield Solutions service representative.
3. Lamps out board LEDs are not flashing.	No power Board not seated properly	Make sure the power LED on the lamps out board is on. If it is not on, turn the power to the ACE2 off. Check the integrity of the header connection on the lamps out board. Turn the power to the ACE2 on. If the problem still persists, contact the ADB Airfield Solutions service representative. Reseat the PC board.
4. ACE2 front panel displays COM A Failure and COM B Failure.	Incorrect ACE type in a Stand Alone installation Loose Communications connection with other ACE2 units.	The ACE has been configured to communicate with a host system. Contact ADB Airfield Solutions for further assistance. Check both sides of the communications wiring make sure it is securely plugged into both the other devices.
5. Modified CONFIG data is not being saved.	Loose connection on Main Board with Non-Volatile Memory.	Turn off power to ACE2 and open enclosure. Check Non-Volatile memory at U6. (Figure 22) Check to make sure it is secure.
6. No IRMS version number is displayed.	IRMS board not connected via fiber optic cable No power.	Connect IRMS board via fiber optic cable to the ACE2. Connect power to IRMS board.
7. Every time the ACE2 resets when using ALCMS Step setting drops to step 0.	If ACE2 was configured for Stand-Alone, and was used in ALCMS mode, upon reset the ACE2 attempts to go passive. The Regulator begins to operate at Step 0.	Call ADB Airfield Solutions, for assistance.

Table 4: Troubleshooting Chart (continued)

Problem	Possible Cause	Corrective Action
8. Incorrect voltage and/or current reading occurs on the ACE2 front panel display.	No power. Fiber optic cable not connected.	Check the Current Voltage Monitor (CVM) power source. Check the fiber optic connection from the Lamps-Out Board to the CVM.
9. Low VA displayed on LCD panel and all CCR steps.	CCR shorted Part of field load is shorted or not operating.	CCR output may be shorted. Remove the short from the CCR output. The most common reason for this is an alteration of the field. If this is the case recalibrate the load using the Lamps-Out Calibration. If that is not the problem check the field circuit completely and correct any problems.
10. Periodic IRMS megging is not being performed	No power. Fiber optic cable not connected. IRMS configuration not set properly.	Verify the IRMS has power. Check the fiber optic connection from the IRMS to the ACE2 processor board. Verify the IRMS date, time, and period are set correctly.

The second bank of LEDs indicates communication status and internal processor board diagnostic status. This bank of LEDs also form binary error codes. These are used by ADB Airfield Solutions to determine board level problems. [Table 4](#) summarizes the function of the Processor Board LEDs and enumerates the function of the Lamps-Out Board LEDs listed in [Table 5](#).

Table 5: Processor Board LED Description

Circuit Board Label	LED Description	Normal Working Operation
D1	Processor board Power	Always On
D7	Flashing Interval Indicates CPU Load	Flashing
D8	CPU Running Indication	Flashing
D9	Not Used	Off
D10	Lamps-Out Monitoring or IRMS Communication Transmitting	Flashing if LOM or IRMS is Installed
D11	Lamps-Out Monitoring or IRMS Communication Transmitting	Flashing if LOM or IRMS is Installed and Responds
D12	RS232 Communication Port Status	Flashing if there is Communication
D13	Channel B Communications Port Status	Flashing if there is Communication
D15	Channel A Communications Port Status	Flashing if there is Communication

Table 6: Lamps-Out Board LED Description

Circuit Board Label	LED Description	Normal Working Operation
D10	Lamps-Out Board Power	Always On
D2	Idle Task Running	Always On
D3	Processor Heartbeat	Flashing
D4	Communications with ACE2 control board	Flashes when communicating
D6	Channel 0 communications with a CVM	Flashes when communicating
D7	Channel 1 communications with a CVM	Flashes when communicating
D8	Channel 2 communications with a CVM	Flashes when communicating

