

**Product Manual  
for  
*Micro ARE-M Series*  
24V Float Chargers  
Single-Phase Input**

PM990.1070.24, Rev. 15

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# **RECEIVING INSTRUCTIONS**

## **and**

# **GENERAL EQUIPMENT INFORMATION**

## **IMPORTANT SAFETY INSTRUCTIONS**

1. **SAVE THESE INSTRUCTIONS-** This manual contains important safety and operating instructions for the *Micro ARE-M Series* units.
2. Before using the *Micro ARE-M Series* unit, read all instructions and cautionary markings on the unit, battery, and products using battery.
3. **CAUTION-** When used with batteries, use only lead-acid or nickel-cadmium type rechargeable batteries. Other types of batteries may burst causing personal injury and damage.

**ATTENTION:** Lorsque utilisé avec des accumulateurs, utilisez **UNIQUEMENT** des accumulateurs acides plomb ou nickel-cadmium **RECHARGABLE**. AUTRES TYPES DE BATTERIE peuvent causer, éclatement ET BLESSURES personnelles.

*Please Note: For your protection, this product manual should be read and thoroughly understood before unpacking, installing, using, or servicing the described equipment.*

UNIPOWER, LLC presents all equipment to the delivering carrier securely packed and ready for transport. Upon acceptance of the equipment from us, the delivering carrier assumes responsibility for its safe delivery to you. Once you receive the equipment, it is your responsibility to document any damage to the equipment that was sustained during transport to you and to file your claim with the carrier promptly and accurately.

### **PACKAGE INSPECTION**

Before unpacking the shipment, examine the shipping container for any visible damage: punctures, dents, and any other signs of possible internal damage.

Describe any damage or shortage on the receiving documents and have the carrier's representative sign his/her full name.

If the receiving freight bill notes that a Tip-N-Tell is attached to your freight, locate the indicator and note the color of the arrow. If the Tip-N-Tell arrow has turned even partially blue, this means the freight has been tipped in transport. Make sure the carrier notes this on your receipt before you sign for the freight.

## EQUIPMENT INSPECTION

Promptly upon receipt of shipment, open the container and inspect the contents for damage; see the unpacking section that follows. If it is necessary to move or otherwise handle the shipment, refer to the Handling section for instructions and warnings.

Unpack the shipment carefully to avoid scratching or otherwise marring the exterior finish. Be careful not to discard any included equipment, parts, or manuals. If damage is detected, call the delivering carrier to determine appropriate action. The carrier may require an inspection.

**IMPORTANT:** If damage is detected, save all shipping material for the carrier's representative!

If damage is detected, also notify UNIPOWER, LLC; contact information is in Section 1.5 Product Support. UNIPOWER, LLC will determine if the equipment should be returned for repair. If it is determined that the equipment should be returned to UNIPOWER, LLC, ask the delivering carrier to send the packages back to UNIPOWER, LLC at the delivering carrier's expense. Be sure that the equipment is properly packaged for shipment.

If repair is necessary, UNIPOWER, LLC will invoice you for the repair so that you may submit the bill to the delivering carrier with your claim form.

It is your responsibility to file a claim with the delivering carrier. Failure to properly file a claim for shipping damages may void warranty service for any physical damages later reported for repair.

## UNPACKING

A charger is shipped attached to a wood skid. This facilitates handling with a lift truck by inserting the forks under the bottom of the skid. A smaller unit is covered by a carton and banded to a skid. A larger unit is bolted to a skid and covered by a shipping carton that is banded to the skid.

Export packaging consists of a crate, a moisture-resistant cover for the charger, and a drying agent. The charger is bolted to the crate.

To unpack:

<b>CAUTION</b>	<b>ATTENTION</b>
Do not stand in front of steel bands since they may whip out when cut.	Ne pas se tenir devant les bandes d'acier, lorsque coupées.

Cut the bands and remove carton from the skid.

1. Either remove the unit from the carton or unbolt the unit from the skid.
2. Check the shipping carton, before discarding, for the packing slip and other material, which may be contained in it.
3. Carefully inspect the charger for shipping damage (i.e. loosened connections or mountings, dislodged circuit boards). If damage is detected, notify UNIPOWER, LLC; contact information is provided in Section 1.5 Product Support.

## STORAGE

If the charger is not to be used immediately, store it (fully packed, if possible) in a clean, dry location protected from physical damage, condensation, and overhead drip.

## HANDLING

Refer to the product nameplate for the model information and then see the Specifications section for charger dimensions and weight. Use sufficient personnel and power equipment to ensure safe handling.

<b>WARNING</b>	<b>AVERTISSEMENT</b>
<b>Crush hazard</b>  The charger can weigh up to 216 lbs. (98 kg). Keep hands and feet from beneath the charger. Use a forklift or other equipment to move or transport the charger.	<b>Risque d'écrasement</b>  Le chargeur peut peser jusqu'à 216 lb. (98 kg). Gardez les mains et les pieds libres du dessous du chargeur. Utilisez un chariot élévateur ou autres équipements pour déplacer ou transporter le chargeur.

Use care in handling and unpacking the charger. Refer to the previous sections as needed.

## NAMEPLATE

A UNIPOWER, LLC product is identified by a nameplate that includes model number, part number, and serial number information, as appropriate. Please include this information in all correspondence with UNIPOWER, LLC. A sample nameplate is shown below.

<b>MODEL NO.</b>	<b>ARE-M02406</b>	<b>SPEC.</b>	<b>102.1041.00A</b>
<b>SER.NO.</b>	<b>APS0719978</b>	<b>°T C</b>	<b>50</b>
<b>AC VOLTS</b>	<b>120/208/240</b>	<b>AC AMPS</b>	<b>2/1.2/1</b>
<b>PH 1 HZ</b>	<b>60</b>	<b>CELLS</b>	<b>12</b>
<b>DC VOLTS</b>	<b>26.4</b>	<b>DC AMPS</b>	<b>6</b>
<b>EMERGENCY</b>		<b>TECHNICAL SUPPORT</b>	
		<b>CALL FIELD SERVICE</b>	

## INITIAL SETTINGS

All equipment is shipped from the factory fully inspected and adjusted. Read the technical reference or product manual before installing or making any adjustments.

## SPARE PARTS

See Table 6-2 Parts Lists to select the spare and replacement parts you want immediately available to minimize downtime should a failure occur.

**PRODUCT MANUAL ISSUE HISTORY**

Rev	Description	Checked/Approved by & Date
13	Updated cabinet assembly sections to show optional DNP3 as depicted on product drawings. PCO# 44853	WD 10/2/18
14	See PCO# 45387	CJM 8/1/19
15	See ECN# 46140	JPR 1/3/24

**PRODUCT MANUAL SUMMARY**

This product manual provides installation, operation, maintenance, and troubleshooting procedures for the UNIPOWER, LLC *Micro ARE-M Series 24V Chargers*.

Thank you for purchasing a *Micro ARE-M Series 24V Charger*. We at UNIPOWER, LLC are proud of the quality of our products and welcome any suggestions to further improve our design to fit your needs.

**PROPRIETARY AND CONFIDENTIAL**

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Throughout the remainder of this manual, "UNIPOWER" will mean "UNIPOWER, LLC."

**PERSONNEL REQUIREMENTS**

Installation, setup, operation, and servicing of this equipment should be performed by qualified persons thoroughly familiar with this Product Manual and Applicable Local and National Codes. A copy of this manual is included with the equipment shipment.

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## 1.0 INTRODUCTION

The purpose of this manual is to provide the reader with the procedures for installing, configuring, operating, and servicing UNIPOWER *Micro* ARE-M Float Chargers.

Chapter 1 Introduction provides a description of the *Micro* ARE-M series chargers, the model designation list, and detailed specifications. This chapter also has product support telephone and FAX numbers and the company's Internet URL where the latest issue of this manual can be found.

Chapter 2 Installation describes mechanical and electrical installation of the charger. Each aspect of the installation is discussed and supporting illustrations are provided.

Chapter 3 Commissioning presents a suggested procedure that can be integrated into or modified by your company's commissioning procedures.

Chapter 4 Setup and Operation describes charger displays and use of the 4-button keypad. Setup menus are provided to ease navigation through the provided displays. Default setup values are listed.

Chapter 5 Circuit Description includes a block diagram level description of the charger circuitry. Read this chapter before installing, configuring, operating, or servicing the charge.

Chapter 6 Maintenance provides preventive maintenance and troubleshooting information. A troubleshooting chart is included as are component location drawings and schematics for all charger models. These drawings are followed by a section containing replacement parts lists. Troubleshooting information for the Interface Board and the Control and Display Board follows the parts lists.

Chapter 7 Options and Accessories furnishes details concerning the accessories available at the time this manual was published.

### 1.1 PRODUCT DESCRIPTION

The *Micro* ARE-M series of single-phase, controlled ferroresonant float chargers is intended for utility, communications, and other applications where a source of stable, electrically clean, reliable DC power is needed. Available models provide an output voltage of 24 VDC and an output current from 6-100 amperes, depending upon model. Refer the Model Designation for a list of standard models and options.

Installation is quick and easy. The design accommodates floor, wall, or rack mounting with standard and optional brackets. A mounting method is usually specified on the equipment order so the proper brackets can be supplied.

The charger is configured and operated from the front of the unit. The control section includes a 2-line digital display, 4-button keypad, green AC on LED and a red alarm LED, an AC input circuit breaker, and a DC output circuit breaker. An optional control board offers front panel LED indicators, showing the status of the High Voltage Alarm, Low Voltage Alarm, No Charge Alarm and AC Fail Alarm on the telecom models. For the utility models two additional LEDs show the state of the Positive and Negative ground fault alarms.

Access to internal components for servicing by qualified personnel is through the door comprising the front of the unit. The door is hinged on the left and secured on the right by two fasteners.

## 1.2 MODEL DESIGNATION

The nameplate on the charger contains an alphanumeric model number. The model number describes the features built into a particular charger. Table 1-1 provides the product characteristic defined by each character in the model number.

### 1.2.1 Options

Temperature Compensation .....	Slopes adjusted from $-0.1\text{mV/cell/C}$ to $-10.0\text{mv/cell/C}$
Lightning Arrester.....	AC input; prevents equipment damage due to a nearby lightning strike
Fungicide Treatment .....	Applied to inside of charger
Drip Shield.....	Prevents overhead drops from entering unit
SIS Control Wiring .....	Excludes ribbon cable and power cables
High Interrupt DC Breakers.....	10K AIC minimum
Engraved Nameplates .....	Contact UNIPOWER Applications Engineering
Blocking Diode .....	Prevents charger faults from shortening the battery plant
High Interrupt AC Breakers.....	10K AIC minimum
MOVs.....	On DC output, prevents equipment damage due to excessive voltage transients
DNP3 Communications .....	Allows charger to be controlled and monitored from a remote location using the DNP3 protocol. See manuals PM990.1074.00 (Installation guide) and PM990.1072.00 (Device Profile) on the ARE-M webpage at <a href="http://www.unipowerco.com">www.unipowerco.com</a> for more information.

**TABLE 1-1 MODEL DESIGNATION****DC VOLTAGE & CURRENT**

ARE-M02406A (AC Input Voltage: 120V/208V/240V)

ARE-M02412A (AC Input Voltage: 120V/208V/240V)

ARE-M02425A (AC Input Voltage: 120V/208V/240V)

ARE-M02450A (AC Input Voltage: 120V/208V/240V/480V)

ARE-M024100A (AC Input Voltage: 120V/208V/240V/480V)

**AC Input Voltage / Breaker**

- A** 120V - 60 Hz Standard Capacity AC Breaker
- B** 208V - 60 Hz Standard Capacity AC Breaker
- C** 240V - 60 Hz Standard Capacity AC Breaker
- D** 480V - 60 Hz Standard Capacity AC Breaker (50 A & 100 A only)
- 1** 120V - 60 Hz High Capacity AC Breaker
- 2** 208V - 60 Hz High Capacity AC Breaker
- 3** 240V - 60 Hz High Capacity AC Breaker
- 4** 480V - 60 Hz High Capacity AC Breaker (50 A & 100 A only)

**AC Protection**

- 1** Not Required (Standard)
- 2** 480/240 VAC Input Lightning Arrestor
- 3** 240/208/120 VAC Input Lightning Arrestor

**DC Circuit Breaker**

- 1** Standard Capacity AC Breaker/ Standard Capacity DC Breaker
- 2** Standard Capacity AC Breaker/ High Capacity DC Breaker
- 3** Standard 480V AC Breaker/ Standard Capacity DC Breaker
- 4** Standard 480V AC Breaker/ High Capacity DC Breaker
- 5** High Capacity AC Breaker/ Standard Capacity DC Breaker
- 6** High Capacity AC Breaker/ High Capacity DC Breaker
- 7** High 480V AC Breaker/ Standard Capacity DC Breaker
- 8** High 480V AC Breaker/ High Capacity DC Breaker
- A** Telecom Standard Capacity AC Breaker/ Standard Capacity DC Breaker
- B** Telecom Standard 480V AC Breaker/ Standard Capacity DC Breaker
- C** Telecom High Capacity AC Breaker/ Standard Capacity DC Breaker
- D** Telecom High 480V AC Breaker/ Standard Capacity DC Breaker

