AcuTemp® AX56L
(formerly HemaCool®)

Advanced Technology Product Storage and Transport Refrigerator/Freezer

Model HMC-MIL-1A
NSN 4110-01-629-9593

USER MANUAL

a CSafe Brand
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February, 2015

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Acronyms and Abbreviations

° C	Degrees, Celcius
° F	Degrees, Farenheit
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
COM*x*	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]
EDST	Eastern Daylight Savings Time
EEPROM	Electronically Erasable Programmable Read Only Memory
EST	Eastern Standard Time
Evap	Evaporator
EXT, Ext	external
EXT PWR	External Power
F	Farenheit
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

In.	inch
Info	Information
kg	kilogram
LCD	Liquid Crystal Display
lb	pound
LED	Light Emitting Diode
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	mililiter
mm	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

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.

Read This User Manual

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.

Chapter 1: Introduction

About This User Manual

This User Manual is divided into chapters that provide a complete description of the AcuTemp® 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-1A (NSN 4110-01-629-9593) 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 AcuTemp® 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 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 two internal 21-ampere-hour batteries are properly charged, will maintain a temperature range of 1° C (34° F) to 6° C (43° F) for more than 24 hours at 24° C (75° F) ambient temperature. In the COOL mode (4° C [39º F] set point), the unit prevents payload freezing in sub-zero environments by applying heat, rather than cooling.

In the FREEZE mode, the unit should achieve -22° C (-7.6° F) or below in four hours or less at room temperature. The unit will maintain frozen medical products below freezing indefinitely provided external DC or external AC power is maintained.

In FREEZE mode, using its two internal batteries, properly charged, the unit will keep blood products frozen for more than eight hours, at an ambient temperature of 24° C (75° 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.

CAUTION

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

- **Connect (or reconnect) the internal battery cables to the two lead-acid batteries. (See operating instructions in Chapter Four.)**
- **Connect AC power cord from AC power connector on the front panel into the AC power source (the exhaust fan will activate and should be quietly audible).**
- **Install (or re-install) the 3.6 V lithium battery (positive side towards payload compartment). (See operating instructions in Chapter Four.)**
- **For the AX56L unit to power on, charged and fully functional batteries must be installed. The unit will not operate with AC power if two functioning batteries are not properly installed in the battery compartment. (See operating instructions in Chapter Four.)**

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

3. All power connections must be made in the specific order indicated in this user 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.

Customer Support

The customer support is available via the following methods:

Please contact AcuTemp® Brand Technical Support at:

(USA) 1-888-323-9576

(International) +1-937-245-6350

(FAX) +1-937-312-1277

(Email) support@CSafeGlobal.com

Offices Hours: 9.00 am – 5.00 pm

Monday – Friday (EST or EDST)

Warranty Information

The AX56L is warranted to be free from defects in manufacturing and workmanship for a period of one (1) year from the date of purchase. This limited warranty covers repair or replacement of the unit at CSafe's discretion. Customer abuse is not covered by this warranty.

In no event shall CSafe be liable for any indirect, special, consequential, or incidental damages, including but not limited to, damages for loss of use of equipment, loss of revenue, loss of product, loss of profits, or loss of goodwill, regardless of whether CSafe (a) has been informed of the possibility of such damages or (b) is negligent.

If the unit fails during the warranty period, it must be shipped to CSafe or to a factory-designated service center for repair or replacement. The unit must be packaged such that it will not be damaged in transit and insured for its full value. Should the failure be attributed to customer abuse, CSafe will charge the customer for the costs of repair.

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.

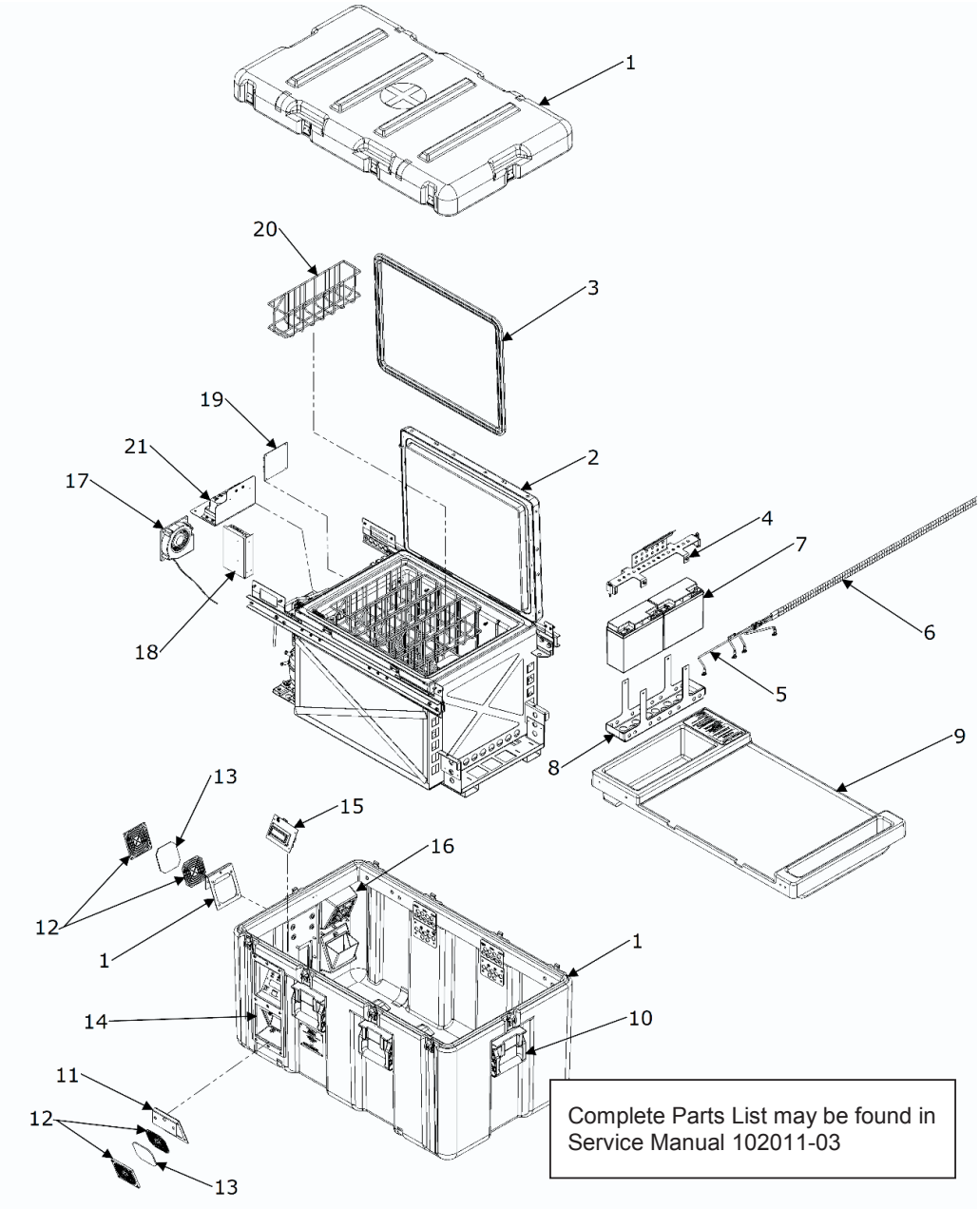

Figure 1. Major AX56L Components

Table 1. AX56L Component Nomenclature

Key	*Component*	*Function*
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 removable lid and a connector panel at the front to connect external AC or DC power. The user controls and displays are also located there. The outer lid is secured to the lower case with ten positive locking latches for secure storage and transport.
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.
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 two lead-acid batteries inside the battery compartment.
5	Battery power harness	Connects the lead-acid batteries to the fusible link assembly.
6	Fusible link assembly	Connects the lead-acid power source to the power panel and is designed to act as a fuse in the event of a power surge that could damage electrical and mechanical components.
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 8 hours in the FREEZE mode or 24 hours in the COOL mode.
8	Battery compartment	Contains and secures two lead-acid batteries and associated harness and fusible link assembly.
9	Cover panel	Covers the left and right compartments and acts as a support frame for inner lid and storage space for accessories.
10	Handle assembly	Six tie-down-rated carrying handles for two- or four-person carry transportation
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 and control panel	Located in the left front of the exterior case, it holds the main display and user controls.

Key	*Component*	*Function*
15	Control / Display Board	Provides the interface for operating the AX56L. The user interface includes a power switch, 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 ten easy-load wire baskets that provide all-around convection and air circulation for uniform temperature control of all payload packs.
21	Input Power Assembly	Contains a Controller (Battery Charger) for charging the internal batteries. Also, a Steering Diode, which is used to allow the Controller to use either internal DC power from the power supply or external DC power.

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)
FREEZE Mode Set Point	-22° C (-7.6° F)

AX56L Refrigeration 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)	180 lb (81.7 kg)
Tare Weight (case)	142 lb (64.5 kg)
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, 21 ampere-hour	42 ampere-hour capacity for 24 hours of storage-only mode operation
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. 14 hours at 43° C (110° F) ambient b. 48 hours at 25° C (77° F) ambient

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

AX56L Dimensions

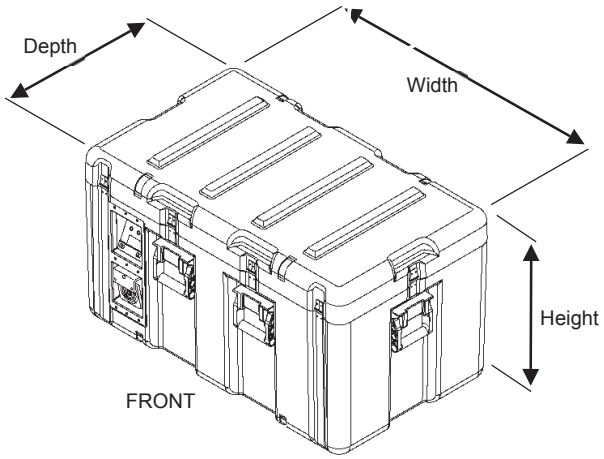

Figure 2. AX56L External Dimensioning

Table 2. AX56L Outer Dimensions

Dimension	*Imperial*	*Metric*
Width	39.2″	99.6 cm
Depth	23.2″	58.9 cm
Height	22.8″	57.9 cm

Table 3. AX56L Payload Compartment Dimensions

Dimension	*Imperial*	*Metric*
Width	18.0″	45.7 cm
Depth	14.0″	35.6 cm
Height	13.0″	33.0 cm

Concept of Operation

The AcuTemp® 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 two minutes, 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.

Functional Block Diagram

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

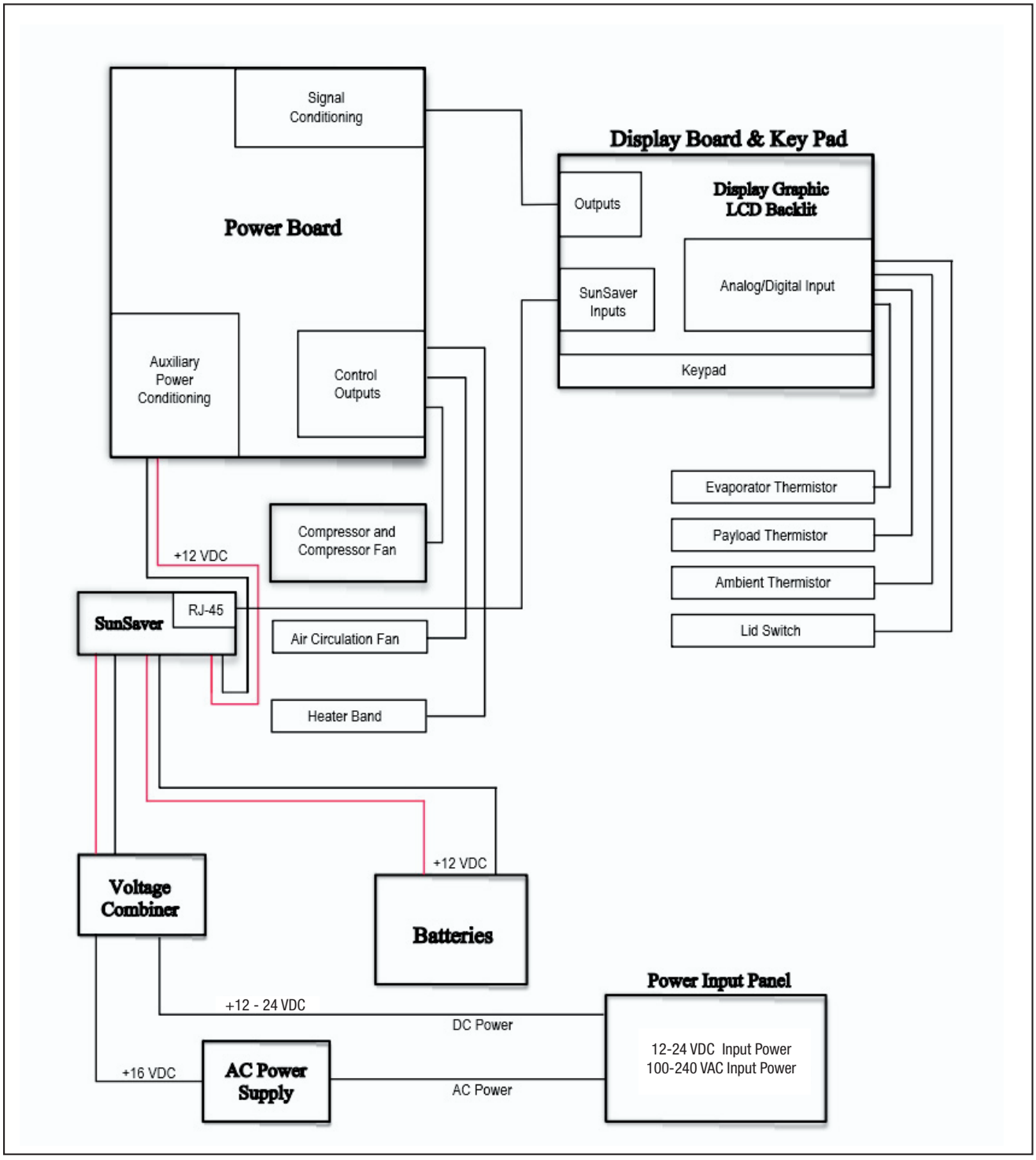

Figure 3. AX56L Block Diagram

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. The AC power connector is fused by two fuses on this panel. Two fuses are employed because the unit will operate on either 115 VAC or 250 VAC. Operation on 250 VAC requires both non-ground leads to be fused.