6.2 Error Messages

Table 7: Error Messages

Error Message	Possible Cause	Corrective Action
Lcl (Local Control) This message is located on the bottom of the LCD screen in smaller lettering	The regulator has been turned into Local Control mode.	N/A
Rmt (Remote Control) This message is located on the bottom of the LCD screen in smaller lettering	The regulator has been turned into Remote Control mode.	N/A
LoP (Loss of Power) This message is located on the bottom of the LCD screen in smaller lettering	There is a loss of main power in the regulator. The Input wiring may be damaged	Restore power to the Regulator. Locate the input that monitors the Primary Power at J4 Pin 9 (Figure 22) see specific wire diagram for the situation, and make sure connection is being made.
COM A Failure	The ACE2 is configured for ACLS mode, but is meant to be a Stand-Alone system. The ACE, ACE2 or Vault that is connected though COM A is not powered up. The COM A cable is unplugged or loose.	Call ADB Airfield Solutions for assistance if this is the situation Power up the other unit. Check to ensure the cable is securely attached to the ACE2, as well as the other unit to communicate with.
COM B Failure	The ACE2 is configured for ACLS mode, but is meant to be a Stand Alone system. The ACE, ACE2, or Vault that is connected though COM B is not powered up. The COM B cable is unplugged or loose.	Call ADB Airfield Solutions for assistance if this is the situation. Power up the other unit. Check to ensure the cable is securely attached to the ACE2, and to the other unit.
Pr Power Failure (Primary Power Failure)	There is a loss of main power in the regulator. The Input wiring may be damaged	Restore power to the Regulator. Locate the input that monitors the Primary Power at J4 Pin 9 (Figure 22) see specific wire diagram for the situation, and make sure connection is being made.
Low VA	The ACE2 is not correctly calibrated. The regulator has a bad field circuit or has become shorted.	Run though the Lamps-Out Calibration; during that process the ACE2 calibrates the system. Recalculated the present load, and adjust accordingly.
Incorrect Current (Incorrect Current)	ACE2 configuration does not match regulator. The ACE2 is not properly reading the steps of the regulator. (In Stand-Alone Only) The regulator is not outputting the correct current levels.	Make sure that the ACE2 is configured for 3 Step or 5 Step depending on the regulator. Ensure the regulator is set to 6.6A or 20A depending on the regulator type. In the lower left corner of the LCD screen, the step of the regulator is displayed, if this does not match the actual step, there is a problem with the internal wiring. See wiring diagrams. There is an internal problem in the regulator; call ADB Airfield Solutions for further assistance. Return CCR to RMT control.
Protective Shutdown CHECK THE CALLOUT (Protective Shutdown)	The regulator had an error such as Open Circuit or Low VA and was shut down. The regulator was commanded On but has no output current.	Check the Regulator for open connections and visible damage. Restart the system.

Table 7: Error Messages (continued)

Error Message	Possible Cause	Corrective Action
Over Current	The regulator's output has gone above the acceptable threshold. The ACE2 is set to the incorrect regulator values.	Open Circuit problems, or the SCR has become damaged. Check the SCR and all connections. Check to ensure the ACE2 is set for the current regulator. If the regulator is a 20A output, ensure ACE2 is set to 20A. If the regulator is a 6.6A output ensure ACE2 is set to 6.6A.
Open Circuit	The regulator does not have a connection to the load. Or the field circuit is open.	Remove main power. CAREFULLY Check all connections in field circuit.
Lamps-Out Warn (Lamps-Out Warning)	Too many lamps have gone out passing the set threshold. The Lamps-out warning threshold is too low.	Replace burned-out lamps. Reset the Lamps-out threshold using the display in standalone. (Figure 7) Or use ACLMS configuration.
Lamps Out Alarm	Too many lamps have gone out passing the set threshold. The Lamps out Alarm threshold is too low.	Replace burned-out lamps. Reset the Lamps-out threshold using the display in stand-alone. (refer to Figure 7) Or use ACLMS configuration.
Insulation Warn (Insulation Warning)	Somewhere on the load a wire has become exposed, allowing current to flow to ground. The Insulation Alarm threshold is too low.	Check load for damaged lines. Reset the Insulation threshold using the display in standalone. (Figure 7) or use ACLMS configuration.
Insulation Alarm	Somewhere on the load a wire has become exposed, allowing current to ground out. The Insulation Alarm threshold is too low.	Check load for damaged lines. Reset the Insulation threshold using the display in stand-alone. (refer to Figure 7) or use ACLMS configuration.
In Local Control	The regulator is set in Local Control mode.	N/A

6.3 Wiring Schematics

This section provides wiring schematics for L-827/L-829 Advanced Control Equipment (ACE2).