**DC Protection**

- 1** None (Standard)
- 2** MOVs

**Blocking Diode**

- 1** None (Standard)
- 2** Yes (Negative Leg)

**Temperature Compensation**

- 1** None (Standard)
- 2** Battery Temperature Compensation (Temperature Sensor with 25' lead)

**Control Wiring**

- 1** Floating Ground (Standard) - PVC
- 2** Floating Ground Switchboard - SIS
- A** Telecom - Positive Ground - PVC
- B** Telecom - Negative Ground - PVC

**Individual Alarm Relays**

- 1** Utility - AC Fail, High Voltage, Rectifier Fail
- 2** Utility - AC Fail, High Voltage, Rectifier Fail, Hi VDC, Low VDC, NO Charge, GND+, GND-, Summary
- 3** Utility - AC Fail, High Voltage, Rectifier Fail, w/Ground Enable Switch
- 4** Utility - AC Fail, High Voltage, Rectifier Fail, Hi VDC, Low VDC, NO Charge, GND+, GND-, Summary, w/Ground Enable Switch
- A** Telecom - AC Fail, High Voltage, Rectifier Fail
- B** Telecom - AC Fail, High Voltage, Rectifier Fail, Hi VDC, Low VDC, NO Charge, Summary

**Control Board**

- ~~**1** Utility (Standard)~~ (Discontinued)
- 2** Utility Alarm Lights - AC, Summary Alarm, HVA, LNA, NCA, ACF, GND+, GND-
- ~~**A** Telecom (Standard)~~ (Discontinued)
- B** Telecom Alarm Lights - AC, Summary Alarm, HVA, LNA, NCA, ACF

**Mounting**

- 1** Wall 19"
- 3** Relay 19"
- 4** Relay 23"
- 5** Floor Mount
- 6** Floor Mount with Drip Shield

**Packaging**

- 1** Domestic (Standard)
- 2** Export
- 3** None (For relay rack installation only)

**DNP3 Communications Port**

- 1** No Port (Standard)
- 2** DNP3 Ethernet 4 foot cable
- 3** DNP3 Ethernet 2 foot cable
- 4** DNP3 Ethernet 25 foot cable
- 5** DNP3 Ethernet 50 foot cable

**Special Instructions**

- 1** No
- 2** Yes

**ARE-M**      **2406**

Base Model

**A**   **2**   **2**   **1**   **1**   **2**   **1**   **1**   **1**   **3**   **1**   **1**   **1**   **1**

S Build Number

### 1.3 SPECIFICATIONS

This section provides the mechanical, electrical, and environmental specifications. The charger nameplate is located on the front panel.

#### 1.3.1 Mechanical

Cabinet .....NEMA1; steel with baked powder coat finish

Cable Entrances .....Three; see the dimension drawings in Chapter 2 Installation

Cabinet Dimension and Weight .....See the following table and dimension drawings in Chapter 2 Installation.

Model	Cabinet Size	Height*	Width*	Depth Maximum*	Mounting Depth**	Shipping Weight*
ARE-M02406 ARE-M02412 ARE-M02425	12"	12.25 (311)	17 (432)	15 (381)	6 (152)	65 (30) 75(33) 102 (46)
ARE-M02450 ARE-M24100	24"	24.5 (622)	17 (432)	15 (381)	6 (152)	162 (74) 216 (98)

\*Cabinet dimension in inches (mm). Does not include mounting brackets or drip shield. Weight in lbs. (kg).

\*\* Dimension from cabinet front to installed rack mounting angle brackets.

Mounting Locations ..... Wall, relay rack, or floor

Select a location for the charger. The chargers are cooled by natural convection and require at least 3" (76mm) of space below the charger and 3" above the charger.

#### Mounting Brackets

Supplied ..... Wall mount and standard relay rack mount

Optional ..... Larger relay rack mount or floor mount

Internal Combustible Materials ..... 94V-1 or better

## 1.3.2 Electrical

**Model Specific and Related Specifications**

Refer to the equipment nameplate for the model number of the *Micro ARE-M* at hand.

**ARE-M02406**

DC Output Voltage and Current .....	26.4V@ 6A
Ripple	
On Battery .....	NA
Off Battery .....	30 mV rms
No. Cells, L-A.....	12
Recommended DC Cable .....	14 AWG (2.1 mm <sup>2</sup> )
Terminal Block Capacity .....	24-12 AWG (.21-5.3 mm <sup>2</sup> )
DC Circuit Breaker .....	10A
AC Input Voltage and Current.....	120V @ 2A, Single Phase
	208V @ 1.1A, Single Phase
	240V @ 1A, Single Phase
AC Frequency .....	57-63 Hz
AC Breaker Interrupt Current .....	2,000A @ 240V (5,000A @ 125V or with a 125A series fuse)
AC Breaker Interrupt High Capacity .....	10,000A
Heat Dissipation.....	200 BTU/Hour

**ARE-M02412**

DC Output Voltage and Current .....	26.4V @ 12A
Ripple	
On Battery .....	NA
Off Battery .....	30 mV rms
No. Cells, L-A.....	12
Recommended DC Cable .....	12 AWG (3.3 mm <sup>2</sup> )
Terminal Block Capacity .....	24-12 AWG (.21-3.3 mm <sup>2</sup> )
DC Circuit Breaker .....	20A
AC Input Voltage and Current.....	120V @ 4A, Single Phase
	208V @ 2.3A, Single Phase
	240V @ 2A, Single Phase
AC Frequency .....	57-63 Hz
AC Breaker Interrupt Current .....	2,000A @ 240V (5,000A @ 125V or with a 125A series fuse)
AC Breaker Interrupt High Capacity .....	10,000A
Heat Dissipation.....	440 BTU/Hour

**ARE-M02425**

DC Output Voltage and Current .....	26.4V @ 25A
Ripple	
On Battery .....	NA
Off Battery .....	30 mV rms
No. Cells, L-A.....	12
Recommended DC Cable .....	8 AWG (8.4 mm <sup>2</sup> )
Terminal Block Capacity .....	14 - 10 AWG (2.1 to 5.3 mm <sup>2</sup> )
DC Circuit Breaker .....	35A
AC Input Voltage and Current.....	120V @ 8.3A, Single Phase
	208V @ 4.7A, Single Phase
	240V @ 4.1A, Single Phase
AC Frequency .....	57-63 Hz

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**General**

AC Voltage Range ..... The AC supply voltage specified in Model Specific and Related Specifications must be within the following ranges:

Nominal Voltage	Minimum Voltage	Maximum Voltage
120 Vac	106 Vac	132 Vac
208 Vac	184 Vac	228 Vac
240 Vac	212 Vac	264 Vac
480 Vac	424 Vac	528 Vac

Power Factor (Resistive Load) ..... >0.92 at full load

Efficiency (Resistive Load) ..... >87%

**DC Regulation****Static**

Float .....  $\pm 0.5\%$  with a fixed load and simultaneous variations<sup>1</sup>

Equalize .....  $\pm 1.0\%$  with a fixed load and simultaneous variations<sup>1</sup>

Dynamic .....  $\pm 6\%$  for a step load change of 10 to 90% or 90 to 10% of rated current; Charger will recover to regulation range within 300 milliseconds; transient behavior will disappear within 500 milliseconds.

**Current Limiting**

Factory Setting ..... 110% of full rated load

Field Settable ..... 80-110% of full rated load

Continuous Operation ..... 110% of full rated load maximum

Surge Protection ..... Optional MOVs (metal-oxide varistors) on output terminals  
Optional Lightning arrestor on input terminals

Current Walk-In (Soft Start) ..... Less than 15 seconds for output current increase from 0-100%

**Alarms**

Standard Interface Board ..... 3 alarm relay outputs: AC Fail, Rectifier Fail, and HVSD

Multiple Alarm Interface Board ..... 9 alarm relay outputs: Summary, GND+, GND-, LVA, HVA, NCA, AC Fail, Rectifier Fail, and HVSD

**Alarm Indicators**

Front Panel ..... Common red alarm LED and 2-Line LCD display

Optional Indicators ..... Optional front panel indicators, consisting of a red High Voltage LED, red Low Voltage LED, red No Charger LED, yellow AC Fail LED on the telecom models, and two additional green Positive and Negative Ground LEDs on the utility models.

Alarm Relay Contacts ..... Form C, 2A @ 30 Vdc; 0.6A @ 110 Vdc; 0.6A @ 125 Vac

**Customer Connections**

Connector ..... One plug-in 3-position terminal block per alarm, compression-style wire clamp

Wire Size ..... 12-28 AWG (2.5-0.08 mm<sup>2</sup>)

<sup>1</sup> Load, input voltage, frequency, and temperature varied within range for that model. The Float and Equalize voltage regulation excludes any voltage drop from the blocking diode, if present.

### 1.3.3 Front Panel Displays and Controls

Display .....	LCD, 2 lines x 20 characters, with green LED backlight
Display Accuracy.....	1% (voltage, current, or time reading)
Control Modes .....	Manual float/equalize, user selectable from keypad
LED Indication Standard .....	Alarm - red; AC power - green
LED Indication Optional .....	HVA, LVA, NCA-red, ACF-yellow, +GND,-GND-green
<b>High Voltage Shutdown</b>	
Adjustable .....	2.00-2.53 Vpc (Volts per cell), LED indicator; see table below; 1-30 Sec delay
Fixed Redundant.....	2.66 +/-0.08 Vpc
Float/Equalize .....	State indicated; Equalize remaining time shown
Load Share Active .....	Chargers operating in parallel with +/-5% of rated output over 10% to 100% of current threshold
<b>Ground Detection</b>	
Disconnect Switch (optional) .....	Breaks the connection to the chassis (earth) for troubleshooting grounds on the dc system or to eliminate interaction with an external ground detection system
Relay/Lamp Test.....	Provided in setup routine (password protection available)
<b>Control Adjustments (password protection available)</b>	
Float Voltage .....	1.85-2.35 Vpc (Volts per cell); see table below
Equalize Voltage .....	2.0 -2.45 Vpc; see table below
Manual Equalize.....	On, Off, Equalize Duration (1-255 hours)
<b>Auto-Equalize</b>	
After AC Fail.....	On, Off, Equalize After (1-7200 minutes), Equalize Duration (1- 255 hours)
Periodic .....	On, Off, Equalize Duration (1-255 hours)
Current Limit .....	80-110% of charger rating
Periodic Equalize.....	Off, 168-8760 hours
Temp Comp.....	0.1-10 mV/cell/°C

**TABLE 1-2 SETTABLE PARAMETERS, STANDARD MODELS**

Model	Float Range	Equalize Range	HVSD Range
ARE-M24 Series	22.2-28.2V	Float-29.4V	24-30.4V

<b>Alarm Adjustments (password protection available)</b>	
Low Voltage (LVA) .....	1.50-2.20 Vpc; alarm delay 1-300 seconds
Very Low Voltage (VLVA) .....	1.50-2.20 Vpc; alarm delay 1-300 seconds
High Voltage (HVA) .....	2.20-2.50 Vpc; alarm delay 1-300 seconds
No Current .....	Up to 30% of rated current; alarm delay 1-300 seconds
Positive Ground Fault.....	500-20,000 Ohms; 1-300 seconds delay
Negative Ground Fault .....	500-20,000 Ohms; 1-300 seconds delay
Charger Fail .....	1-300 seconds delay
AC Power Fail .....	1-300 seconds delay; relay delay fixed at 0.5 seconds
High Battery Temperature (HBTA) ...	0-200 °C; 1-300 seconds delay
Summary .....	0-300 seconds delay
Password Protection.....	Yes, control and alarm settings; 00001-65500

NOTE: All "per cell" voltages are based upon the unit's nominal number of lead-acid cells.



### 1.3.4 Environmental

Charger Cooling.....	Natural Convection
Temperature, Operating.....	0°C to +50°C (32°F to +122°F); see Altitude
Temperature, Storage.....	–40°C to +85°C (–40°F to +185°F)
Storage Duration.....	One year at specified storage temperature range
Relative Humidity.....	0 to 95% non-condensing
Altitude	
Operating .....	3,300 ft. (1000 meters)
Derate .....	2°C (3.6°F) for each 990 ft. (300m) over 3300 ft. (1000m) above sea level
Audible Noise .....	<65 dBA measured 5 feet (1.7m) from cabinet vertical surface

## 1.4 ABBREVIATIONS AND ACRONYMS

Listed here are many of the abbreviations and acronyms that may appear in this manual.

Abbreviation, Acronym Or Symbol	Meaning
ANSI	American National Standards Institute
AWG	American wire gauge
BATT	Battery
CL	current limit
CM	circular mils
EMI	electromagnetic interference
EQ	equalization
ESD	electrostatic discharge
FL	float
HVA	normally energized high voltage alarm
HVSD	high voltage shutdown
NCA (LCA)	No (low) current alarm
LED	light emitting diode
LSD	least significant digit
LVA	low voltage alarm
LVD	low voltage disconnect
NEC	National Electric Code
NEMA	National Electrical Manufacturers Association
PCB	printed circuit board
RFA	rectifier failure alarm
UL	Underwriters Laboratory
Vpc	Volts/Cell

## 1.5 PRODUCT SUPPORT

Product support can be obtained using the following addresses and telephone numbers.

