

AcuTemp[®] AX56L
(formerly HemaCool[®])



Model HMC-MIL-3
NSN 4110-01-706-6634

USER MANUAL

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**Read Safety Summary on page vii before
operating or servicing this product, and prior
to reading the rest of this document.**

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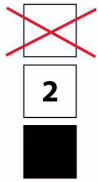
Acronyms and Abbreviations

° C	Degrees, Celsius
° F	Degrees, Fahrenheit
A	Ampere
A:	Ambient [temperature]
AC	Alternating Current
Amb	Ambient
AUX	Auxiliary
B:	Battery [voltage]
BAT:	Current status of internal batteries
BTU	British Thermal Unit
C	Celsius
CD	Compact Disk
CFR	Code of Federal Regulations
Chg %	Change Percentage
cm	Centimeter
COMx	Communications Port [number]
COMP F	Compressor [fast speed]
COMP	Compressor [slow speed]
CPU	Central Processing Unit
csv	Comma-separated values
curr	Current
DC	Direct Current
DOT	Department of Transportation
E:	Evaporator [temperature]
EDT	Eastern Daylight Time
EEPROM	Electrically Erasable Programmable Read Only Memory
EST	Eastern Standard Time
Evap	Evaporator
EXT, Ext	External
EXT PWR	External Power
F	Fahrenheit
FREEZ	Freeze mode
GB	Gigabyte
GMT	Greenwich Mean Time
hh	Hours
hr	Hour
Hz	Hertz
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
IMDG	International Maritime Dangerous Goods
INT BATTERY	Internal Battery power

Acronyms and Abbreviations

In.	Inch
Info	Information
kg.....	Kilogram
LCD	Liquid Crystal Display
lb.....	Pound
LED	Light Emitting Diode
LiFe PO ₄	Lithium Iron Phosphate
LMD.....	Last Measured Discharge [register]
Maint.....	Maintenance
MAX, max.....	Maximum
Max T	Maximum Temperature
MB	Megabyte
MGW	Maximum Gross Weight
MIN.....	Minimum
Min T	Minimum Temperature
mL.....	Milliliter
min	Minutes
Mon.	Monitor
MOSFET	Metal-Oxide Semiconductor Field-Effect Transistor
NACH	Nominal Available Capacity High [byte register]
NACL.....	Nominal Available Capacity Low [byte register]
NSN.....	National Stock Number
OK	Okay
P:	Payload [temperature]
P/N	Part Number
PC	Portable Computer
Pgm.....	Program
PMCS.....	Preventive Maintenance Checks and Service
psi.....	Pounds per square inch
qual.....	Qualifying
SN:	Serial Number
Sys	System
TEMP, Temp.....	Temperature
USB	Universal Serial Bus
V	Volt
VAC	Volts Alternating Current
VDC.....	Volts Direct Current
Ver.....	Version
W.....	Watt

Safety Summary



Do Not Stack More Than 2 High



Mandatory – Follow Operating Instructions



Fragile, Handle with Care



This Side Up



Heavy Load – Two Person Lift



Cold Object Inside – PPE Required



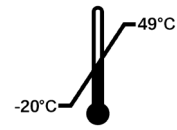
Warning – Dangerous Voltage



Warning



Direct Current



Acceptable Operating Temperature Range



Country and Date of Manufacture



Medical Device



Use-By Date



Separate Collection for Waste Electrical/Equipment

General Safety Instructions

This manual describes equipment with physical characteristics which may cause injury to personnel or damage to equipment if not properly followed. This safety summary includes general safety precautions and instructions that must be understood and applied during operation and maintenance to ensure personnel safety and protection of equipment. Prior to performing any task, review the WARNING, CAUTION, and NOTE statements included in that task to ensure that they are understood.

If any serious incident occurred in relation to the AX56L device, contact CSafe using the information on the title page. If sold in the European Union, also contact the competent authority of the Member State the user is established within.

Any residual risks to be communicated to the user can be summarized within the warnings and caution callouts throughout this manual. Any other residual risks can be mitigated by following the User Preventive Maintenance described in Chapter 5.

Read This User Manual



WARNING

This equipment must be operated only by personnel properly trained in its use and operation. Failure to comply with the instructions provided can result in serious injury or death to personnel. Personnel unable to read or understand these instructions must not operate this equipment.



WARNING

The information available on the LCD (that is, current display information and data log records) must be reviewed to verify that the product has been maintained at the appropriate temperature during storage and shipment before the payload product is used. If the temperature has exceeded the permissible temperature range for the bio-medical products in the payload compartment, consult a bio-medical technician or other qualified personnel to determine the appropriate disposition of the payload. Failure to comply can result in injury or death to personnel.

CAUTION

Failure to understand the purpose and function of the controls and LED readouts explained in this user manual could result in the loss of stored blood, blood products, or medical supplies and possibly damage the unit.

Do not use the AX56L until all of the information in this manual has been read. Follow all procedures as written.

Selecting the wrong set point for bio-medical materials can damage or destroy them. It is the user's responsibility to choose the control set point that matches the temperature requirements of the payload. If in doubt, contact the manufacturer of the bio-medical materials to be stored for the appropriate temperature requirements, so that the correct control set point is selected. The set point selected (COOL or FREEZE) is indicated on the third row of the LCD Information Page 1 (see *Display and Control Panel*, Chapter 2).

Warnings, Cautions, and Notes

Warnings and cautions are used in this manual to highlight operation or maintenance procedures, practices, conditions or statements which are considered essential to protection of personnel (WARNING) or equipment (CAUTION). Warnings and cautions immediately precede the step or procedure to which they apply. Warnings and cautions consist of four parts: Heading (WARNING or CAUTION), a statement of the hazard, minimum precautions, and possible result if disregarded. Notes are used to highlight operating or maintenance procedures and practices that are not essential to protection of personnel or equipment.

A warning highlights a condition which could result in injury or death of personnel



WARNING

A warning highlights an essential operating or maintenance procedure, practice, condition, statement, and so forth, which if not strictly observed, could result in injury to, or death of, personnel or long term health hazards. Failure to comply can result in serious injury or death to personnel.

A caution highlights a condition which, if not observed, could result in damage to equipment:

CAUTION

A caution highlights an essential operating or maintenance procedure, practice, condition, statement, etc., which if not strictly observed, could result in harm to equipment. Failure to comply can result in damage or destruction of equipment.

A note highlights a condition that varies from the norm and deserves special attention, but does not represent a threat of injury or death to personnel or damage or destruction to equipment:

NOTE

A note highlights an unusual condition or procedure



GENERAL WARNING: OPERATOR SKILL LEVEL (pg. ix)

This equipment must be operated only by personnel properly trained in its use and operation. Failure to comply with the instructions provided in this manual can result in serious injury or death to personnel. Personnel unable to read or understand these instructions must not operate this equipment.

Failure to understand the purpose and function of the controls and LED readouts explained in this user manual could result in the loss of stored blood, blood products, or medical supplies and possibly damage the unit.



GENERAL WARNING: POST-STORAGE/SHIPMENT DATA CHECK (pg. ix, pg. 4-5)

The information currently available on the LCD and in the data logs must be reviewed to verify that the product has been maintained at the appropriate temperature during storage and shipment before the payload product is used. If the temperature has exceeded the permissible temperature range for the biomedical products in the payload compartment, consult a biomedical technician or other qualified personnel to determine the appropriate disposition of the payload. Failure to comply can result in injury or death to personnel.



GENERAL WARNING: DEVICE POSITION (pg. 2-7, pg. 4-1)

Before operating the AX56L, position the device such that the battery disconnect switch is free from obstruction and is easily accessible.



GENERAL CAUTION: POWER CONNECTION SEQUENCE (pg. ix, pg. 1-3, 4-1)

Connect power to the AX56L in the following sequence to ensure proper initialization of the onboard electronics:

1. Turn on battery power switch.
2. Ensure that the internal battery cable harness is connected to onboard batteries (2 ea. lead acid; see operating instructions in Chapter 4).
3. Ensure that the 3.6 V lithium battery is properly installed (positive side towards payload compartment; see operating instructions in Chapter 4).
4. Ensure that all internal cover panels are installed.
5. First, plug the AC power cord into the MIL-STD port of the AX56L, and then plug the three-prong end into a mains AC power outlet (the exhaust fan will activate and should be slightly audible).
6. At all times, clear access must be provided to AC mains electrical power source that the AX56L is plugged into, so that one can easily and safely disconnect it.
7. For the AX56L unit to power on, charged and fully functional batteries must be installed. The unit will not operate with AC power if functioning batteries (2 ea. lead acid) are not properly installed (see operating instructions in Chapter 4.)

Failure to follow these instructions can result in damage to the unit or loss of the biomedical payload.



GENERAL WARNING: CERTIFIED PARTS USAGE (pg. 1-4)

Only parts certified and supplied by CSafe shall be used in the AX56L. Failure to follow these requirements will void the equipment warranty and could result with injury to personnel. Parts replacement shall be by authorized service personnel only.



GENERAL WARNING: DEVICE ORIENTATION (pg. 2-7)

If the new unit has been shipped or stored inverted or on its side, allow it to sit upright at least two hours before operating.

Shipping and storage of the AX56L in a non-vertical position is not recommended! Temperature integrity of bio-medical payloads cannot be maintained when the unit is tilted more than 30 degrees. Failure to follow these instructions can result in damage to the unit or loss of the biomedical payload.



GENERAL WARNING: REMOVING OUTER (GREEN) LID (pg. 2-7)

Exercise care when removing the outer lid as it is not attached and should be stowed in a safe manner to prevent injury to personnel. On units without hinged lid, exercise care when removing the outer green lid as it is not attached and should be stowed in a safe manner to prevent injury to personnel.



GENERAL WARNING: REMOVING INNER (WHITE) LID (pg. 2-7)

Exercise care when opening inner lid to prevent falling on operator and possibly causing injury to personnel.



GENERAL CAUTION: STORAGE & AMBIENT CONDITIONS (pg. 3-1)

Shipping and storage of the AX56L in a non-vertical position is not recommended! Temperature integrity of bio-medical payloads cannot be maintained when the unit is tilted more than 30 degrees.

Use the COOL ($4^{\circ} \pm 0.6^{\circ} \text{ C}$ [$39.2^{\circ} \pm 1.1^{\circ} \text{ F}$]) temperature setting only with materials that must be stored above freezing.

Use the FREEZE ($-22^{\circ} \pm 0.6^{\circ} \text{ C}$ [$-7^{\circ} \pm 1.1^{\circ} \text{ F}$]) temperature setting only for materials that must be stored frozen.

If the new unit has been shipped or stored inverted or on its side, allow it to sit upright at least two hours before operating.

Do not store the unit in ambient temperatures below -30° C (-22° F) or over 65° C (149° F).

Unit service life shall be considered to be 7 years when operated in accordance with the conditions listed herein. The unit may be used beyond the 7 year life at the risk of the end user, and should be disposed of when the device no longer functions as described throughout this manual. Disposal shall be performed based on local environmental regulations, especially concerning the batteries and refrigerant (R134a).

Do not operate the unit in the COOL or FREEZE mode in ambient temperatures below -20° C (-4° F) or above 49° C (120° F). Do not transport the unit without the outer lid in place and all inner lid and outer lid latches locked.

During operation, the unit must be situated so that air outlets are open and unblocked. The unit should not be operated in a small, unventilated area. The refrigeration system must be allowed to release heat to cool the payload properly.



GENERAL CAUTION: TRANSPORTATION PREP (pg. 4-1)

Do not transport the AX56L with either the exterior or interior lid unlatched. All exterior and interior lid latches must be firmly fastened for transport. Failure to comply can result in equipment damage.



GENERAL CAUTION: PRE-LOAD PAYLOAD PREP (pg. 4-3)

The AX56L must be started on AC power with the onboard batteries connected and allowed to operate and stabilize at preset temperatures before the payload is loaded in place. This ensures that the unit's batteries are fully operational. Battery charge level is shown on the display. For optimum field performance, do not begin a portable mission if the battery voltage is below 13.5 volts.

The temperature within the AX56L may reach satisfactory levels for storing the payload well before the batteries are fully charged. However, the unit will not achieve peak energy efficiency until 24 hours of continuous operation have transpired.



GENERAL CAUTION: FREEZE MODE COLD (pg. 4-6)

Be aware, when operating in freeze mode, the payload and its surrounding compartment will be at < -20°C. Prolonged exposure to skin may cause injury. Protective equipment should be worn.



GENERAL WARNING: PAYLOAD OR PRODUCT LEAKAGE (pg. 4-6, 7-4)

In the unlikely event of payload or product leakage, the leaking bag(s) must be disposed of. Contact a biomedical technician or other qualified personnel for the appropriate disposition and clean-up requirements. Using abrasives or harsh chemicals may cause equipment damage or negatively impact the unit service life.



GENERAL WARNING: TWO-PERSON CARRY (pgs. 3-1, 5-3, 6-2, 7-4)

The AX56L unit can weigh up to 152 lbs (69 kg) empty and up to 180 lbs (82 kg) loaded. Always use at least two people when lifting or moving the unit. Failure to comply can result in injury to personnel, or damage to equipment.



**GENERAL WARNING: BATTERY CONNECTION /
DISCONNECTION** (pgs. 3-1, 5-3, 6-2, 7-4)

Before connecting or disconnecting batteries, disconnect all external power sources. Failure to comply can result in injury or death to personnel, or damage to equipment.



**GENERAL WARNING: GENERAL MAINTENANCE
OR SERVICE** (pgs. 3-1, 5-3, 6-2, 7-4)

Before performing maintenance or service, disconnect all external power sources. Turn the battery switch to the OFF position. Service shall be performed by a qualified technician.

Failure to comply can result in injury or death to personnel, or damage to equipment.



**GENERAL WARNING: BATTERY MAINTENANCE
OR SERVICE** (pgs. 3-1, 5-3, 6-2, 7-4)

Before performing maintenance or service on the batteries, turn the battery switch to the OFF position, then remove the cover panel. If corrosion/battery is leakage present, proper PPE must be worn to protect against personnel injury. Battery service shall be performed by a qualified technician.

Failure to comply can result in injury or death to personnel, or damage to equipment.



GENERAL WARNING: POWER CONNECTOR USE (pg. 1-3, 3-4, 4-1, 4-2, and 5-3)

The AC and DC power connectors on the power panel are unique and cannot receive the incorrect power cable. Do not use force the incorrect power cable or other components or items into the connectors. Failure to comply can result in injury or death to personnel, or damage to equipment.



GENERAL CAUTION: SHORTING, OPEN, OR INTERMITTENT ELECTRICAL COMPONENTS (pg. 4-1, 5-3, and 7-4)

The AX56L contains electrical equipment that may be at risk of interference by users and the environment. Ensure the cover panels are secure whenever the AX56L is in use. Any required repair shall only be provided by authorized service personnel. If there is evidence of a possible malfunction, stop use of the AX56L and contact CSafe or authorized service personnel. Failure to comply can result in damage to the unit or loss of the biomedical payload.



GENERAL CAUTION: CHECKING THE 3.6V BATTERY (pg. 3-3, 4-1, and 7-4)

Periodically check the 3.6V battery with a voltmeter to ensure that data collection continues in the event of main power loss. Replace the battery if the recorded voltage is lower than 3.2V. Failure to comply can result in loss of information about the payload.



GENERAL WARNING: FUNCTIONAL COMPONENT HAZARDS (pg. 4-1, 5-3, and 7-4)

Functional components contained within the AX56L present a risk of harm which can include burns, lacerations, and shock. Ensure the cover panels are secure whenever the AX56L is in use. Only authorized personnel with appropriate PPE may remove the cover panels and interact with the AX56L functional components. Failure to comply can result in injury or death to personnel, or damage to equipment.



GENERAL CAUTION: PULL HANDLE USAGE (pg. 3-1, 5-3, 6-2, and 7-4)

The AX56L is equipped with a pull handle and wheels for ease of movement. The handle is designed for pulling the unit, not carrying. **DO NOT** attempt to carry the unit with this handle. Failure to comply may result in damage to the equipment and injury to personnel.

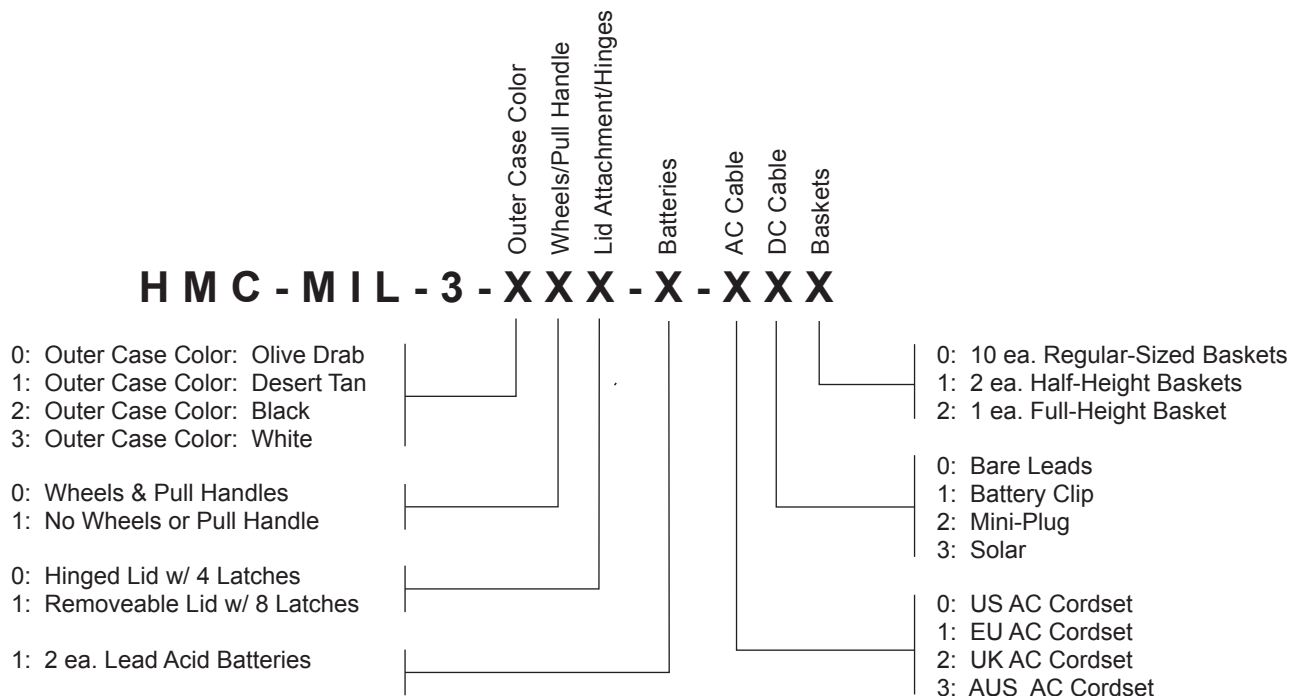
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Chapter 1: Introduction

About This User Manual

This User Manual is divided into chapters that provide a complete description of the CSafe® AX56L Advanced Technology Product Storage and Transport Refrigerator/Freezer. The material presented gives the user the information and procedures needed to provide the safest and most efficient operation of the AX56L. This manual applies to Model HMC-MIL-3 of the AX56L series and includes:

- Safety precautions and procedures to protect personnel and equipment
- Description of the AX56L system and theory of operation
- Function of controls, displays, and indicators
- Operating instructions for use under normal and unusual conditions
- Preventive Maintenance Checks and Service (PMCS) procedures
- Accessories List



General Overview

The AX56L is a self-contained system designed to allow safe transport of materials that must be maintained within a strict temperature range, such as vaccines, medications, reagents, and similar materials. The AX56L is ergonomically designed for quick response operation in the world's harshest operating environments.

Physical Description

The CSafe AX56L is a conventional liquid/vapor-phase refrigerator with a number of special enhancements:

The AX56L is designed to preserve liquid or frozen blood products and medical supplies. AX56L provides exceptional field storage through its combination of superior insulation technology and temperature controls, based on microcontroller solid-state electronics. The device is intended for the temporary storage and transport of product, and not for continuous, static use.

The AX56L's indication for use is preservation and transport of blood products and other life science products. There are no specific clinical conditions, diseases, etc. the AX56L is designed to alleviate, mitigate, prevent, etc., as the blood products or life science products being preserved and transported are defined by the end user. As such, the patient population is not limited to a particular medical condition and can be considered as all end users of blood products or life science products that require its preservation or transportation. The administration of these products is not to be chosen by the patient or user of the AX56L, but instead is performed by a medical professional with an understanding of the patient, their background and condition, and the product to be administered, and will assess whether the overall health, age, etc. of the patient is appropriate to receive the payload that was preserved or transported by the AX56L. The intended user population are medical professionals and 'lay persons', or those without formal education in medical or health, intending to preserve or transport blood products or life science products that may benefit from the positive logistical impact described in the indications for use, and may still successfully operate the AX56L following a review of the User Manual.

The unit's control system works with a number of different power sources without special adapters. The AX56L is portable and self-powered, utilizing internal batteries. The system will accept electrical power from multiple sources, e.g., 12-24 VDC from batteries or other DC sources at the DC power input, or from a wide range of grid power standards (any combination of 100-240 VAC and 50/60 Hz line frequencies) at the AC power input.

AX56L employs vacuum insulation panels to decrease the power required to regulate temperature in a given environment, to increase holdover time when energy sources are lost or disconnected, and to increase internal temperature stability. Small internal fans help circulate cooling air, to maintain uniform temperature.

For example, if the unit is fully stocked with conditioned contents and no power is applied (unit is powered OFF), it will take more than two hours for the internal payload temperature to rise from 4° C (39° F) to 6° C (43° F) in an exterior ambient temperature of 43° C (109° F).

The AX56L's internal design is arranged to accept baskets for holding blood bags (or fresh frozen plasma bags when the unit is operating in FREEZE mode).