See Figure 30 for the L-827/L-829 ACE2 wiring connections to the constant current regulator (CCR).

6.3.1 Connectors

Figure 22: Internal Connections

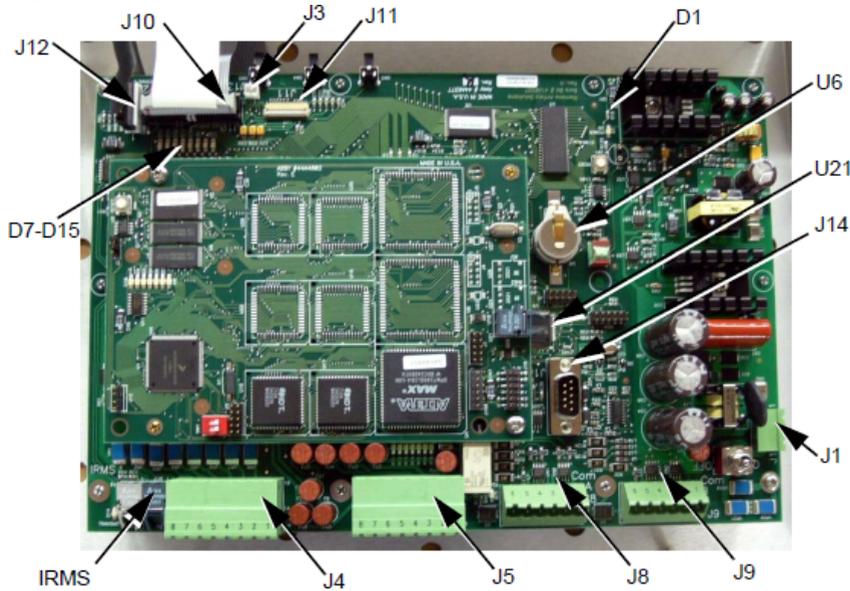


Table 8: Main Board Connectors

Function	Description
J1	Input Power
J4	Discreet Input ¹
J5	Discreet Output ²
J8	Com A RS-422
J9	Com B RS-422
J10	LCD Board Ribbon Cable Connector
J11	LCD Connection Ribbon Cable Connector
J12	External Keypad Connection
J13	ACE2 External Display Power
J14	Configuration Port RS-232
U6	Non-Volatile Memory
U21	CVM Fiber Optic Port
D1	Internal Power Present LED
D7 thru D15	Internal Status LEDs
IRMS	IRMS Fiber Optic Interface Connection

Notes

- ¹ A. Terminal block J4 accepts any discrete contact closure that uses 24 to 250V AC/DC control voltage. Examples of useful inputs are: CCR Over Current, CCR Over Voltage, CCR Primary Power, CCR Remote Local, CCR Open Circuit, CCR Access Door open, etc.
- ² B. Terminal block J5 carries system latching relay outputs that are used to control brightness steps of a CCR. These outputs can also be configured to control any element that requires an ON/OFF contact closure. The output current is 1A max so 20 AWG wire or larger is suggested. In addition, these terminal blocks can be configured to control both CCR brightness steps and a L-847 Circuit Selector Switch.