Manufacturing facility:

UNIPOWER, LLC  
65 Industrial Park Rd  
Dunlap, TN 37327  
United States

Phone: +1-954-346-2442

Toll Free: 1-800-440-3504

Web site – [www.unipowerco.com](http://www.unipowerco.com)

When contacting UNIPOWER, please be prepared to provide:

1. The product model number, spec number, S build number, and serial number - see the equipment nameplate on the front panel
2. Your company's name and address
3. Your name and title
4. The reason for the contact
5. If there is a problem with product operation:
  - Is the problem intermittent or continuous?
  - What revision is the firmware?
  - What actions were being performed prior to the appearance of the problem?
  - What actions have been taken since the problem occurred?

## 2.0 INSTALLATION

This chapter describes installing *Micro ARE Series 24V Chargers*. To contact a UNIPOWER field service technician for assistance, refer to Section 1.5 Product Support.

The charger is fully assembled and tested at the factory. Refer to the Front Matter and Section 2.3 Unpacking for receiving and unpacking instructions and for instructions on moving the equipment to the installation site.

These chargers can be mounted to a wall, in a relay rack, or on a floor. All are furnished with brackets for standard wall or relay rack mounting. Optional floor mounting brackets and extra-wide brackets for wide relay racks are available. Cabinet dimensions and weights are provided in the Specifications section.

Conduit knockouts are located in the cabinet top for AC input cables, DC output cables and alarm wiring. Cables and wires are supplied by the user.

<p><b>WARNING</b></p> <p><b>Electrical shock hazard</b></p> <p>Hazardous voltage can cause death or serious injury. Remove power from all wires and terminals before working on equipment.</p>	<p><b>AVERTISSEMENT</b></p> <p><b>Risque de choc électrique</b></p> <p>Les tensions dangereuses peuvent causer la mort ou des blessures graves. Coupez l'alimentation de tous les fils et les bornes avant de travailler sur les équipements.</p>
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**IMPORTANT:** The installation must conform to the National Electrical Code and other applicable industry and local codes.

### 2.1 INSTALLATION SUMMARY

A typical installation sequence is provided below. References to appropriate sections in this manual are included.

1. Review the list of user-supplied tools and accessories in Section 2.2 Reference Material. This section also contains a table and a procedure for determining battery and distribution cable sizes based on current load and length of run. Refer to the National Electrical Code and other applicable codes to determine AC cable size.
2. Select a location for the charger. The chargers are cooled by natural convection and require at least 3" (76mm) of space below the charger and 3" above the charger. The charger must be mounted over a non-combustible surface. See Section 2.3 Mechanical Installation.
3. Move the charger to the selected location. See Section 2.3.
4. As appropriate, install charger mounting brackets for a wall, relay rack, or floor. Fasten the charger to the selected mounting surface or rack.
5. Install a user-supplied electrical service panel (as needed) for powering the charger. See Section 2.4 Electrical Installation. Install AC input conduit and wiring between the user's AC electrical service panel and the charger.
6. Install battery cabling. Route cabling through overhead cable racks between the battery string and the charger DC output terminals.
7. Install customer load supply and return cabling. Connect the cabling to the battery string or directly to the charger, if a battery string is not to be connected to the charger. If the customer load is connected to the battery string, install a circuit breaker or fuse in-line with the cabling.

8. Connect user-supplied external alarm annunciators.
9. Commission the charger. See Chapter 3.
10. Set LVA, HVA, HVSD, float voltage, equalization, etc. as needed to satisfy installation requirements. Test and verify charger setup and operation. See Chapter 4 Setup and Operation.

## 2.2 REFERENCE MATERIAL

This section contains lists, tables, and methods that are referenced in subsequent procedures. Three subsections comprise the Reference Material section.

- Tools and Accessories – Read the included list for a preview of the user-supplied items that will be referenced during the installation and servicing procedures.
- Selecting and Sizing DC Power Cables – Proper cable sizing is critical to system performance. This section provides a formula and table that simplify cable selection.
- Torque Specifications – The torque specification table in this subsection is referenced in procedures that include hardware.

### 2.2.1 Tools and Accessories

To install the charger, the following user-supplied items should be available.

- Equipment and personnel to safely transport the charger to the installation site
- Mounting brackets and related hardware to securely mount the charger
- Overhead wire racks for AC power and distribution cabling
- Standard insulated installation tools (e.g. socket set, cable cutters, cable insulation strippers)
- Torque wrench to ensure correct tightening of hardware; see Table 2-2 for torque specifications
- User-supplied AC electrical service panel with a circuit breaker for the AC feed to the charger
- Digital Voltmeter with: 4-1/2 digit display, 1/2% accuracy, and 10M ohms input impedance
- Cables and lugs; appropriate crimping tools
- Conduit, conduit connectors, and conduit bending tools
- Anti-Static Service Kit with static dissipative mat and wrist strap for handling electronic circuit boards (e.g. Control and Display Board, User Interface Board)

### 2.2.2 Selecting and Sizing DC Power Cables

Protective circuits, overall system performance, and safety depend on the proper sizing of DC cables for ampere ranges and acceptable DC voltage drop. Read the electrical installation section before sizing the DC cables.

Perform the following procedure to determine wire size.

1. Calculate the minimum circular mils (CM) required for copper wire using the following formula:

$$CM = \frac{22.2 * I * L}{V}$$

where:

CM = minimum area of circular mils in the cable

I = maximum current (in amps)

L = one-way cable length (in feet)

V = allowable loop voltage drop (in volts)

Example:

Assume a maximum output current of 25 amperes, an allowable loop voltage drop of 0.5 volts, and a distance of 50 feet between the charger and the load.

I = 25 amperes

L = 50 feet

V = 0.5 volts

$$CM = \frac{(22.2)(25)(50)}{(0.5)} = 55,000$$

11. After calculating the minimum circular mils, select the proper copper wire size from Table 2-2; always choosing the next larger wire size if the area rating falls between values. For the above example, select 2 AWG (35 mm<sup>2</sup>) wire.
12. Determine the minimum wire size for ampacity according to the code authority having jurisdiction in your location.
13. Select the larger of the sizes calculated for voltage drop or ampacity.

**TABLE 2-1 COPPER WIRE SIZING**

SIZE AWG NO.	AREA IN CM	CURRENT CARRYING CAPACITY* 75°C (167°F)		DIA BARE COND INCHES	RHW DIA OVER INS INCHES	RHW BEND RADIUS INCHES	RHW NET WEIGHT PER 1000 FT IN POUNDS	RHW MAX SHIP LENGTHS PER REEL IN FEET
		OPEN AIR	ENCLOSED					
14	4,110	15	15	0.064	0.19	0.95	26	5,000
12	6,530	20	18	0.081	0.21	1.05	35	3,000
10	10,380	30	25	0.102	0.24	1.20	49	3,000
8	16,510	45	35	0.146	0.31	1.55	84	3,000
6	26,250	70	45	0.184	0.40	2.00	126	2,000
4	41,740	90	60	0.232	0.45	2.25	190	1,500
2	66,370	125	85	0.292	0.51	2.55	278	1,000
1/0	105,500	170	110	0.373	0.63	3.15	443	1,000
2/0	133,100	195	130	0.418	0.68	3.40	540	1,000
4/0	211,600	270	170	0.528	0.78	3.90	814	1,000

\* Data based on NEC Handbook 2005, Table 310-16 and 310-17 adjusted for 50°C (122°F) ambient temperature.

### 2.2.3 Torque Specifications

Proper Charger performance requires that the hardware employed during installation be tightened securely, but not over tightened. Use a torque wrench to ensure that hardware is tightened to the specification provided in the table below.

**TABLE 2-2 TORQUE SPECIFICATIONS, STEEL FASTENERS**

Bolt Size	Inch-Pounds	Foot-Pounds	Newton-Meters
4-40	4.5	0.375	0.51
4-48	5.4	0.450	0.61
6-32	9.0	0.750	1.02
6-40	10.8	0.900	1.22
8-32	17.1	1.425	1.93
8-36	18.0	1.500	2.03
10-24	24.3	2.025	2.75
10-32	27.9	2.325	3.15
1/4-20	59.4	4.950	6.71
1/4-28	70.2	5.850	7.93
5/16-18	118.8	9.9	13.42
5/16-24	129.6	10.8	14.64
3/8-16	216.0	18.0	24.40
3/8-24	248.4	20.7	28.07
7/16-14	324.0	27.0	36.61
7/16-20	378.0	31.5	42.71
1/2-13	540.0	45.0	61.01
1/2-20	594.0	49.5	67.11
9/16-12	756.0	63.0	85.42
9/16-18	864.0	72.0	98.62

## 2.3 MECHANICAL INSTALLATION

Install the charger in a location that provides:

- A dry, well ventilated, vibration-free environment with temperature and humidity limits as stated in Section 1.3 Specifications
- Sufficient access for installation and servicing
- Sufficient ceiling height to permit use of overhead cable trays for distribution wiring
- A level, flat floor or a wall capable of supporting the weight of the charger and accepting anchoring bolts
- A non-combustible surface beneath the charger
- A pest and varmint free area

Charger dimensions are stated in the Section 1.3 Specifications and shown in Figures 2-1 and 2-2. Charger weight is provided in the Specifications section.

The mounting method (floor, rack, or wall) is usually specified on the order so the necessary brackets are installed on the charger at the factory. Charger wall mounting hardware (1/4-20 screws, lock washers and nuts), rack mounting hardware (12-24 screw and nuts) or floor mount hardware (3/8 bolts and anchors) is customer supplied since it must be selected on-site to be appropriate for the mounting surface.

Figures 2-1 and 2-2 show charger mounting bracket locations. Charger mounting options are listed below.

- A 12" or 24" cabinet can be mounted in a 19" rack using the supplied rack angle brackets; the wide bracket option is required for a 23" rack
- All cabinets can be fastened to a wall using the supplied rack angle brackets fastened to rear of cabinet
- All cabinets can be free standing on a solid or elevated floor; optional floor mounting brackets are required

### CAUTION

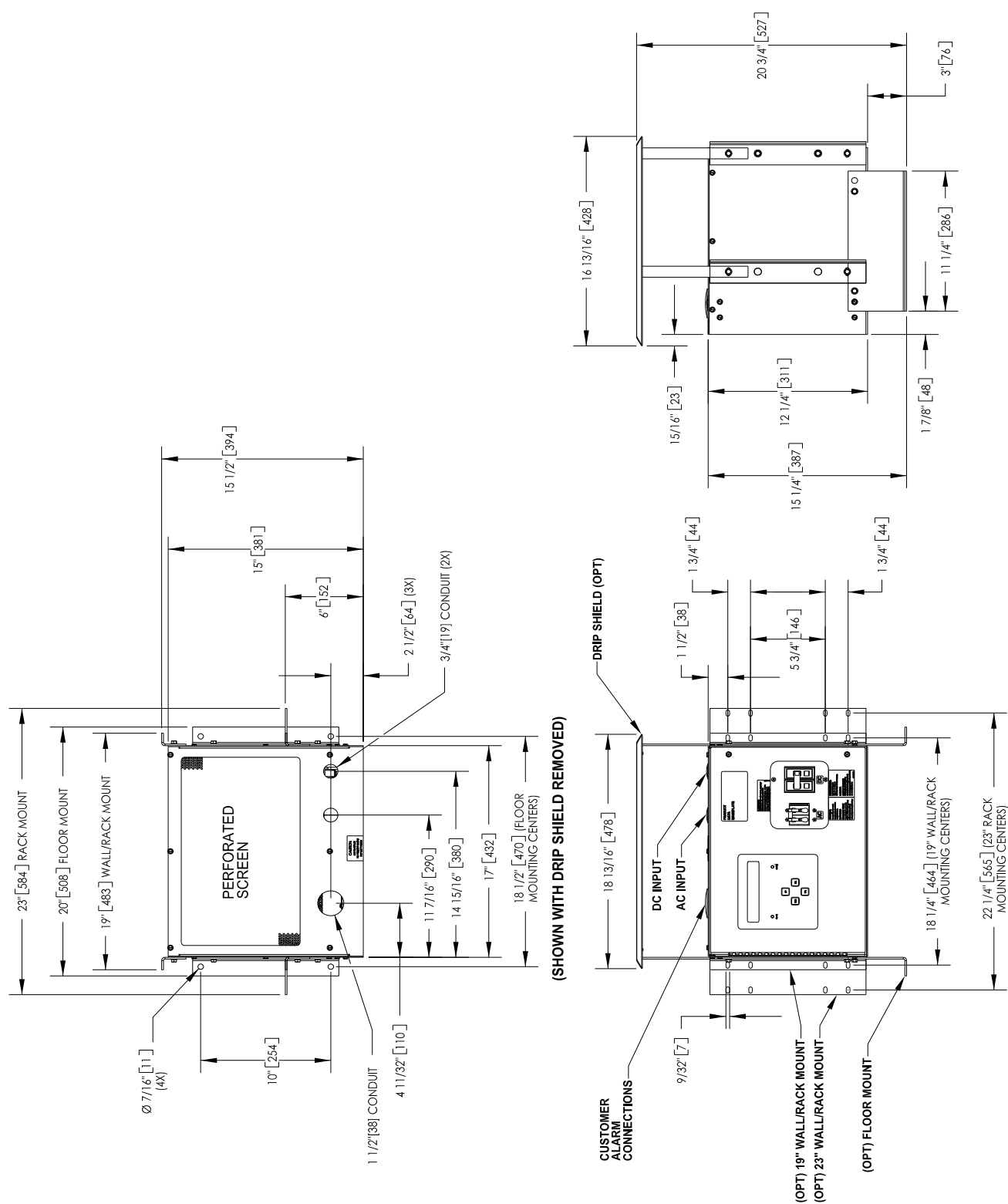
Charger models that output 24 Vdc @ 50A or 100A can have hot cabinet surfaces. Install these models so that top and rear cabinet surfaces are unlikely to be touched by personnel.