The AX56L will perform in either the COOL or FREEZE mode:

In the COOL mode (4° C [39° F]), the unit, provided its internal batteries are properly charged, will maintain a temperature range of 2° C (36° F) to 8° C (46° F) for more than 75 hours at 25° C (77° F) ambient temperature.

In FREEZE mode, using its internal batteries, properly charged, the unit keeps payload frozen for more than 12 hours, at an ambient temperature of 25° C (77° F). FREEZE mode operation, however, reduces the battery-powered hold time for extended product storage where an external power supply is unavailable.

For additional payload security, the AX56L is also equipped with an internal heater that will prevent a refrigerated payload from freezing if the unit is in an environment below 1° C (34° F), but no lower than -20° C (-4° F).

The AX56L includes integral monitoring and logging of payload compartment temperature and battery charging state. The default temperature scale setting for the AX56L is Celsius (° C).

Transportation and Set-Up Safety Instructions

To ensure correct use and personnel safety, the following instructions must be adhered to at all times:

1. The unit is only to be used for the safe transport of bio-medical materials in accordance with all national and international laws and regulations, as they may apply.
2. Movement of the unit by automated equipment should be by performed by certified operators in accordance with local occupational health and safety requirements.
3. When connecting to power source, inspect cables, cords and connections before use. Monitor for proper operation before leaving unit in operation.
4. In the unlikely event of improper operation, immediately remove power and notify qualified service technician.



WARNING

Prior to transporting unit by aircraft, external power must be removed and internal DC power must be removed by turning breaker switch off. See operating instructions in Chapter 4.



WARNING

In the event of power supply or power cable failure – personal injury may result.



CAUTION

See General Caution: Power Connection Sequence



WARNING

See General Warning: Power Connector Use

5. All power connections must be made in the specific order indicated in this manual to ensure that all control and indicator circuits have been initialized and operating correctly to ensure that the selected temperature settings will be maintained as expected.

Minimum List of Substances

Per the AX56L's intended purpose and state-of-the-art standards defining the allowable temperature ranges for specific medical products, see below for a list of blood products and life science products (vaccines) that may be shipped in the AX56L. Note that the list below is not exhaustive, and that other products may also be stored and transported in the AX56L if the temperature ranges provided by COOL or FREEZE mode align with the product's required temperature range, and the payload fits within the AX56L storage area; review technical information for all product intended to be stored by the AX56L to ensure temperature requirements are aligned. Following storage and/or transportation, verification of the efficacy and safety of the payload, and the determination of its eventual use, must be provided by a medical professional even if the product is included on the list below and no temperature excursions occur.

Product	Examples	Storage Temperature	AX56L Mode
Whole Blood (WB)	Whole Blood (no processing after collection), WB with leucocyte removal, etc.	Target: +2 to +6°C Limits: +1 to +10°C	+4°C (Cool Mode)
(Blood) Red Cell Components	WB with major plasma removal, WB with major plasma and leucocyte removal, WB with major plasma and buffy coat removal, WB with major plasma removal in additive solution, apheresis-collected red cells, washed red cells, thawed and reconstituted red cells, etc.	Target: +2 to +6°C Limits: +1 to +10°C	+4°C (Cool Mode)
(Blood) Plasma Components	Fresh frozen plasma, pathogen-reduced fresh frozen plasma, cryoprecipitate, cryoprecipitate-reduced fresh frozen plasma, etc.	Three Month Life: -18° to -25°C	-22°C (Freeze Mode)
Vaccines	Hepatitis A vaccine (2° to 8° C), Cholera vaccine (2° to 8° C), Influenza vaccine (2° to 8° C), Malaria vaccine (2° to 8° C), Polio vaccine (2° to 8° C), Typhoid vaccine (2° to 8° C), etc.	Refrigerated vaccines +2° to +8°C. Frozen vaccines -15° to -50°C.	+4°C (Cool Mode) -22°C (Freeze Mode)

Contraindications

Contraindications are defined as specific situations where the AX56L should not be used as it may present harm or the risk associated with using the AX56L outweighs its benefits. Where warnings and precautions focus on malfunctions, misuse, or changes to the device safety or performance, contraindications are for situations where the risk outweighs the benefits while the device is safe and effective, and is being used correctly. Do not use the device if the below situations arise:

Focus	Contraindications
Battery Duration	Do not use the AX56L if the expected transport duration is beyond the claimed holdover time and there is no reliable access to electric power to charge the AX56L batteries.
Payload Contamination	Do not use the AX56L if the payload is not safely contained in a durable container, such as a sealed blood bag or hard-plastic exterior. The AX56L includes blood baskets to hold payload containers, but exposed blood products without a container are at high risk of contamination.
Temperature Setpoints	Do not use the AX56L if the payload has a unique storage or temperature setpoint requirement that does not align to the Cool Mode or Freeze Mode. AX56L temperature setpoints (+4°C and -22°C) are defined within the center of agreed-upon temperature ranges for the intended payload with an expected fluctuation of $\pm 2^\circ\text{C}$; unique or adjusted payloads with temperature requirements that deviate from the predefined temperature ranges are at risk of not being maintained at their required temperature range. Do not use the AX56L if the possible variation from the provided tolerance exceeds the allowable temperature range for the product being transported.
Payload Monitoring	Do not use the product stored or transported by the AX56L unless the alarm state has been continuously monitored, or the HemaLog data has been reviewed.
Payload Handling	Do not remove or handle product stored or transported by the AX56L without sufficient background knowledge and/or training on how to properly handle, use, or dispose of the payload.
Payload Knowledge	Do not remove or handle product stored or transported by the AX56L without sufficient background knowledge and/or training on the negative impact to patient safety if the payload is compromised; this may include the use of an open container, a temperature excursion, excess storage duration, etc.

Customer Support

Customer support is available via the following methods:

Please contact CSafe® Technical Support at:

(USA) 1-513-360-7189

(International) +1-513-360-7189

(Email) techsupport@csafeglobal.com

Office Hours: 9.00 am – 5.00 pm

Monday – Friday (EST or EDT)

Warranty Information

CSafe warrants the AX56L to be free from defects in material and workmanship. Buyer must notify CSAFE in writing claiming defective material within ninety (90) days after delivery. Absence of such notice constitutes a waiver by Buyer of all claims for defect. Products will operate substantially in conformance with CSAFE published specifications, when subjected to normal, proper and intended usage by properly trained personnel, for a period of one (1) year from the date of shipment to Buyer (the "Warranty Period"). In no event shall CSAFE have any obligation to make repairs, replacements or corrections required, in whole or in part, as the result of (i) normal wear and tear, (ii) accident, disaster or event of force majeure, (iii) misuse, fault or negligence of or by Buyer, (iv) use of the Products in a manner for which they were not designed, (v) causes external to the Products, including but not limited to, power failure or electrical power surges, (vi) improper storage of the Products or (vii) use of the Products in combination with equipment or software not supplied by CSAFE. Product may not be returned to CSAFE until Buyer is in receipt of an RA number (return authorization) from CSAFE. Product shall be returned at the Buyer's expense. CSAFE will inspect all returned product. If returned product qualifies for return, CSAFE will, at its option, either replace the product or credit the Buyer, but CSAFE shall not be liable for loss, damage, or expense directly or indirectly arising from the use of the product or from any other cause. If in CSAFE judgment the product does not qualify for return, CSAFE reserves the right to reject the Buyer's return and will return the product to the Buyer at Buyer's expense. CSAFE's liability shall be expressly limited to the replacement or credit for the value of the defective product. CSAFE shall not be liable for any loss or damage resulting from the handling or use of the product shipped, whether in manufacturing process or otherwise. CSAFE makes no warranty expressed or implied as to the suitability of any of its products in Buyer's applications.

INSTALLATION, MAINTENANCE, REPAIR, SERVICE, RELOCATION, TAMPERS OR ALTERATION TO THE PRODUCTS PERFORMED BY ANY PERSON OR ENTITY OTHER THAN CSAFEE WITHOUT CSAFEE'S PRIOR WRITTEN APPROVAL, OR ANY USE OF REPLACEMENT PARTS NOT SUPPLIED BY CSAFEE OR DESIGNATED 3RD PARTY DISTRIBUTOR, SHALL IMMEDIATELY VOID AND CANCEL ALL WARRANTIES WITH RESPECT TO THE AFFECTED PRODUCTS. THESE WARRANTIES ARE BUYER'S EXCLUSIVE WARRANTIES AND REPLACE ALL OTHER WARRANTIES OR CONDITIONS, EXPRESS OR IMPLIED, INCLUDING, BUT NOT LIMITED TO, THE IMPLIED WARRANTIES AND CONDITIONS OF MERCHANTABILITY, SATISFACTORY QUALITY, OR FITNESS FOR A PARTICULAR PURPOSE.



WARNING

See General Warning: Certified Parts Usage

Service Personnel Training Requirements

Units shall be returned to factory for service or have service performed at CSAFE authorized facility. Factory training for service personnel can be provided at factory upon request.

The AX56L does not require calibration, and cannot be calibrated by the end user. If validation is requested via the end user, units shall be returned to factory or at a CSAFE authorized facility to have measurements validated.

Chapter 2: Equipment Description

Major AX56L Components

Major components are shown in Figure 1, with numbers keyed to the nomenclature in Table 1, AX56L Component Nomenclature.

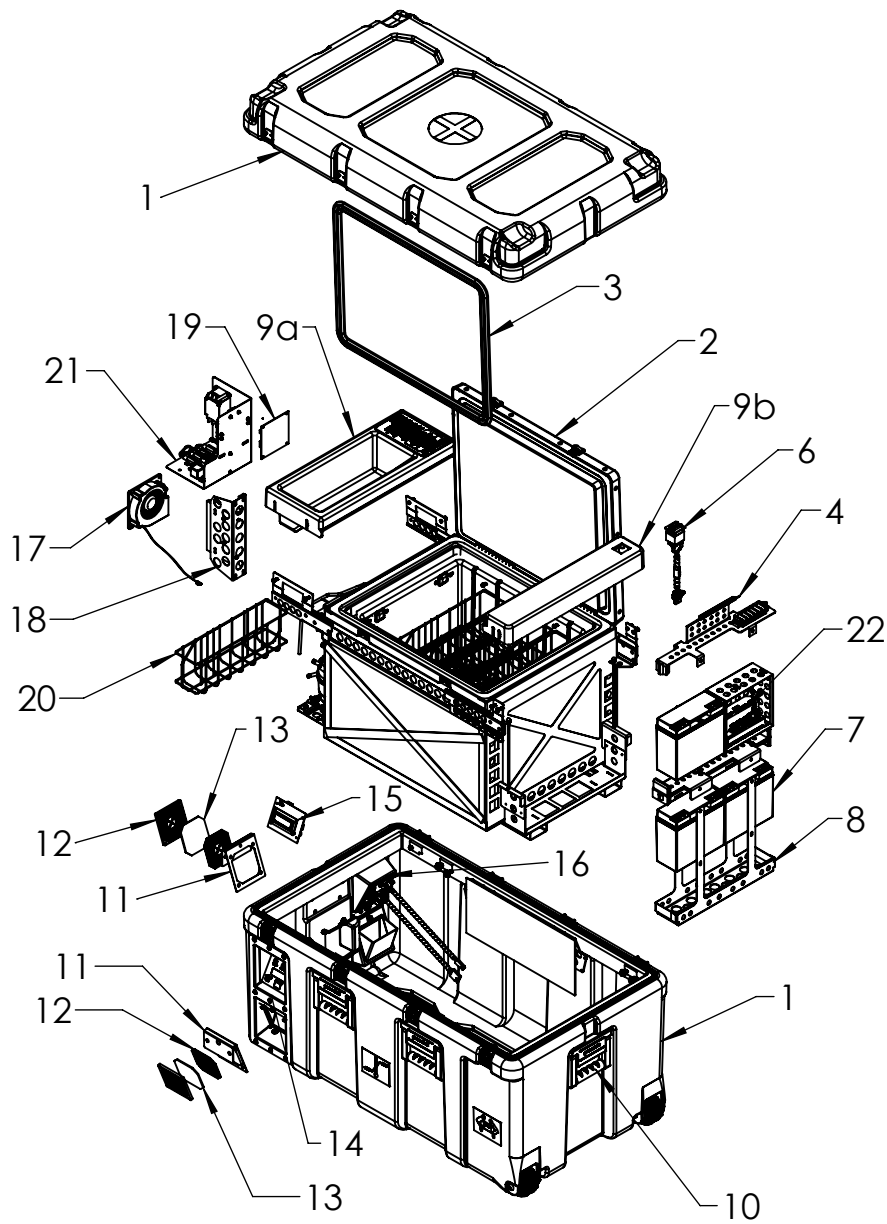


Figure 1. Major AX56L Components

Table 1. AX56L Component Nomenclature

<i>Key</i>	<i>Component</i>	<i>Function</i>
1	Case with lid	Ruggedized military-specification container houses the internal components and provides handles and tie-downs for handling during shipment. This case has a connector panel at the side to connect external AC or DC power, and a user control / display panel on the left front. The outer lid is secured to the lower case with positive locking latches for secure storage and transport, (See Table 2. for case options).
2	Refrigeration compartment and inner lid assembly	The refrigeration compartment is equipped with adjustable wire storage baskets and circulation fans. The payload is stowed inside the refrigeration compartment where the temperature is maintained according to settings entered using the user control. Inner lid assembly seals the refrigeration compartment for efficient temperature maintenance and control. (See Table 2. for basket options).
3	Inner lid gasket	Flexible plastic material that maintains an air-tight seal to help retain a constant temperature inside the refrigeration compartment.
4	Battery lockdown bracket	Secures the 12 volt batteries inside the battery compartment.
5	Battery power harness / Battery jumpers	Connects the 12 volt power source to the power panel. The fusible link is designed to act as a fuse in the event of a power surge that could damage electrical and mechanical components. Not Shown.
6	Battery Disconnect Switch	Allows user to easily disconnect the internal 12 volt battery source before storing the unit.
7	Battery, 12 VDC	During shipment, the AX56L is typically powered by the internal battery located in the right compartment. The battery will maintain the temperature of the refrigeration compartment for a minimum of 12 hours in the FREEZE mode or 75 hours in the COOL mode, at an ambient temperature of 25° C (77° F).
8	Battery compartment	Contains and secures the 12 volt batteries and associated harness and fusible link assembly.
9a 9b	Cover panels	Quick release covers covering the left and right compartments acting as a support frame for inner lid and storage space for accessories. The battery disconnect switch is mounted to the top of the right compartment cover.
10	Handle assembly	(See Table 2. for handle options).
11	Air intake filter mount	Holds the air filter in place in front of the air intake aperture.
12	Plastic filter assembly	Mounting assembly for filter and air intake components.
13	Air filter	Filters the intake air forced into the left and right compartments by the exhaust fan. Replacement filters available in bag of 10 (P/N 101964).
14	Display / control panel and power panel	Control panel is located in the left front of the exterior case. It holds the main display and user controls. Power panel with connectors for external AC and DC power is also located on the opposite side.

<i>Key</i>	<i>Component</i>	<i>Function</i>
15	Control / Display Board	Provides the interface for operating the AX56L. The user interface includes an on/off, display, and mode buttons, graphic display, status indicator LEDs, and adjustment controls.
16	Power panel assembly	The AX56L can be powered using either an external AC or DC power sources from the panel located on the left side of the case. External power is connected via circular connectors. Two user- serviceable fuses are located on the right side of the panel, power circuits including a power conditioner, relays, and fuses supply the proper voltage level to the various electrical components.
17	Fan, 12 VDC	Exhausts air from the refrigeration compartment using power from internal batteries or external power sources.
18	Power supply	Provides for conversion and conditioning of external AC and DC power and internal DC battery power.
19	Power Board	Contains the electronics and solid state control circuits that operate the AX56L cooling and heating systems in response to input from the user control and temperature sensors inside and outside the refrigeration compartment to maintain the desired set point.
20	Basket, blood storage	The refrigeration compartment is equipped with easy-load wire baskets that provide all-around convection and air circulation for uniform temperature control of all payload packs. (See Table 2 for basket options).
21	Filter mounting subassembly	Includes (a) the AC filter and (b) the DC filter, as well as (c) the diode/jumper.
22	Cage Assembly (Charge Controller)	Fixed mounting for the charge controller above the 12 VDC batteries.

Table 2. AX56L Options Nomenclature

<i>Options Sequence</i>	<i>Option</i>	<i>Description</i>
A – Case Color	0	Olive Drab
	1	Desert Tan
	2	Black
	3	White
B – Wheel / Handles	Option	Description
	0	Wheels and pull handle
	1	No wheels nor pull handle
C – Lid Attachment	Option	Description
	0	Hinged case lid with 4 latches
	1	Removable case lid with 8 latches
D – Batteries	Option	Description
	0	N/A
	1	2 ea. lead acid batteries

E – AC Cable	Option	Description
	0	US AC cord set
	1	EU AC cord set
	2	UK AC cord set
	3	AUS AC cord set
F – DC Cable	Option	Description
	0	Bare leads
	1	Battery clip
	2	Mini-plug
	3	Solar
G – Baskets	Option	Description
	0	10 ea. regular-sized baskets
	1	2 ea. half-height baskets
	2	1 ea. full-height basket

Operational Parameters

AX56L Refrigerated Payload Compartment Temperature	
Operating Ambient Temperature Limit	-20° C to 49° C (-4° F to 120° F)
Storage Temperature Limit	-30° C to 65° C (-22° F to 149° F)
COOL Mode Set Point	+4° C (39.2° F) +/- 0.6° C (1.1° F)
FREEZE Mode Set Point	-22° C (-7.6° F) +/- 0.6° C (1.1° F)

AX56L Refrigerated Compartment Parameters	
Compartment Volume	56 liter (2 cubic feet)
Payload Capacity	40 450-mL or 60 250-mL blood units
Cooling Capacity	60 Watts (205 BTU/hr)
Heating Capacity	40 Watts (136 BTU/hr)

AX56L Weight Parameters	
Maximum Gross Weight (MGW) (case + payload)	195lbs (88.6kg)
Tare Weight (case)	(case + payload) 195lbs (88.6kg) (case) 157lbs (71.4kg)
Load Capacity (payload)	38 lb (17.2 kg)

AX56L Power Requirements and Consumption	
Power consumption in COOL mode start-up	< 40 W at room temperature (55 W at 40° C [104° F])
Power consumption in COOL mode storage	< 20 W at room temperature (55 W at 40° C [104° F])
Batteries, 12 VDC, 21Ah (X2)	42Ah capacity (Lead-Acid)
Estimated Power Consumption (COOL Mode)	a.12 Watts at 25° C (77° F) b.35 Watts at 43° C (110° F) c.55 Watts at 49° C (120° F)
Hold Times Below 10° C (Internal Battery Run Time)	a.(42Ah Battery) 38 hours at 43C (110° F) ambient b.(42Ah Battery) 78 hours at 25° C (77° F) ambient

AX56L Power and Charging Source	
Operation - Integral Power DC	12 VDC Internal Battery, 100W 12 to 24VDC, 240W external supply
Operation and Charging - Ground Power AC	100 to 240 VAC, 50/60Hz, 240W external supply

AX56L Environmental Condition Ratings	
Indoor or outdoor use	Device is suitable for indoor or outdoor use.
Altitude	2000m
Relative Humidity	0-95%
Overvoltage Category	Cat I
Wet Location	Not intended for use in wet location
Pollution degree of the intended environment	Pollution Degree II

AX56L Dimensions

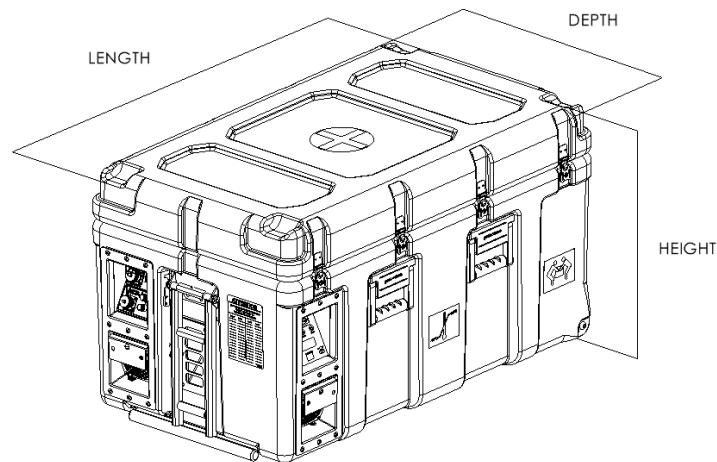


Figure 2. AX56L External Dimensioning

Table 2. AX56L Outer Dimensions

<i>Dimension</i>	<i>Imperial</i>	<i>Metric</i>
Length	41"	104.2 cm
Depth	24"	61.0 cm
Height	22"	55.9 cm

Table 3. AX56L Payload Compartment Dimensions

<i>Dimension</i>	<i>Imperial</i>	<i>Metric</i>
Length	18.0"	45.7 cm
Depth	14.0"	35.6 cm
Height	13.0"	33.0 cm

Concept of Operation

The CSafe brand AX56L mobile refrigerator/freezer is designed to safely store and transport temperature-sensitive blood supplies, vaccines, and pharmaceuticals even under the harshest environmental conditions.

In normal operation, the evaporator temperature sensor is monitored by the control board processor chip. The compressor on/off function is performed by an optically isolated MOSFET switch on the power board. This control signal comes from the display board. This switch

acts in place of the conventional thermostat switch to tell the compressor driver to run the compressor and fans.

The compressor can operate in two speed settings, slow or fast. Whenever the compressor is started, it runs in slow speed. If the compressor runs continuously for 30 seconds, and the temperature has still not reached the desired target, the compressor switches to fast speed. It continues to run in fast speed until it cycles, or is turned off.

Because thermal contact between the evaporator and the payload is made through air circulated by the internal fans, it is imperfect. In above 0° C (32° F) ambient temperatures, this means the evaporator runs cooler than the payload temperature. The only exception is when the heater operates to prevent payload freezing in outside ambient temperatures below 0° C (32° F).