Figure 23: ACE2 PCB to URClI/I PCB for CCF 3 and 5 Step CCR

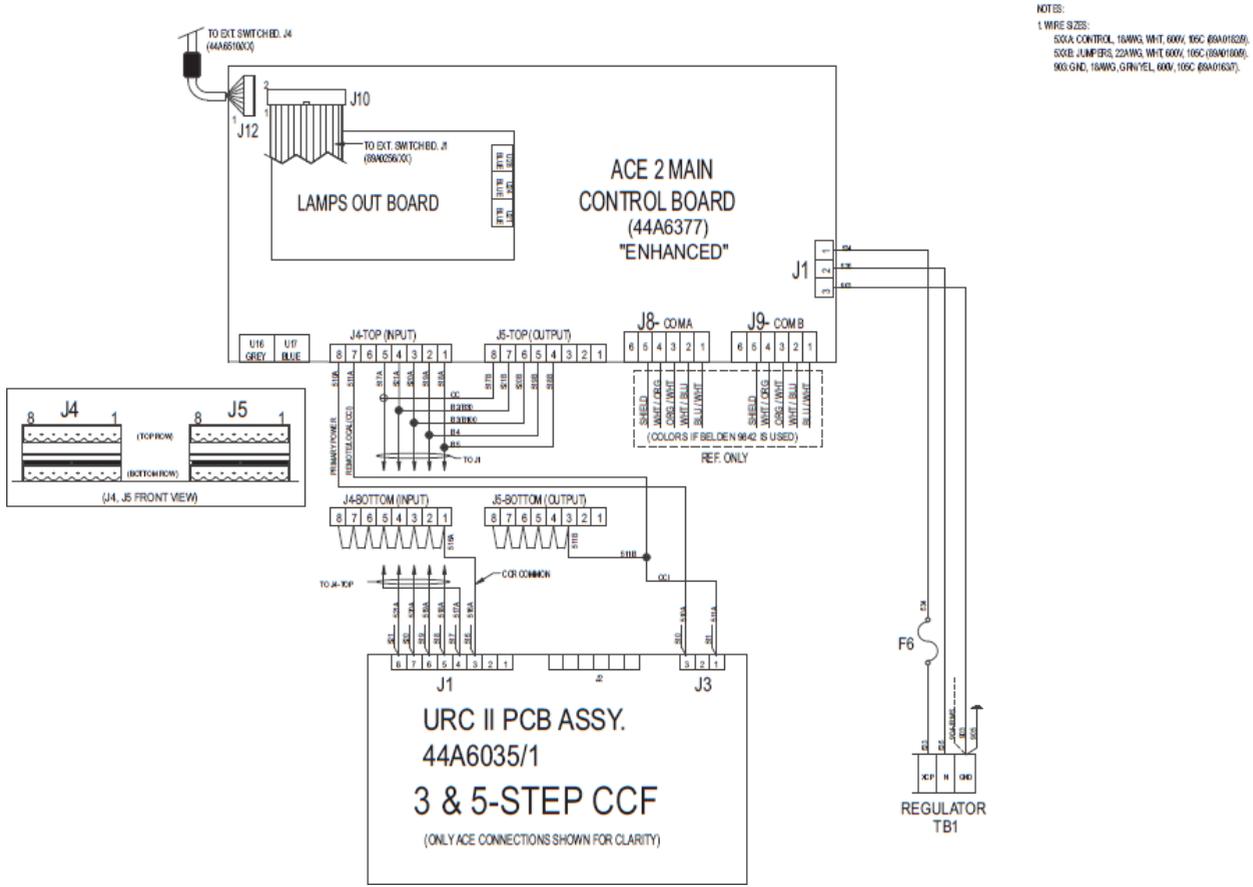


Figure 24: ACE2 PCB to CCT 3 and 5 Step Control PCB

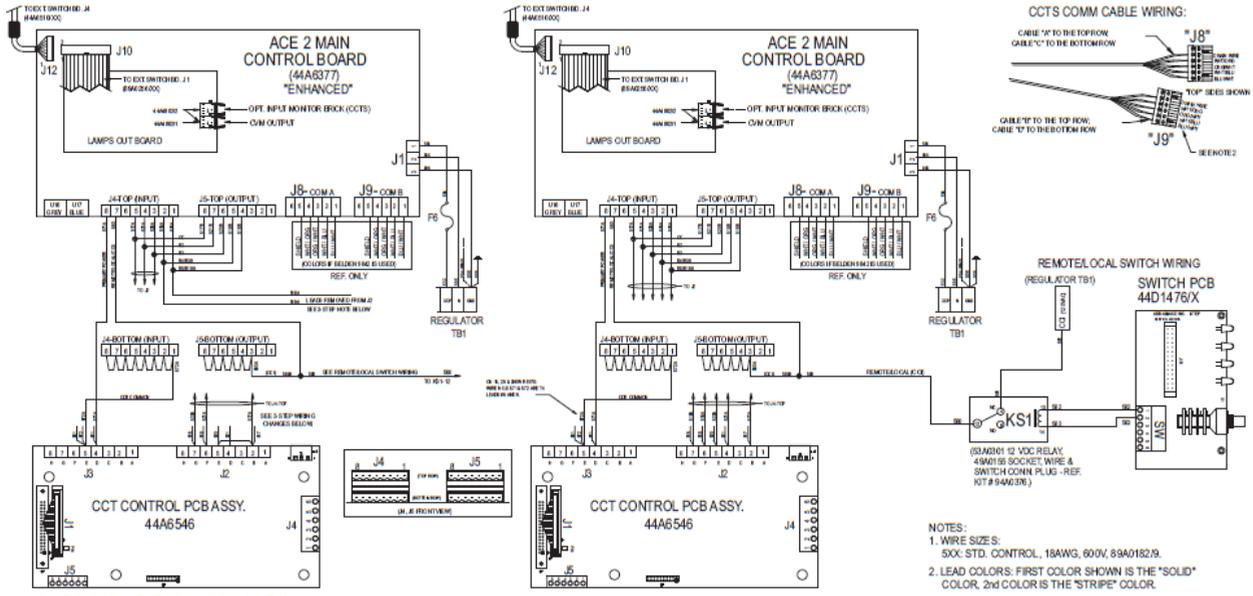


Figure 25: ACE2 Internal and Combo Box Wiring

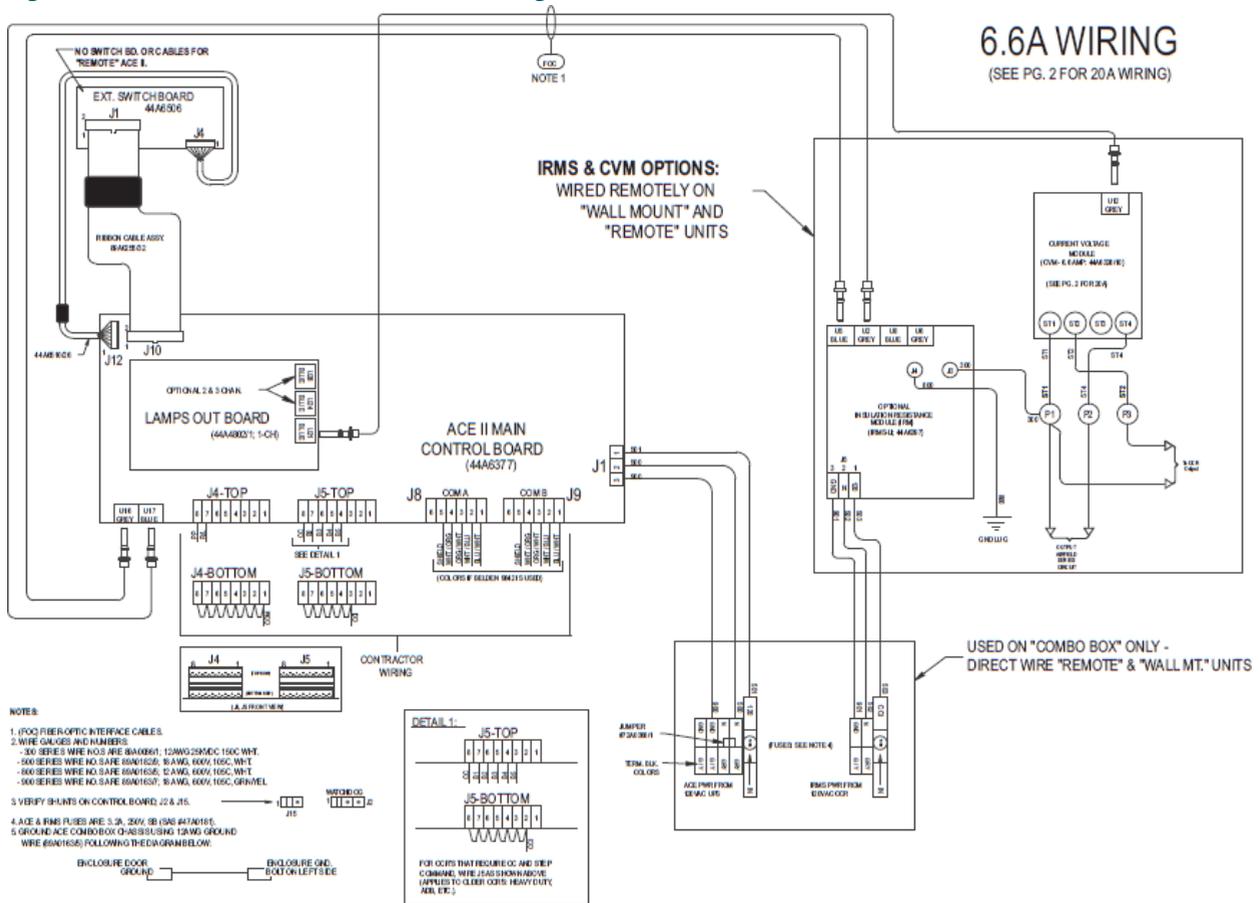