Charger models with drip shields are to be placed where the shield is unlikely be in contact with people. The shield should not have anything set upon it.

### ATTENTION

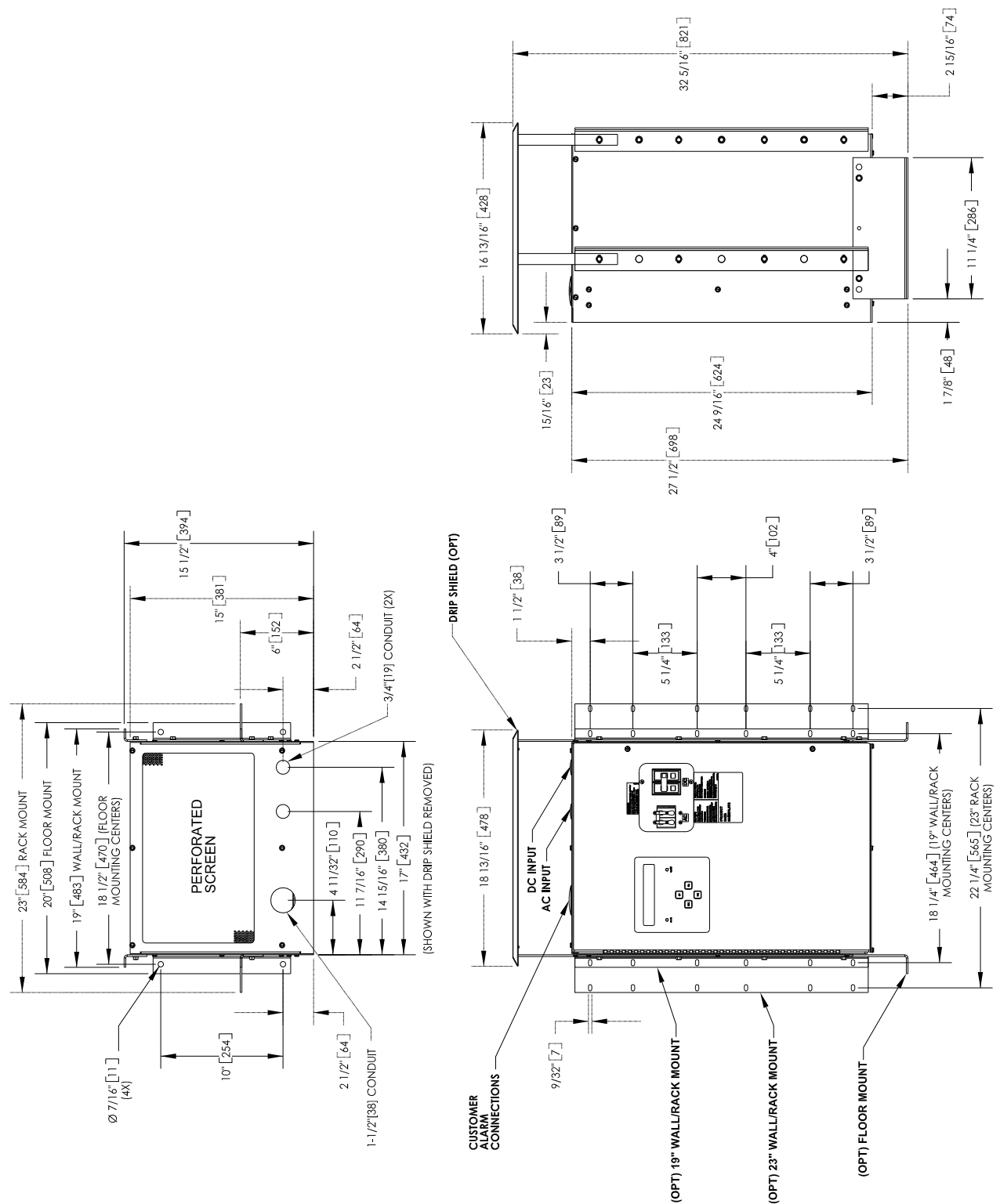
La surface des cabinets peut être CHAUDE pour les modèles de chargeur avec une sortie de 24 Vdc @ 50A ou 100A. Installez ces modèles dans un endroit où ils sont peu susceptibles d'être touchés par le personnel.

Les modèles avec un « pare-gouttes » doivent être placés là où le dessus est peu probable d'être en contact avec du personnel. Ne rien placer sur le pare-gouttes.



**FIGURE 2-1 12" CABINET DIMENSIONS**





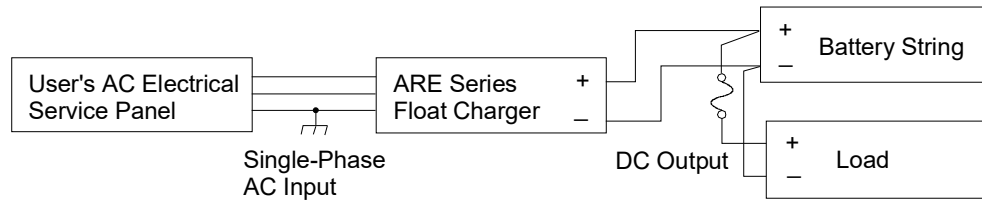
### FIGURE 2-2 24" CABINET DIMENSIONS

## 2.4 ELECTRICAL INSTALLATION

Each charger is internally connected for the nominal AC input voltage stated in the charger's model number. Refer to the model number on the charger nameplate and Section 1.2 Model Designation to be sure that the charger is intended for your incoming AC line voltage.

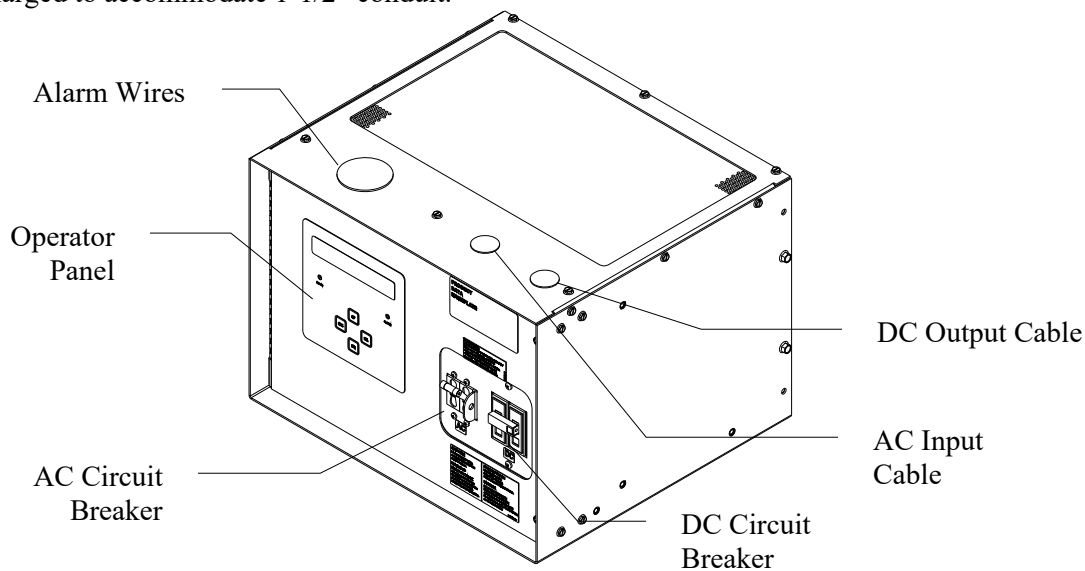
If there are sustained AC voltage fluctuations outside the ranges given in the Specifications section of this manual, contact the Field Service Department of UNIPOWER.

A block diagram of a typical charger electrical installation is shown in Figure 2-3. Note that the load is connected to the battery string terminals through a fuse or circuit breaker.



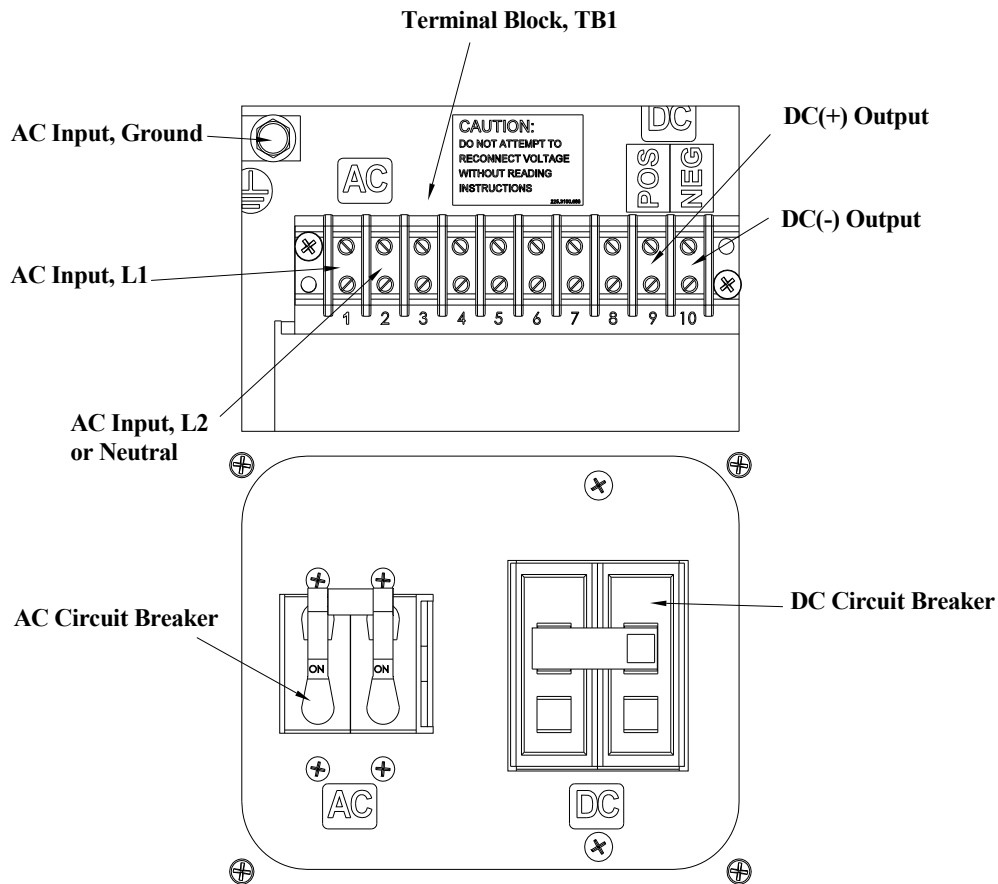
**FIGURE 2-3 ELECTRICAL INSTALLATION, BLOCK DIAGRAM**

Chargers are furnished with three holes for top conduit entrances; see Figure 2-4. These holes can be enlarged to accommodate 1-1/2" conduit.



**FIGURE 2-4 TYPICAL ELECTRICAL ENTRANCE AND BREAKER LOCATIONS**

All charger connection terminals are accessed by opening the hinged front panel. AC input and DC output power terminals are located on the accessory panel at the right front of the unit. The alarm terminal block is located on the Interface Board at the left front of the unit. AC and DC terminals are shown in Figure 2-5. Connection locations vary with cabinet size.

**FIGURE 2-5 ELECTRICAL INSTALLATION TERMINALS, 12" AND 24" CABINET MODELS**

\*NOTE: GENERIC; MAY VARY PER SYSTEM

#### 2.4.1 Grounding the Cabinet

Ground the charger to the site's earth/safety ground. Figure 2-5 show the provided ground terminal. Connections must comply with the National Electrical Code and all applicable local codes and ordinances.

1. Open the front panel by loosening the quarter-turn captive screws at the right edge of the panel. Swing the panel open.
2. Locate the ground terminal near the upper center of the internal panel. It is labeled with a ground symbol. Internally, this terminal is connected to the charger cabinet/chassis.
3. Route the user-supplied ground wire through one of the cable entrance holes and connect it to the ground terminal.
4. Connect the other end of the cable to the site's earth/safety ground.

#### 2.4.2 Installing a User's AC Electrical Service Panel

The user should furnish an electrical service panel with either a fuse-protected AC disconnect switch or an AC circuit breaker for supplying power to the charger. Before selecting the rating of the protective device and the AC and DC cables sizes, check the equipment nameplate and the Specifications section in Section 1-3 for charger input and output voltage and current. The rating of the protective device on the power circuit feeding the unit must equal or exceed equipment breaker rating. When standard AC circuit

breakers are provided in the unit, the upstream protection shall not exceed 4 times the rating of the input breaker and shall not exceed 225A. The available fault current shall not exceed the interrupt rating list in section 1.3.2 for the model being installed. For locations with fault currents in excess of the standard capacity, optional high interrupting circuit breakers are required. Refer to the National Electrical Code (NEC) to select cable sizes.