Because of the temperature difference between the payload and the evaporator, as well as to have faster response, the temperature sensor for the evaporator is separate from the payload compartment temperature sensor and mounted directly on the evaporator.

The payload compartment temperature sensor is monitored by the microprocessor to alert it to any failure of the temperature regulating system and to generate the temperature readout in the display. Temperature information supplied to the data logger is provided by the payload, evaporator, and ambient sensors.

The processor takes a new reading of the temperature (and also of battery voltage) every 1.25 seconds. It averages ten readings before updating the display. This means the display updates every 10 to 13 seconds.

When the unit is operating on DC current from its batteries or external DC auxiliary power, the internal and external fans operate only when the control board operates the compressor.

When AC power is available, the power supply runs constantly to keep the batteries charged, and the 12 VDC fan runs constantly to exhaust heat from the converter. The internal fans are switched through a magnetic reed switch activated by the payload compartment lid. If the lid is open, the internal fans turn off to prevent the mixing of outside air with the payload.

The control board determines which power source is used to operate the unit. This ensures the AC supply takes over for the batteries and charges them during operation. A manual temperature or other change may not be displayed for up to 10 seconds.



WARNING

See General Warning: Removing Outer (Green) Lid



WARNING

See General Warning: Removing Inner (White) Lid



WARNING

See General Warning: Device Orientation



WARNING

See General Warning: Device Position

Functional Block Diagram

Figure 3 shows a functional block diagram of key components of the AX56L.

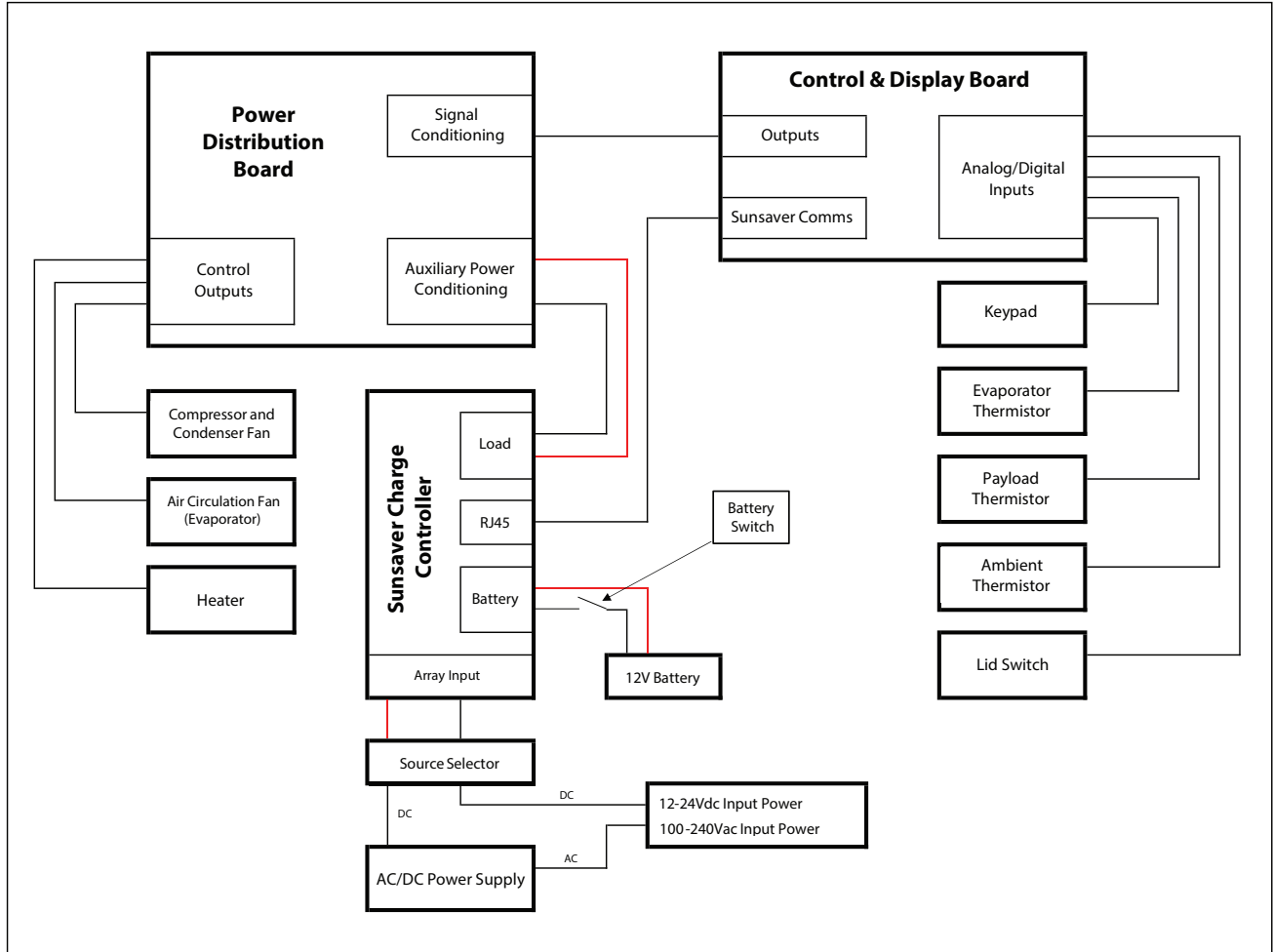


Figure 3. AX56L Block Diagram

Controls and Indicators

The primary AX56L controls and indicators are described in Figure 4 and Table 4.

Power Panel

The power panel (Figure 4) in the compressor and electronics compartment has input connectors for auxiliary DC power and for an AC power cord. Each of the two Lines of the AC power connector is protected by a fuse on this panel. This ensures fused protection for either 120 VAC or 240 VAC operation.

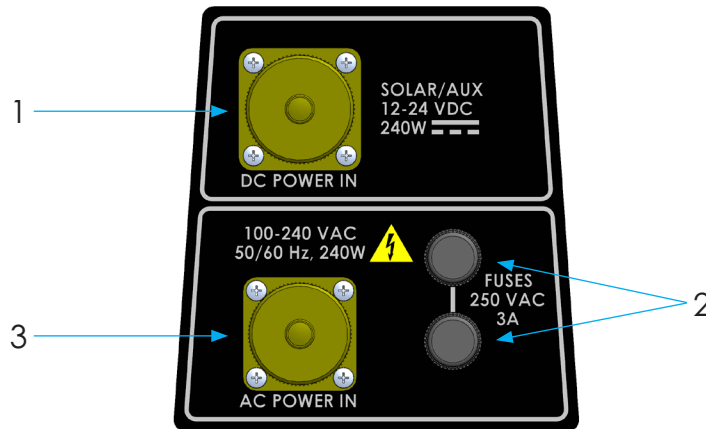


Figure 4. AX56L Power Panel Component Locations

Table 4. AX56L Power Panel Nomenclature

Key	Component	Function
1	DC Power Connector	Connection to external DC power sources
2	Line Fuses	User-replaceable overload protection
3	AC Power Connector	Connection to external AC power sources

Internal Battery Charging through DC Power Jack

To charge the batteries, a minimum 15 VDC **must** be supplied through the DC power jack.

Display and Control Panel

The display and control panel (Figure 5) contains the LCD and LED displays and user controls. The panel also includes the RS-232 serial port for the data logger (Table 5).

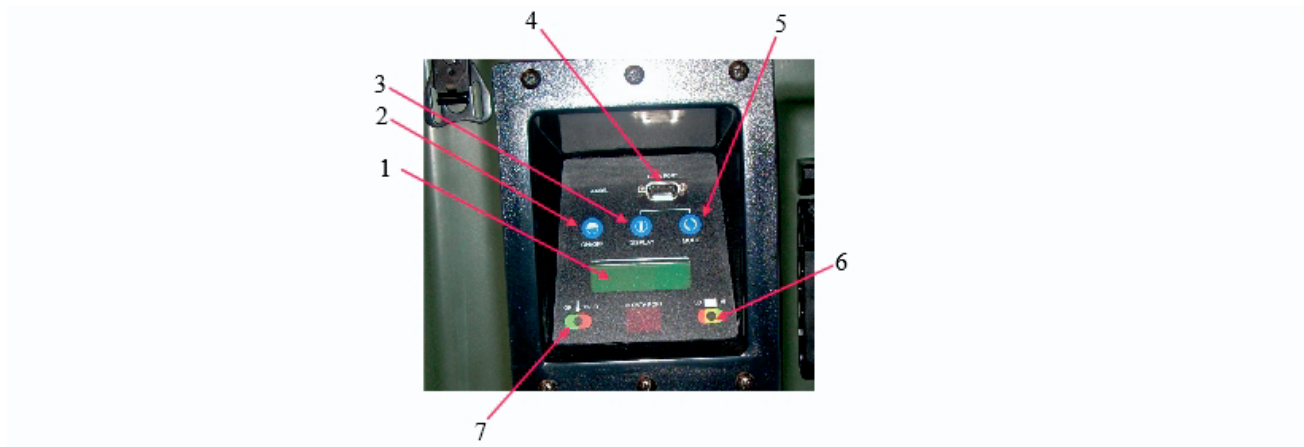


Figure 5. Display and Control Panel Component Locations

Table 5. Display and Control Panel Nomenclature

<i>Key</i>	<i>Component</i>	<i>Function</i>
1	Multifunction LCD	Displays detailed information on a number of operating parameters, and when compressor is off, the display shows IDLE
2	ON/OFF Key	Changes operation between IDLE and either COOL or FREEZE mode, and sets the time and date when used in conjunction with the MODE key
3	DISPLAY Key	Changes LCD screen function, displays history graph information, and when used in conjunction with MODE key, changes operation between COOL and FREEZE
4	RS-232 Data Port	Used to download data logging information via hard wire connection
5	MODE Key	Used in conjunction with DISPLAY key to change operation between COOL and FREEZE, toggles the display information and diagnostic pages, and when used in conjunction with the ON/OFF key, sets the time and date
6	Battery LED	Indicates a charge condition of the internal 12 VDC batteries
7	Temperature LED	Indicates when payload compartment temperature is in or out of the selected range

Displays and Alerts

The status of the AX56L is shown on a panel (Figure 5), which employs two Light Emitting Diodes (LEDs) and a Liquid Crystal Display (LCD) that contains up to four rows of text.

Light Emitting Diodes

Two multicolored LED indicators provide temperature and battery status alarms. The temperature LED (on the left) shows GREEN when the temperature is in the selected range and RED when it is outside that range. The battery status LED (on the right) shows GREEN when the battery has 35 percent or more of charge, YELLOW when it has 10 percent to less than 35 percent charge, and RED when the charge is less than 10 percent. When the unit is operated on AC power, the battery status (right LED) should always illuminate GREEN or change to GREEN within a few minutes as the internal batteries recharge.

Temperature LED indicators

Tables 6 and 7 show the temperatures and battery charging percentages that trigger the LED color changes for different temperature set points and battery charge levels (Table 8):

Table 6. Temperature Indicators for COOL Mode

<i>LED Color</i>	<i>Payload Space Temperature</i>
Green	Between 1.0° C (34° F) and 6.0° C (43° F)
Red	Below 1.0° C (34° F) or above 6.0° C (43° F)

Table 7. Temperature Indicators for FREEZE Mode

<i>LED Color</i>	<i>Payload Space Temperature</i>
Green	Below -20° C (-4° F)
Red	-20° C (-4° F) or above

Battery Charge Level LED Indicators

Table 8 shows the percentage of battery charge that triggers specific LED color changes:

Table 8. Battery Charge Percentages Indicated by LED Colors

<i>LED Color</i>	<i>Battery Charge Remaining</i>
Green	35% to 100% charge remaining
Yellow	10% to less than 35% charge remaining
Red	Less than 10% charge remaining

Audible Alarm

The AX56L has an audible alarm that sounds when the unit is operating on AC power. The alarm sounds to indicate that the payload space is not at the temperature and needs attention. The alarm also sounds when a RED alarm condition occurs whenever the temperature is outside of

nominal operating ranges. (This can occur only after the initial temperature set point has been achieved.)

Control Modes

The AX56L operates in two different control modes: (1) the temperature alarm mode, and (2) the control logic mode. The temperature alarm mode notifies the user of payload temperatures by displaying status on both the temperature LED and on Information Page 1 (current status), line 1. The control logic mode will indicate on Information Page 1 (current status), line 3, if the unit is in the heating or cooling mode and if the compressor is operating.

COOL Mode Temperature Alarm

- When payload is between 1° C (33.8° F) and 6° C (42.8° F), the GREEN temperature LED will be illuminated.
- When payload is at or below 1° C (33.8° F), the RED temperature LED will be illuminated.
- When payload is at or above 6° C (42.8° F), the RED temperature LED will be illuminated.

COOL Mode Control Logic

- When either heating or cooling, the unit will start heating when the payload is below 2° C (35.6° F), the evaporator is below 1° C (33.8° F).
- When either heating or cooling, the unit will start cooling when the payload is above 4° C (39.2° F), the evaporator is above 3° C (37.4° F).
- When heating, the unit will stop heating when the payload or the evaporator is above 4° C (39.2° F).
- When cooling, the unit will stop cooling when the payload is below 2° C (35.6° F).

FREEZE Mode Temperature Alarm

- When the payload is below -20.2° C (4.4° F), the GREEN temperature LED will be illuminated.
- When the payload is above -20.2° C (4.4° F), the RED LED will be illuminated.

FREEZE Mode Control Logic

- When the evaporator is at or above -24.0° C (-11.2° F), control logic will turn the compressor on.
- When the evaporator is at or below -26.0° C (-14.8° F), control logic will turn the compressor off.

Battery Level LED

The battery level indicator LED changes color to indicate the percentage of battery power remaining in the onboard batteries:

- Green: Battery level 35% or above
- Yellow: Battery level 10% to less than 35%
- Red: Battery level below 10%

DC Power Cord

The DC input power jack will accept external DC power from 12-24 VDC.

The white wire is the positive (+) input and goes to the red or positive terminal on the battery, generator, or solar array.

The black wire is the negative (-) input and goes to the black or negative terminal on the battery, generator, or solar array.

Solar Requirements

The AX56L is solar array-capable using the DC input power jack. An appropriately sized solar array must be used to power the AX56L and to charge the internal batteries. The AX56L requires at least 120 watts capable power from a solar array.

AX56L Firmware

The AX56L is equipped with a data logging system that is run by a sophisticated data sampling and recording software program. This program monitors the payload temperature, ambient temperature, and the main battery voltage.

Logging

Whenever the cooling or freezing control operation is active, an entry is added to the data log every five minutes.

Each log entry includes:

- Payload temperature (Temp)
- Ambient (external) temperature (Amb)
- Battery charge level (%)
- Battery voltage output (Bat)
- System status, which includes:
 - o Operating (Y) or IDLE (N)
 - o COOL (L) or FREEZE (F) mode
 - o Compressor on/off (C)
 - o Heater on/off (H)
 - o Lid open/closed (O) (reports OPEN if lid was opened at any time during previous five minutes)

The data log can hold up to 14 days of data. If logging continues for more than 14 days, the oldest entry is discarded each time a new entry is added so that the log always contains the most recent 14-day period.

If, during active control operation (cooling or freezing), the onboard batteries become discharged, logging continues until the battery power is restored (or AC power connected).

Log data can be retrieved via the RS-232 serial port.

Serial Port

The RS-232 serial port is located in the display and control panel on the front of the unit.

1. The RS-232 serial port is used to download logged data to a PC.
2. The port is only available for use when the LCD is on (whenever the unit is using external power or battery power and control is active).

HemaLog Program

The HemaLog program allows monitoring of all major system functions; storage of operational data, particularly temperature history; printing stored data; erasing stored data; and updating the unit's electronic firmware.

The HemaLog program cannot directly influence the performance of the AX56L software, such as changing set points or alarms. Interaction between the AX56L firmware and HemaLog program is limited to pulling information recorded in the device's log. The AX56L firmware may only be updated through the HemaLog program using a CSafe-provided update file

The HemaLog program is installed onto a PC running an operating system of Windows XP or newer; approximately 2.5 MB of space is required for installation.

Disposal

The AX56L is intended for reuse until seven years from the date of manufacture, where the device's thermal insulation may decay in performance and the device will not be able to achieve the claims detailed. Support from CSafe technical staff and repair and replacement components are available to support the repair of the device rather than immediate disposal; note that any repair efforts beyond what is detailed within this User Manual must be performed by a qualified repair technician. The user assumes total risk if the AX56L continues to be used seven years from manufacture, even if the device's safety and performance do not appear affected.

The AX56L cannot be discarded into unsorted waste. At a minimum, the batteries, control board, and compressor-evaporator assembly must be removed for selective treatment; details for the removal of these components are detailed within the preventive and corrective maintenance sections of this user manual or the provided service manual. The remaining AX56L and the components removed for selective treatment must then be disposed of per local regulations.

Where there is potential for the cost of disposing an AX56L at the end of its life, or if removing the components for selective treatment is not practical or safe, CSafe may instead be contacted to pickup the AX56L for disposal.

Chapter 3:

Shipment and Storage



CAUTION

See General Caution: Storage & Ambient Conditions

Unpacking and Ready for Operation



WARNING

See General Warning: Two-Person Carry



WARNING

See General Warning: Battery Connection/Disconnection



CAUTION

See General Caution: Pull Handle Usage

Upon receipt of a new AX56L, the unit should be unpacked and inspected for any shipping damage. An inventory of all basic issue items contained in the external package should be taken and compared to the packing list to ensure that all items have been received

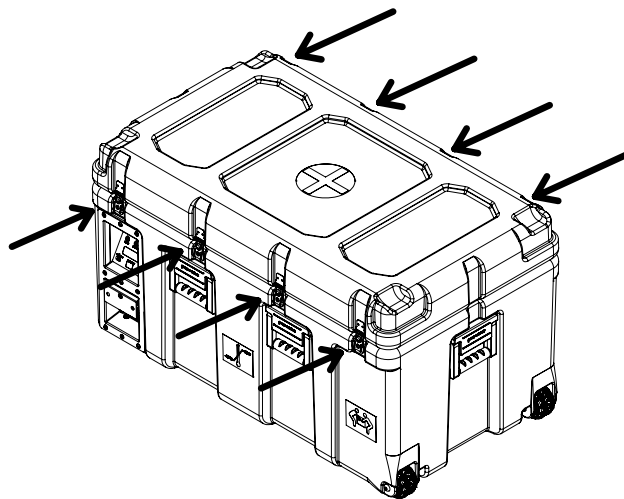


Figure 6: AX56L Outer Lid Latches

1. Remove the AX56L from its crating materials.
2. This lid has 8 latches, 4 on the front and 4 on the back (Figure 6). (On units with optional hinged lid there are only 4 latches on the front).
3. Flip out and rotate the key tabs on each latch until the latch claw has released its hasp.
4. Remove the power cord from the lid organizer.
5. Open the inner lid to access payload storage (Figure 7).

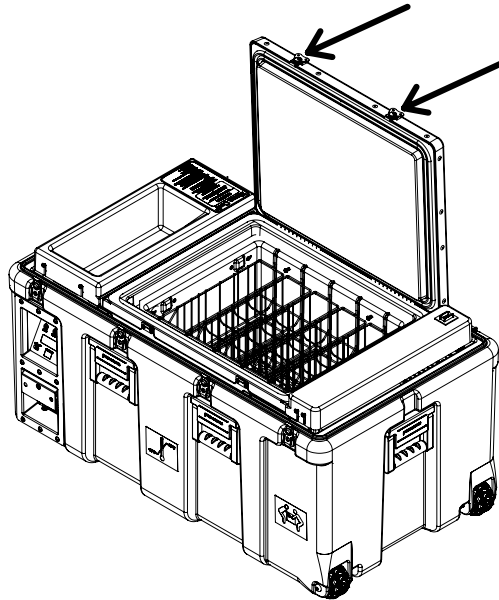


Figure 7. AX56L Inner Lid and Fasteners

Site Selection

The AX56L is designed as a transport and storage container, and as such does not have specific site selection requirements, other than it must be shipped, stored, and operated in an upright orientation on a level surface when carrying a bio-medical payload. Unit safe operation has been confirmed up to 2000m elevation.

Tools and Materials Required

No special tools or materials are required for installation of the AX56L.

Receiving after Routine Shipment

In routine use, the AX56L should always be inspected after each shipment to identify any damage that could compromise the integrity of the contents:

At the conclusion of each shipment, inspect the exterior and interior of the container for signs of physical damage that may have occurred during shipment. Ensure that the:

- Exterior skin of the case is free of holes or tears.
- Interior surfaces of the refrigeration compartment are free of holes or tears.
- Refrigerated compartment lid and latch system operates and engages securely.
- Interior lid seals for the refrigerated compartment are free of tears or rips.

If any damage is found, it should be reported and assessed by calling CSafe® technical support (Chapter 1). CSafe® technical support will assist in evaluating any damage and provide technical guidance regarding applicable repairs or service center locations.

Preparation for Shipment



CAUTION

See General Caution: Transportation Prep



CAUTION

See General Caution: Checking the 3.6V Battery

Verify that both lids are closed and all latches fastened before transporting the AX56L.

Shipment of Sealed Lead-Acid Batteries: Non-Restricted Status

North America Surface and Air Shipments

The AX56L nonspillable lead-acid batteries are listed in the U.S. Department of Transportation (DOT) hazardous materials regulations but are excepted from these regulations since they meet all of the requirements found at 49 CFR 173.159(d) – NMFC # 60680 Class 65:

- When offered for transport, the batteries are protected against short circuits and securely packaged as required by 49 CFR 173.159(d)(1).
- The batteries and outer packaging are marked with the words “NONSPILLABLE BATTERY” as required by 49 CFR 173.159(d)(2).
- The batteries comply with the vibration and pressure differential tests found in 49 CFR 173.159(d) (3) and “crack test” found at 49 CFR 173.159(d)(4).