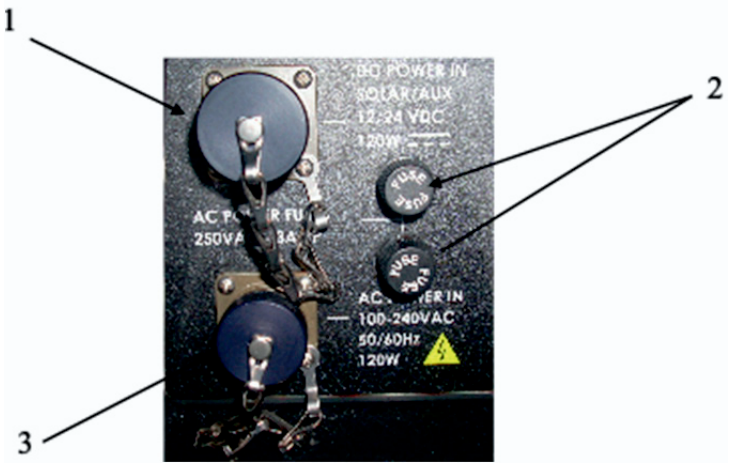

Figure 4. AX56L Power Panel Component Locations

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

DC Power Cord

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

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

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

The AX56L is solar array-capable using the DC input power jack.

An appropriately sized Solar Array can be used to power the AX56L and to charge the internal batteries.

Solar Requirements

The AX56L requires at least 120 watts capable power from a solar array.

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).

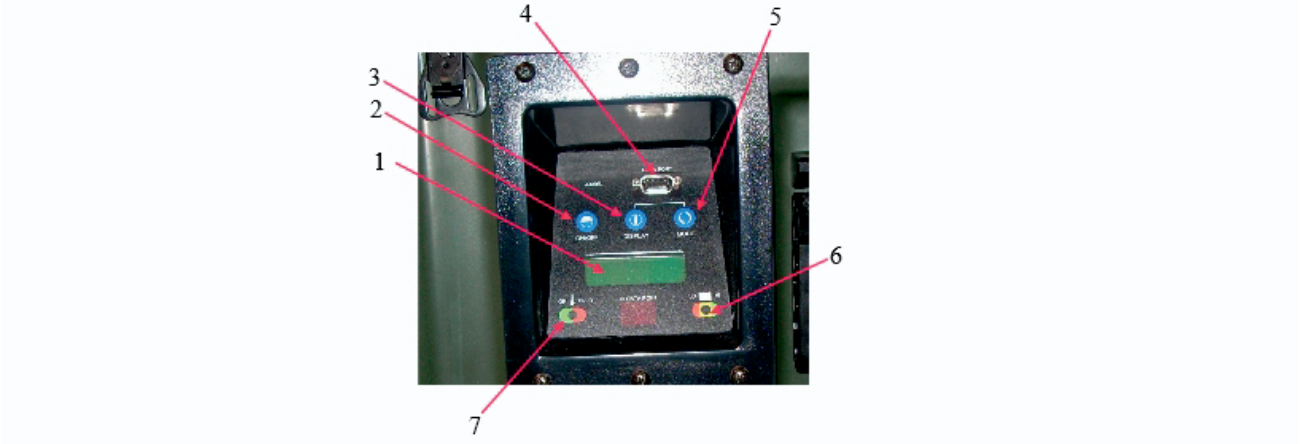

Figure 5. Display and Control Panel Component Locations

Table 5. Display and Control Panel Nomenclature

Key	*Component*	*Function*
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	Starts and shuts down unit, and when used in conjunction with the MODE key, sets the time and date
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

LED Color	*Payload Space Temperature*
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

LED Color	*Payload Space Temperature*
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

LED Color	*Battery Charge Remaining*
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 1º C (33.8° F) and 6º C (42.8° F), the GREEN temperature LED will be illuminated.
- When payload is at or below 1º C (33.8° F), the RED temperature LED will be illuminated.
- When payload is at or above 6º 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 2º 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 4º C (39.2° F), the evaporator is above 3º C (37.4° F).
- When heating, the unit will stop heating when the payload or the evaporator is above 4º C (39.2° F).
- When cooling, the unit will stop cooling when the payload is below 2º 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 -24.0º C (-11.2° F), control logic will turn the compressor on.
- When the evaporator is at or below -26.0º 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 lead-acid 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.

HemaLog Program

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. 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.

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
- Ambient (external) temperature
- Battery charge level
- Battery voltage output
- System status, which includes:
    - Operating or IDLE
    - COOL or FREEZE mode
    - Compressor on/off
    - Heater on/off
    - Lid open/closed (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 30-day period.

If, during active control operation (cooling or freezing), the main battery becomes 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).

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Chapter 3:
Shipment and Storage

CAUTION

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° ±1° C [39.2° ±2° F]) temperature setting only with materials that must be stored above freezing.

Use the FREEZE (-22° ±6° C [-7° ±11° 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).

Do not operate the unit in the COOL 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.

Unpacking and Readying for Operation

WARNING

The AX56L unit weighs 142 lb (64.5 kg) empty and up to 180 lb (81.7 kg) loaded. Always use at least two people when lifting or moving the unit. Failure to comply can result in injury to personnel.

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

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.

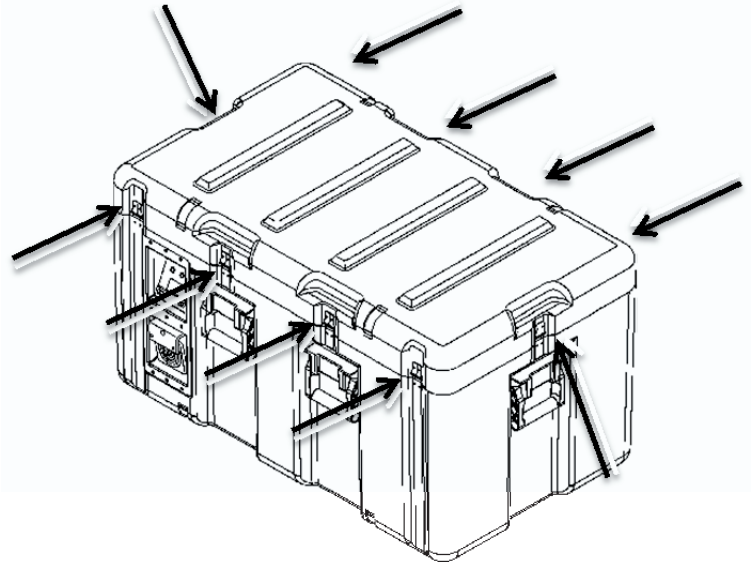

Figure 6. AX56L Outer Lid Latches

1. Remove the AX56L from its crating materials.
2. Unlatch the outer lid. This lid has 10 latches, one on each short side, four on the front, and four on the back (Figure 6).
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 cover panel.
5. Open the inner lid to access payload storage (Figure 7).

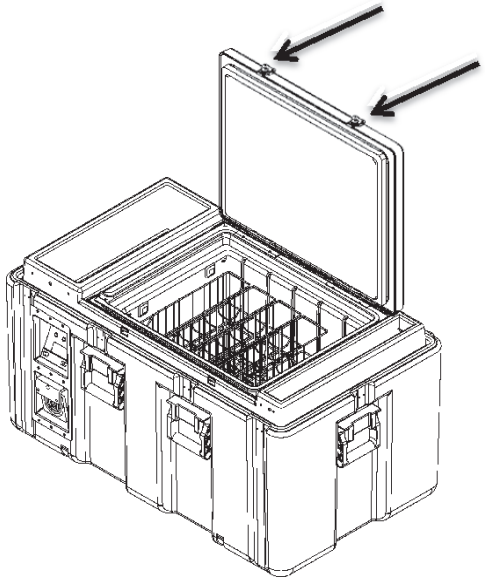

Figure 7. AX56L Inner Lid and Fasteners

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.

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 fiberglass 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.

This inspection will ensure the unit is in a serviceable condition for immediate use. If any damage is found, it should be reported and assessed by calling AcuTemp® technical support (Chapter 1). AcuTemp® technical support will assist in evaluating any damage and provide technical guidance regarding applicable repairs or service center locations.

Preparation for Shipment

CAUTION

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.

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.

Charge Batteries Before Storage

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

1. Plug AC power cord into wall outlet (the exhaust fan will come on).
2. Allow batteries to charge until LCD display shows BAT; FLOAT (Fig. 25).
3. Disconnect AC power cord from wall outlet.
4. Disconnect 12 V batteries from unit by pulling apart the connector in the battery compartment.
5. Remove 3.6 V lithium battery from the control board.

Recharge Batteries In Storage

The lead-acid 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. Reconnect harness in battery compartment.
2. Plug AC power cord into wall outlet (the exhaust fan will come on).
3. Allow batteries to charge until the LCD battery indicator reads BAT; FLOAT
4. Disconnect AC power cord from wall outlet.
5. Disconnect harness in battery compartment.
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.

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 fiberglass. Use only mild detergent cleaning products that are compatible with fiberglass surfaces and obey all associated material safety instructions.

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Chapter 4: Operation

Startup Procedures

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

1. Remove the accessory contents from the storage bins on each side of cover panel.
2. Remove eight screws that hold cover panel in place and remove cover (Figure 8).
3. Connect the battery power harness to the fusible link assembly (Figure 9).
4. Plug AC cord from AC power connector on case into wall outlet.
5. Position the 3.6 V lithium battery and retaining clip on the display board. (Positive terminal towards payload compartment.)
6. Reset the serial number, time, and date.
7. Re-install the cover panel with the eight screws.
8. Return accessory contents from the storage bins on each side of cover panel.

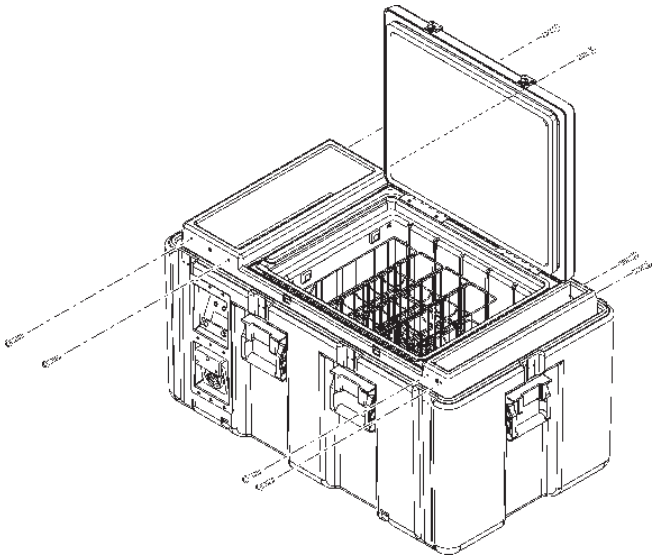

Figure 8. AX56L Battery Access

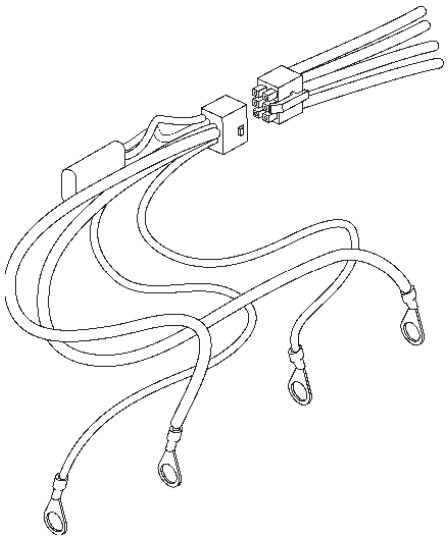

Figure 9. AX56L Battery Connection

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

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

- **Connect (or reconnect) the internal battery cables to the two lead-acid batteries.**
- **Connect AC power cord from AC power connector on the front panel into the AC power source (the exhaust fan will activate and should be quietly audible).**
- **Install (or re-install) the 3.6 V lithium battery (positive side towards payload compartment).**

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

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 10) on the left side of the unit's exterior case.