\*Note: 24 inch cabinets require wire rated 75°C or greater.

#### 2.4.3 Connecting AC Input Cables

1. Confirm the required AC input voltage. Refer to the model number on the charger nameplate and to the Model Designation table 1-1. See the Specifications section 1-3 for AC voltage and current requirements.

A tag in the unit tells the factory voltage setting. If the AC input voltage must be changed, refer to the voltage changeover instructions. Go to Chapter 6 Maintenance and locate the cabinet assembly and schematic for the model at hand. Each schematic has a table and a connector detail drawing showing the needed connections.

2. Determine the AC input cable wire size. Refer to the National Electrical Code and local codes as necessary. The 24 inch cabinets require wire rated 75°C or greater.
3. At the charger, switch the AC input breaker to off.
4. Locate the conduit entrance hole and install conduit as necessary.
5. Route the AC cable from the user's AC electrical service panel and into the charger cabinet. Strip the cable ends and install cable lugs, as desired.
6. Connect the cable to the AC input terminal block. See Figure 2-5 for connections. The power supply electrical circuits are isolated from ground so the AC supply must be connected to terminals TB1-1 and TB1-2 on all models.
7. At the user's AC electrical service panel, set the circuit breaker to off. Connect the AC cable at the service panel.

#### 2.4.4 Connecting the Battery String

Routing stiff, heavy gauge battery cables can be difficult. Two people may be needed. Exercise **extreme caution** to avoid a short circuit across the battery terminals.

<b>WARNING</b>	<b>AVERTISSEMENT</b>
<p><b>Arcing hazard</b></p> <p>Arcing can cause equipment damage, load interruptions, and personal injury. Remove watch and jewelry. Use insulated tools, appropriate arc flash personal protective equipment, and extreme caution when working with a battery string. Carefully insulate unterminated battery cable ends. Carefully check connection polarity.</p>	<p><b>Risque d'arc</b></p> <p>Un arc électrique peut causer des dommages sur les équipements, des interruptions de charge, et des blessures. Retirez vos montres et bijoux. Utiliser des outils isolés, équipement de protection individuelle approprié contre les arc électrique, et une prudence extrême lorsque vous travaillez avec des batteries. Isoler les extrémités des câbles de batterie. Vérifiez la polarité de connexion.</p>

To connect the battery string:

1. Refer to the Specifications section in Chapter 1 for charger output current and recommended cable size. Additional cable selection information is provided in Section 2.2 Reference Material. The 24 inch units require wires rated 75°C or greater.
2. At the charger, locate the DC Output conduit entrance and install conduit as necessary.
3. Route the DC cable from the battery (or output load) to the charger and into the cabinet.
4. Switch the DC output circuit breaker to off.
5. Connect the battery leads to the terminal block. See Figure 2-5 for the terminal block location. Mark the free cable ends with the polarity (+ or -).
6. At the battery, strip the wire ends and install lugs appropriate to the battery terminals.
7. Check cable polarity and connect the lugs to the battery (or output load) terminal plates or posts.

#### 2.4.5 Connecting an External DC Load

Load connections depend upon whether the charger is connected to a battery string.

- Battery String Connected – Connect the external load to the battery string terminals through a circuit breaker or fuse.
- Battery String Not Connected – Connect the external load to charger DC output terminals.

Read the Warning statements in Section 2.4.4 Connecting the Battery String before proceeding.

To connect a load:

8. Refer to the Specifications section in Chapter 1 for charger output current and recommended wire size. Refer to the charger nameplate and to the Model Designation table in Chapter 1 for the charger model number. Additional cable selection information is provided in Section 2.2 Reference Material. The 24 inch units require wire rated 75°C or greater.
9. At the charger, locate the DC Output conduit entrance and install conduit as necessary.
10. Route the DC supply and return cables between the load and either the battery or the charger.
11. At the load, connect the supply and return cables. Mark the free cable ends with the polarity (+/-).
12. At the battery string or charger, strip the wire ends and install lugs, as required.
13. Carefully check cable polarity and connect the cables.

### 2.4.6 Connecting Alarm Annunciation

Connect user-supplied alarm annunciators to terminal block TB1 on the Interface Board. Refer to Section 1.3 Specifications for alarm relay specifications and for recommended wire size.

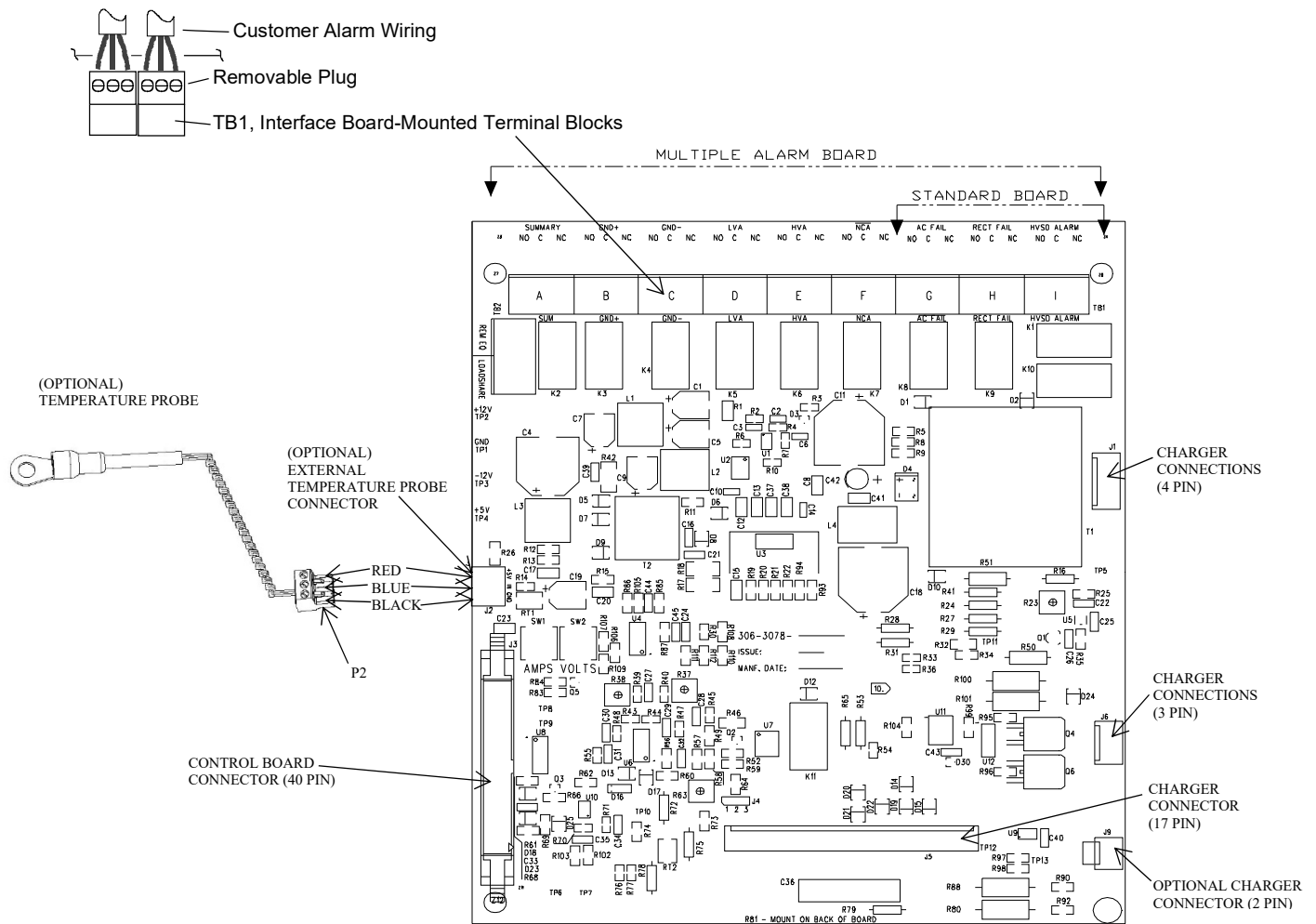
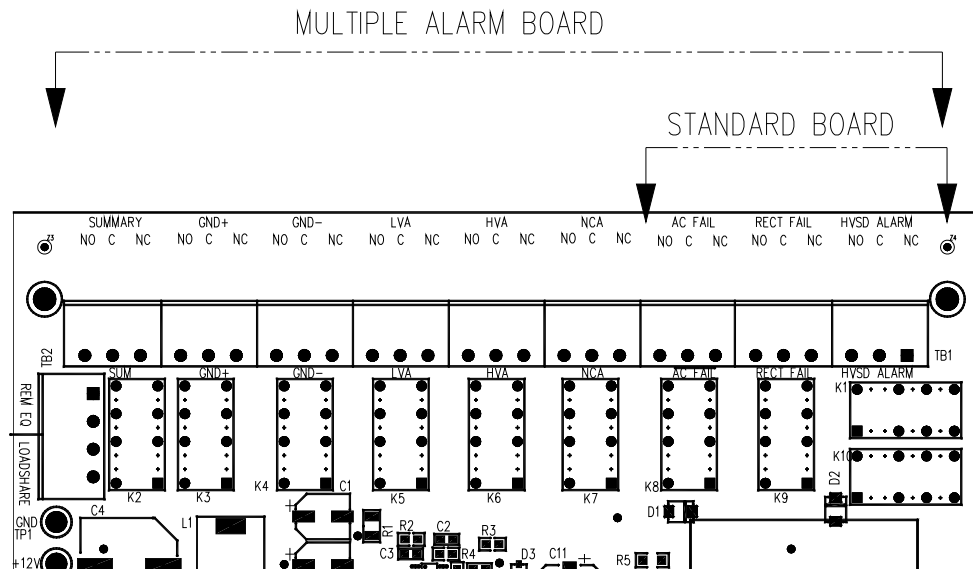
As shown by the detail on this page and Figures 2-6 and 2-7, each relay has three connections: common, normally open, and normally closed. The normally open (NO) and normally closed (NC) labels are for an un-powered charger.

ALARM STATE	NORMAL CONDITION	ALARM CONDITION
LVA	De-Energized	Energized
HVA	De-Energized	Energized
HVSD	De-Energized	Energized
NCA	Energized	De-Energized
GND-	De-Energized	Energized
GND+	De-Energized	Energized
RECT FAIL	De-Energized	Energized
AC FAIL	Energized	De-Energized
SUMMARY	De-Energized	Energized

To connect alarm annunciators:

1. Open the front panel. Loosen two quarter-turn captive screws at the right edge of the panel. Swing the panel open.
2. Locate the Interface Board on the left side of the internal panel. See Figures 2-6 and 2-7 for a view of terminal block TB1 and connector labeling. TB1 consists of either 3 or 9 separate 3-terminal blocks.
3. For each alarm output, strip the wire ends 1/4" to 5/16" and make the needed connections as shown in Figure 2-7.

**Note:** If desired, the plug can be pulled straight up and out of the terminal block for wiring. After wiring the plug, insert the plug into the appropriate terminal block.

**FIGURE 2-6 INTERFACE BOARD****FIGURE 2-7 ALARM CONNECTIONS DETAIL, INTERFACE BOARD**

### 2.4.7 Connecting the Battery Temperature Probe (Option)

When the battery temperature probe option is ordered with the charger, a temperature probe is connected to the charger's Interface Board and the probe and wires coiled and tied near the Interface Board, behind the front panel.

To connect the battery temperature probe:

1. Open the front panel. Loosen two quarter-turn captive screws at the right edge of the panel. Swing the panel open.
2. If not already connected, connect the probe's three wires into P2, then plug P2 into J2 on the Interface Board as shown in Figure 2-6.
3. Route the probe to the battery string. Cable length is approximately 25 feet (8m).
4. Determine which battery cell or group of cells will have the highest operating temperature.
5. Determine the charge/discharge status of the battery string. Connecting the probe may result in a momentary battery string open circuit when the terminal bolt is removed.

<p><b>CAUTION</b></p> <p><b>DO NOT</b> proceed if the battery string is in a high charge or discharge state.</p>	<p><b>ATTENTION</b></p> <p><b>NE PAS</b> procéder si la batterie est en haute recharge ou en mode décharge.</p>
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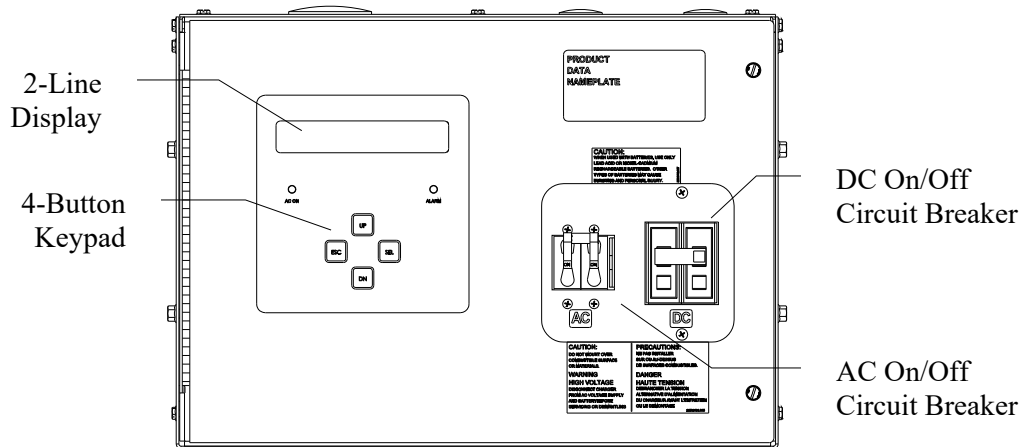
6. Remove the bolt holding the intercell battery strap in place. Insert the bolt through the battery temperature probe ring lug, through the strap, and into the battery terminal. Tighten the bolt as recommended by the battery manufacturer.
7. Bundle and secure any excess wire.