International

The AX56L nonspillable lead-acid batteries are excepted from the international hazardous materials (also known as “dangerous goods”) regulations since they comply with the following requirements:

- The vibration and pressure differential tests found in Packing Instruction 806 and Special Provision A67 of the International Air Transport Association (IATA) Dangerous Goods Regulations.
- The vibration and pressure differential tests found in Packing Instruction 806 and Special Provision A67 of the International Civil Aviation Organization (ICAO) Technical Instructions for the Safe Transport of Dangerous Goods by Air.
- The vibration, pressure differential, and “crack” tests found in Special Provision 238.1 and 238.2 of the International Maritime Dangerous Goods (IMDG) Code.

Preparation for Long-Term Storage

When the AX56L is stored for extended periods (more than 90 days), the internal batteries should be periodically charged to prevent degradation of battery performance. For proper battery maintenance, the AX56L should be connected to an AC power source every 120 days and allowed to charge for at least eight hours.

Battery Storage Instructions



WARNING

See General Warning: Power Connector Use

Charge Batteries Before Storage

Before putting a working AX56L unit into storage, perform the following steps:

1. Plug AC power cord into a properly grounded wall outlet (the exhaust fan will come on).
2. Allow batteries to charge until LCD display shows BAT: FLOAT (Fig. 24).
3. Disconnect AC power cord from wall outlet.
4. Disconnect 12 V batteries from unit by turning the battery disconnect switch OFF.
5. Remove 3.6 V lithium battery from the control board.

Recharge Batteries In Storage

The 12 V batteries must be recharged every four months. For a working unit, follow the steps outlined above. If the AX56L is in storage (i.e., batteries disconnected), perform the following:

1. Turn battery disconnect switch ON.
2. Plug AC power cord into wall outlet (the exhaust fan will come on).
3. Allow batteries to charge until LCD display shows BAT: FLOAT (Figure 24).
4. Disconnect AC power cord from wall outlet.
5. Turn battery disconnect switch OFF.
6. Put unit back in storage.

Equipment Care

The AX56L is a ruggedized system built to military specifications, but care should be taken in its use and operation. The following precautions will ensure proper operation and long service life:

- For maximum efficiency, do not tilt the unit at all during operation.
- Do not stack AX56L units more than two high.
- Do not obstruct air filter screens when storing the unit in a vehicle or structure.
- Do not submerge the unit in water.
- Do not sit or stand on the unit.
- Maintain air filter screens on the case clean and free of debris.
- Maintain gasket and sealing surfaces clean and free of debris.
- Unit safe operation has been confirmed up to 2000 meters elevation.

Case Exterior Cleaning

Remove any decals, placards or markings from the exterior of the AX56L that were applied during the shipment. Remove adhesives residue from the surface with a mild cleaning product suitable for polyethylene. Use only mild detergent cleaning products that are compatible with polyethylene surfaces and obey all associated material safety instructions.

Chapter 4: Operation



CAUTION

See General Caution: Power Connection Sequence



WARNING

See General Warning: Device Position



CAUTION

See General Caution: Shorting, Open, or Intermittent Electrical Components



WARNING

See General Warning: Power Connector Use



CAUTION

See General Caution: Checking the 3.6V Battery



WARNING

See General Warning: Functional Component Hazards

Startup Procedures

The AX56L is shipped with its internal batteries disconnected. Before initial use, the batteries must be connected as follows:

1. Remove Outer Lid (See Chapter 7, Pg. 7-7). Remove any accessory contents from storage bin on large cover panel.
2. Loosen four screws that hold cover panel in place and remove cover (Figure 8.)
3. Turn battery disconnect switch ON.
4. Position the 3.6 V lithium battery and retaining clip on the display board. (Positive terminal towards payload compartment.) See Chapter 7, Pg. 7-4 for installation procedure for lithium battery.
5. Re-install the cover panel and tighten the four screws.



CAUTION

See General Caution: Power Connection Sequence

6. Plug AC cord into power panel, then plug into wall outlet with properly grounded connection.
7. Reset the serial number, time, and date.
8. Return any accessories that were removed in step 1.

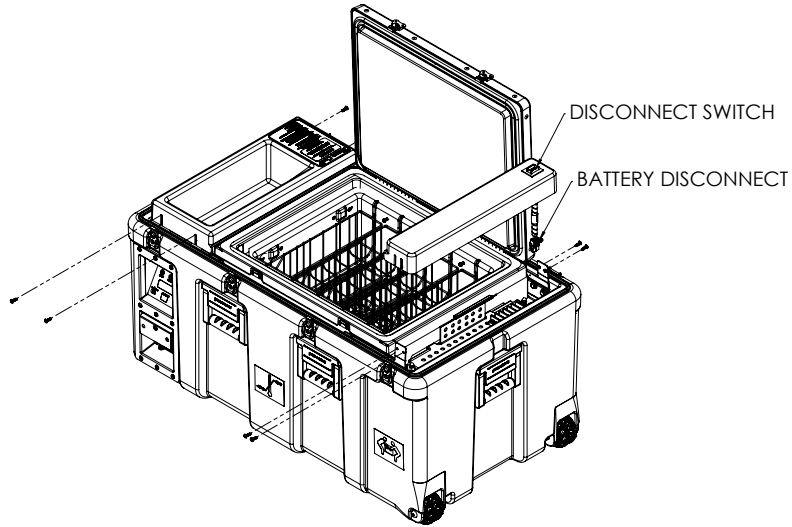


Figure 8. AX56L Battery Access

NOTE

During the initial shipment of the AX56L unit, the 3.6 V lithium battery is shipped separately, inside the manual tool kit.

Connect External Power



CAUTION

See General Caution: Power Connection Sequence



WARNING

See General Warning: Power Connector Use

Attach the external source of power selected for the unit's initial start-up (cool-down) period. Plug the power source into the power panel (Figure 9) on the left side of the unit's exterior case.

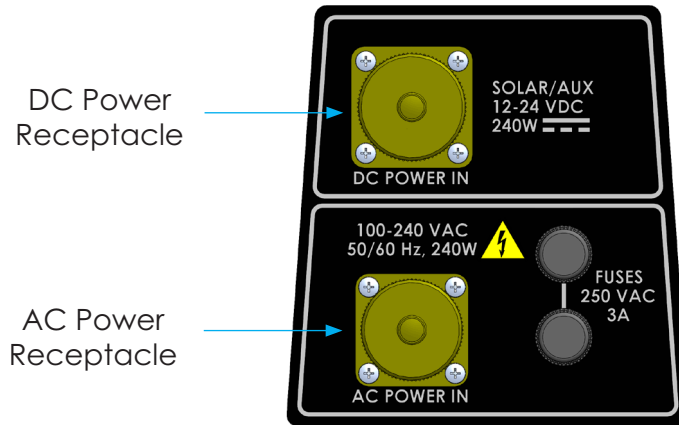


Figure 9. AX56L Power Panel

1. If the unit is operating on internal battery power only, the unit will run and the second row of text on the LCD will display "Batt %". When operating on AC power, the unit will run and the second row of text on the LCD will display "Batt XX% EXT POWER." (Figure 10) This verifies that the AC power is connected.
2. From IDLE mode, press and hold the ON/OFF button to switch to COOL mode. Press the DISPLAY and MODE buttons simultaneously to toggle from the COOL mode to FREEZE mode. To toggle from the FREEZE mode to COOL mode, press the DISPLAY and MODE buttons simultaneously one more time.
3. The COOL (4° C [39° F]) control point is ONLY used for storing materials that must be stored above freezing.
4. The FREEZE (-22° C [-7° F]) control point is ONLY used for materials to be stored frozen. (If the ambient temperature is more than 30° C [86° F], the device may not have the capacity to hold the payload at FREEZE temperature below -20° C [-4° F]. See "Operational Parameters" in Chapter 2.)



CAUTION

See General Caution: Pre-Load Payload Prep

6. Before reaching a preset temperature, the unit's power demand will be above average. Charging should be accomplished with an external AC power source during the initial start-up (cool-down) period to ensure maximum battery operation.
7. After the battery is fully charged, the unit may be disconnected from the cabled external power source. It is then portable and under internal battery operation. If the unit is disconnected long enough for the payload space to reach ambient temperature, the initial start-up (cool-down) period must be repeated.

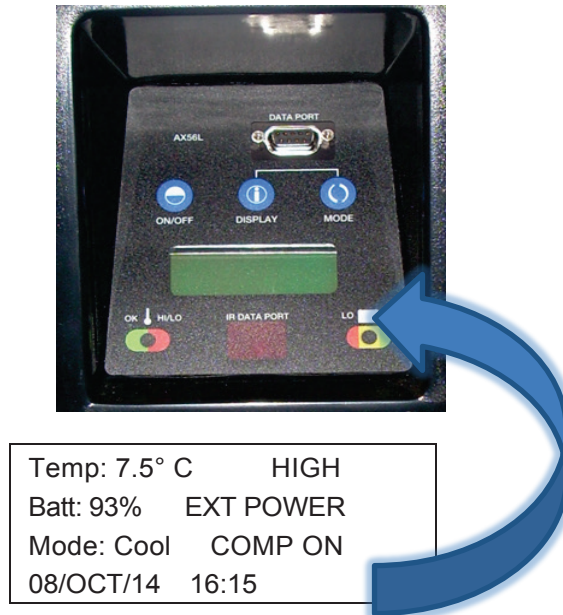


Figure 10. LCD Line 2 Battery Charge Level (93%) Example

Change of Mode

Selecting the wrong set point for bio-medical materials can damage or destroy them. It is the user's responsibility to choose the control set point that matches the temperature requirements of the payload. If in doubt, contact the manufacturer of the bio-medical materials to be stored for temperature requirements, so that the correct control set point is used.

The set point selected is indicated on the LCD readout (COOL or FREEZE) on the third row of Information Page 1 (Figure 11).

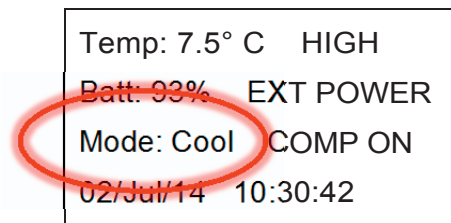


Figure 11. Information Page 1: Mode: Cool Example

- The temperature control point may be changed during operation by depressing both the DISPLAY and the MODE keys at the same time, until the change shows on the display.
- Avoid damage to stored bio-medical products when changing the set point.
- If the temperature is changed during operation, the AX56L must be allowed to stabilize to the new temperature set point before it is loaded to store or transport bio-medical materials at the new temperature.

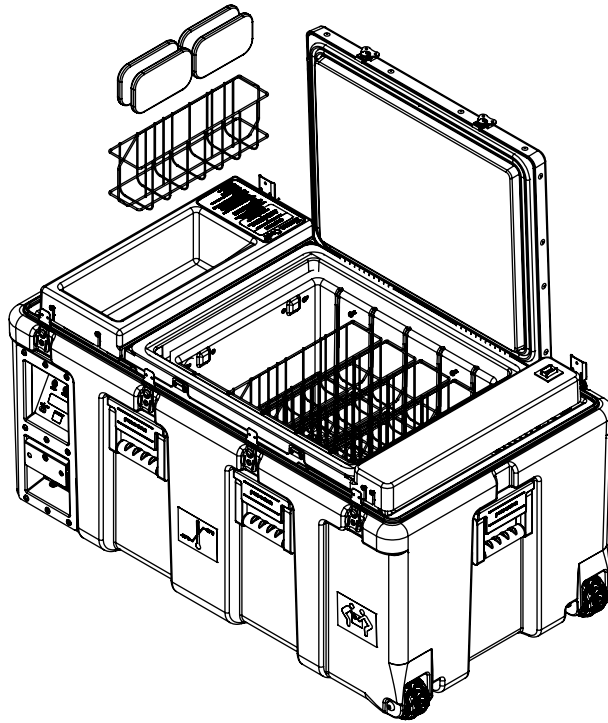


Figure 12. Loading Bio-Medical Materials into AX56L Payload Baskets

Loading Bio-Medical Payloads

The AX56L is equipped with different basket options for storage of blood and blood products (Figure 12).

- Different Basket Options
 - 10 Individual Baskets
 - 2 Half Baskets
 - 1 Full Basket
- Baskets slide into the liner in two layers (upper and lower) of five baskets each.
- Load bags evenly into basket. Each basket holds four 450-ml bags or six 250-ml bags.
- Align ends of the baskets with slots in the liner and slide into the AX56L. Upper-layer baskets rest on top of lower-layer baskets.

Unloading Bio-Medical Payloads



WARNING

See General Warning: Post Storage/Shipment Data Check

**WARNING**

See General Warning: Payload or Product Leakage

**CAUTION**

See General Caution: Freeze Mode Cold

AX56L Operation

On Power Up

On power up, the Serial Number screen appears as the default. In the event a new control board is installed, the serial number can be updated, as required (Figure 13).

- ON/OFF key is associated with the word UP on the display.
- DISPLAY key is associated with the word NEXT on the display.
- MODE key is associated with the word DOWN on the display.
- ON/OFF key will increase the digit number (0 to 9) highlighted on the screen.
- MODE key will decrease the digit number (9 to 0) highlighted on the screen.
- DISPLAY key advances to the next digit in the serial number.

If an error is made while entering the serial number, remove power from the unit, reapply power, and start over. Unless replacing a control board, the serial number of the unit should never have to change.

Pressing the NEXT key should suffice for normal operation.

Enter Serial Number Screen



UP NEXT DOWN
 ENTER SERIAL NUMBER
 00001

Figure 13. Serial Number Display Screen

Enter Date & Time

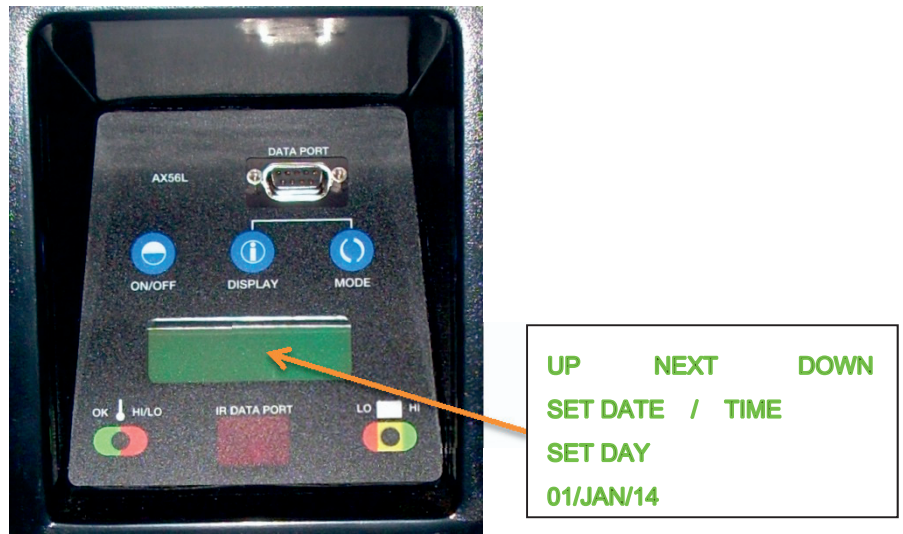


Figure 14. Date & Time Display Screen

The ON/OFF key is associated with the word UP on the display (Figure 14).

The DISPLAY key is associated with the word NEXT on the display (Figure 14).

The MODE key is associated with the word DOWN on the display (Figure 14).

The ON/OFF key will increase the digit number (1 to 31) highlighted on the screen for entering the DAY of the Month (Figures 15 and 16).

The ON/OFF key will increase the MONTH (JAN to DEC) highlighted on the screen for entering the MONTH on the display (Figures 15 and 16).

The ON/OFF key will increase the YEAR (14 to 99) highlighted on the screen for entering the Year on the display.

The MODE key will decrease the digit number (31 to 1) highlighted on the screen for entering the DAY of the Month.

The MODE key will decrease the MONTH (DEC to JAN) highlighted on the screen for entering the MONTH on the display.

The MODE key will decrease the YEAR (99 to 14) highlighted on the screen for entering the Year on the display.

The DISPLAY key advances from the day to the month and then to the year.

UP	NEXT	DOWN
SET DATE / TIME		
SET DAY		
02/JAN/14		

Figure 15. Enter Date & Time Screen; Day

UP	NEXT	DOWN
SET DATE / TIME		
SET HOUR		
02/JAN/14	00:00	

Figure 16. Enter Date & Time Screen; Hour

After Setting Date & Time

After setup, the unit will begin in IDLE mode (Figures 17 and 18, internal and external power).

TEMP: -22.2 C	
BATT: 100%	
MODE: IDLE	
02/JAN/14	08:30

Figure 17. Idle Mode Screen

TEMP: -22.2 C	
BATT: 100%	EXT POWER
MODE: IDLE	
02/JAN/14	08:30

Figure 18. Idle Mode Screen, External Power Applied

By pressing and holding the ON/OFF key for two seconds, the mode will change from IDLE to COOL (Figures 19 and 20, internal and external power).

TEMP: 3.9 C	
BATT: 90%	
MODE: COOL	COMP: ON
02/JAN/14	05:32

Figure 19. Cool Mode Screen

TEMP: 3.9 C	
BATT: 100%	EXT POWER
MODE: COOL	COMP: ON
02/JAN/14	05:32

Figure 20. Cool Mode Screen, External Power Applied

To change from COOL mode to FREEZE mode, press and hold the MODE and DISPLAY keys for two seconds.

To revert to IDLE, press the ON/OFF key for two seconds. Pressing the ON/OFF key again for two seconds will revert to FREEZE mode (Figures 21 and 22, internal and external power).

```

TEMP: -22.2 C
BATT: 90%
MODE: FREEZ  COMP: ON
02/JAN/14   05:36
    
```

Figure 21. Freeze Mode Screen

```

TEMP: -22.2 C
BATT: 100%   EXT POWER
MODE: FREEZ  COMP: ON
02/JAN/14   05:36
    
```

Figure 22. Freeze Mode Screen, External Power Applied

Informational Screens

Rotate through the different informational and diagnostic display screens by pressing the DISPLAY key. The display screens include:

- IDLE (COOL or FREEZE)
- MIN / MAX (Figure 23)
- Diagnostic (Figure 24)
- Graph (Figure 25)

If the mode is changed to IDLE after the Graph screen is displayed, the Date & Time screen is displayed. The date and time can be changed, but *only* in the IDLE mode. If the date and time are correct, press the NEXT key (DISPLAY) multiple times until the IDLE screen is displayed.

MIN / MAX Screen Example

```

MAXIMUM: -21.8 C
03/JAN/14   15:36
MINIMUM: -23.9 C
02/JAN/14   22:10
    
```

Figure 23. MIN / MAX Screen, Example A

Diagnostic Screen Example

```

02/JAN/14   05:36   V 2.18
P: -22 C     E: -24.0 C
A: 23.5 C    B: 13.6
SN: 00001    BAT: FLOAT
    
```

Figure 24. Diagnostic Screen, Example A

Graph Screen Example

```

MAX: -21.8 C ┌
              │
              └─
MIN: -23.9 C └
    
```

Figure 25. Graph Screen, Example B

Enter Date & Time Screen

Date and time shown in Figure 26 will ONLY appear if in IDLE mode:

UP	NEXT	DOWN
SET DATE / TIME		
SET DAY		
02/AUG/14		

Figure 26. Date & Time Screen, IDLE Mode

MIN / MAX Screen

The MIN / MAX (Figure 27) screen displays the highest and lowest temperature the payload compartment since it has been powered up. It also records the date and time in which the maximum and minimum temperatures were reached.

MAXIMUM: -20.5 C	
15/JAN/14	12:30
MINIMUM: -21.8 C	
17/JAN/14	20:15

Figure 27. MIN / MAX Screen, Example B

Diagnostic Screen

The Diagnostic screens (Figures 28 and 29) display the current date and time and the version of software in the control board.

15/JUN/14	04:15	V 2.18
P: -21.5 C	E: -21.0 C	
A: 20.5 C	B: 11.5	
SN: 02341	BAT: BULK	

Figure 28. Diagnostic Screen, Example B

- The P: is for the current Payload temperature.
- The E: is for the current evaporator temperature.
- The A: is for the current ambient air temperature.
- The B: is for the current battery voltage of the internal batteries (or the current voltage being applied to the batteries if the unit is on AC or external power).
- The SN: is the serial number of the control board in the AX56L unit.
- The BAT: is the current status of the internal batteries.
- The Status categories include ABSORP, BULK, and FLOAT, if the internal batteries are being charged.

If no external power is detected, then INT BATTERY is displayed on the screen.

02/JAN/14	05:36	V 2.18
P: -221 C	E: -24.0 C	
A: 23.5 C	B: 13.6	
SN: 00001	BAT: FLOAT	

Figure 29. Diagnostic Screen, Example C

Graph Screen

The Graph screen (Figures 30) plots a point (dot) on the screen for the payload temperature for approximately the last two hours of operation.

The MAX and MIN do not represent the same MAXIMUM and MINIMUM temperatures shown on the Information screen.

This MAX and MIN are only for the current time span of the Graph, approximately two hours.

MAX: -21.8 C	┌
MIN: -23.9 C	└

Figure 30. Graph Screen, Example B

HemaLog Installation

NOTE

Revised HemaLog software, version 2.0 or later, is required to be able to download log files. Older versions of the HemaLog software will not work.

Install CD

Insert the HemaLog installation CD into the PC's CD drive (Figure 31).