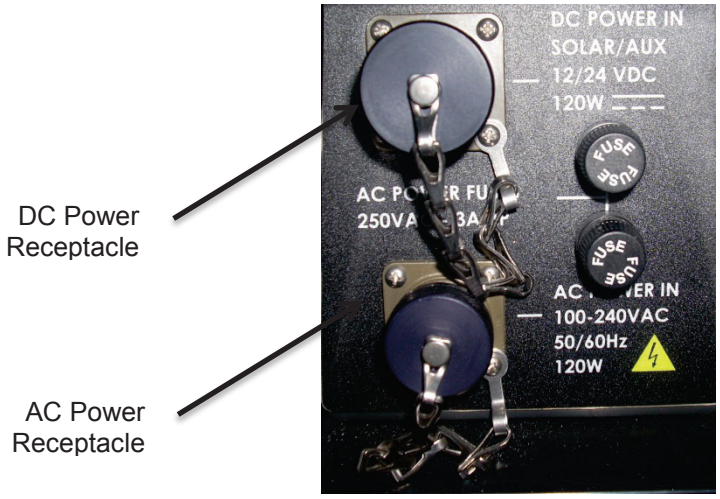

Figure 10. AX56L Power Panel

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 11) 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

5. **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 (Figure 11). For optimum field performance, do not begin a portable mission if the battery voltage is below 13.5 volts.**
6. **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.**

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7. 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.
8. 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.

Temp: 7.5° C HIGH
Batt: 93% EXT POWER
Mode: Cool COMP ON
08/OCT/14 16:15

Figure 11. 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 12).

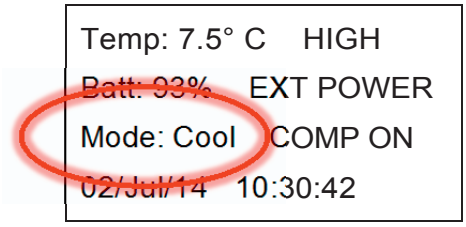


Figure 12. Information Page 1: Mode: Cool Example

- 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.

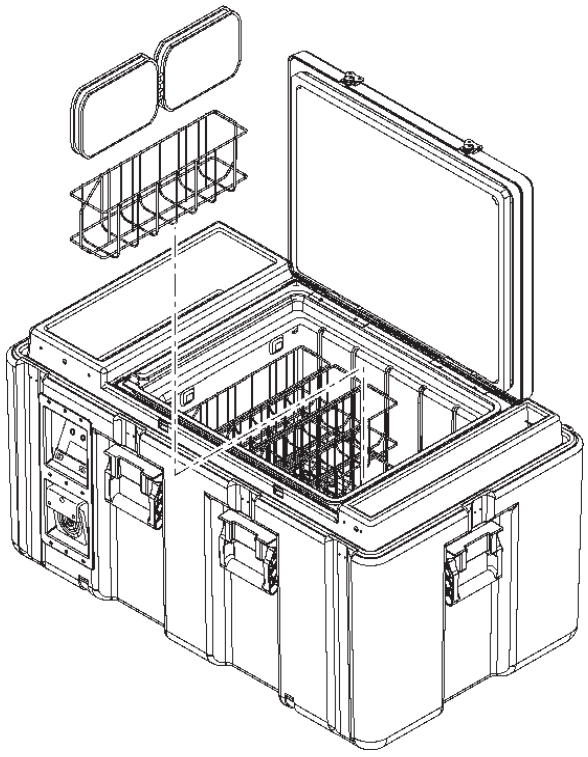


Figure 13. Loading Bio-Medical Materials into AX56L Payload Baskets

Loading Bio-Medical Payloads

The AX56L is equipped with 10 easy-loading individual baskets for storage of blood and blood products (Figure 13).

- 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.

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 14).

- 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

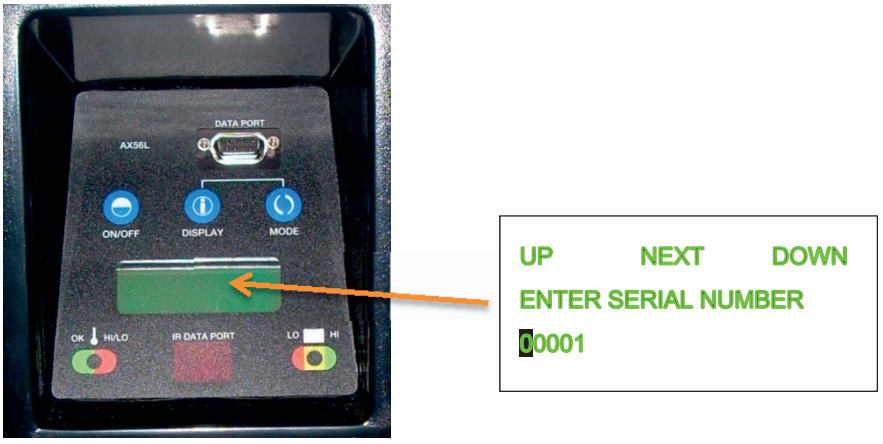


Figure 14. Serial Number Display Screen

Enter Date & Time

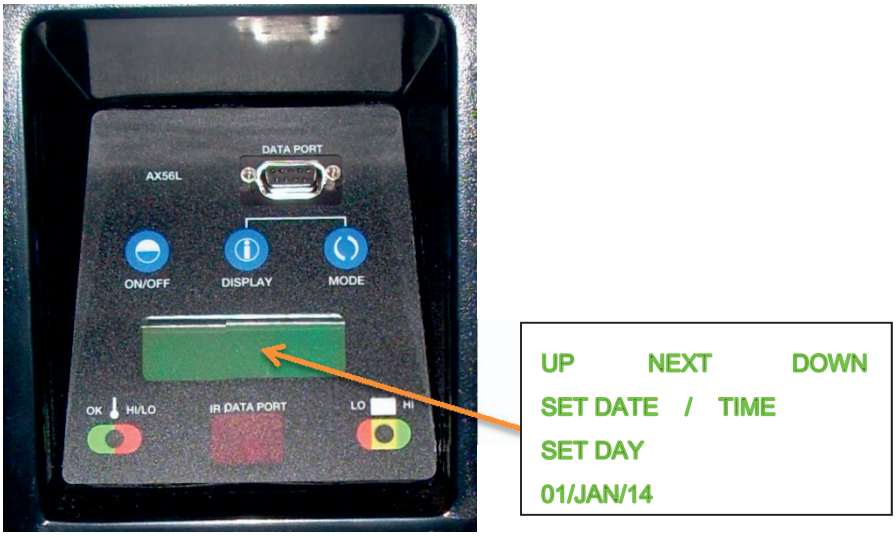


Figure 15. Date & Time Display Screen

The ON/OFF key is associated with the word UP on the display (Figure 15).

The DISPLAY key is associated with the word NEXT on the display (Figure 15).

The MODE key is associated with the word DOWN on the display.

The ON/OFF key will increase the digit number (1 to 31) highlighted on the screen for entering the DAY of the Month (Figures 16 and 17).

The ON/OFF key will increase the MONTH (JAN to DEC) highlighted on the screen for entering the MONTH on the display (Figures 16 and 17).

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.

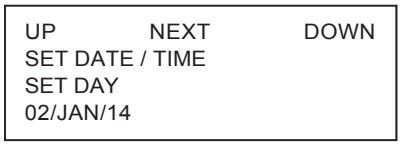


Figure 16. Enter Date & Time Screen; Day

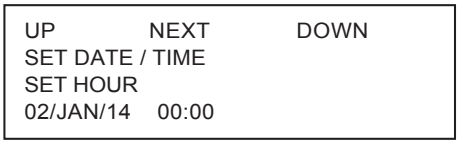


Figure 17. Enter Date & Time Screen; Hour

After Setting Date & Time

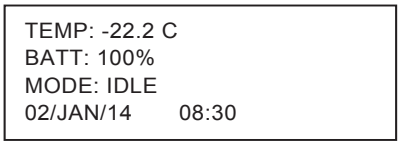


Figure 18. Idle Mode Screen

By pressing and holding the ON/OFF key for two seconds, the mode will change from IDLE to COOL (Figures 18 and 19, internal and external power).

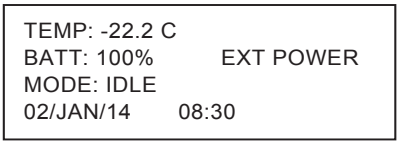


Figure 19. Idle Mode Screen, External Power Applied

By pressing the ON/OFF key for two seconds, mode reverts to IDLE (Figures 20 and 21, internal and external power).

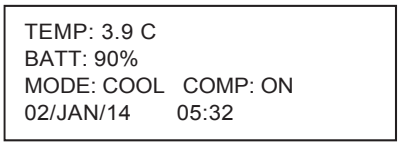


Figure 20. Cool Mode Screen

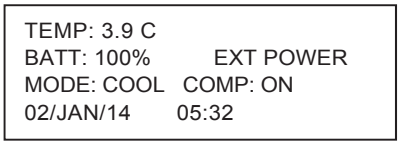


Figure 21. Cool Mode Screen, External Power Applied

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 22 and 23, internal and external power).

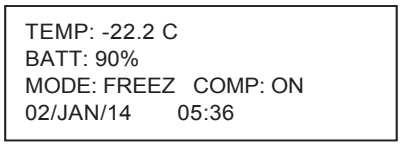


Figure 22. Freeze Mode Screen

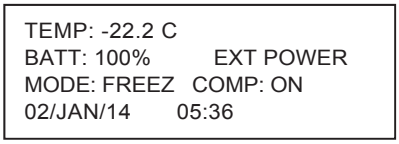


Figure 23. Freeze Mode Screen, External Power Applied

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 24)
- Diagnostic (Figure 25)
- Graph (Figure 26)

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

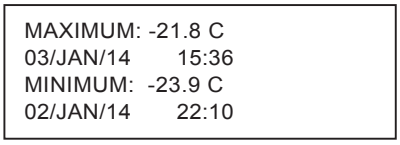


Figure 24. MIN / MAX Screen, Example A

Diagnostic Screen Example

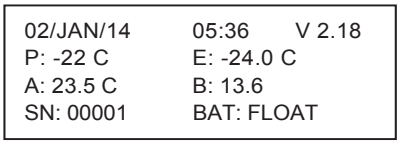


Figure 25. Diagnostic Screen, Example A

Graph Screen Example

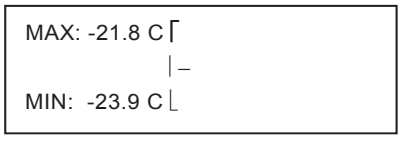


Figure 26. Graph Screen, Example B

Enter Date & Time Screen

Date and time shown in Figure 27 will ONLY appear if in IDLE mode:

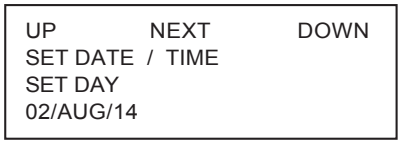


Figure 27. Date & Time Screen, IDLE Mode

MIN / MAX Screen

The MIN / MAX (Figure 28) 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.

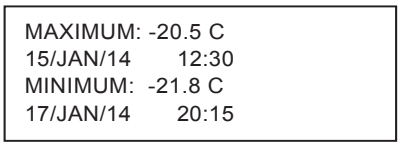


Figure 28. MIN / MAX Screen, Example B

Diagnostic Screen

The Diagnostic screens (Figures 29 and 30) display the current date and time and the version of software in the control board.

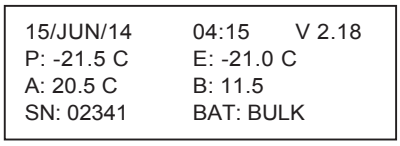


Figure 29. Diagnostic Screen, Example B

- 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.

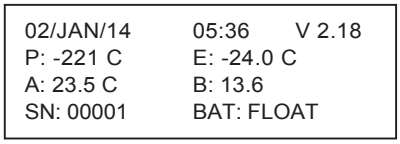


Figure 30. Diagnostic Screen, Example C

Graph Screen

The Graph screen (Figures 31) 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.

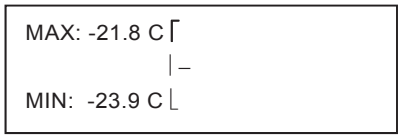


Figure 31. Graph Screen, Example B

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 32).