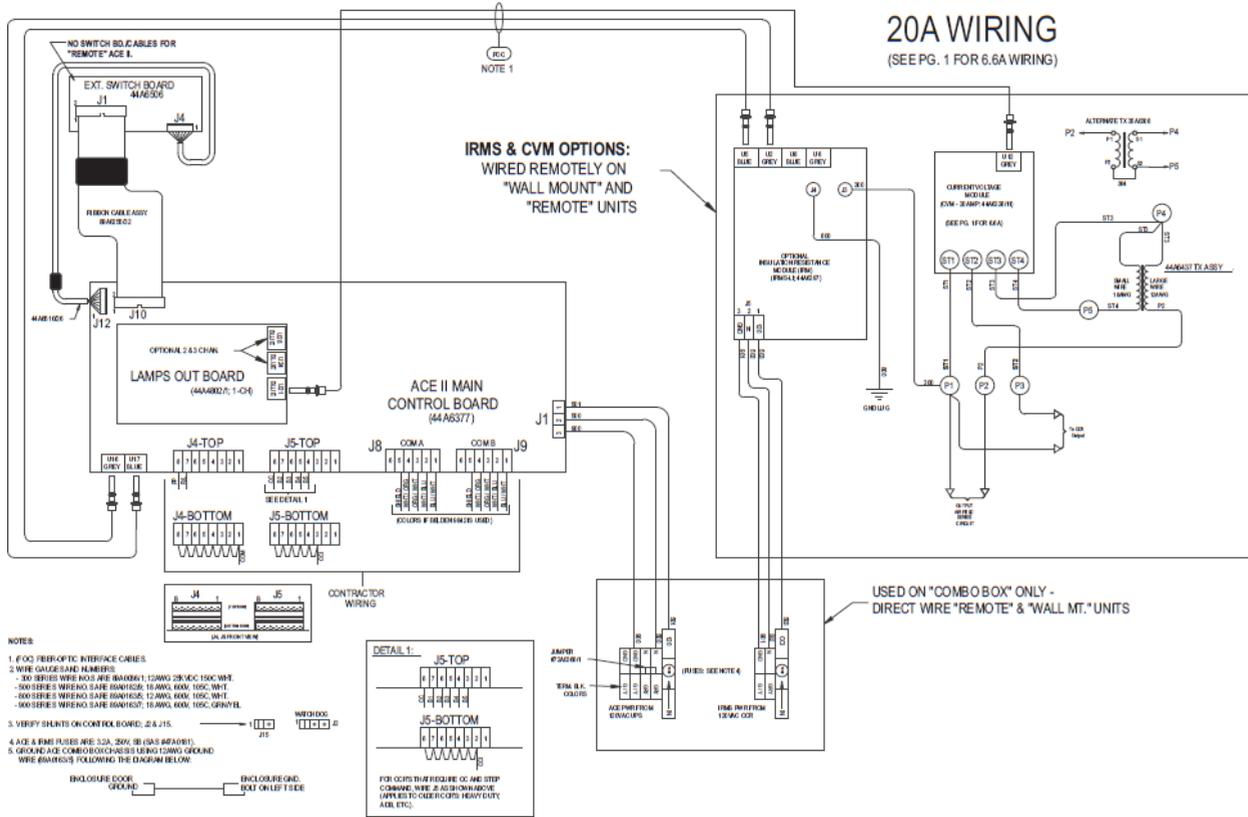


Figure 26: ACE Combo/Wall-Mount Internal



7.0 Parts

To order parts, call ADB Safegate Customer Service or the local ADB Safegate representative. Use this four-column parts list to describe and locate parts.

This description uses a fictional number to show the use of the parts list sections. It does not provide the actual parts list.

The Part Number column gives the ADB Safegate part number. The Description column gives the part name, its dimensions, and other characteristics when appropriate. Indentions show the relationships among assemblies, subassemblies, and parts.