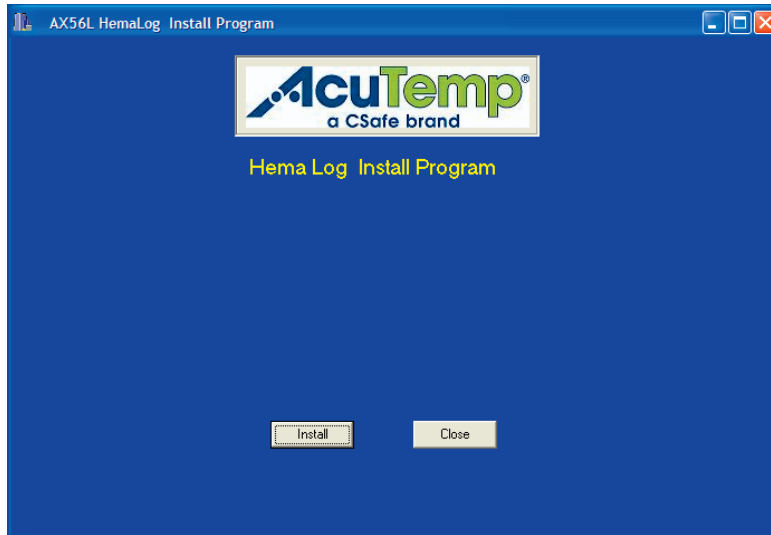


Figure 31. HemaLog Install Screen

Press the **Install** button to install the HemaLog software to a PC. Press the **Close** button if you do not wish to install the software.

Confirm Installation Message

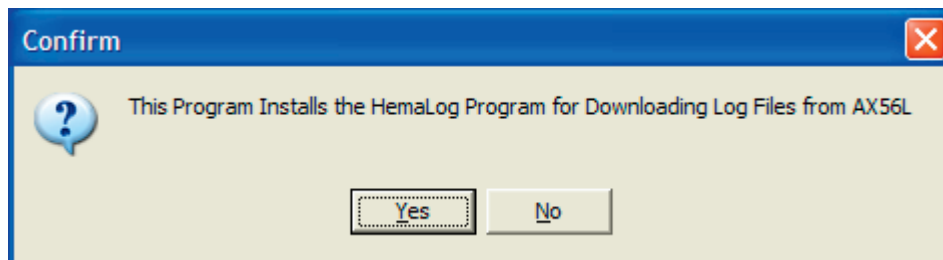


Figure 32. Confirmation Dialog Box

Press the **Yes** button to install the HemaLog software in the PC (Figures 32). Press **No** to discontinue with the HemaLog software installation at this time.

Close Any Open Programs

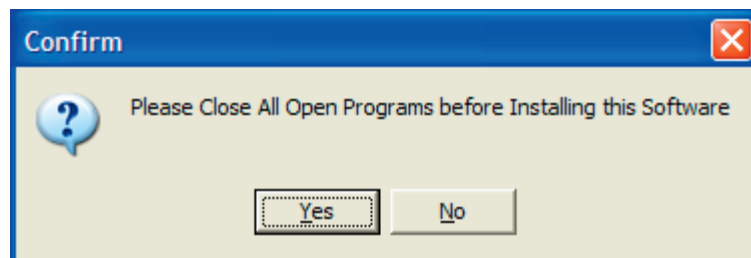


Figure 33. Close Open Programs Dialog Box

Close all other programs (Figure 33). Press the **Yes** button to continue installing the HemaLog software to the PC. Press **No** to discontinue installing the HemaLog software at this time. Press the **Close** button to exit the installation program on the HemaLog Install Screen.

Copying Files Message

Pressing the **Yes** button displays the copying files message on the screen (Figure 34).

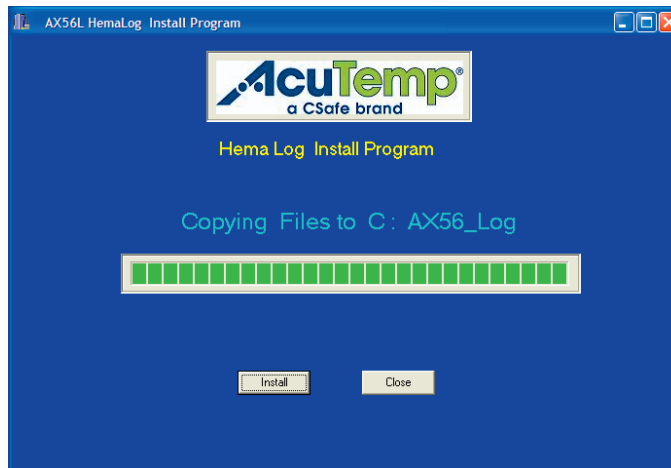


Figure 34. Copying Files Screen

The message **Copying Files to C: AX56_Log** appears as folders are being created and the files are extracted from the CD and copied to the appropriate folders.

Finished Copying Files Message

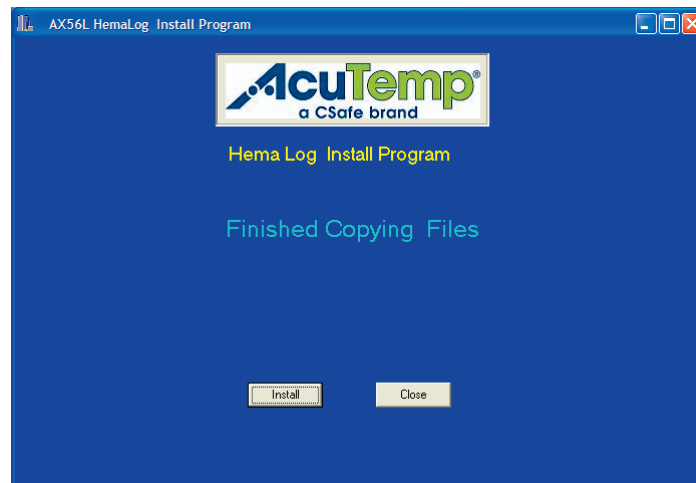


Figure 35. Finished Copying Files Screen

When the files have been copied to the newly created folders you see the “Finished Copying Files” message (Figure 35). The HemaLog installation software has created an **AX56_Log** folder on the C: drive. **Log** and **Pgm** files have also been created in the **AX56_Log** folder as **C:/AX56_Log/Log/** and **C:/AX56_Log/Pgm/** files. The **Log** files from the AX56L unit will be downloaded to and stored in the **C:/AX56_Log/Log/** folder.

The HemaLog software is now installed on the C: drive. Remove the CD from the drive and store in a safe place.

HemaLog Main Screen

The Main screen of the HemaLog software is shown in Figure 36. All AX56L activities can be performed from this screen.

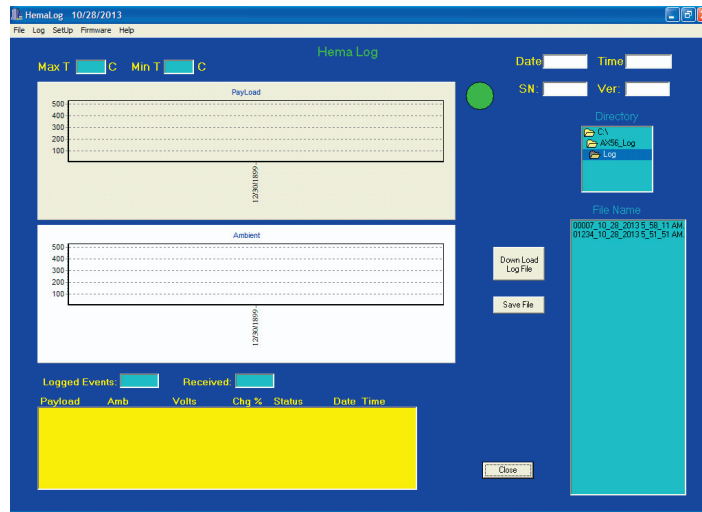


Figure 36. Main HemaLog Screen

File Menu

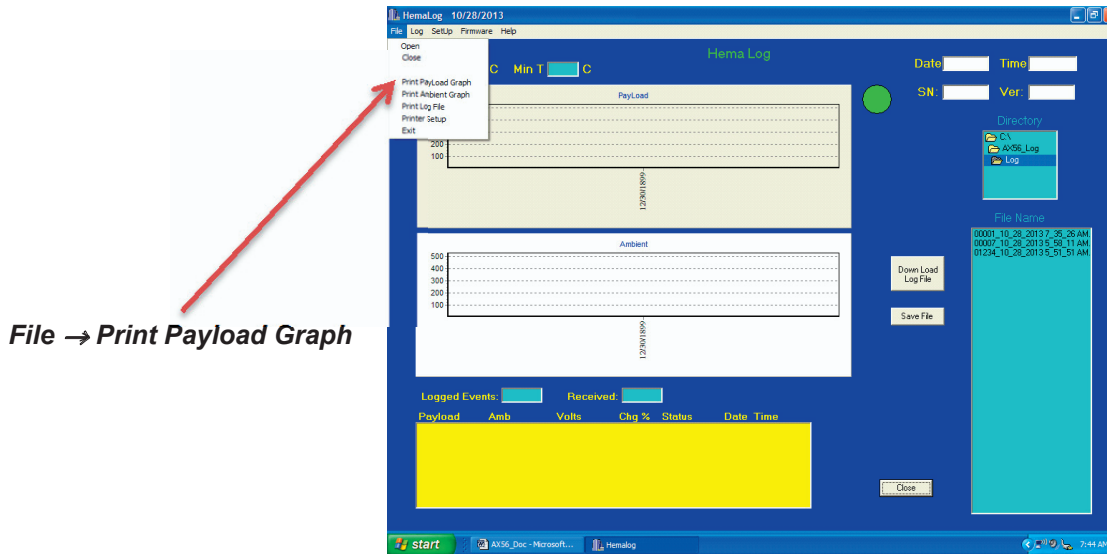


Figure 37. HemaLog File Menu Screen

The File Menu (Figure 37) items allow the user to click on:

- The **Print Payload Graph** dropdown menu to print the Payload graph displayed on the Main screen.
- The **Print Ambient Graph** dropdown menu to print the Ambient graph displayed on the Main screen.
- The **Print Log File** dropdown menu to print the log file to hard copy.

The software can record 288 log file entries per 24-hour period, creating four printed pages of data per day. When printing hard copies of the log file, ensure that the printer has ample paper.

Set Up Menu

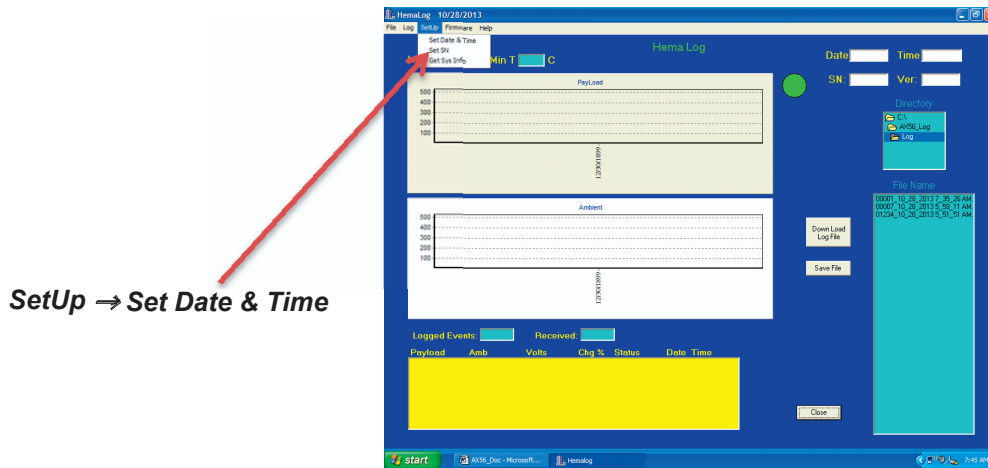


Figure 38. HemaLog Set Up Screen

Set Date & Time

Selecting Set Date & Time (Figure 38) sets the control board to PC's current date and time.

Set Serial Number

Selecting “Set Serial Number” allows changing the serial number of the unit. This is useful when installing a new control board or if a mistake is made setting the serial number on power up.

Get Sys Info

Selecting the “Get System Info” downloads the current date and time to which the AX56L control board is set.

- The serial number and version number of the firmware are also shown on the screen.
- The number of log records stored in memory is displayed in the Logged Events box.

Set Serial Number

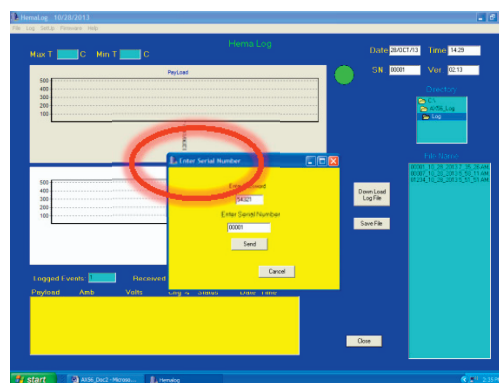


Figure 39. Enter Serial Number Screen

Selecting **Set Serial Number** (Figure 39) will display the **Enter Serial Number** dialog box that will prompt the user to enter a password:

1. Enter the password **54321** and press the **OK** button.
2. Enter the appropriate five-digit serial number for the AX56L unit.
3. Press the **Send** button to send the serial number to the AX56L unit.
4. The message “Please Wait: Sending Serial Number” is displayed.
5. After several seconds, the **Enter Password Number** box disappears.

The updated serial number will appear on the display screen of the AX56L unit or it can be retrieved by pressing the **Get Sys Info** on the File menu of the Main HemaLog screen.

Down Load Log File

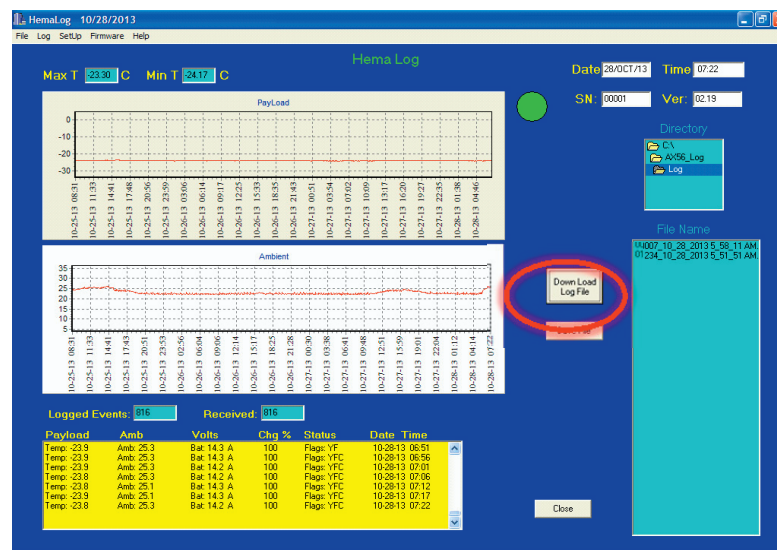


Figure 40. Down Load Log File Screen

Press the **Down Load Log File** button (Figure 40) to download a file from the AX56L unit.

- Connect cable from RS-232 serial port on AX56L unit to serial port (RS-232) connection on PC.
- If the PC does not have a serial port, then attach a USB-to-Serial dongle plugged into a USB port.
- Select the serial port to be used (Figure 41). (If multiple COMx numbers are shown in the drop down menu, then choose the bottom COMx number.)
- Press the **OK** button to continue.

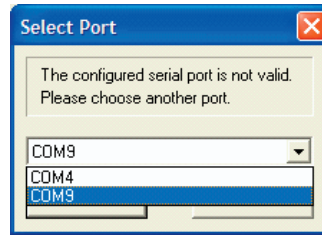


Figure 41. Select Port Dialog

The boxes on the Main screen will become populated with the date, time, and serial number of unit and the version number of the control software programmed into control board. Numbers will appear in the **Logged Events** and **Received** boxes:

- The **Logged Events** box displays the number of records stored in memory in the unit.
- The **Received** box shows how many records are being downloaded.

As data is plotted to the graphs, the **Max T** and **Min T** boxes display progressive data.

The **Max T** box shows the **maximum** temperature during the shipment and **Min T** box shows the **minimum** temperature recorded during the shipment.

If there is an error during a log file download, the green circle indicator to the right of the Payload graph turns **Red** and an appropriate message is displayed on the screen indicating the kind of error that was detected.

Once the log file is downloaded from the unit, press the **Save File** button.

The **File Name** dialog box will turn **yellow**, indicating the log file is being saved.

The log file will be saved in the **C:/AX56_Log/Log/** folder using the serial number of the unit plus the date and time the log file was downloaded (Figures 42 and 43).

Saving Log File

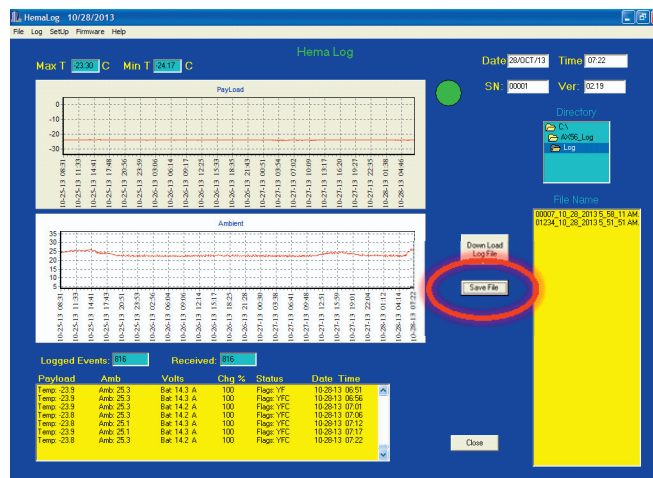


Figure 42. Saving Log File Screen

Log File Saved

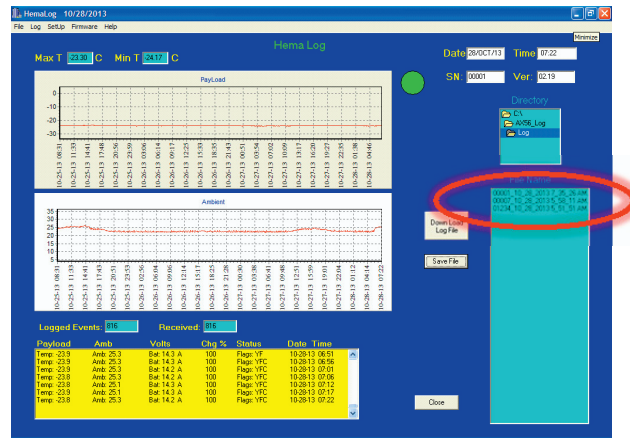


Figure 43. Log File Saved Screen

Log Menu

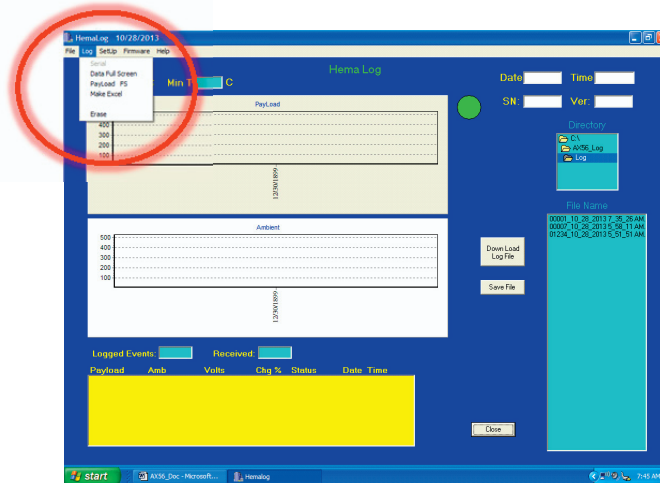


Figure 44. Log Menu Screen

The **Log Menu** screen (Figure 44) provides four functions:

- **Data Full** screen (Figure 45) alerts the user that the data buffers are full and must be downloaded or deleted.
- **Payload FS** screen (Figure 46) displays the temperature history of the payload.
- **Make Excel** screen (Figure 47) converts data into a downloadable *Excel* spreadsheet.
- **Erase** screen (Figure 48) allows the user to erase the contents of the stored log file.

Data Full Screen

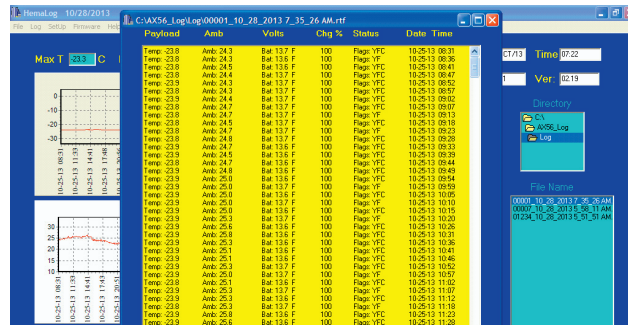


Figure 45. Example of a Data Full Screen

Payload FS

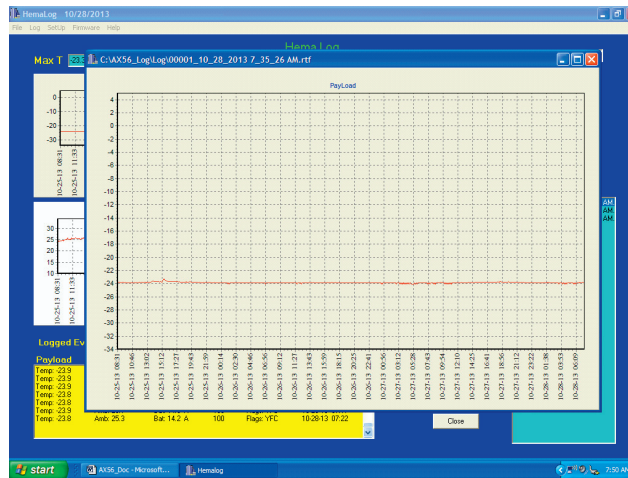


Figure 46. Example of a Payload FS Screen

Make Excel

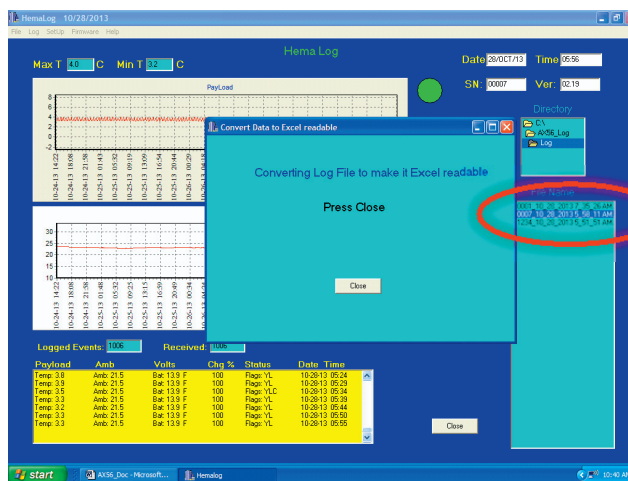


Figure 47. Example of a Make Excel Screen

To create an *Excel* spreadsheet, the log file must be displayed in the **Main Screen**.