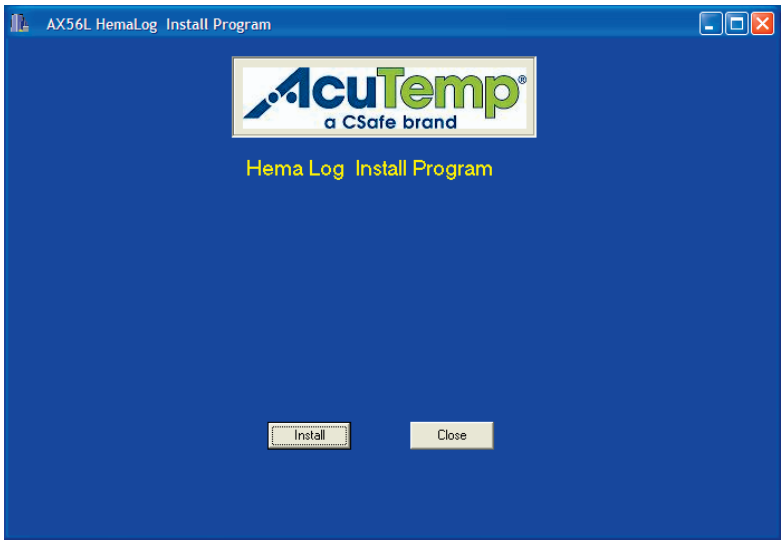


Figure 32. HemaLog Install Screen

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

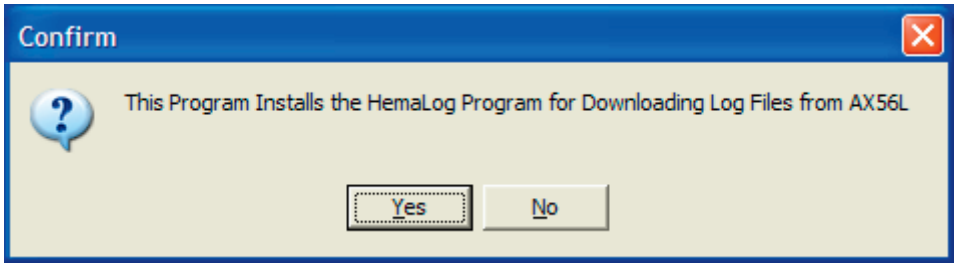


Figure 33. Confirmation Dialog Box

Press the ***Yes*** button to install the HemaLog software in the PC (Figures 33). Press ***No*** to discontinue with the HemaLog software installation at this time.

Close Any Open Programs

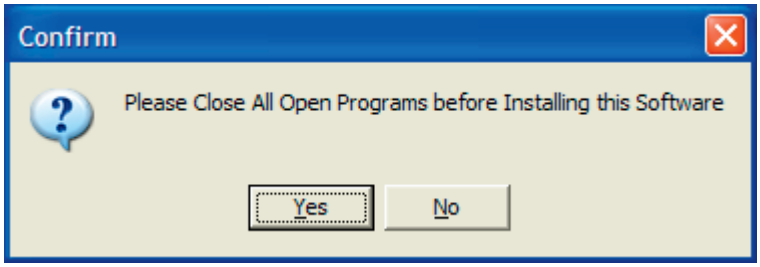


Figure 34. Close Open Programs Dialog Box

Close all other programs (Figure 34). 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 35).

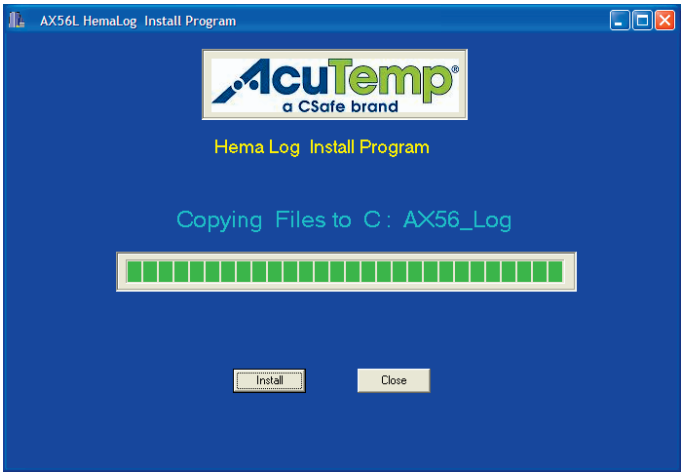


Figure 35. Copying Files Screen

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

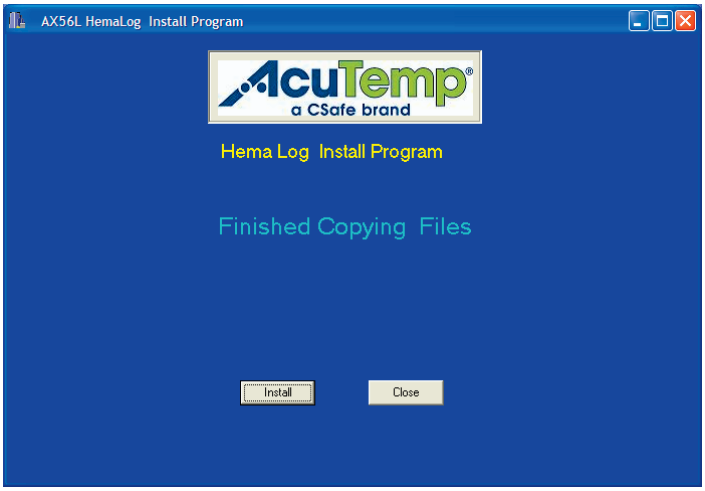


Figure 36. Finished Copying Files Screen

When the files have been copied to the newly created folders you see the “Finished Copying Files” message (Figure 36). 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 37. All AX56L activities can be performed from this screen.

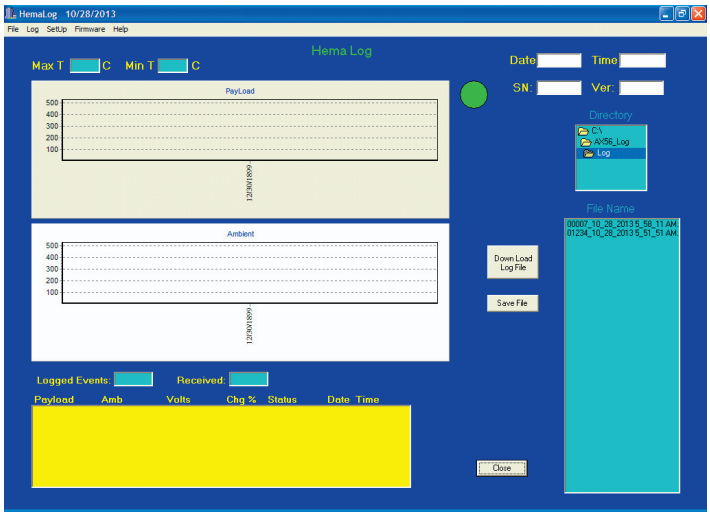
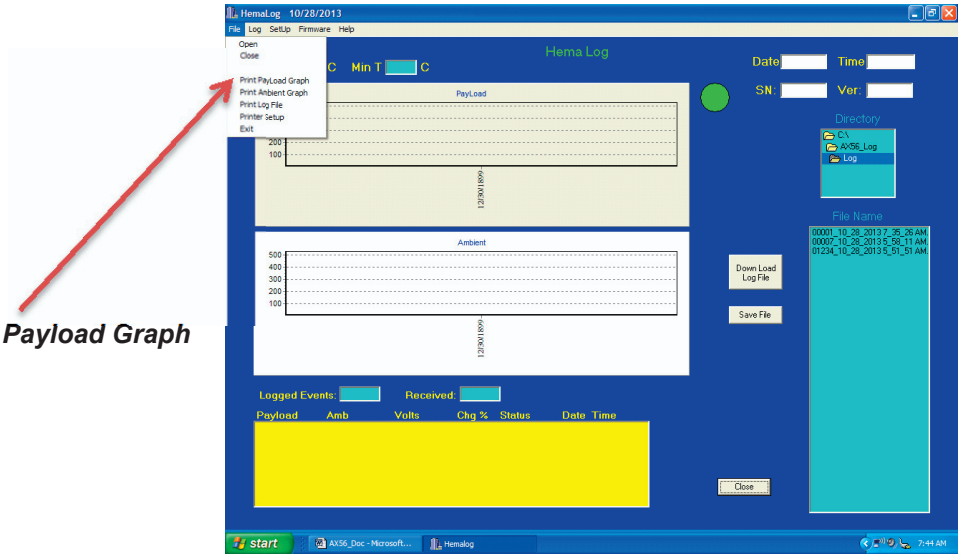


Figure 37. Main HemaLog Screen

File Menu



File → Print Payload Graph

Figure 38. HemaLog File Menu Screen

The File Menu (Figure 38) 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

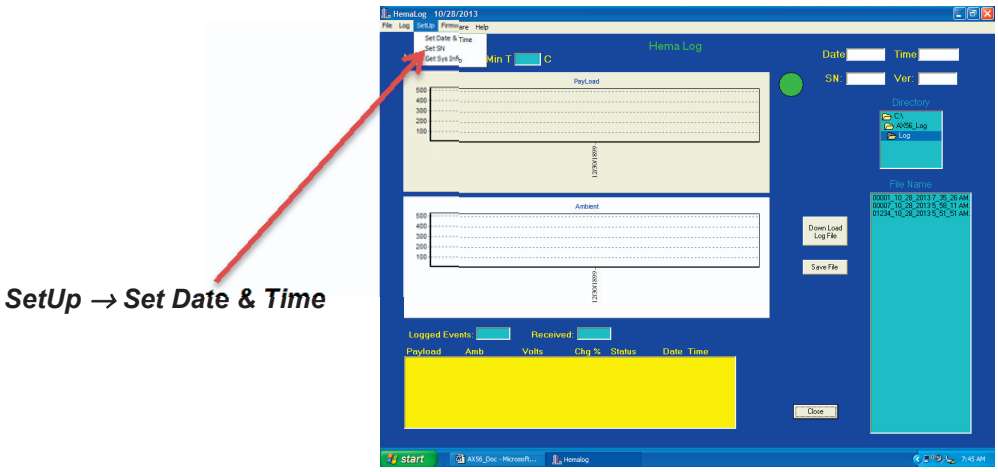


Figure 39. HemaLog Set Up Screen

Set Date & Time

Selecting Set Date & Time (Figure 31) 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

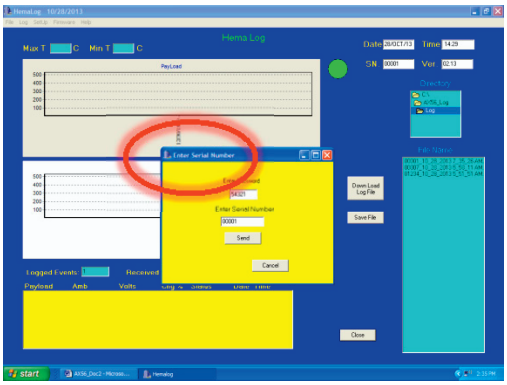


Figure 40. Enter Serial Number Screen

Selecting ***Set Serial Number*** (Figure 40) 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

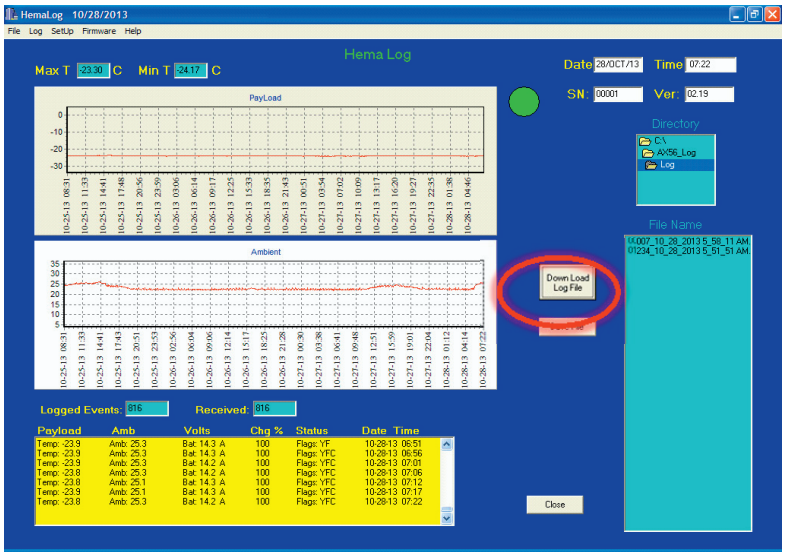


Figure 41. Down Load Log File Screen

Press the ***Down Load Log File*** button (Figure 41) to download a file from the AX56L unit.

- 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 42). (If multiple COM*x* numbers are shown in the drop down menu, then choose the bottom COM*x* number.)
- Press the ***OK*** button to continue.

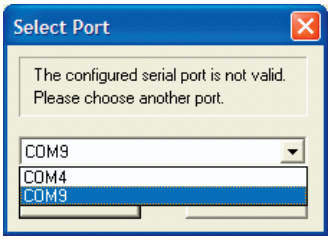


Figure 42. Select Port Dialog

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 43 and 44).