During commissioning, enable battery temperature compensation using the front panel keypad and 2-line display. (See Section 4.3.4.2)



### 3.0 COMMISSIONING

This chapter describes configuring, commissioning, and operating an ARE-Series 24V Charger. A front view of a typical charger is shown in Figure 3-1. All operator controls are on the front of the charger.



**FIGURE 3-1 OPERATOR CONTROLS**

The front of the unit has a large, high-contrast 2-line digital display, a 4-button keypad with tactile feedback for positive data entry, two LEDs for charger On/Off and alarm indications, and AC and DC circuit breakers. An optional control board offers front panel indicators, consisting of a High Voltage Alarm, Low Voltage Alarm, No Charger Alarm, AC Fail Alarm on the telecom models, and an additional Positive and Negative Alarm indicators are on the utility models. A microcomputer-based controller manages charger operation. The keypad and display provide the means for entering charger setup data (e.g. float voltage, high voltage shutdown, and temperature compensation on/off).

**IMPORTANT:** Press the keypad with your finger. Pressing with a sharp or pointed tool will damage the switch overlay and can damage the switch itself.

The following two sections will describe charger commissioning.

#### 3.1 PREPARATORY STEPS

Perform the following steps prior to actually commissioning a charger.

1. Gather system wiring diagrams, battery data sheets, and other site documentation for ready reference should it be needed.
2. Check that all installation steps have been completed. Review Chapter 2 Installation. The system can be commissioned with or without a battery string.
3. If a battery string is connected to the charger, temporarily disconnect any external load connected to the battery string.
4. Review the steps in Section 3.2 Commissioning Procedure.
5. Become familiar with the operation of the front panel and the setup menus by reading Chapter 4 Setup and Operation.
6. Read the two statements below to determine whether charger setup parameter values can be displayed and edited prior to application of AC power to the charger. See Chapter 4 Setup and Operation for setup details. Table 4-1 lists default parameters and values.

- **Battery String Connected to Charger** – The string will power the charger controller if there is at least a minimal battery charge. The 2-line display, keypad, and Alarm LED will be active. The setup can be edited at the charger front panel without applying AC power to the charger.
- **No Battery String Connected** – When AC power is applied to the charger, the controller will load a default charger setup. You may then use the front panel to change many of the default parameter values to accommodate the application.

7. Set the AC and DC breakers on the charger front panel to off.
8. Finally, perform the steps in Section 3.2 Commissioning Procedure.

### 3.2 COMMISSIONING PROCEDURE

This procedure assumes a newly installed system that includes a connected battery string and load. The voltages and currents shown in the screens in this section are examples. They can vary with the charger model, charger setup, connected load, and other factors.

1. Check that the AC and DC circuit breakers on the charger front panel are switched to **off**.
2. Check that the circuit breaker in the user's AC electrical service panel is switched **off**.
3. Check that:
  - The AC input cable is connected to the correct terminals and that connections are tight
  - DC load and battery cables are correctly connected and that connections are tight; check polarity as well
  - Alarm wiring is correct and tight, and that user-supplied alarm annunciators function
  - The charger chassis is correctly grounded

4. Switch the DC output breaker on the charger front panel to on.

- **Battery string connected to charger** – The filter capacitors connected across the DC output will be charged by the string. The 2-line display on the front panel should show the battery voltage and current.

Note: The inrush current may trip the DC breaker. If so, close the breaker.

26.4VDC 0.0ADC FLOAT
-------------------------

ACTIVE ALARMS LCA
----------------------

The green AC input ON/OFF LED should be off. The red Alarm LED may be lit since all loads are disconnected, a low current alarm condition and the AC power is off. The low voltage alarm may be activated. The factory-installed or user-edited setup will specify the low current alarm value.

- **No battery string connected** – The 2-line display will not be active. The capacitors will charge when the AC input breaker is closed in step 6. Both the output current and voltage will build up gradually, provided some load is connected.
5. At the user's AC electrical service panel, switch the AC circuit breaker On to power the charger.
  6. At the charger, switch the AC input breaker **on**. The DC output current will build up gradually due to the "walk-in" or "soft-start" characteristic of the equipment. The green AC on/off LED should be **on**.

The 2-line display will show the Home screen. If an alarm is present, the display will indicate an alarm on the Home screen; pressing the down button will indicate the alarms. The red Alarm LED will be lit if an alarm condition exists. See step 4 for sample displays.

7. Connect a load of about 10% of charger capacity to the battery terminals through a circuit breaker or fuse. If a battery string is not connected, wire the load directly to the charger DC output terminals. Refer to the Section 2 Installation as necessary.
8. Refer to Chapter 4 Setup and Operation and use the front panel keypad and menus to:
  - 1) Turn Off battery temperature compensation. (Note: If the float voltage is set at high or low battery temperature with battery temperature compensation turned on, compensation may adjust the charger voltage by as much as 2 volts.)
  - 2) If not performed previously, configure the charger by editing the factory setup to set the FLoad voltage, EQualize voltage, and other parameters to accommodate the application.
9. Thoroughly test the setup to ensure that all configurable parameters are correct for the application. Test the alarm circuits to ensure correct activation and annunciation.
10. Operate the system for 15-20 hours to charge the battery string(s) before placing the system on-line or as recommended by the battery manufacturer.

## 4.0 SETUP AND OPERATION

This chapter describes setting up and operating a Micro ARE Series Charger using the 2-line display and 4-button keypad on the charger. See Figure 3-1 for the location of the panel, display, and keypad. The figure also shows the locations of the AC and DC circuit breakers mentioned in sections 4.1 & 4.2.

### 4.1 TURNING ON A COMMISSIONED CHARGER

1. Set the AC and DC circuit breakers on the front of the charger to off. See Figure 3-1 for the location of the breakers.
2. At the user's AC electrical service panel, switch on the appropriate circuit breaker to supply power to the charger.
3. At the charger, switch the AC circuit breaker on. The message "Starting" will appear and output current will build up gradually due to the "walk-in" or "soft-start" characteristic of the equipment. During normal ramping LVA and RECTF alarm messages may appear and the alarm LED may flash.
4. At the charger, switch the DC breaker on.
  - Battery string connected - The filter capacitors connected across the DC output will charge. The 2-line display on the front panel should read the battery voltage. Note: The inrush current may trip the DC breaker. If so, again close the breaker.
  - No battery string connected - The capacitors will become charged when the AC breaker is closed in step 4. Both current and voltage will then build up gradually, provided some load is connected.

### 4.2 TURNING OFF A COMMISSIONED CHARGER

1. At the charger, open the AC circuit breaker on the front panel. While the output voltage and current are decreasing, an AC Fail alarm message may appear and the alarm LED may flash.
2. Open the DC circuit breaker.
3. If the charger is to be serviced, open the front panel and press the capacitor discharge button for 60 seconds.

### 4.3 SETTING UP AND OPERATING A CHARGER

Set up and operate the charger using the 2-line alphanumeric display and the 4-button keypad on the front panel. A series of menus provides access to charger status, active alarms, and setup parameter values. Menus are shown in Figures 4-1 through 4-4.

**IMPORTANT:** Press the keypad with your finger. Pressing with a sharp or pointed tool will damage the switch overlay and can damage the switch itself.

**Note:** The charger can be set up without AC power being applied if a battery string is connected. The keypad and controller board are powered whenever a battery string is connected to the charger.

#### The 4-Button Keypad

The four buttons on the keypad are labeled UP, DN (Down), SEL (Select), and ESC (Escape).

- UP or DN is pressed to move vertically through a menu. Also, parameter values (e.g. float set point, low voltage alarm set point, alarm enable/disable) are set using these buttons.

When changing a parameter value using UP or DN, a single press will increment (UP) or decrement (DN) the value. Pressing and holding either button will cause the value to scroll, allowing large value changes to be made quickly.

- SEL is pressed to move to the right, to select an operation, or to store parameter value.
- ESC is pressed to move to the left or to cancel an operation or parameter value (before the SEL button is pressed). Generally, pressing ESC will display either a **Main Menu** screen or the previous screen.

### The Home Screen and Menus

The **Home** screen, shown at right, is the default display. It will first appear when a charger is turned on. Charger output voltage and current and charger operating mode (float or equalize) are shown in the **Home** screen. If another screen is displayed and there is no keypad activity for 5-6 minutes (the timeout period), the **Home** screen will automatically be displayed.

26.4VDC 22.8ADC FLOAT
--------------------------

If equalization is enabled, the **Home** screen will show the charger output voltage and current and the equalization time remaining.

28.0VDC 1.7ADC Equalize 24hrs left
---------------------------------------

Active alarms will also be displayed in the **Home** screen. The descriptor for an active alarm will alternate with the charger operating mode in the lower line of the **Home** screen. If multiple alarms are present, all descriptors will scroll across the display. Alarms and operating mode will alternate in the **Home** screen until all alarms are cleared.

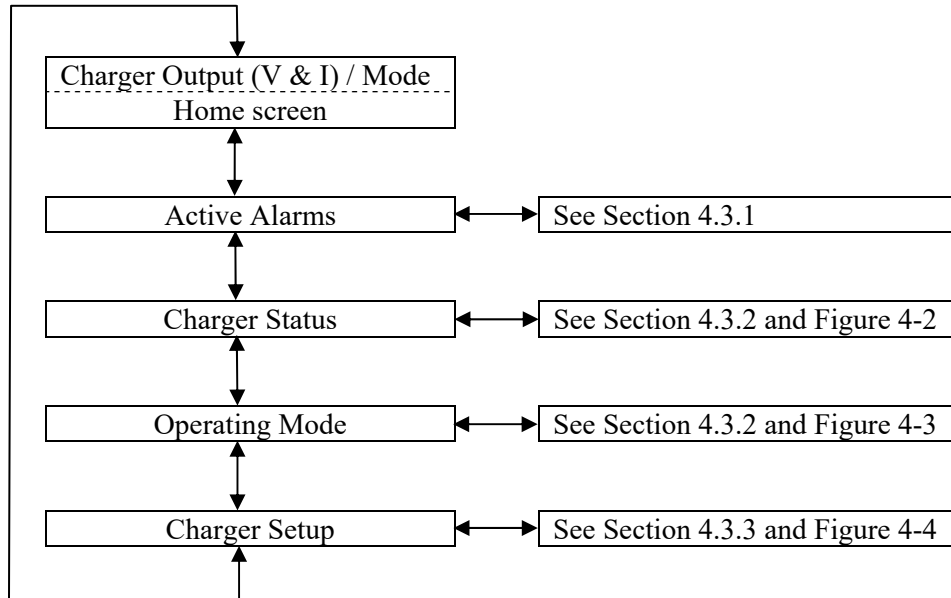
26.4VDC 0.0ADC NCA RECTF
-----------------------------

Unacknowledged alarms are indicated by a flashing Alarm LED. A steadily glowing LED indicates that an alarm has occurred and has been acknowledged. Acknowledge alarms by pressing any button on the keypad.

### Changing Parameters

1. Push SElect, "=" will flash indicating the parameter can be changed.
2. Push UP and DN to change to the required value.
3. Push SElect or ESCape to stop "=" from flashing, and save/abort change.
  - a. A parameter will not change until SElect is pressed (and "=" stops flashing).
  - b. If ESCape is pressed, parameter value changes will be lost.

The **Home** screen is part of the **Main Menu**, which is shown in Figure 4-1. All charger statuses, alarms, and parameters can be accessed from the **Main Menu**. This menu has five screens: **Home**, **Active Alarms**, **Charger Status**, **Operating Mode**, and **Charger Setup**. Press UP or DN to move from the **Home** screen to another **Main Menu** screen. Each of these screens will be briefly described below and then discussed in detail in subsequent sections.



In all menus:

- Press UP or DN to move vertically.
- Press SEL to move to the right.
- Press ESC to cancel a selection or move to the left.