- Select the log file to convert from the **File Name** box (Figure 47).
- Select **Make Excel** from the Log menu; this converts the log file into a format that can be imported into *Excel*. The converted file will be saved in the **C:/AX56_Log/Excel/** folder.
- Import the file manually into *Excel* and choose the “|” (bar) as the delimiter.

Eraser

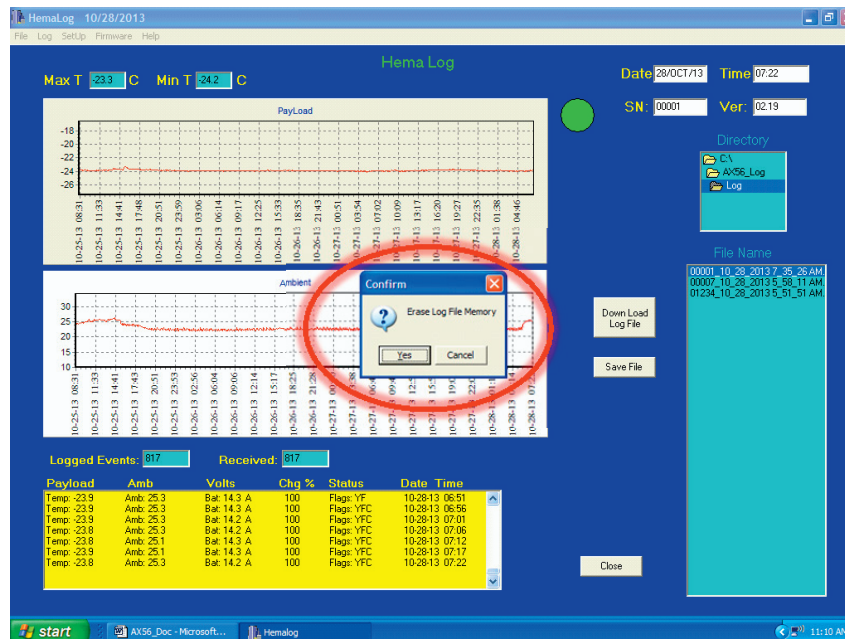


Figure 48. Example of an Erase Screen

CAUTION

Once data is erased, it is gone forever.

Click **Yes** on the **Confirm** dialog box to erase the onboard memory on the AX56L unit or click **Cancel** if you do not want to erase the memory (Figure 48).

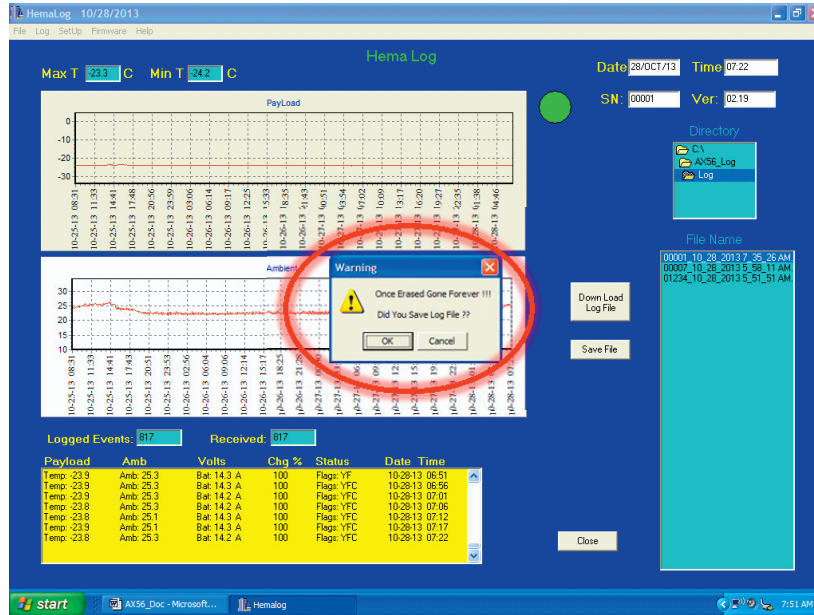


Figure 49. Example of an Erase Final Warning

Selecting **Erase** will prompt two confirmations to ensure positive user actions (Figure 49). Acknowledge by pressing the **Yes** button. Press the **Cancel** button to abort the erase memory action.

Screen Showing Erased Memory

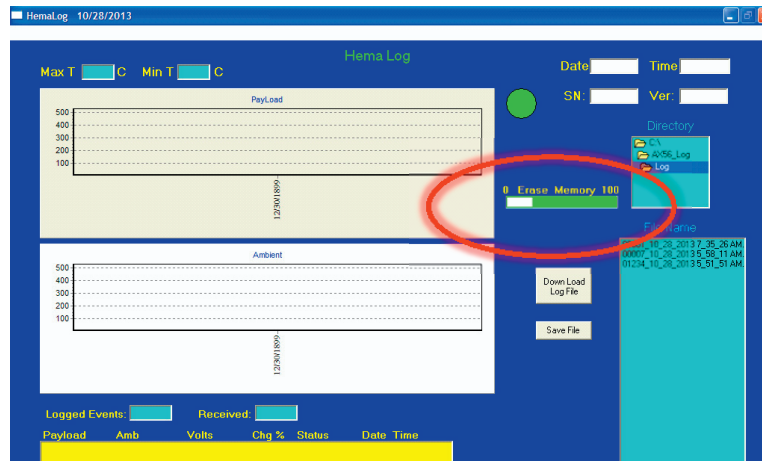


Figure 50. Example of an Erased HemaLog Screen

The onboard memory is erased after the progress bar disappears (Figure 50).

Firmware Update

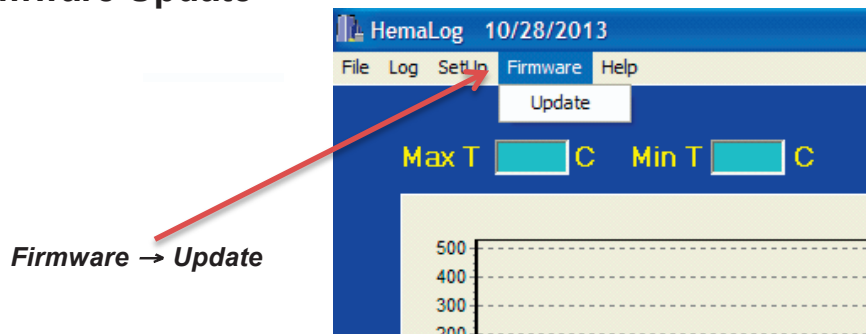


Figure 51. Firmware Update Dropdown Menu

Update Preparation

Before continuing, make a backup of the old firmware file and store in a safe place. The original copy of the firmware is on the **Install CD** that accompanies the AX56L unit.

- The **AX56L.Hex** file must be placed in the **C:/AX56_Log/Pgm** folder on the PC where the HemaLog software is installed.
- Once the new firmware file has been placed into the **C:/AX56_Log/Pgm** folder of the PC, press **Update** under the **Firmware** menu on the task bar of the HemaLog program to update the microprocessor's firmware. (See Figure 51.)

Update Completion

Follow the screen prompts to successfully update the firmware:

1. Acknowledge firmware update (Figure 52) by pressing **Yes** to update the microprocessor's firmware on the control board for the AX56L unit or press **Cancel** if you do not want to update the firmware.

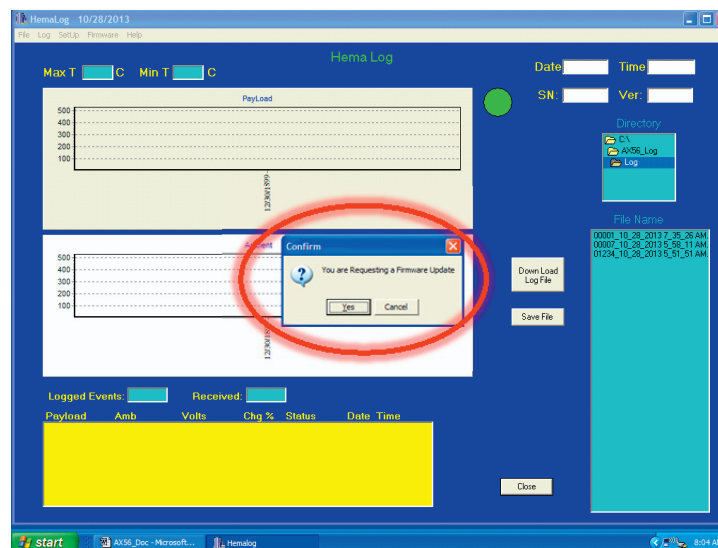


Figure 52. Confirm Firmware Update Dialog Box

2. Remove AC and external power from the AX56L unit (Figure 53).

3. Remove the 3.6 V lithium battery from its holder on the control board.
4. Press the **OK** button to continue.

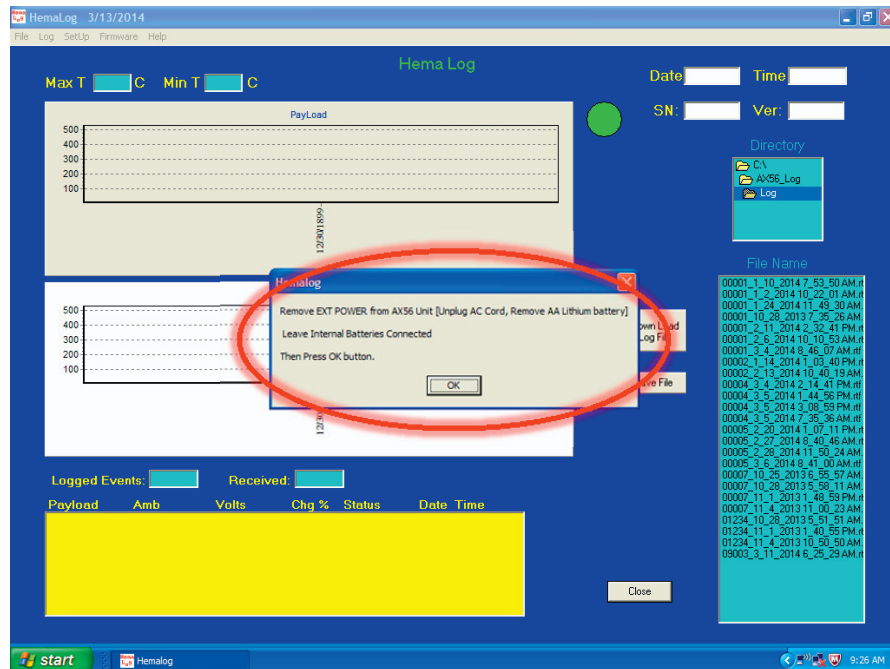


Figure 53. Remove All Power

5. A reset is required for a firmware update. Attach a connector for batteries. Acknowledge by pressing the **OK** button to continue (Figure 54).

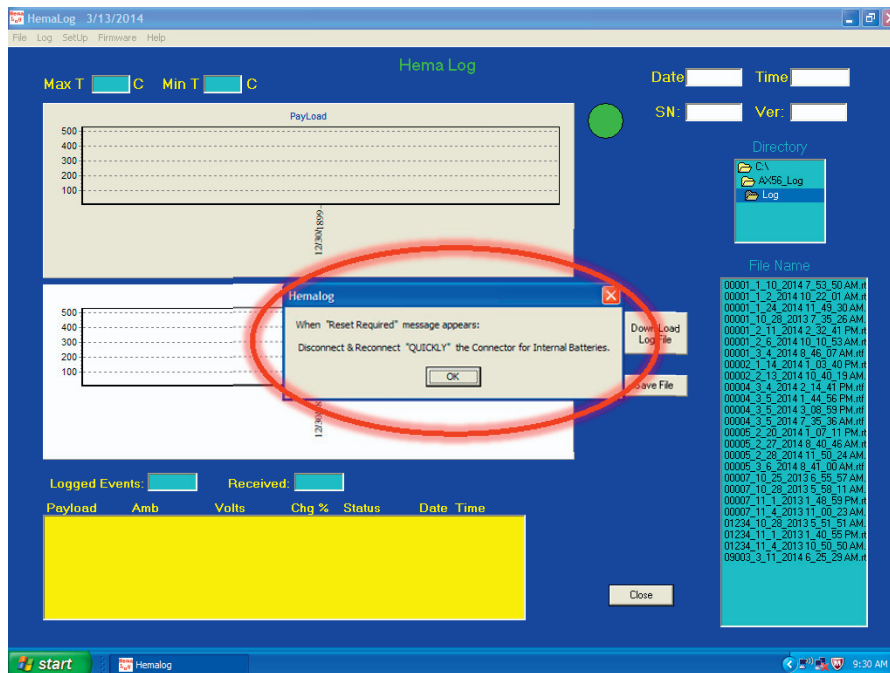


Figure 54. Acknowledge Reset Required

- When the **Reset Required** dialog box appears, quickly(within 2 or 3 seconds) disconnect and reconnect the internal battery connector. The firmware will then download (Figure 55).

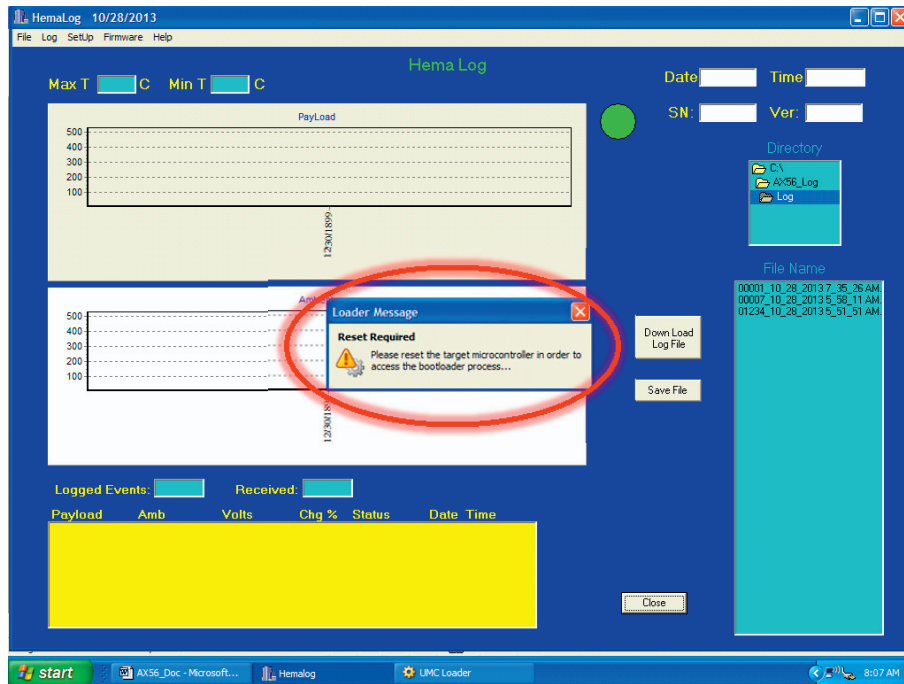


Figure 55. Reset Required Dialog Box

- If **Select Port** dialog box appears, select another com port from the drop down list (Figure 56).

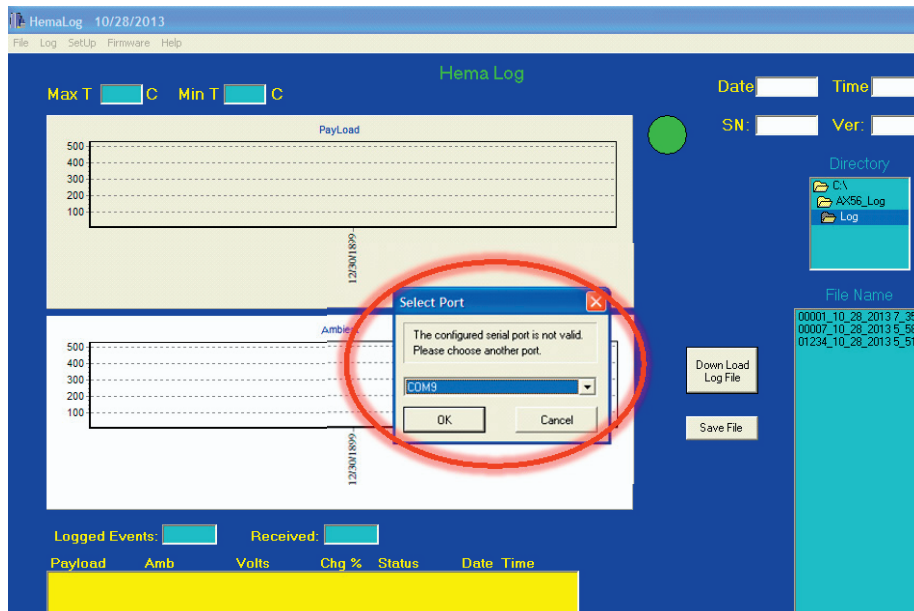


Figure 56. Select Serial Port Dialog Box

Operating the Audible Alarm

The audible alarm sounds to indicate that the payload space is not at the required temperature and requires attention. Typically, the appropriate response to this alarm requires attaching a different power source with sufficient power to maintain unit operation while simultaneously charging the internal batteries.

To turn the alarm off:

NOTE

Powering off unit will cause accumulated logged data to be lost.

NOTE

No Audible Alarm while on DC internal Battery Power

1. Power off the unit.
2. Power unit back on.
3. Select COOL or FREEZE mode.

Or:

1. Press the ON/OFF key to put AX56L unit into IDLE mode.
2. Quickly press the ON/OFF key to revert back to the previous mode. This will silence the alarm buzzer. This allows the AX56L to continue to run for a few minutes to lower the temperature.

If the temperature does not cool down, the alarm buzzer will sound again. Several factors could cause this:

1. The AX56L was not properly conditioned before product was placed in the unit.
2. The payload was not properly conditioned before being placed in the unit.
3. The ambient temperature has exceeded 49° C.
4. The air filters are dirty.

Ensure that the power outlet is supplying AC current, batteries are charged and properly installed, and that EXT PWR shows on the display and control panel.

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Chapter 5: User Preventive Maintenance Checks and Service (PMCS)

Inspection

Table 9 provides criteria for performing user-level Preventive Maintenance Checks and Service (PMCS) for the AX56L. Perform each procedure at intervals indicated in the table. Refer to corrective maintenance procedures in Chapter 7 as appropriate.

Table 9. User PMCS Procedures

<i>Interval</i>	<i>Item</i>	<i>Action</i>
Weekly and After Each Shipment	Visual Inspection	<ul style="list-style-type: none"> • Visually inspect the exterior of the AX56L for any signs of damage to case, shipping damage, loose or missing latches, handles, or hardware. Repair or replace as necessary. • Open outer cover and inspect latches to ensure tight closure of refrigerator door. Inspect the display and control panel for signs of damage or wear. Inspect the power panel for signs of damage or wear. Repair or replace as necessary. • Open inner lid and check the two latches for damage. Ensure that wire basket(s) are in place and undamaged. Visually inspect interior of refrigerator compartment for any signs of interior damage, particularly indications that underlying insulation panels may be damaged. • Inspect inner lid gasket for signs of damage, wear, or debris. • Check bottom of payload compartment for accumulated condensation or water, if present see Pg. 5-2. • Inspect power receptacles /connections for indications of pin damage or bad connection (sparking - scorch marks). Refer unit to a qualified service technician. • Personal injury may result if exposed to damaged electrical wiring.
Monthly	12 V Battery	If Battery LCD indicates a charge of 90% or less, recharge using external AC power. Charge until LCD indicator (Figure 57) shows "BATT: FLOAT." Check for corrosion on terminals and cables. Check for signs of battery leakage (Pg. 5-3). In event of corrosion residue presence, wear proper PPE as contact with skin may cause personal injury.
	3.6 V Lithium Battery	Inspect for signs of damage, corrosion or leakage. If any indications, dispose of battery as per local regulations and install new battery. In event of corrosion residue presence, wear proper PPE as contact with skin may cause personal injury.
	Air Filter	Brush or blow out accumulated dirt, and debris. Wash filter.
	Wiring and Fuses	Remove and inspect fuses, then reinstall. Replace any fuses that are burned out. Inspect wiring for damage or signs of possible failure. In the event of wiring damage or signs of possible failure, personal injury may result. Contact qualified service technician.
Quarterly	Air Filter	Replace with new air filter.
	Wheels	Visually inspect wheels for damage.
	Handle/ Case	Check pull handle and case for cracks/rusting.

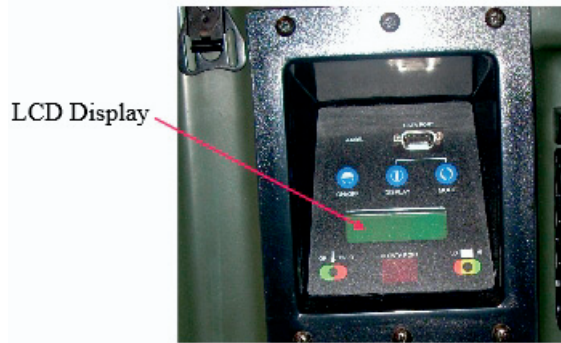


Figure 57. LCD Display

Inspect For Moisture Accumulation

If the unit's inner lid gasket seal is compromised, or if the lid is opened and closed frequently in a humid environment, moisture will accumulate in the bottom of the refrigerated compartment. This moisture may be removed using a sponge or absorbent towels. If a sponge is not sufficient to absorb accumulated moisture, use a wet-dry shop vacuum cleaner to remove excess moisture, as needed.