Saving Log File

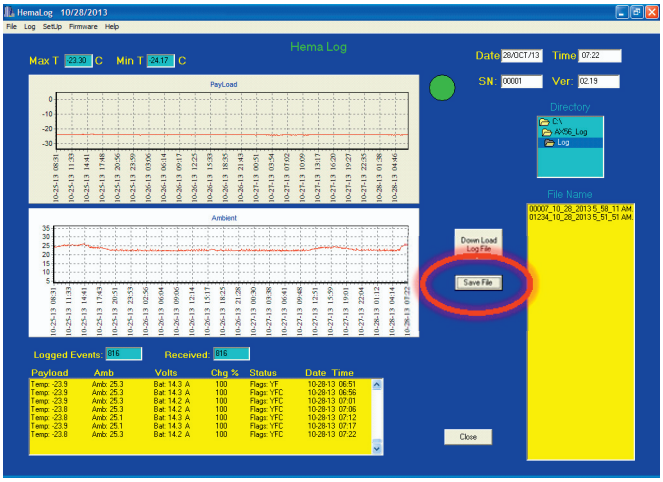


Figure 43. Saving Log File Screen

Log File Saved

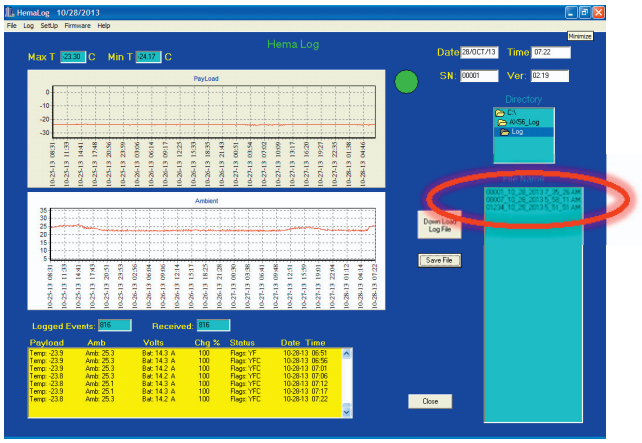


Figure 44. Log File Saved Screen

Log Menu

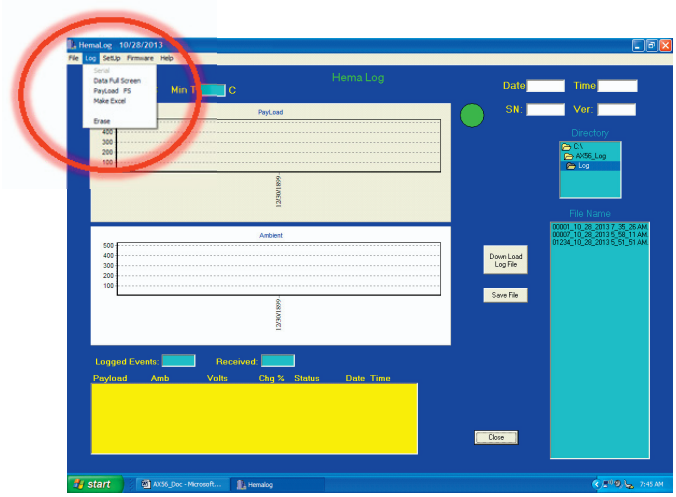


Figure 45. Log Menu Screen

The ***Log Menu*** screen (Figure 45) provides four functions:

- ***Data Full*** screen (Figure 46) alerts the user that the data buffers are full and must be downloaded or deleted.
- ***PayLoad FS*** screen (Figure 47) displays the temperature history of the payload.
- ***Make Excel*** screen (Figure 48) converts data into a downloadable *Excel* spreadsheet.
- ***Erase*** screen (Figure 49) allows the user to erase the contents of the stored log file.

Data Full Screen

Figure 46. Example of a *Data Full* Screen

Payload FS

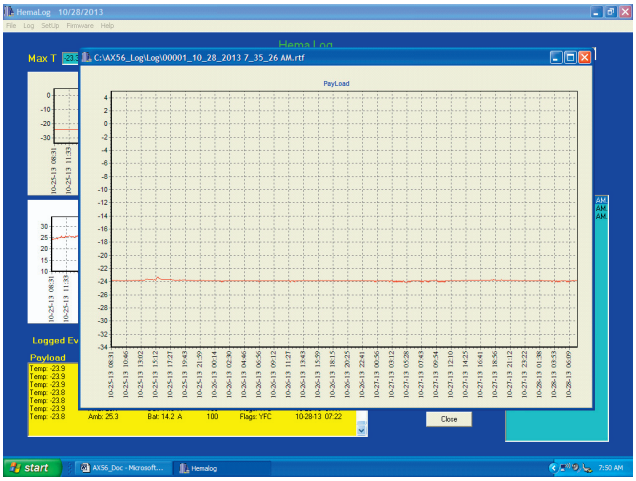


Figure 47. Example of a *Payload FS* Screen

Make Excel

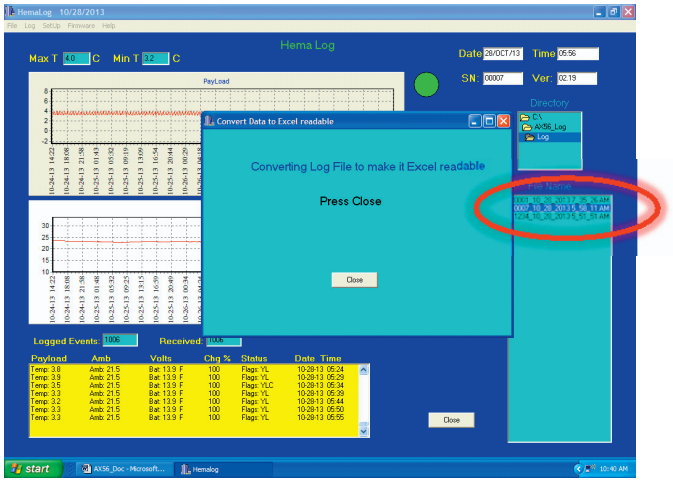


Figure 48. Example of a *Make Excel* Screen

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 48).
- 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.

Erase

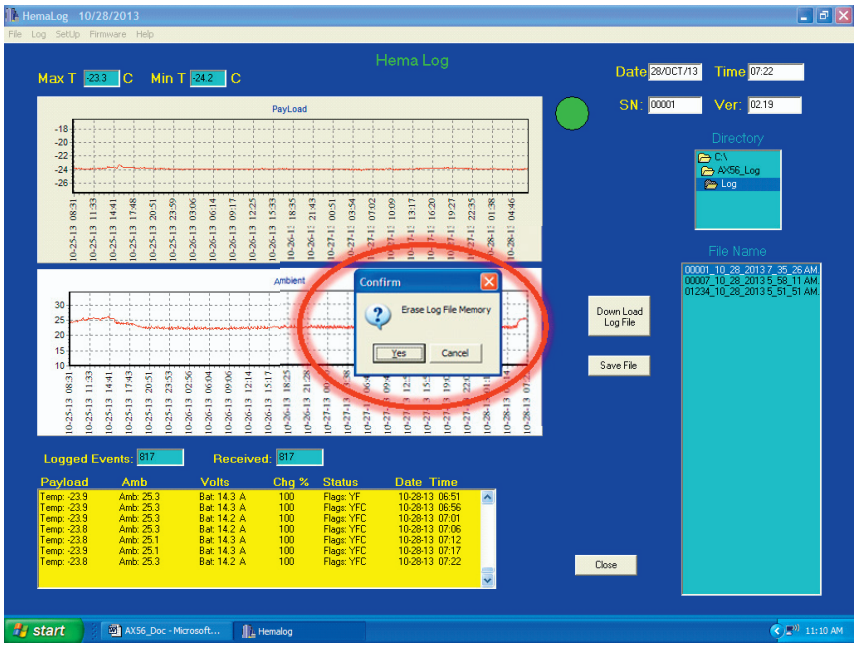


Figure 49. Example of an *Erase* Screen

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 49).

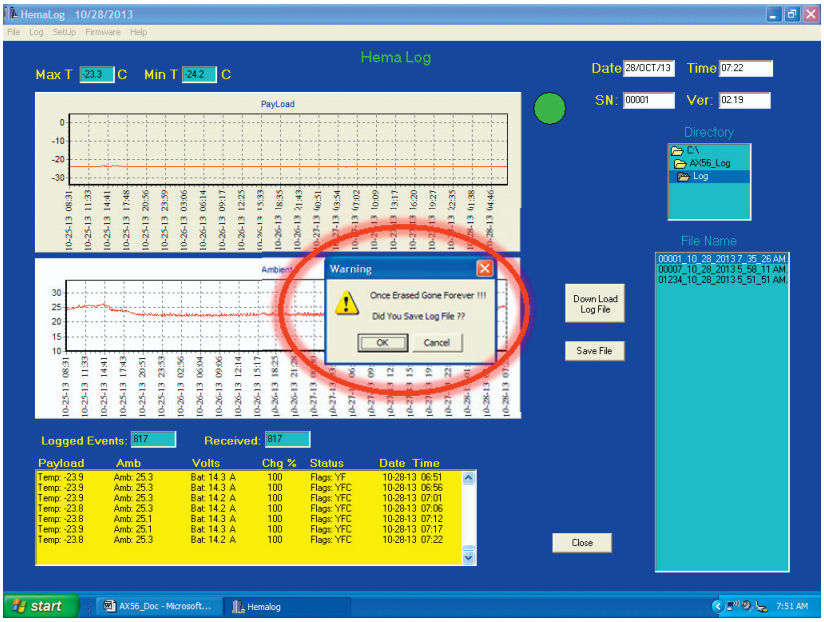


Figure 50. Example of an Erase Final Warning

Selecting ***Erase*** will prompt two confirmations to ensure positive user actions (Figure 50). Acknowledge by pressing the ***Yes*** button. Press the ***Cancel*** button to abort the erase memory action.

Screen Showing Erased Memory

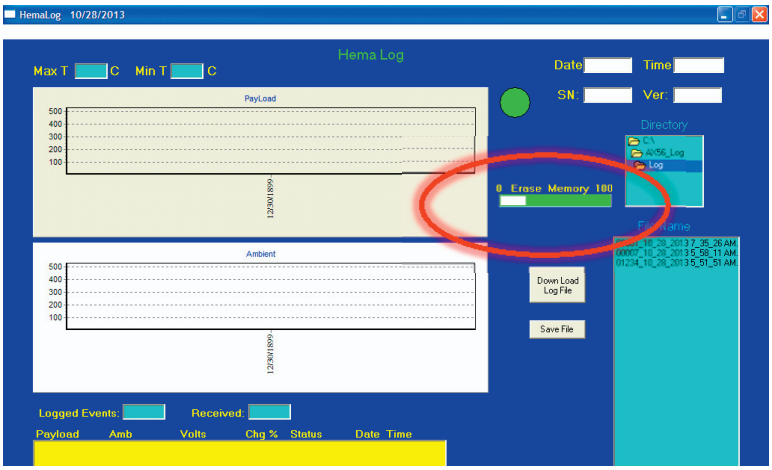


Figure 51. Example of an Erased HemaLog Screen

The onboard memory is erased after the progress bar disappears (Figure 51).

Firmware Update

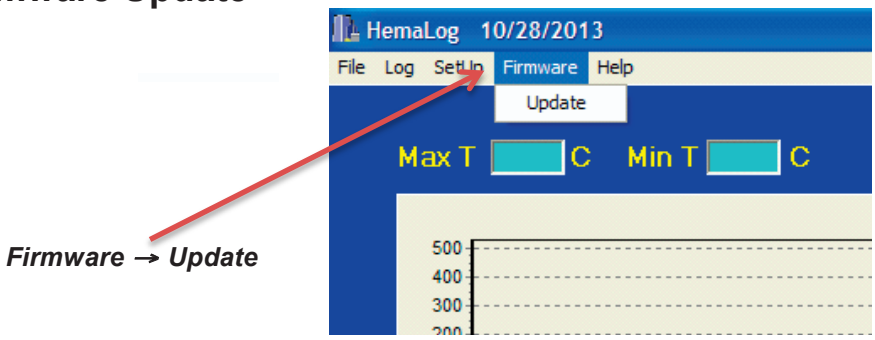


Figure 52. Firmware Update Dropdown Menu

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 52.)