**FIGURE 4-1 MAIN MENU**

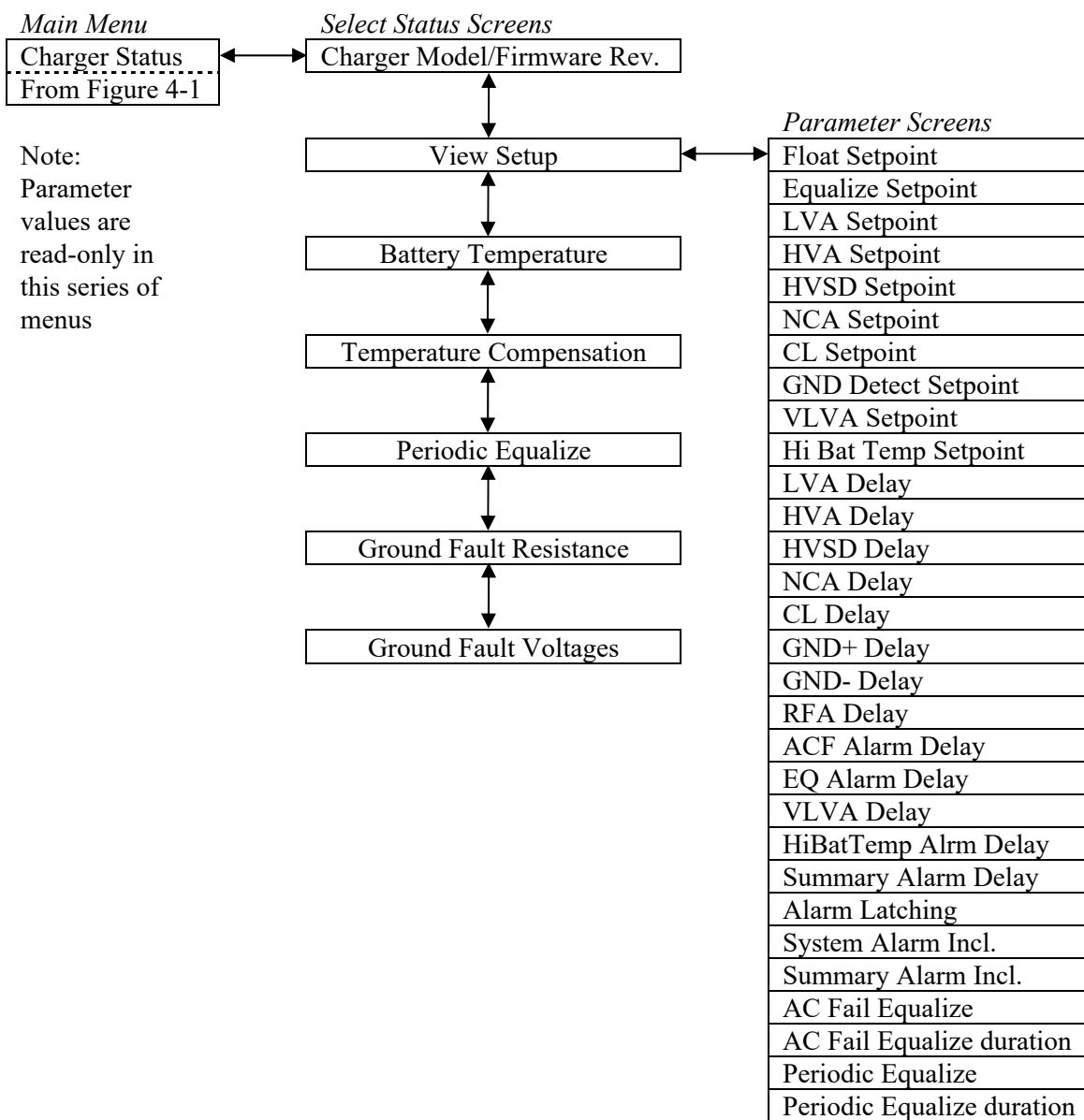
The **Active Alarms** screen will show all current alarms. If multiple alarms are present, their alarm descriptors will scroll through the screen. Viewing an alarm also acknowledges that alarm.

Press SEL at the **Charger Status** screen to view charger-operating parameters; see Figure 4-2. Parameter values cannot be changed in this series of screens.

Press SEL at the **Operating Mode** screen to select float or equalization as the desired operating mode. This menu also contains a relay/lamp test function. See Figure 4-3. If password protection is enabled, a password is required to access these menus.

Press SEL at the **Charger Setup** screen to change charger setup; see Figure 4-4. If password protection is enabled, a password is required to access these menus.

**Note:** Each of the procedures in the following sections is complete in that each begins and ends at the **Home** screen. However, it is not necessary to begin or end at the **Home** screen to perform a procedure. Simply use the 4-button keypad to navigate to the next desired screen following the most direct path.



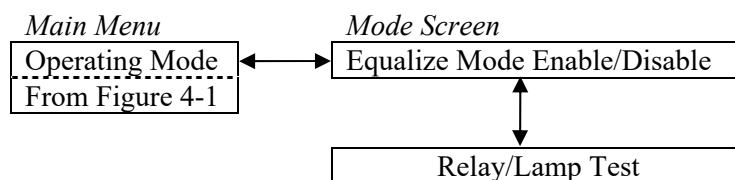
In all menus:

Press UP or DN to move vertically.

Press SEL to move to the right.

Press ESC to move to the left.

**FIGURE 4-2 CHARGER STATUS MENU**



**FIGURE 4-3 CHARGER OPERATING MODE MENU**

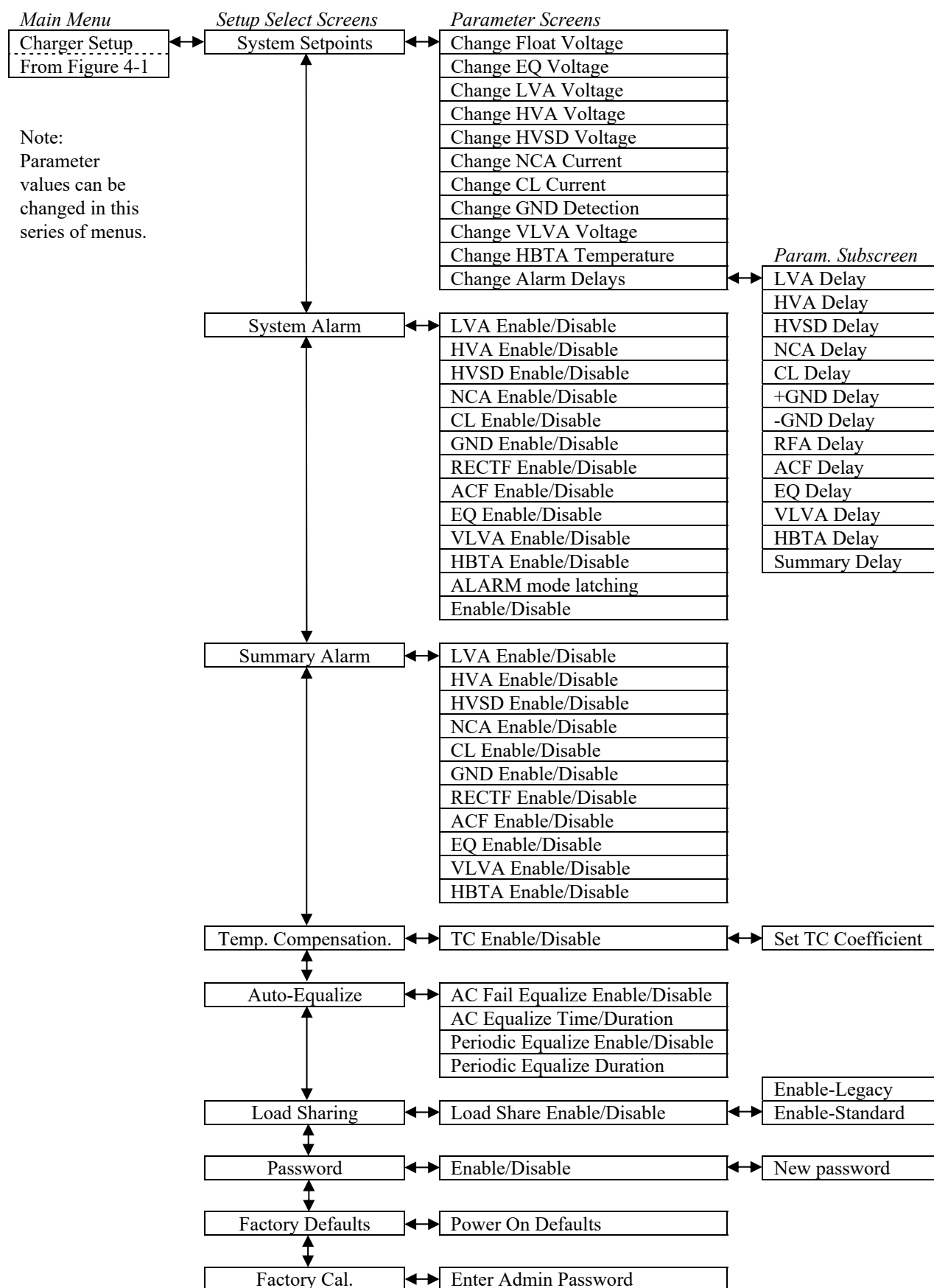


FIGURE 4-4 CHARGER SETUP (CONFIGURATION) MENU



### 4.3.1 View Active Alarms

All active alarms appear in the **Active Alarms** screen. Multiple alarms will scroll across the screen. A flashing Alarm LED indicates unacknowledged alarms. An optional control board offers front panel indicators, consisting of High Voltage Alarm, Low Voltage Alarm, No Charger Alarm, AC Fail Alarm on the telecom models and an additional Positive and Negative Alarm indicators are on the utility models. A steadily glowing LED indicates alarms are present and have been acknowledged. An alarm will remain in the **Active Alarms** screen until the event causing that alarm is cleared. Enabling password protection will not limit access to this screen.

To view active alarms:

1. At the **Home** screen, press DN until ACTIVE ALARMS appears. See Figure 4-1. A \* No Alarms \* message indicates that there are no active alarms. If alarms are present, the alarm descriptors will appear in, or automatically scroll through, the display and the Alarm LED will glow.

ACTIVE ALARMS  
 \* No Alarms \*

Alarm descriptors are: LVA (Low Voltage Alarm), HVA (High Voltage Alarm), HVSD (High Voltage Shutdown), NCA (No or Low Current Alarm), CL (Current Limit), GND+ (Ground fault to +), GND- (Ground fault to -), VLV (Very Low Voltage), HBTA (High Battery Temperature Alarm), RECTF (Rectifier Fail), ACF (AC Fail), EQ (Equalize), and SUMM (SUMMARY).

2. To return to the **Home** screen, press ESC.

### 4.3.2 View Charger Status

This series of screens provides read-only access to charger setup parameter values. Enabling password protection will not limit access to these screens.

To view charger status:

1. At the **Home** screen, press UP or DN until CHARGER STATUS appears. See Figure 4-2.
2. Press SEL to display charger model, type utility (UTL)/telecom (TEL) and firmware revision.
3. Press DN to display the **View Setup** screen. Press SEL to view the **Float Setpoint** screen and then press UP or DN to move through the View Setup parameters. Press ESC at any time to return to the View Setup screen.
4. From the **View Setup** screen, press DN (or UP) to display the **Battery Temperature, Temperature Compensation, (Time to Next) Periodic Equalize, Ground Fault Resistance, or Ground Fault Voltage** screen.

ARE-M 24V-50A UTL  
 Firmware X.XX

**Note:** Battery Temperature, Temperature Compensation and High Battery Temperature Alarms require that Temperature Compensation option 2 is ordered and that the temperature sensor is installed. See Table 1-1 Model Designation for the option location in the charger model number.

5. Press ESC at any time to step back up through the menu hierarchy to the **Home** screen.

### 4.3.3 Change Operating Mode (Manual Equalization)

Use this series of screens to manually enable and terminate equalization.

**Note:** If password protection is enabled, only authorized personnel will be able to change the operating mode.

To enable equalization:

1. At the **Home** screen press UP or DN until OPERATING MODE appears. See Figure 4-3.
2. Press SEL. The **Equalize Mode** screen will appear.
3. Press SEL. If the **Begin Equalize** screen appears, go to step 5. If the **Enter Password** screen appears, go to step 4.
4. At the **Enter Password** screen, press UP until your password is displayed and then press SEL. Go to step 5.
5. At the **Begin Equalize** screen, press one of the following:
  - Press SEL to select equalize mode. Go to step 6.
  - Press ESC to remain in float mode. Go to step 7.
  - Pressing UP or DN displays the **Stay in Float Mode** screen; press SEL to stay in float mode. Go to step 7.
6. At the **Equalize Duration** screen, press UP or DN to set the duration (1-255 hours or Always On). Press SEL to store the time.
7. Press ESC to step back up through the menu hierarchy to the **Home** screen.

EQUALIZE MODE SEL to activate
----------------------------------

To terminate equalization and return to float mode:

1. At the **Home** screen, press UP or DN until OPERATING MODE appears.
2. Press SEL. If the **Equalize Mode** screen at right appears, go to step 4. If the **Enter Password** screen appears, go to step 3.
3. At the **Enter Password** screen, press UP until your password is displayed and then press SEL. Go to step 4.
4. At the **Equalize Mode** screen, press one of the following:
  - Press SEL to terminate (cancel) equalization and go to float mode; go to step 5.
  - Press ESC to stay in equalize mode. Go to step 5.
  - Pressing UP or DN displays the **Stay in Equalize Mode** screen; press SEL to stay in equalize mode. Go to step 5.
5. Press ESC to step back up through the menu hierarchy to the **Home** screen.