If cuts or tears in the gaskets are found, refer the unit to a qualified technician for replacement. (See the AX56L HMC-MIL- 3 Service Manual, Publication 102011-06.)

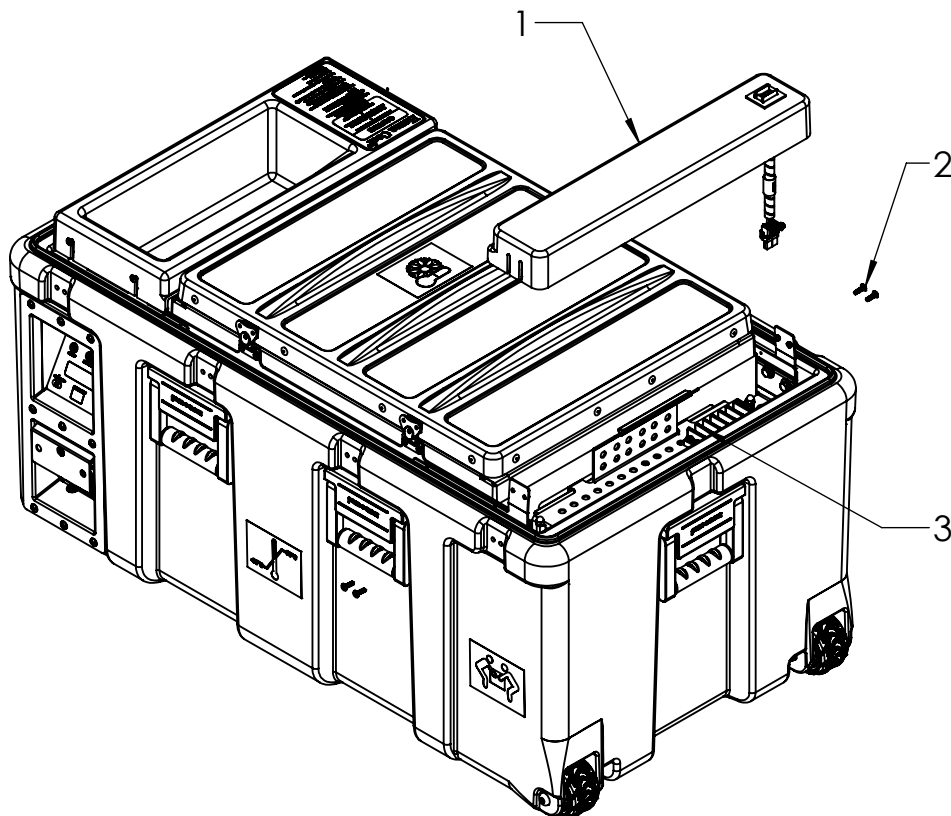


Figure 58. Battery Terminal Location

Inspect For Battery Terminal Corrosion And Battery Leakage



CAUTION

See General Caution: Shorting, Open, or Intermittent Electrical Components



WARNING

See General Warning: Battery Connection/Disconnection



WARNING

See General Warning: Battery Maintenance or Service



WARNING

See General Warning: Functional Component Hazards

If the unit is in a humid environment, check for battery terminal corrosion once a month.

If the unit has symptoms of poor battery performance (short run-time on internal battery power), check for battery cable and battery terminal corrosion.

1. Ensure the battery disconnect switch is OFF.
2. Loosen the four screws and the cover panel.
3. Inspect the terminal block, battery connections and wires for corrosion.
4. If corrosion is visible on the terminals or wires, refer the unit to a qualified service technician.

Keep Batteries Charged



WARNING

See General Warning: Two-Person Carry



WARNING

See General Warning: Battery Maintenance or Service



WARNING

See General Warning: General Maintenance or Service



WARNING

See General Warning: Power Connector Use



CAUTION

See General Caution: Pull Handle Usage

If operating the unit under battery power, a battery percentage reading of less than 15% indicates the need for immediate recharging; the unit should be plugged into an AC power source.

If the AX56L runs out of battery power and shuts down due to low power, immediately plug the unit into AC power. Discharged batteries should be recharged as soon as possible.

The batteries in this unit require a full charge to maintain their full capacity. Allowing a discharged battery to remain discharged for even a short period deteriorates its capacity to hold a full charge in as little as a few hours. When the unit is plugged into external power, the batteries will charge automatically.

Batteries that are fully discharged may require as much as 24 hours to fully recharge on external power. If fully recharged batteries run down quickly, initiate action to have a qualified technician replace the onboard batteries. Batteries should be disposed of as per local regulations.

Chapter 6:

User Troubleshooting

AX56L User Check-Out Procedure

This procedure is intended to verify the correct operation of the critical functions of an AX56L unit. The testing is intended to be performed at room temperature (20-24° C [68-75° F]). Only the wire baskets are to be in the payload compartment during testing and the compartment latched completely closed. The user may choose to verify the temperature readings shown on the AX56L by using a temperature measuring device. If this is done, take into account the accuracy tolerance and calibration of the temperature measuring device that is being used. If the unit fails to pass established criteria, contact Csafe technical support.

FREEZE Mode

Turn the battery disconnect switch ON and plug the unit into AC power supply and connect the 12 volt battery connector. Using a voltmeter, verify the lithium battery measures at least 3.5 volts and is installed correctly (positive side away from the user). Set the unit on FREEZE mode. Record the length of time it takes for the payload temperature to reach -22° C or below. The pass criteria requires the unit to achieve -22° C or below in four hours or less at room temperature. Verify that the unit maintains -22° C or below for at least two hours.

Warm-up Cycle

Set the unit on COOL mode. Keep the AC power cord plugged in. The payload is being warmed by the internal heaters. The pass criteria require that the unit warm to 4° C in four hours or less. Also, to pass, the audible alarm should sound and the temperature alarm LED on the control panel should illuminate red to indicate that the payload temperature is out of range.

COOL Mode on Battery

Verify the payload temperature has stabilized to approximately 4° C in COOL mode and the battery is 100% charged. While the unit is in COOL mode, unplug the AC power supply. The exhaust fan will stop running and only come on when the compressor is running. The pass criteria requires the unit to maintain the payload at 4° C for at least 24 hours under its own internal DC power at ambient (normal room) temperature. At elevated ambient temperatures, this hold time may be reduced slightly.

Data Log

Verify that the correct payload temperature was maintained in the COOL mode during the battery power test using the data that was logged. There are two ways to do this:

1. View the graphed data on the AX56L display by depressing the display key twice. The graph should reflect the results of FREEZE mode, warm-up cycle, and COOL mode tests.
2. Download the logged data with the HemaLog software. This method provides a more accurate way to verify the temperature control history of the unit during the test.

Storage and Battery Maintenance



WARNING

See General Warning: Two-Person Carry



WARNING

See General Warning: Battery Connection/Disconnection



CAUTION

See General Caution: Pull Handle Usage

To prepare the unit for storage make sure the batteries are fully charged. Disconnect the AC power and turn the battery disconnect switch OFF and remove the lithium battery from the main control board.

To prolong the life of the onboard batteries, it is necessary to cycle recharge the batteries periodically (at least every four months). It is also very important to store the batteries fully charged and disconnected.

LCD Fails to Illuminate

If the LCD on the front of the case is blank, perform the following steps:

1. Remove AC power and turn the battery disconnect switch OFF.
2. Remove the retaining clip and the 3.6 V lithium battery from the control display board.
3. Wait 15 seconds and then turn the battery disconnect switch ON.
4. Reset the serial number, time, and date.
5. Replace the 3.6 V lithium battery and retaining clip on the control display board.
6. If the LCD still fails to illuminate, contact CSafe® technical support

Chapter 7:

User Corrective Maintenance Procedures

Introduction

This chapter provides user accessible maintenance procedures for the AX56L. Repair consists of removal and replacement of defective components.

Change Fuse

The AC power fuses (item 2, Figure 59) are located adjacent to the power input connectors (item 2).

1. To remove a fuse, press inward on the fuse holder cap while turning it one quarter-turn counter clockwise and pull straight out.
2. Insert a new fuse (P/N 100523) and reverse the procedure.

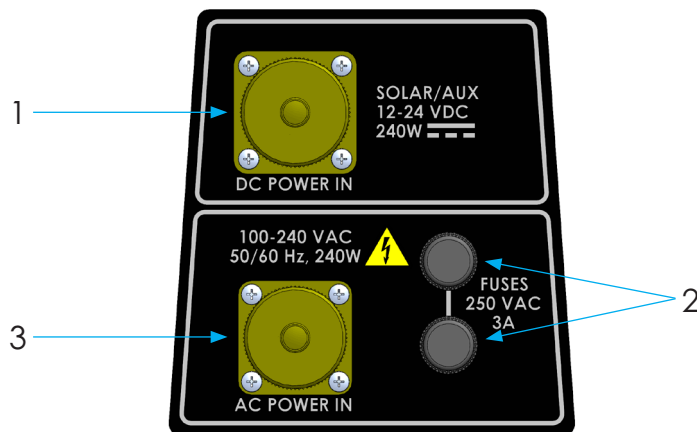


Figure 59. Change Fuse

Clean Intake Filters

Removal

One filter is located below the power panel (item 1, Figure 60) and the other filter is located below the control panel display (item 1, Figure 61).

The top of each filter is locked in place by a recessed slotted quarter-turn stud (item 2) and the bottom edge is placed behind the two inner bezel rivets (item 3).

1. Insert a 1/4-inch flat-bladed screwdriver through the hole in the handle (item 4) of the display and control panel filter (item 1).
2. Turn the slotted quarter-turn stud (item 2) one quarter-turn counterclockwise to unlock the filter (item 1).

3. Grasp underneath the filter handle (item 4) and pull outward.
4. Repeat steps 1. through 3. for the display and control panel air filter (Figure 61).

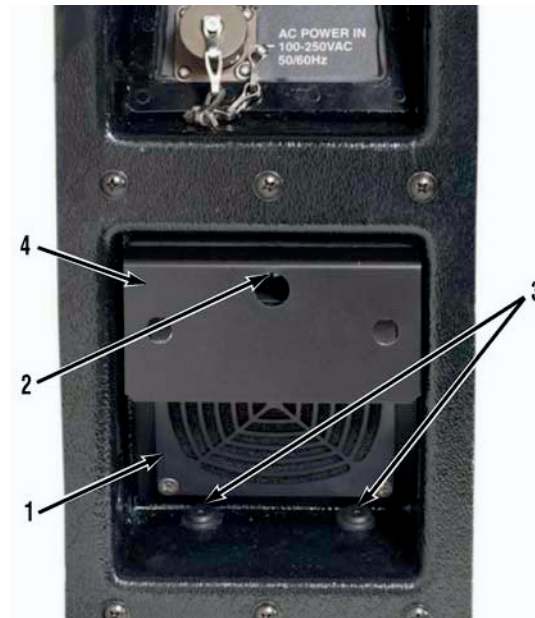


Figure 60. Power Panel Air Filter

Cleaning

1. Clean filters with water or with a mild soap or dishwashing liquid and water.
2. Rinse air filters thoroughly with clean water.
3. After rinsing filters, blow dry or allow them to air dry.

Installation

1. Place the bottom edge of the filter (item 1, Figure 60) into the power panel behind the two inner bezel rivets (item 3).
2. Ensure that the slot in the quarter-turn stud (item 2) is vertical, and then push the filter (item 1) firmly inward.
3. Insert a 1/4-in flat-bladed screwdriver and turn quarter-turn stud (item 2) clockwise until it is fully engaged.
4. Pull on the filter handle (item 4) to make sure the filter (item 1) is locked in place.
5. Repeat steps 1. through 4. for the display and control panel air filter (Figure 61).

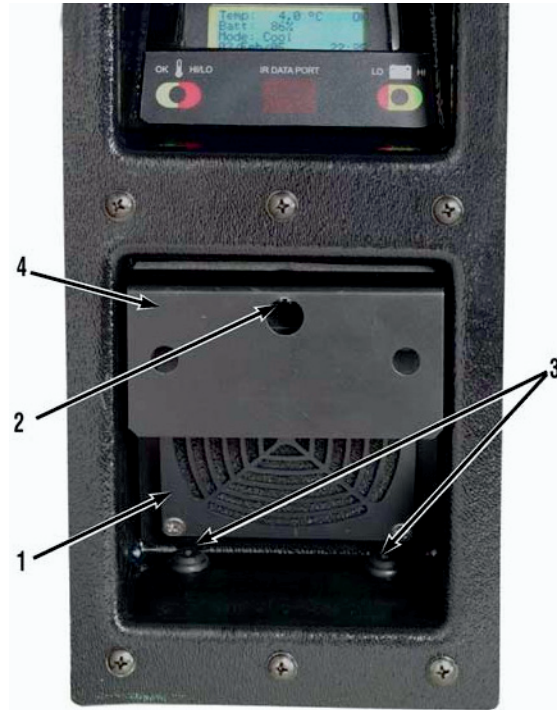


Figure 61. Display and Control Air Filter

Inspect and Clean Lid Gaskets

When the lid gaskets (item 2, Figure 62) are in good working order, there should be little or no accumulated moisture inside the AX56L, unless the lid (item 1) is opened and closed frequently.

If excessive moisture seems to be accumulating while the lid (item 1) is closed, it may be that the lid gaskets (item 2) are dirty, the lid is closing on debris, or the gasket is cut or damaged.

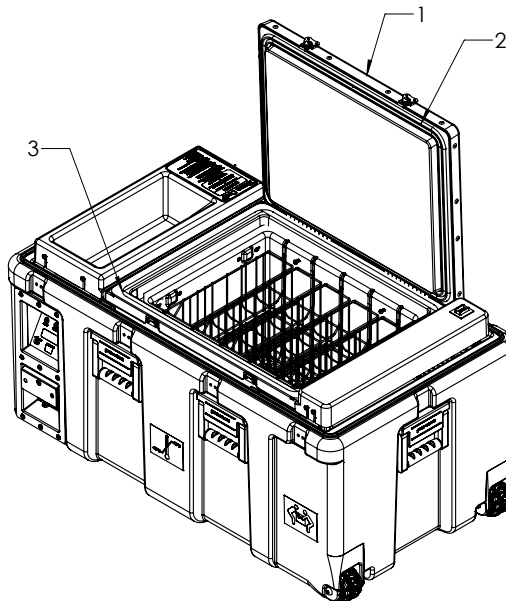


Figure 62. Inspecting Lid Gasket and Mating Surface

To inspect the seal, open the lid (item 1) and look for any dirt or debris accumulation on the black rubber gaskets (item 2), and along their edges:

1. Check for dirt and debris along the gasket's mating surface (item 3) inside the unit. Clean the unit using a damp sponge and a mild dishwashing detergent, if needed.
2. Cleaning with a damp sponge should be done quickly, so the payload does not need to be moved to another refrigerator during cleaning.
3. Heavy cleaning of severe deposits of dirt and debris requires the payload be moved to another storage refrigerator during cleaning to protect the payload from both heat and contamination.
4. Users are advised to follow their own local sanitizing protocols for the interior refrigerated compartment, keeping in mind that harsh chemicals and abrasives should be avoided. Users are expected to clean the payload area at a frequency and cleanliness level sufficient for the payload being stored or transported. Disinfectant cleaning chemicals are considered sufficient for typical upkeep, such as CloroxPro Formula 409; Spray the chemical on the interior compartment and allow to sit for a minimum duration, then wipe with a clean, dry rag or towel; review the data sheets provided by the cleaning chemical used to determine the minimum duration for the level of disinfection required.



WARNING

See General Warning: Payload and Product Leakage

Removal and Installation of 3.6 Volt Lithium Battery

Removal



WARNING

See General Warning: Two-Person Carry



WARNING

See General Warning: Battery Connection/Disconnection



WARNING

See General Warning: Battery Maintenance or Service

NOTE

All data points will be lost when the Lithium Battery and all power sources are removed from the unit.



CAUTION

See General Caution: Shorting, Open, or Intermittent Electrical Components



CAUTION

See General Caution: Checking the 3.6V Battery



WARNING

See General Warning: Functional Component Hazards



CAUTION

See General Caution: Pull Handle Usage

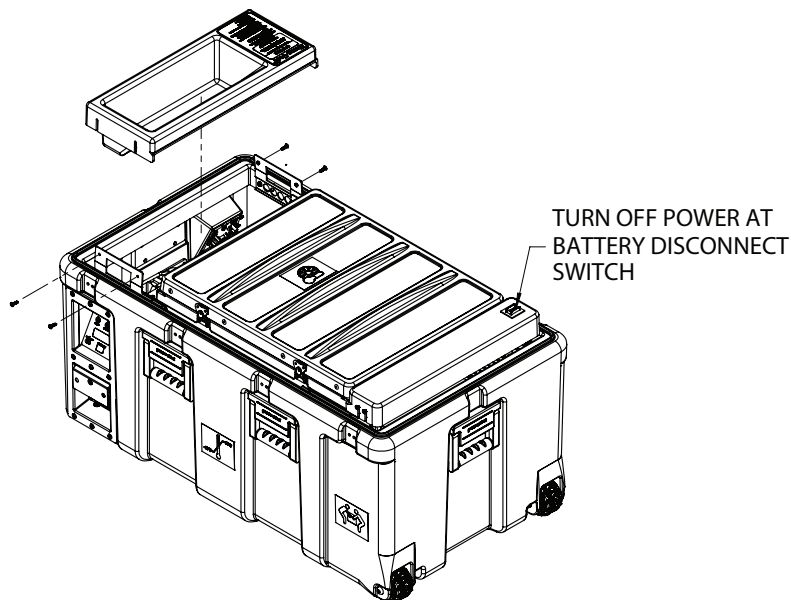


Figure 63. Removing and Re-installing the Control Panel, Compressor Side

1. Remove outer lid per instructions on Pg. 7-7.
2. Disconnect all external power sources and prepare the unit for maintenance.
3. Refer to Figure 63.

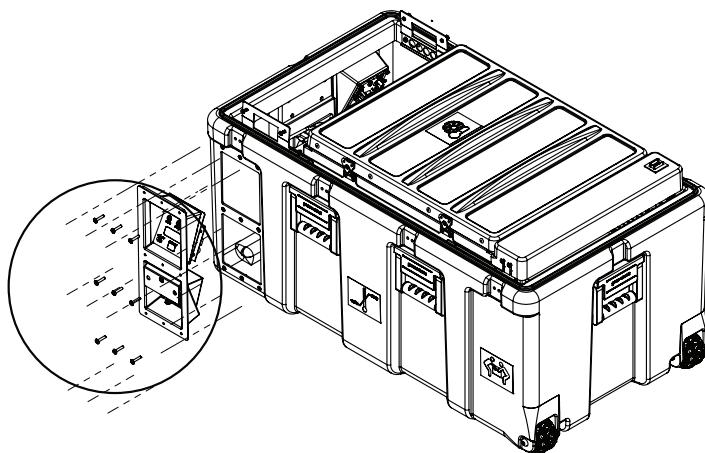


Figure 64. Removing and Re-installing the Control Panel Bezel

4. Loosed four screws on large cover panel.
5. Turn battery disconnect switch off.
6. Refer to Figure 64.
7. Remove nine screws (circled) from the Control Panel Assembly and remove from Green Case.

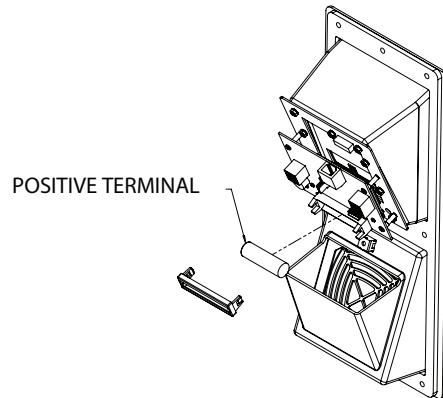


Figure 65. Removing and Installing the AA Battery on the Control Panel

8. Refer to Figure 65.
9. Remove the Retaining Clip from the Lithium Battery holder located on the Display Board by expanding the end tabs and pulling outward.
10. Remove the 3.6V Lithium Battery from the holder.

Installation

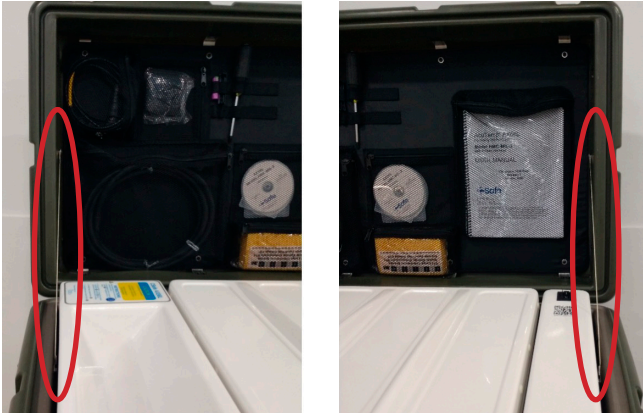
NOTE

If removing the 3.6 volt Lithium Battery is being done to clear all data from the display board, replacing the Lithium Battery with a new one will not be necessary.

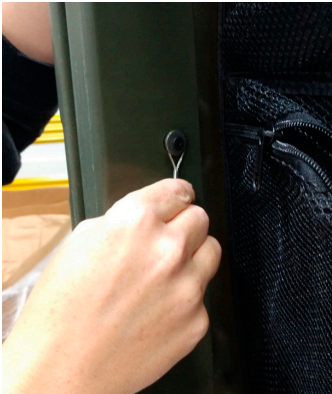
1. Refer to Figure 65.
2. Install the 3.6 volt Lithium Battery into the Display Board with the positive terminal toward payload compartment.
3. Install the Retaining Clip by aligning it over the Lithium Battery and pushing inward until both end tabs are securely locked into the battery holder.
4. Refer to Figure 63 and Figure 64.
5. Install the Control Panel Assembly into the Green Case using nine screws (circled).
6. Install the cover panel with four screws.