Update Completion

Follow the screen prompts to successfully update the firmware:

1. Acknowledge firmware update (Figure 53) 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.

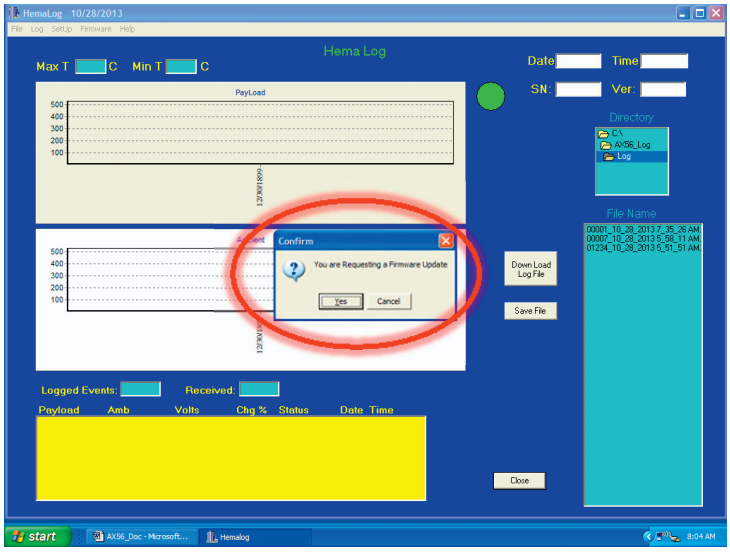


Figure 53. Confirm Firmware Update Dialog Box

2. Remove AC and external power from the AX56L unit (Figure 54).

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

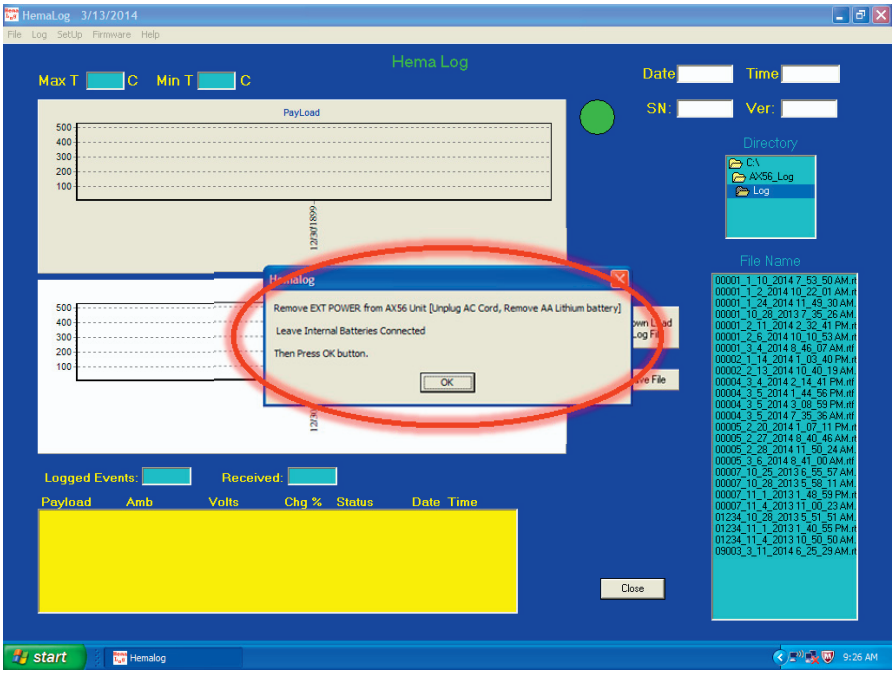


Figure 54. Remove All Power

5. A reset is required for a firmware update. Attach a connector for batteries. Acknowledge by pressing the ***OK*** button to continue (Figure 55).

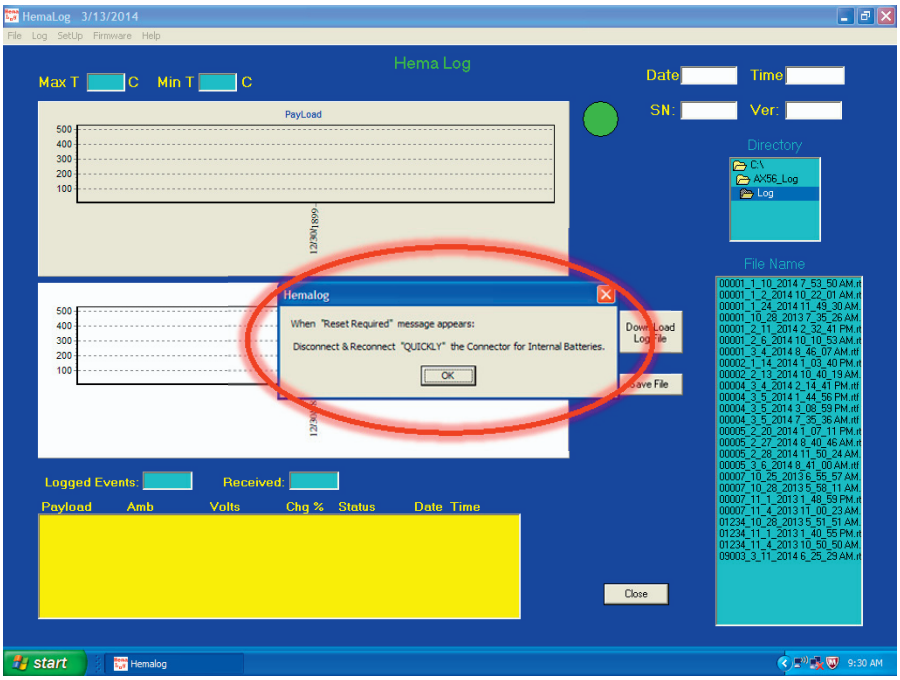


Figure 55. Acknowledge Reset Required

6. 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 56).

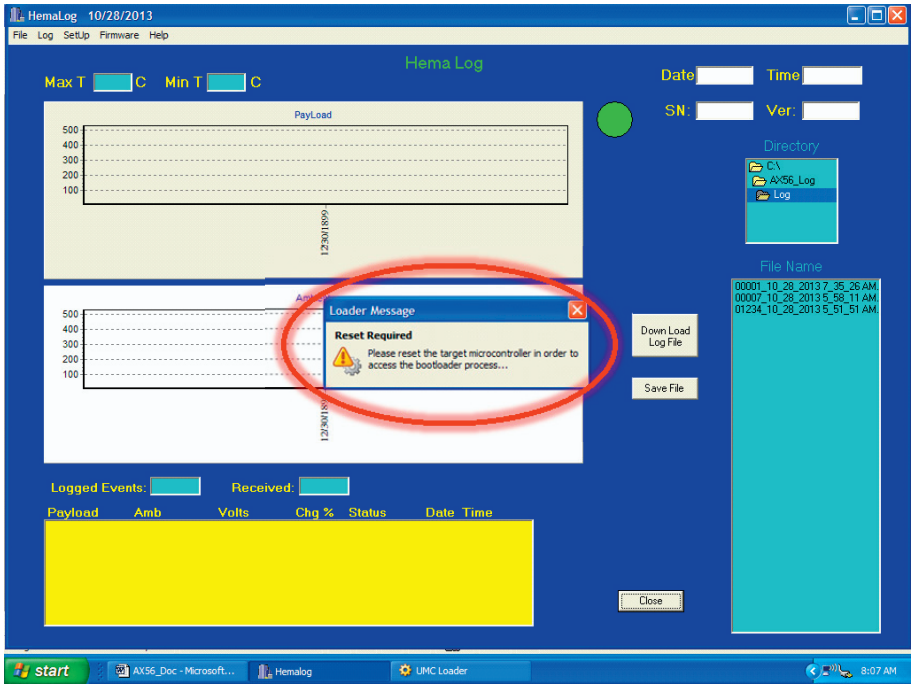


Figure 56. Reset Required Dialog Box

7. If ***Select Port*** dialog box appears, select another com port from the drop down list (Figure 57).

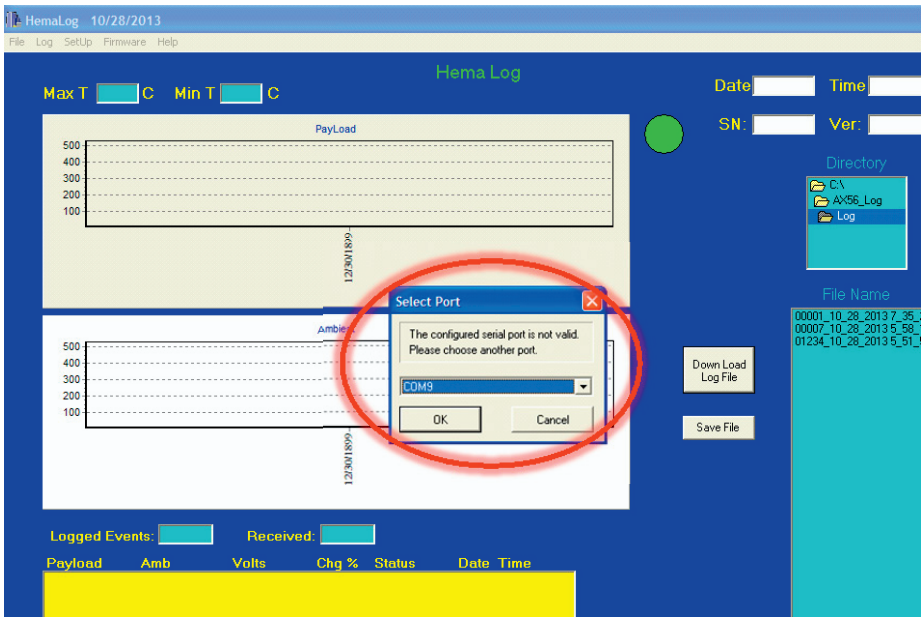


Figure 57. Select Serial Port Dialog Box

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.
5. There is no AC power to the unit.

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

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.

Table 9. User PMCS Procedures

Interval	*Item*	*Action*
Weekly and After Each Shipment	Visual Inspection	• Visually inspect the exterior of the AX56L for any signs of 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 • Open inner lid and check the two latches for damage. Ensure that ten wire baskets 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
Monthly	Battery	If Battery LCD indicates a charge of 90% or less, recharge using external AC power. Charge until LCD indictor (Figure 58) shows “BATT: FLOAT.” Check for corrosion on terminals and cables.
	Air Filter	Brush or blow out accumulated dirt, and debris. Wash filter.
	Fuses	Remove and inspect fuses, then reinstall. Replace any fuses that are burned out.
Quarterly	Air Filter	Replace with new air filter.

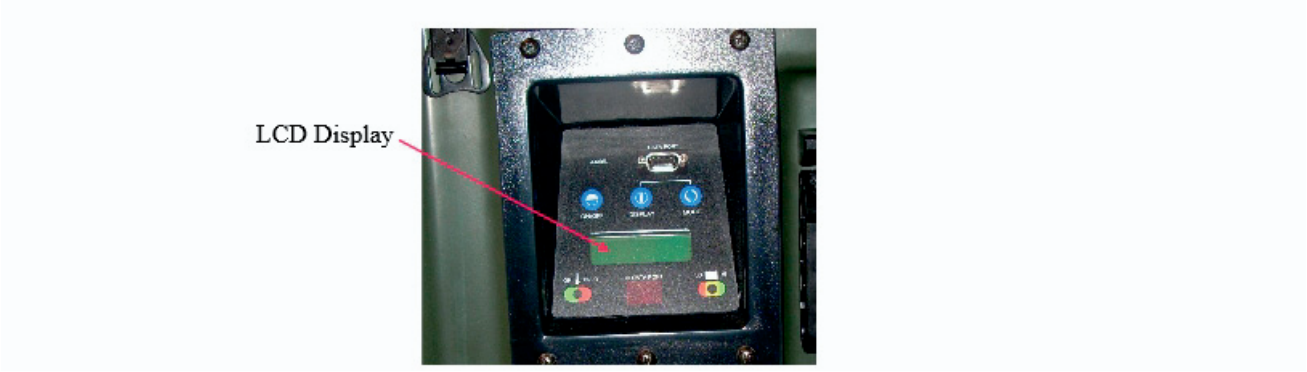


Figure 58. LCD Display

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-1A Service Manual,* Publication 102011-03.)

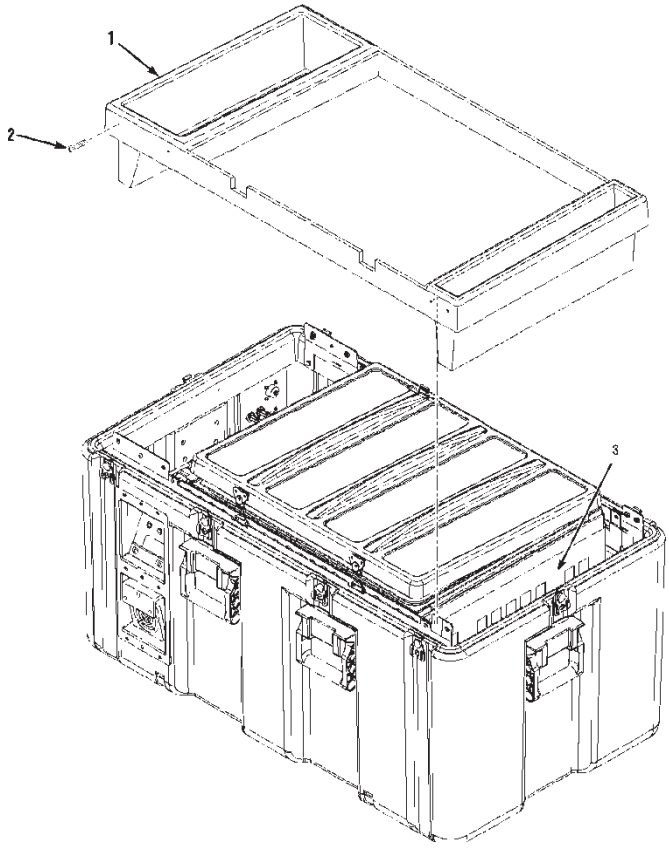


Figure 59. Battery Terminal Location

Inspect For Battery Terminal Corrosion

WARNING

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

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. To check for battery terminal corrosion, remove the contents from the cover panel storage bins (item 1, Figure 59).
2. Remove eight screws (item 2) and the cover panel (item 1).
3. The battery terminals (item 3) are visible after the cover panel is removed.
4. If corrosion is visible on the battery cables or terminals, refer the unit to a qualified service technician.