Table 9: Simulated Parts List

Part Number	Description	Quantity	Note
44A6602-101320	Assembly	1	1
xxxxxxx	Part	1	
xxxxxxx	Part or Assembly		
xxxxxxx	Assembly	1	

Notes

¹ NOTE A

The Quantity column contains the quantity required per unit, assembly, or subassembly. The code AR (As Required) is used if the part number is a bulk item ordered in quantities or if the quantity per assembly depends on the product version or model.

The Note column contains letters that refer to notes at the end of each parts list. Notes contain special ordering or product/part version information.

7.1 Parts List

L-827/L-829 ACE2 Ordering Code

This subsection provides the ordering code for the L-827 Advanced Control Equipment (ACE2).

Table 10: ACE2 Spare Parts List

Part Number	Description	Quantity	Note
33A0079	Cable, Flat Ribbon	1	
44A4802-1	PCB Assembly – Lamps-Out Monitoring 1- channel	1	
44A4802-2	PCB Assembly – Lamps-Out Monitoring 2- channel	1	
44A4802	PCB Assembly – Lamps-Out Monitoring 3- channel	1	
44A6377	PCB Assembly – Main	1	
44A6494	LCD Display	1	

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

Live Technical Support - Americas

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ADB SAFEGATE **Americas Technical Service & Support (US & Canada): +1-800-545-4157**

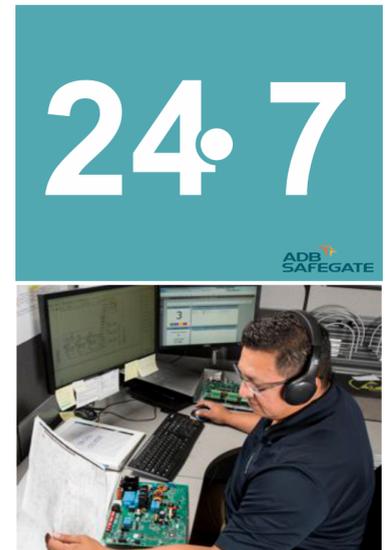
ADB SAFEGATE Americas Technical Service & Support (International): +1-614-861-1304

During regular business hours, you can also Chat with a Service Technician. We look forward to working with you!

Before You Call

When you have an airfield lighting or system control system problem it is our goal to support airfield maintenance staff as quickly as possible. To support this effort we ask that you have the following information ready before calling.

- The *airport code*
- If not with an airport, then company name (prefer customer id number)
- Contact phone number and email address
- Product with part number preferable or product number
- Have you reviewed the product's manual and troubleshooting guide
- Do you have a *True RMS* meter available (and any other necessary tools)
- Be located with the product ready to troubleshoot



Note

For more information, see www.adbsafegate.com, or contact ADB SAFEGATE Support via email at support@adbsafegate.com or

Brussels: +32 2 722 17 11

Rest of Europe: +46 (0) 40 699 17 40

Americas: +1 614 861 1304. Press 3 for technical service or press 4 for sales support.

China: +86 (10) 8476 0106

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.

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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

ADB SAFEGATE	ADB SAFEGATE, Belgium: Leuvensesteenweg 585, B-1930 Zaventem Belgium
Contact: Tel.: +32 2 722 17 11, Fax: +32 2 722 17 64	Email: marketing@adbsafegate.com Internet: www.adbsafegate.com
Americas LLC	ADB SAFEGATE, Americas: 977 Gahanna Parkway, Columbus, 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 AB	ADB SAFEGATE, Sweden: 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 Airfield Technologies Ltd. China	ADB SAFEGATE, China: Unit 603, D Block, CAMIC International Convention Center, No 3, Hua Jia Di East road, ChaoYang district, Beijing 100102 P.R. China
Contact: Tel.: +86 (10) 8476 0106, Fax: +86 (10) 8476 0090	Email: china@safegate.com Internet: www.adbsafegate.com
ADB SAFEGATE Germany GmbH	ADB SAFEGATE Germany GmbH, Mannheim: Konrad-Zuse-Ring 6, D-68163 Mannheim Germany
Contact: Tel.: +49 (621) 87 55 76-0, Fax: +49 (621) 87 55 76-55	Email: marketing@adbsafegate.com Internet: www.adbsafegate.com



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