Outer Lid Removal

1. Unlatch and open the outer lid. Note the tethers at each end of the lid.



2. Remove the tethers at each end of the lid by hand and allow them to hang outside the case.



3. With the lid standing upright, lift towards the center of the unit to disengage the hinges. Some re-positioning of the lid may be necessary to allow the hinges to successfully disengage.



Outer Lid Installation

1. Simply reverse the order of outer lid removal, ensuring the tethers are re-attached to the lid.

NOTE

When installing the lid, start by engaging the hinge furthest away from you and work your way back towards yourself.

Other Repair and Maintenance

Other maintenance, such as replacing the 12V batteries, the data logger battery, or the indicator lamps cannot be performed by the user. A qualified technician must perform these tasks. Both battery sets should last several years (up to five), but such indicators as shortened battery operating time may indicate that conditions make it necessary to replace batteries sooner.

Qualified technicians must perform all repair work. If none are available, arrangements may be made to return the AX56L to the factory for repair. CSafe technical support can also be contacted to provide training for technicians.

Operating principles, technical diagrams and procedures, and more comprehensive part lists than those described in this manual are provided in the AX56L HMC-MIL-3 Service Manual, Publication 102011-0.

In the event of a possible malfunction, change in unit performance, or change in the device that may affect safety, stop using the unit and contact a qualified technician with access to the AX56L HMC-MIL-3 Service Manual, Publication 102011-06, or arrange the return of the AX56L to the factory for repair.

Appendix A:

Accessory List for Model HMC-MIL-3

The following items are supplied with each AX56L Model HMC-MIL-3 unit.

<i>Quantity</i>	<i>Description</i>	<i>Part Number</i>
2 ea.	Fuse 3-Amp, 3AG-Type I ² t = 14A ² s 1.25" x 0.25" (31.75 x 6.35) Breaking Capacity = 10,000A@125Vac	100523
1 ea.	Manual/Tool Kit Assembly	101957-06
1 ea.	Screwdriver, No. 2 Phillips-Head (Incl. in P/N 101957-06)	100631
1 ea.	Cellulose Sponge (Incl. in P/N 101957-06)	101832
1 ea.	Bubble-Out Storage Bag (Incl. in P/N 101957-06)	101961
1 ea.	Replacement Filters, bag of 10 (Incl. in P/N 101957-06)	101964
1 ea.	CD - User Manual, Model HMC-MIL-3 (Incl. in P/N 101957-06)	101962-06
1 ea.	CD - Service Manual, Model HMC-MIL-3 (Incl. in P/N 101957-06)	101963-06
1 ea.	CD - HermaLog Software (Incl. in P/N 101957-06)	102009-01
1 ea.	Manual, User, Model HMC-MIL-3 (Incl. in P/N 101957-06)	102010-06
1 ea.	Manual, Service, Model HMC-MIL-3 (Incl. in P/N 101957-06)	102011-06
1 ea.	Serial Cable	270277-01

Appendix A:

Accessory List for Model HMC-MIL-3

The following items are optional with each AX56L Model HMC-MIL-3 unit.

<i>Quantity</i>	<i>Description</i>	<i>Part Number</i>
	Blood Basket	
10 ea.	Basket, Blood Storage (AX56)	100000
2 ea.	Large Basket, AX56L, Half Height	100001
1 ea.	Large Basket, AX56L, Full Height	100002
	AC Power Cord	
1 ea.	Power Cord, A/C Input (USA)	100970
1 ea.	Power Cord, A/C Input (Australia)	240002-01
1 ea.	Power Cord, A/C Input (EU)	240002-02
1 ea.	Power Cord, A/C Input (UK)	240002-03
	DC Power Cord	
1 ea.	Power Cord, DC Input, 16-9 Config	100968-01
1 ea.	Power Cord, DC Input w/ Batt Clip	100968-02
1 ea.	Power Cord, DC Input w/ Mini Plug	100968-03
	Batteries	
2 ea.	Battery, 12 Volt, 21 Ah (Lead Acid)	101880
	Cases (Contact CSafe for case color other than OD)	
1 ea.	Case with wheels and hinges	101875-000
1 ea.	Case with wheels and latches	101875-001
1 ea.	Case without wheels and hinges	101875-010
1 ea.	Case without wheels and latches	101875-011

Appendix B: Component Diagrams for Model HMC-MIL-3

Major component diagrams for the AX56L Model HMC-MIL-3 unit include:

Power Board

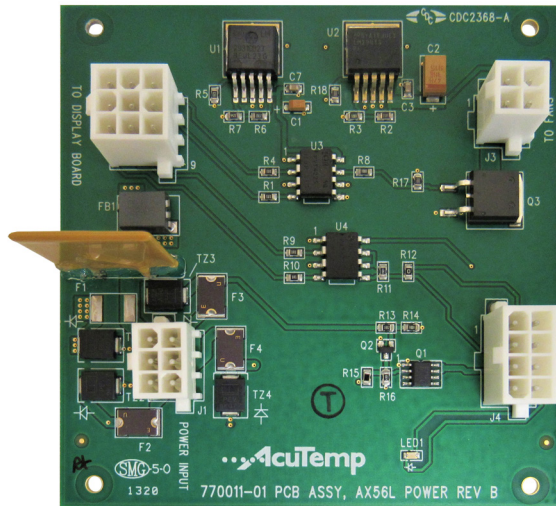
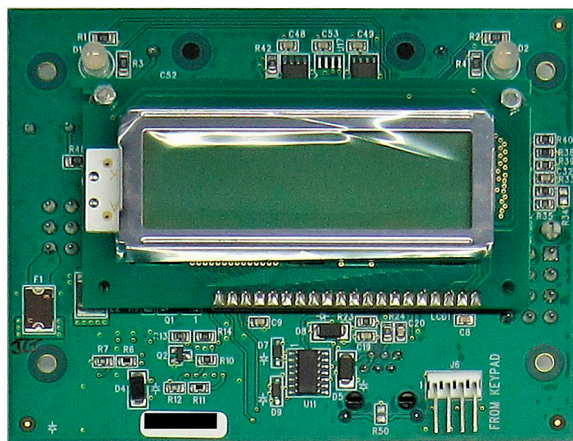
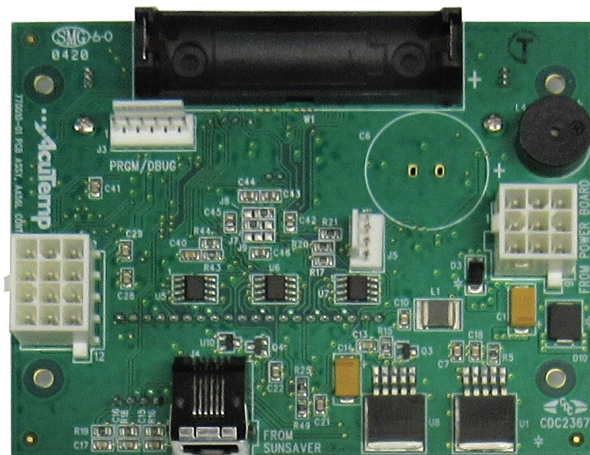


Figure B-1. AX56L Power Board

Control / Display Board



Top

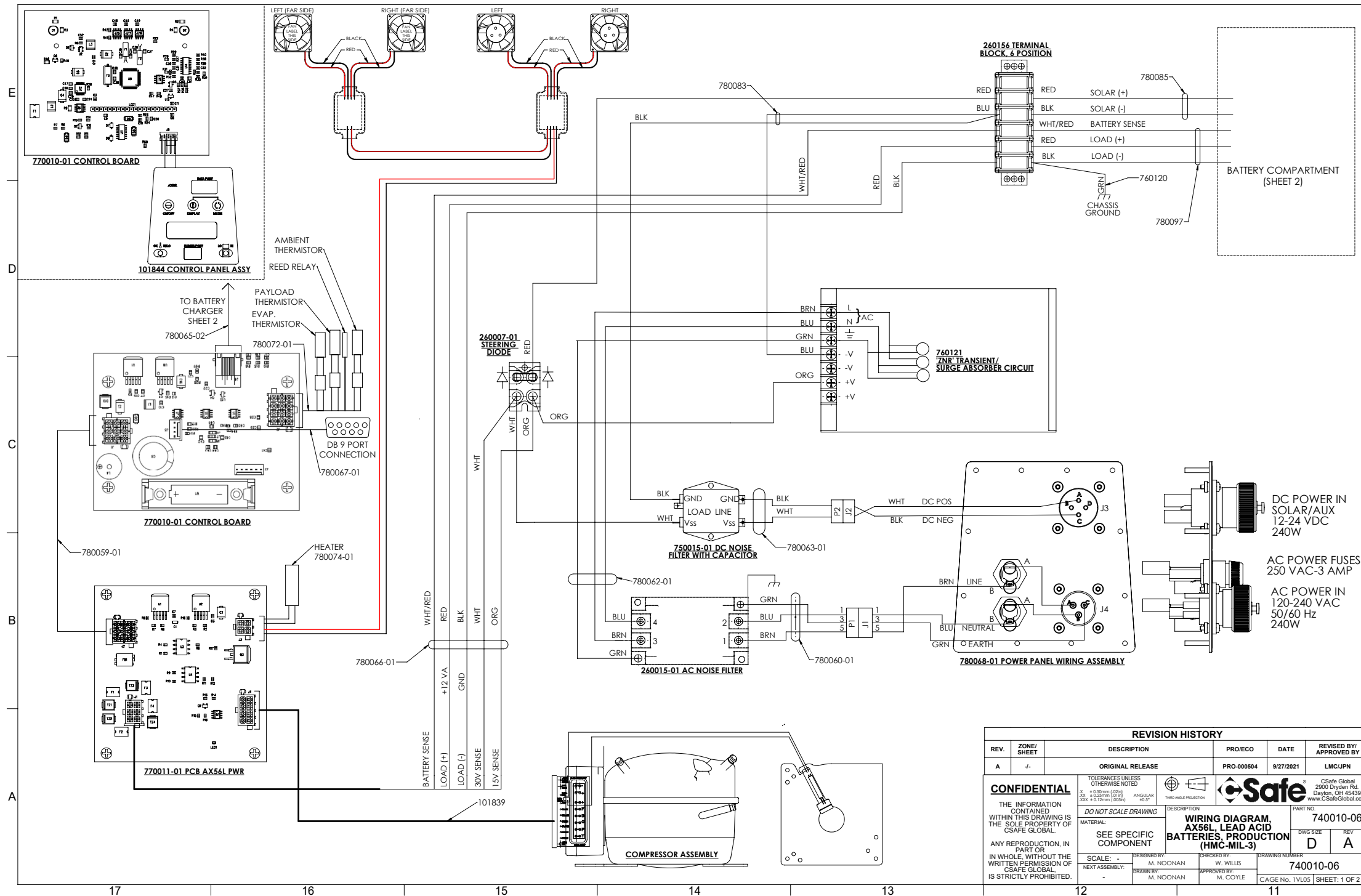


Bottom

Figure B-2. AX56L Control / Display Board

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Appendix C: AX56L Wiring Diagrams

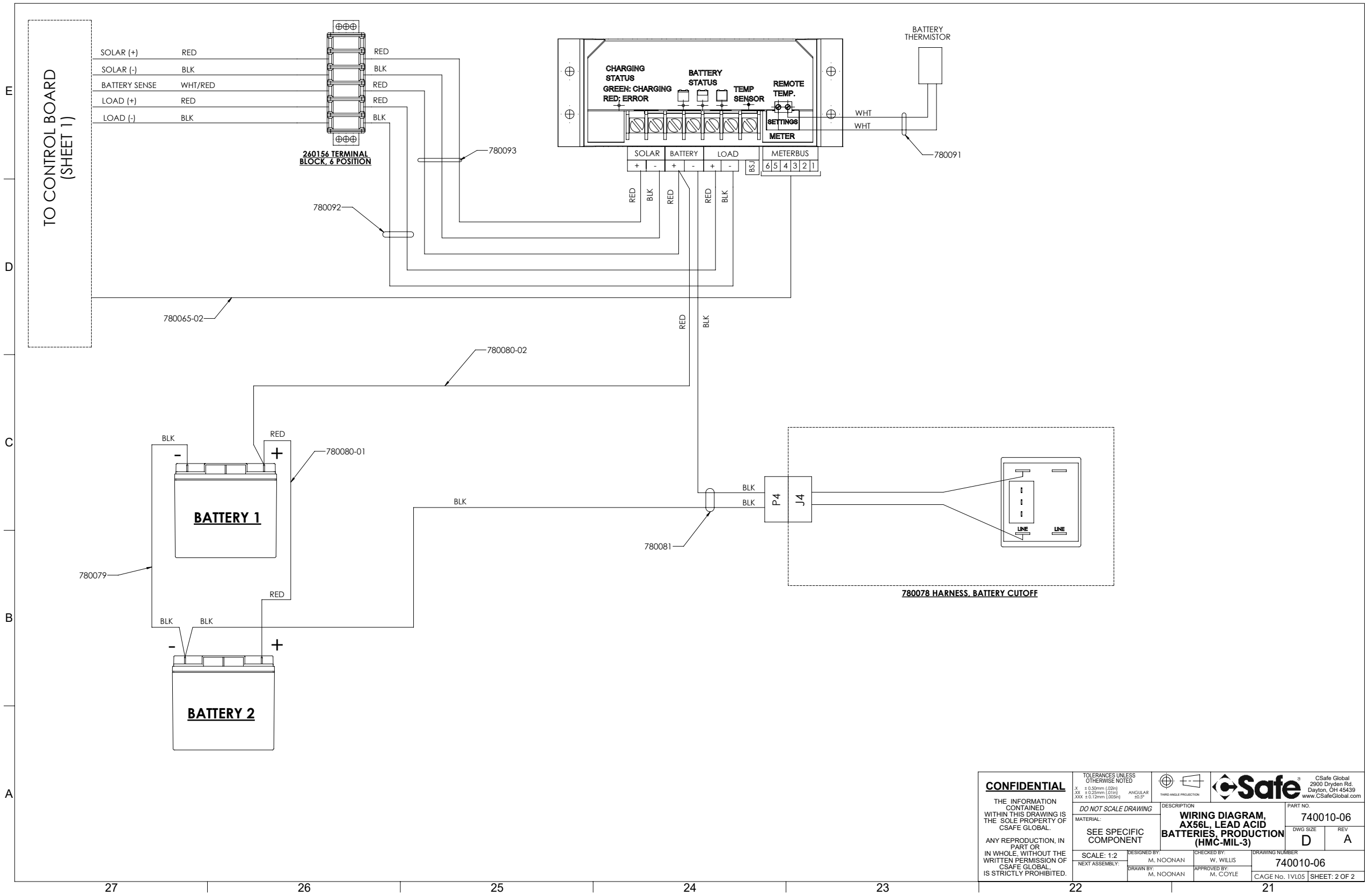


REVISION HISTORY					
REV.	ZONE/SHEET	DESCRIPTION	PROJECO	DATE	REVISED BY/ APPROVED BY
A	-	ORIGINAL RELEASE	PRO-000504	9/27/2021	LMCUPN

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	<p>DO NOT SCALE DRAWING</p> <p>MATERIAL: SEE SPECIFIC COMPONENT</p> <p>SCALE: -</p> <p>DESIGNED BY: M. NOONAN</p> <p>DRAWN BY: M. NOONAN</p>		<p>DESCRIPTION</p> <p>WIRING DIAGRAM, AX56L LEAD ACID BATTERIES, PRODUCTION (HMC-MIL-3)</p> <p>DWG SIZE: D</p> <p>REV: A</p> <p>DRAWING NUMBER: 740010-06</p> <p>CAGE No. 1VLOS SHEET: 1 OF 2</p>	

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	<p>DO NOT SCALE DRAWING</p>	<p>DESCRIPTION</p> <p>WIRING DIAGRAM, AX56L, LEAD ACID BATTERIES, PRODUCTION (HMC-MIL-3)</p>	<p>PART NO.</p> <p>740010-06</p>
	<p>SEE SPECIFIC COMPONENT</p>	<p>SCALE: 1:2</p> <p>DESIGNED BY: M. NOONAN</p> <p>CHECKED BY: W. WILLIS</p> <p>DRAWN BY: M. NOONAN</p> <p>APPROVED BY: M. COYLE</p>	<p>DWG SIZE</p> <p>D</p> <p>REV</p> <p>A</p>
	<p>NEXT ASSEMBLY:</p>	<p>DRAWING NUMBER</p> <p>740010-06</p>	<p>CAGE No. 1VL05</p> <p>SHEET: 2 OF 2</p>

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Appendix D: EMC Guidelines

Table 1

Guidance and manufacturer's declaration - electromagnetic emissions		
The AX56L is intended for use in the electromagnetic environment specified below. The customer or the user of the AX56L should assure that it is used in such an environment		
Emissions Test	Compliance	Electromagnetic environment - guidance
RF Emissions CISPR 11	Group 1	The AX56L uses RF energy only for its internal function. Therefore, its RF emissions are very low and are not likely to cause any interference in nearby electronic equipment
RF Emissions CISPR 11	Class B	The AX56L is suitable for use in all establishments including domestic and those directly connected to the public low-voltage power supply network power supply that supplies buildings used for domestic purposes.
Harmonic emissions IEC/EN 61000-3-2	Class A	
Voltage fluctuations / flicker emissions IEC/EN 61000-3-3	Complies	

Table 2

Guidance and manufacturer's declaration - electromagnetic immunity			
The AX56L is intended for use in the electromagnetic environment specified below. The customer or the user of the AX56L should assure that it is used in such an environment			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Electrostatic discharge (ESD) EN/IEC 61000-4-2	± 6 kV Contact ± 8 kV Air	Complies	Floors should be wood, concrete, or ceramic tile. If floors are covered with synthetic material, the relative humidity should be at least 30%
Radiated RF EN/IEC 61000-4-3	3 V/m 80MHz to 2.5GHz	Complies	Field strengths outside the shielded location from fixed RF transmitters, as determined by an electromagnetic site survey should be less than 3 V/m. Interference may occur in the vicinity of equipment marked with the following symbol:
Conducted RF EN/IEC 61000-4-6	3 Vrms 150kHz to 80MHz	Complies	
Electrical fast transient EN/IEC 61000-4-4	+ 2 kV power line + 1 kV I/O lines	Complies	Mains power quality should be that of a typical commercial or hospital environment.
Surge EN/IEC 61000-4-5	+ 1 kV differential + 2 kV common	Complies	
Power frequency magnetic field EN/IEC 61000-4-8	3 A/m	Complies	Power frequency magnetic fields should be at levels characteristic of a typical location in a typical commercial or hospital environment.
Voltage dips, short interrupts and voltage variations on power supply input lines EN/IEC 61000-4-11	>95% dip 0.5 cycle 60% dip 5 cycles 70% dip 25 cycles 95% dip 5 sec.	Complies	Mains power quality should be that of a typical commercial or hospital environment. If the user of the AX56L requires continued operation during power mains interruptions, it is recommended that the AX56L be powered from an uninterruptible power supply or battery.

Table 3


Guidance and manufacturer's declaration - electromagnetic immunity (not life-supporting)			
The AX56L is intended for use in the electromagnetic environment specified below. The customer or the user of the AX56L should assure that it is used in such an environment			
Immunity test	IEC 60601 test level	Compliance level	Electromagnetic environment - guidance
Conducted RF IEC 61000-4-6	3 Vrms 150kHz to 80MHz	3 Vrms	Portable and mobile RF communications equipment should be used no closer to any part of the AX56L, including cables, than the recommended separation distance calculated from the equation applicable to the frequency of the transmitter. Recommended separation distance $d = 1.17 \sqrt{P}$ 80 MHz to 800 MHz $d = 2.33 \sqrt{P}$ 800 MHz to 2.5 GHz Where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer and d is the recommended separation distance in meters (m) Field strengths from fixed RF transmitters, as determined by an electromagnetic site survey, ^a should be less than the compliance level in each frequency range. ^b Interference may occur in the vicinity of equipment marked with the following symbol: 
Radiated RF IEC 61000-4-3	3 V/m 80 MHz to 2.5 GHz	3 V/m	
NOTE 1 At 80 MHz and 800 MHz, the higher frequency range applies.			
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			
^a Field strengths from fixed transmitters, such as base stations for radio (cellular/cordless) telephones and land mobile radios, amateur radio, AM and FM radio broadcast and TV broadcast cannot be predicted theoretically with accuracy. To assess the electromagnetic environment due to fixed RF transmitters, an electromagnetic site survey should be considered. If the measured field strength in the location in which the AX56L is used exceeds the applicable RF compliance level above, the AX56L should be observed to verify normal operation. If abnormal performance is observed, additional measures may be necessary, such as re-orienting or relocating the AX56L.			
^b Over the frequency range 150 kHz to 80 MHz, field strengths should be less than 3 V/m			

Table 4

Recommended separation distances between portable and mobile RF communications equipment and the AX56L			
The AX56L is intended for use in an electromagnetic environment in which radiated RF disturbances are controlled. The customer or the user of the AX56L can help prevent electromagnetic interference by maintaining a minimum distance between portable and mobile RF communications equipment (transmitters) and the AX56L as recommended below, according to the maximum output power of the communications equipment.			
Rated maximum output power of transmitter P (Watts)	Separation distance (d) according to frequency of transmitter (meters)		
	150kHz to 80 MHz d = 1.167 √P	80 MHz to 800 MHz d = 1.167√P	800 MHz to 2.5 GHz d = 2.33 √P
0.01	0.12	0.12	0.23
0.1	0.37	0.37	0.75
1	1.17	1.17	2.33
10	3.70	3.70	7.37
100	11.70	11.70	23.30
For transmitters rated at a maximum output power not listed above, the recommended separation distance d in metres (m) can be estimated using the equation applicable to the frequency of the transmitter, where P is the maximum output power rating of the transmitter in watts (W) according to the transmitter manufacturer.			
NOTE 1 At 80 MHz and 800 MHz, the separation distance for the higher frequency range applies.			
NOTE 2 These guidelines may not apply in all situations. Electromagnetic propagation is affected by absorption and reflection from structures, objects and people.			

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