Keep Batteries Charged

WARNING

The AX56L unit weighs 142 lb (64.5 kg) empty and up to 180 lb (81.7 kg) loaded. Always use at least two people when lifting or moving the unit. Failure to comply can result in injury to personnel.

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

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 lead-acid batteries.

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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 AcuTemp® technical support.

FREEZE Mode

Plug the unit into an 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

The AX56L unit weighs 142 lb (64.5 kg) empty and up to 180 lb (81.7 kg) loaded. Always use at least two people when lifting or moving the unit. Failure to comply can result in injury to personnel.

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

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

To prolong the life of the lead-acid batteries, it is necessary to cycle (discharge and 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. Open the battery compartment and disconnect the battery harness from the fusible link assembly.
2. Remove the retaining clip and the 3.6 V lithium battery from the control display board.
3. Wait 15 seconds, and then reconnect the battery power harness to the fusible link assembly.
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. Connect the battery harness to the fusible link assembly and close the battery compartment.
7. If the LCD still fails to illuminate, contact AcuTemp® 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 60) 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.

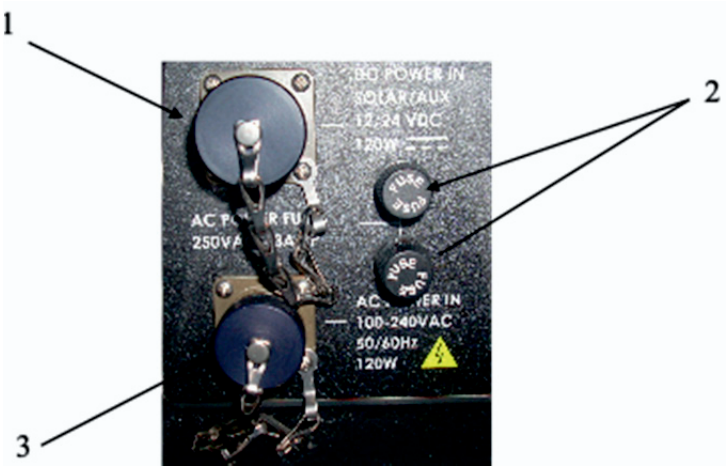

Figure 60. Change Fuse

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 filter on the power panel (Figure 61).

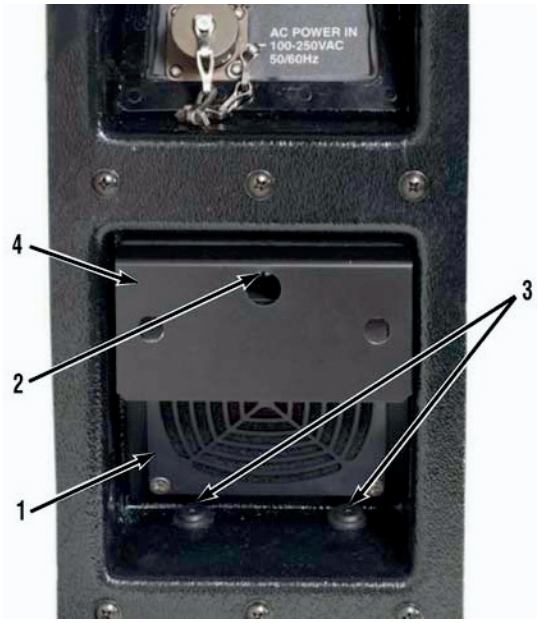

Figure 61. Power Panel Air Filter

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 61) 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 62).

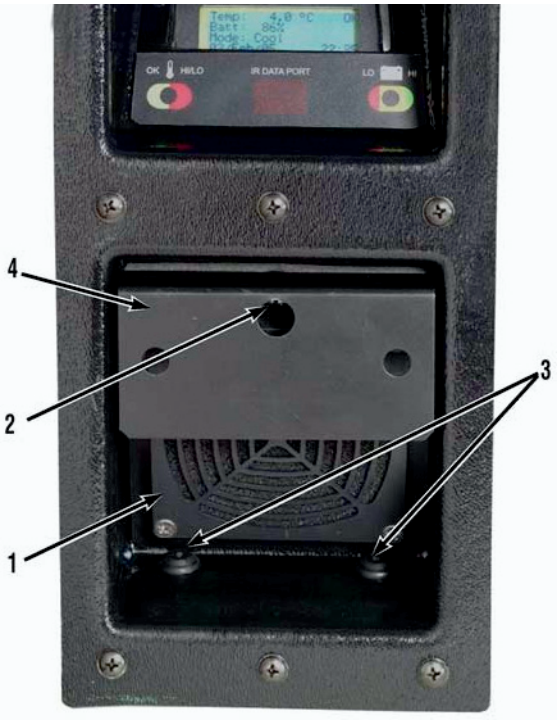

Figure 62. Display and Control Air Filter

Inspect and Clean Lid Gaskets

When the lid gaskets (item 2, Figure 63) 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.

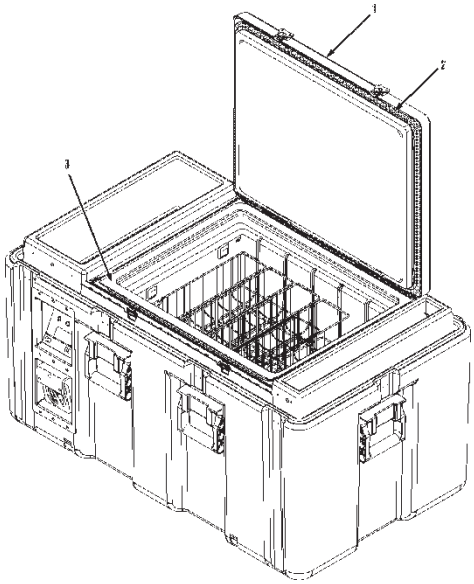

Figure 63. Inspecting Lid Gasket and Mating Surface

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.

Other Repair and Maintenance

Other maintenance, such as replacing the main 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. AcuTemp® 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-1A Service Manual,* Publication 102011-03.

Appendix A:
Accessory List for Model HMC-MIL-1A

The following items are supplied with each AX56L Model HMC-MIL-1A unit.

Quantity	*Description*	*Part Number*
10 ea.	Blood Basket	100000
1 ea.	DC Power Cord	100968
1 ea.	AC Power Cord	100970
2 ea.	Battery, 12 volt, 21 ampere-hour	101880
1 ea.	Manual/Tool Kit Assembly	101957-03
1 ea.	.Screwdriver, No. 2 Phillips-Head (Incl. in P/N 101957-03)	100631
1 ea.	.Cellulose Sponge (Incl. in P/N 101957-03)	101832
1 ea.	.Bubble-Out Storage Bag (Incl. in P/N 101957-03)	101961
1 ea.	.Replacement Filters, bag of 10 (Incl. in P/N 101957-03)	101964
1 ea.	.CD – User Manual, Model HMC-MIL-1A (Incl. in P/N 101957-03)	101962-03
1 ea.	.CD - Service Manual, Model HMC-MIL-1A (Incl. in P/N 101957-03)	101963-03
1 ea.	.CD - HemaLog Software (Incl. in P/N 101957-03)	102009-01
1 ea.	.Manual, User, Model HMC-MIL-1A (Incl. in P/N 101957-03)	102010-03
1 ea.	.Manual, Service, Model HMC-MIL-1A (Incl. in P/N 101957-03)	102011-03
1 ea.	Battery, Lithium, AA, 3.6 V	103014

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Appendix B: Component Diagrams for Model HMC-MIL-1A

Major component diagrams for the AX56L Model HMC-MIL-1A unit include:

Power Board

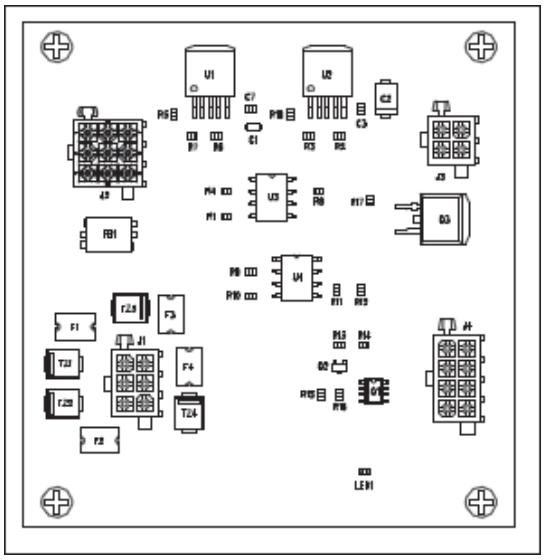

Figure B-1. AX56L Power Board

Control / Display Board

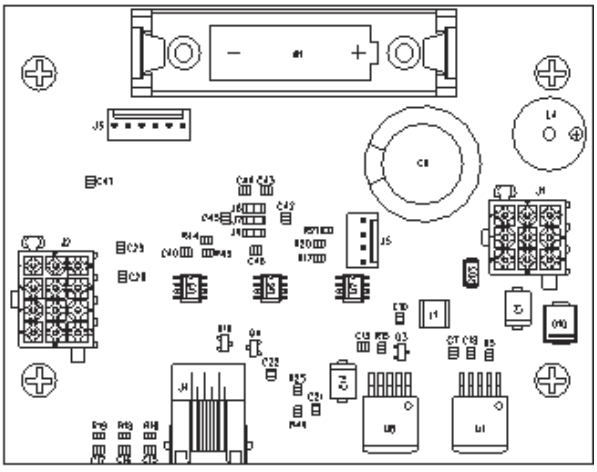

Figure B-2. AX56L Control / Display Board

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Appendix C: AX56L Wiring Diagrams

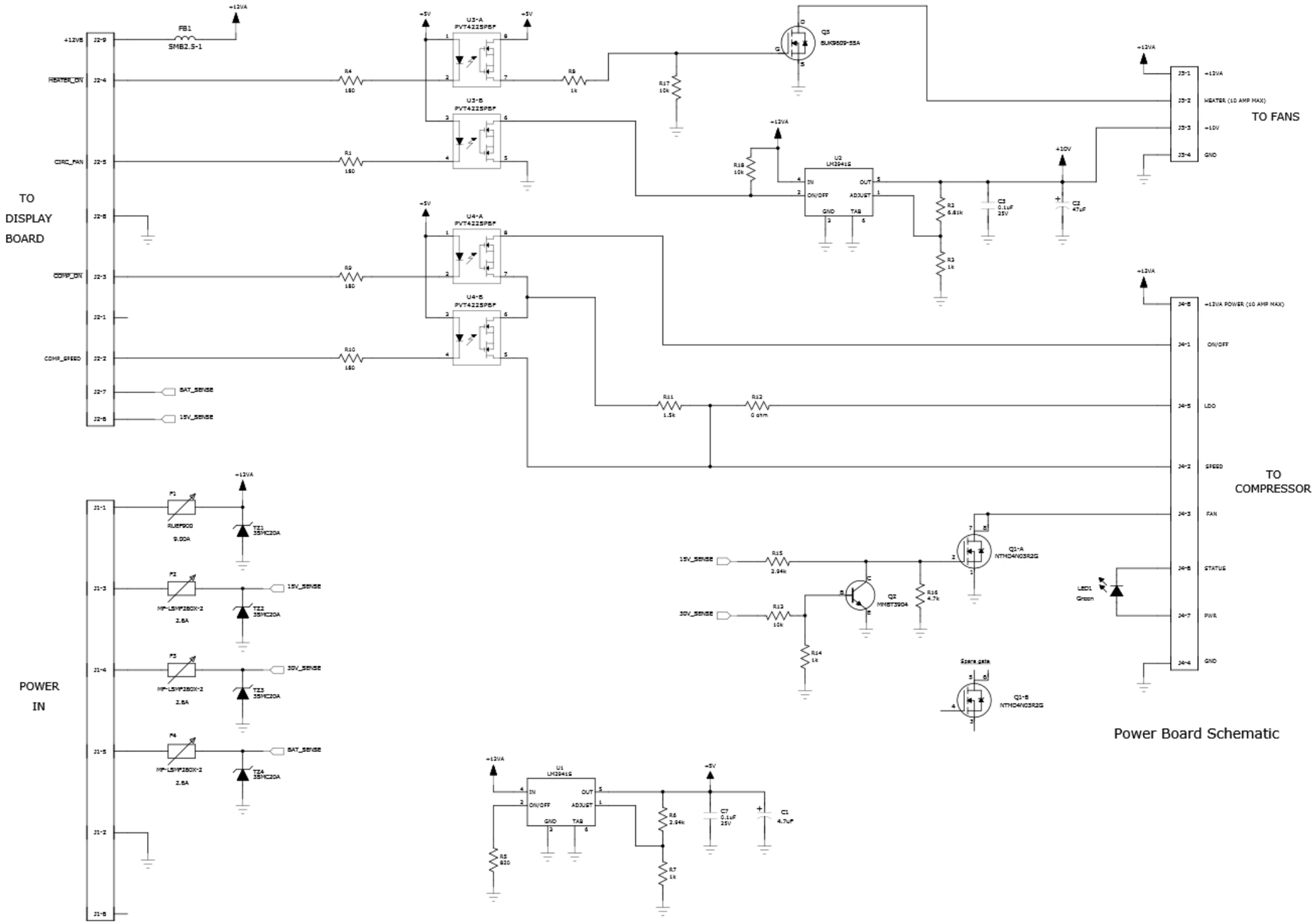

Figure C-1. AX56L Power Board Wiring Diagram

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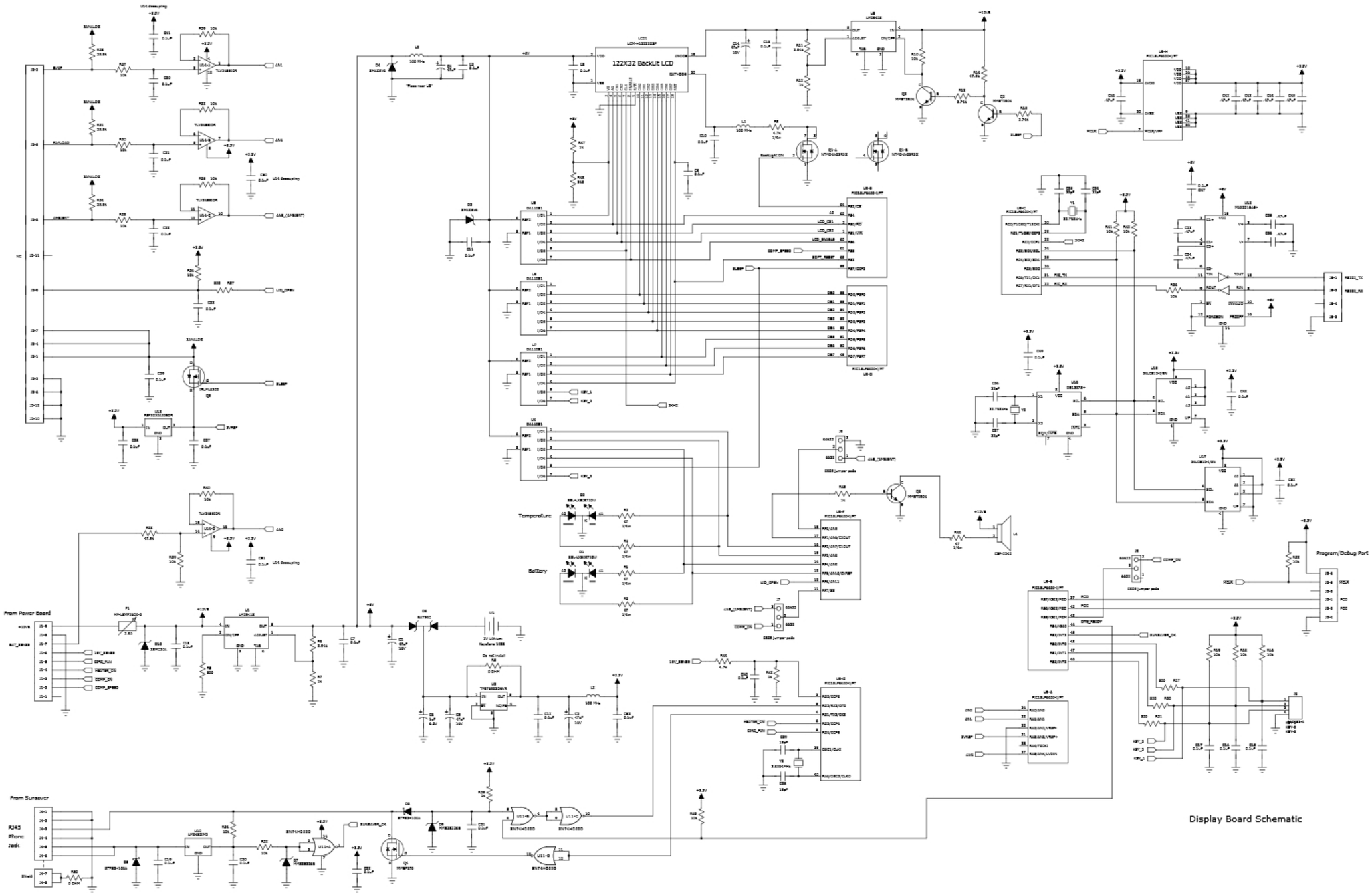

Figure C-2. AX56L Control / Display Board Wiring Diagram

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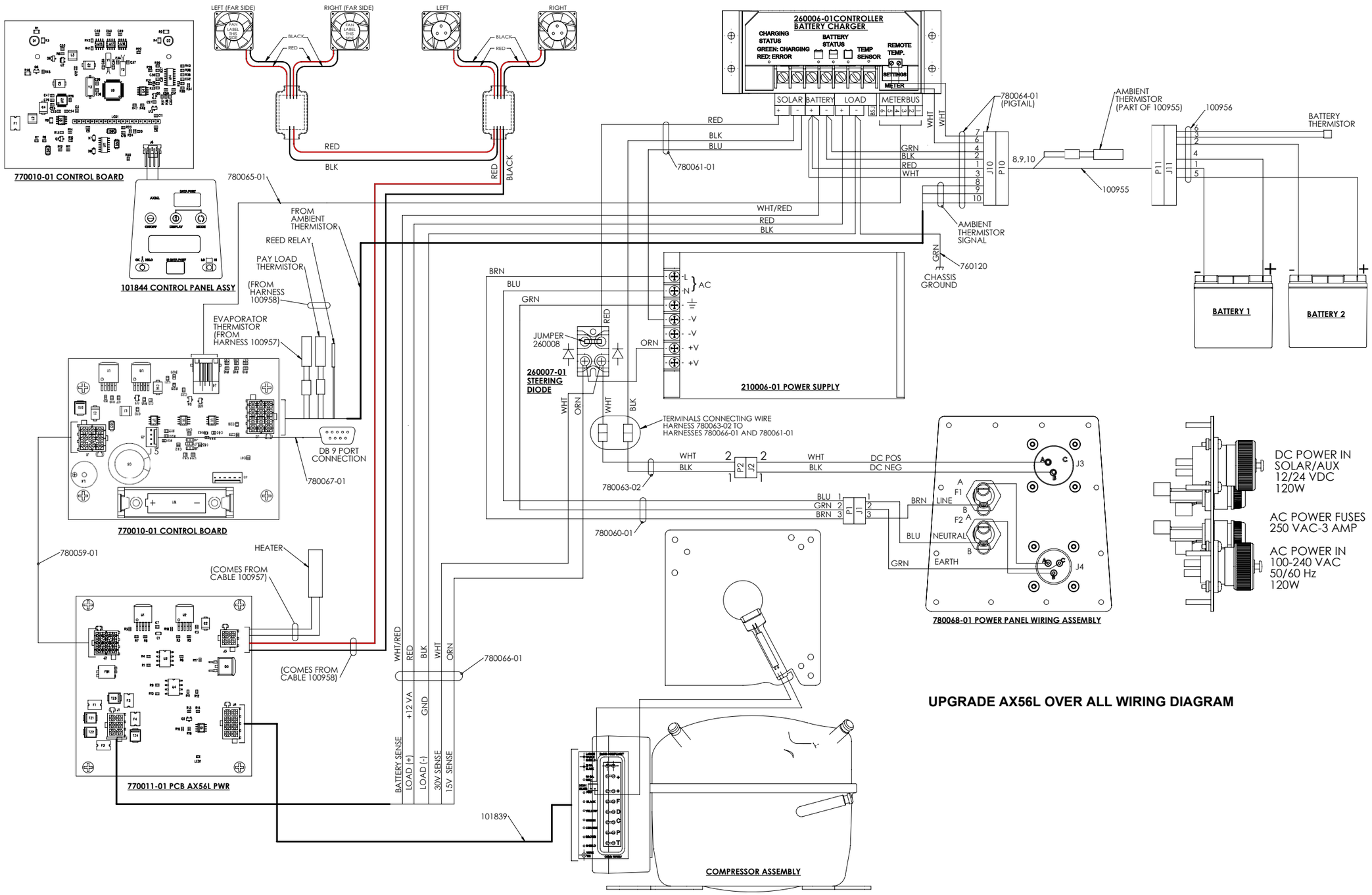

UPGRADE AX56L OVER ALL WIRING DIAGRAM

Figure C-3. AX56L Overall Wiring Diagram

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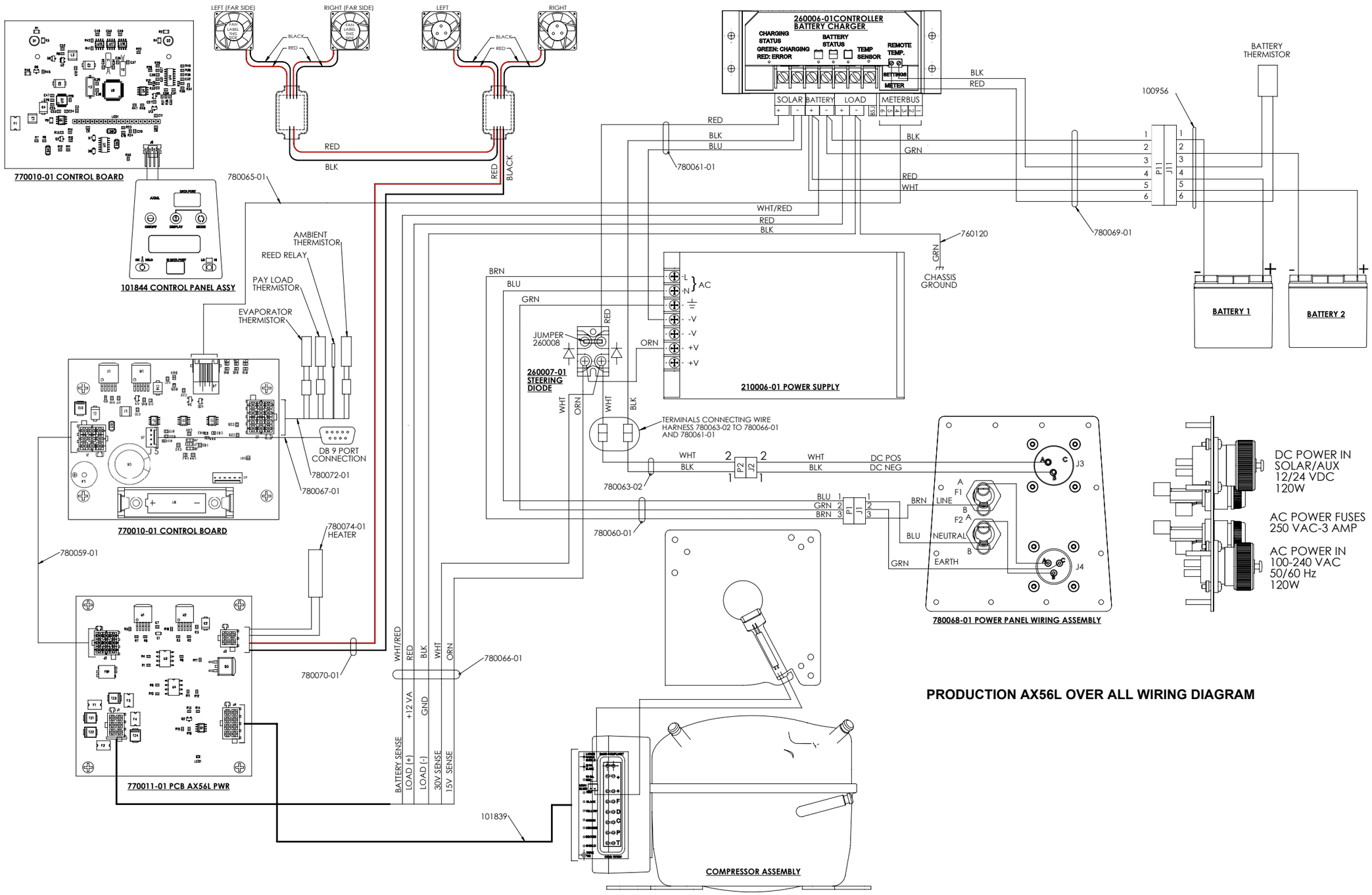

PRODUCTION AX56L OVER ALL WIRING DIAGRAM

Figure C-4. AX56L Overall Wiring Diagram

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