28.0VDC 1.7ADC Man. Equalize 24hrs left
--

EQUALIZE MODE SEL to terminate
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#### 4.3.4.1 Alarm Relay/Lamp Test

This series of screens is used to test the alarm relays and Alarm LED. Since the alarm relays are being toggled (de-activated and activated),<sup>2</sup> any attached annunciator (e.g. horn, siren, electronic messaging)

<sup>2</sup>See section 2.4.6 for the relay state for "NORMAL CONDITION" and "ALARM CONDITION".

will be toggled on and off. This test will produce an audible clicking as the relays are switched. The AC fail relay is not toggled.

1. At the Home screen press UP or DN until OPERATING MODE appears. See Figure 4-3.
2. Press SEL. The present operating mode will be displayed.
3. Press DN. If the **RELAY/LAMP TEST** screen appears, go to step 5. If the **Enter Password** screen appears, go to step 4.
4. At the **Enter Password** screen, press UP until your password is displayed and then press SEL. Go to step 5.
5. Press SEL to begin the test. Testing will continue until ESC is pressed.
6. Press ESC to step back up through the menu hierarchy to the **Home** screen.

#### 4.3.4 Change Charger Setup (Configuration)

A default setup (i.e. configuration) is factory-installed. Table 4-1 lists the factory parameter values. Customer parameter values can be loaded if supplied with the order for the charger.

Refer to the menu shown in Figure 4-4 when setting-up a newly installed charger or when changing the setup of an operating charger. The figure shows how to navigate the **Charger Setup** menu so that you can change operating parameters to accommodate your application.

**Note:** If password protection is enabled, only authorized personnel will be able to change setup parameter values. When changing multiple values, you will be asked for your password only once during a charger setup session.

**TABLE 4-1 FACTORY DEFAULT SETUP PARAMETER VALUES**

Parameter	Factory Default
Operating Mode (FL/EQ)	Float
Float Setpoint	26.4V
Equalization (EQ)	28.0V
Low Voltage Alarm (LVA)	24.0V
Very Low Voltage Alarm (VLVA)	23.3V
High Voltage Alarm (HVA)	29.0V
High Voltage Shutdown (HVSD)	30.0V
Low Current Alarm (NCA/LCA)	2% of rating
Current Limit (CL)	110% of rating
High Battery Temperature (HBTA)	35°C
Temperature Compensation	Disabled
AC Fail Equalize	Disabled
Periodic Equalize	Disabled
Load Share	Disabled

Some parameters are dependent upon optional features. For example, temperature compensation requires the installation of an optional temperature sensor. Before setting up a charger, refer to Table 1-1 Model Designation and determine which options are installed in the charger at hand.

The procedures in this section are a bit more detailed than in the preceding sections. Consequently, several subsections are employed to simplify describing of the setup options available within this menu.

#### 4.3.4.1 System Setpoints, System Alarms, and Summary Alarm

The System Setpoints, System Alarms, and Summary Alarm menu selections, shown in Figure 4-4, are used to change set point voltages and currents, enable and disable system and summary alarms, set alarm delays, and adjust other parameter values. Guidelines for establishing values for some of these parameters are provided immediately below. Following the guidelines is a procedure for accessing and setting parameter values.

The adjustment range of system Setpoints will vary with charger voltage and current capacity. See Section 1.3 Specification for additional information.

For systems with blocking diodes, the Float and Equalize voltage should be set about 0.7 volts above the desired battery voltage to compensate for the diode voltage drop. This offset should be adjusted to obtain the desired output voltage for each installation.

### Guidelines

#### Float and Equalize Voltages

Table 4-2 shows typical float and equalize voltages on a per cell basis for several types of batteries.

<b>CAUTION</b>	<b>ATTENTION</b>
<p>Refer to the battery manufacturer's data sheet for the float and equalization setpoints that best fit your application and battery type.</p> <p>Do not set either float voltage or equalize voltage while the charger is operating in the current-limit mode.</p> <p>Disable battery temperature compensation (see Section 4.3.4.2) before setting the float voltage.</p>	<p>Reférez-vous à la fiche technique du fabricant de la batterie pour la tension d'entretien et d'égalisation qui correspondent le mieux à votre application et du type de batterie.</p> <p>Ne pas régler la tension d'entretien ou d'égalisation lors que le chargeur fonctionne en mode limite de courant.</p> <p>Désactiver la compensation de température de la batterie (voir la section 4.3.4.2) avant de régler la tension d'entretien.</p>

**TABLE 4-2 TYPICAL FLOAT/EQUALIZE VOLTAGES**

<b>Battery Type</b>	<b>Float</b>	<b>Equalize</b>
Lead Antimony (1.210 Specific gravity)	2.15 – 2.17	2.33
Lead Calcium (1.210 Specific gravity)	2.17 – 2.25	2.33
Nickel Cadmium	1.43	1.55
Nickel Iron	1.50 – 1.55	1.60 – 1.65
Lead-Acid, Valve-Regulated (Sealed) (1.300 Specified gravity)	2.25 – 2.30	**
(1.290 Specified gravity)	2.25 – 2.30	**
(1.245 Specified gravity)	2.17 – 2.22	**

\* Equalize charge is required only if cells have experienced a discharge.

\*\* Additional equalize charging is not recommended after initial equalization.

Consult battery manufacturer for particular recommendations.

**Note:** Lead-calcium alloy grid batteries do not require regular equalizing. Set the equalization voltage to equal the float voltage.

### **Low Voltage Alarm (LVA)**

Set the LVA alarm to a voltage that, if charger output voltage falls below this setting, an alarm will be annunciated.

### **High Voltage Alarm (HVA)**

Set the HVA alarm to a voltage that, if charger output voltage goes above this setting, an alarm will be annunciated.

### **High Voltage Shutdown Voltage (HVSD)**

Set the HVSD alarm to a voltage that, if charger output voltage goes above this setting, the charge will shutdown.

### **High Voltage Shutdown Reset**

Press the SEL on the keypad to reset the HVSD.

NOTE: The charger voltage must drop below the HVSD set voltage. In addition if the hardware overvoltage protection has been engaged, two methods can be used to reset the hardware. The first is to remove the wiring harness (J5) from the interface board for 5 seconds, then replace. The second method is to physically disconnect the battery from the charger.

### **Low Current (No Charge) Alarm (NCA)**

Set the NCA alarm to a current that, if charger output current falls below this setting an alarm will be annunciated.

### **Ground Detection Alarm (GND) - Two pole DC breaker models only**

Gives a +GND or –GND alarm when the resistance between the charger output and ground, is below the set point. The Ground Alarm resistance is adjustable. High resistance values are for a very sensitive detection, low values are for less sensitive detection. The ground fault resistance and fault voltages can be monitored using the “Ground Fault Resistance” and “Ground Fault Voltages” submenus as shown in Fig. 4-2.

The resistance value displayed for the set point is the resistance that the system will detect from one output pole to earth with no other current paths from output to earth. The presence of other current paths, intentional or not, can affect the operation of the alarm. Intentional current paths on the output of the unit may be external ground detection systems or ground reference connections in loads. Unintentional current paths may be leakage currents over the battery cases, conductive pollution accumulation on connections, or moisture on cables and connections.

If you have nuisance ground alarm indication and there are no intentional current paths and there are not faults on the DC system (battery, charger, loads, and all interconnecting dc cabling), and all equipment is properly grounded, you may lower the sensitivity of the detection to eliminate the nuisance alarm. If the system has external ground detection, the ground alarm on the charger may be disabled. If the charger’s ground detection circuitry is interfering with the external ground detection, the optional ground detection switch may be turned off. (The optional ground detection switch is a factory-installed option.)

NOTE: See section 7.6 for ground detection switch options.

## Very Low Voltage Alarm (VLVA)

Set the VLVA alarm to a voltage that, if charger output voltage falls below this setting, an alarm will be annunciated.

## High Battery Temperature Alarm (HBTA)

Set the HBTA alarm to a temperature that, if the battery temperature rises above this setting, an alarm will be annunciated. The temperature compensation (option 2) must be purchased and installed in order for this alarm to work. If this option is installed the battery temperature can be found in the “Battery Temperature” menu as shown in Fig. 4-2.

## Rectifier Fail Alarm (RECTF)

Gives a RECTF alarm, if enabled, if both an alarm that can cause a rectifier failure alarm (RECT) is enabled and the alarm is active.

## AC Fail Alarm (ACF)

Gives an ACF fail alarm when the AC power to the charger is missing.

## Alarm Mode Latching

In the enable mode this allows alarms to be latched in the alarm state until an operator clears them by pressing any key on the key pad. In the disable mode, the alarms clear once the alarm condition has cleared.

## Set Parameter Values

Parameter values accessed from the **System Setpoints**, **System Alarms**, and **Summary Alarm** screens are changed as follows.

1. From the **Home** screen press UP or DN until CHARGER SETUP appears. Press SEL.
2. From the **System Setpoints** screen, press one of the following:
  - Press SEL to set system set point parameters.
  - Press UP or DN to move to another screen in the *Setup Select Screens* column. Then press SEL.
3. If a parameter screen appears, see example at right, go to step 5.  
If the **Enter Password** screen appears, go to step 4.
4. At the **Enter Password** screen, press UP until your password appears and then press SEL. Go to step 5.
5. At the parameter screen, press UP or DN to display the parameter to be changed. Press SEL.
  - If changing a parameter value, the on-screen equals sign (=) will flash. Go to step 6.
  - To change Alarm Delays, again press SEL and go the step 6.
6. Press UP or DN until the desired value (e.g. set point voltage or current, enable/disable, or alarm delay time) is displayed. Press one of the following:
  - Press SEL to store the new value. The equals sign will stop flashing.
  - Press ESC to cancel or abort changes.
7. Press UP or DN to move vertically to the next value to be changed.

Change Float Voltage  
Float = 26.4V

8. When all setup parameters have been set, press ESC to return to the higher level menu
9. As needed, repeat the above for each of the three *setup select screens* in this section.
10. When parameters have been set, press ESC to return to the higher level menu or press ESC until the **Home** screen appears.

#### 4.3.4.2 Battery Temperature Compensation

Temperature compensation option 2 must be installed for compensation to function. See Table 1-1 Model Designation for the option location in the charger model number.

To enable compensation:

1. From the **Home** screen, press UP or DN until CHARGER SETUP appears. Press SEL.
2. From the **System Setpoints** screen, press UP or DN until the **Temperature Compensation** screen appears.
3. Press SEL. If the **Battery Temperature Compensation** Screen appears, go to step 5. If the **Enter Password** screen appears, go to step 4.
4. At the **Enter Password** screen, press UP until your password appears and then press SEL. Go to step 5.
5. At the **Compensation disabled** screen, press SEL. The equals sign (=) will begin to flash.
6. Press UP to toggle to “enable.” Press one of the following:
  - Press SEL to store the change. The equals sign (=) will stop flashing. Go to step 7.
  - Press ESC to cancel or abort compensation. Go to step 10.
7. Press DN to display the **Set Temperature Coefficient** screen.
8. To change the coefficient, press SEL. The equals sign (=) will flash.
9. Press UP or DN to display the desired **mv/Cell/C** value. Press SEL to store the new value.
10. Press ESC to return to the **Temperature Compensation** screen. Either press UP or DN to move to another *Setup Select Screen* or press ESC until the **Home** screen appears.

Note: Refer to the battery manufacturer for the correct temperature compensation value.

To disable Temperature Compensation:

1. From the **Home** screen, press UP or DN until CHARGER SETUP appears. Press SEL.
2. From the **System Setpoints** screen, press UP or DN until the **Temperature Compensation** screen appears.
3. Press SEL. If the **Battery Temperature Compensation** Screen appears, go to step 5. If the **Enter Password** screen appears, go to step 4.
4. At the **Enter Password** screen, press UP until your password appears and then press SEL. Go to step 5.
5. At the **Compensation enabled** screen, press SEL. The equals sign (=) will begin to flash. Press one of the following:
  - Press UP to toggle to “disable.” Press SEL to store the change. The equals sign (=) will stop flashing.
  - Press ESC for Compensation to remain enabled and return to the higher level screen.

6. Press ESC to return to the **Temperature Compensation** screen. Either press UP or DN to move to another *Setup Select Screen* or press ESC until the **Home** screen appears.

#### 4.3.4.3 Auto-Equalize

There are two Auto-Equalize modes: AC Fail Equalize and Periodic Equalize. Both are disabled by default. Both or either may be enabled.

- AC Fail Equalize will automatically switch the charger to equalize mode for a user-set time when there has been no AC input to the charger for a period exceeding a user-set time.
- Periodic Equalize causes the charger to switch to equalization mode for a user-set time after a user-set time in float mode elapses.

To enable one or both Auto-Equalize modes:

1. From the **Home** screen, press UP or DN until CHARGER SETUP appears. Press SEL.
2. At the **System Setpoints** screen, press UP or DN until the **Auto-Equalize** screen appears.
3. At the **Auto-Equalize** screen, press SEL. If the **AC Fail Equalize** screen appears, go to step 5. If the **Enter Password** screen appears, go to step 4.
4. At the **Enter Password** screen, press UP until your password appears and then press SEL. Go to step 5.
5. At the **AC Fail, Equalize** screen, perform one of the following:
  - To enable AC Fail Equalize, press SEL. The equals sign will flash. Press UP to enable AC Fail, Equalize and display the **AC Fail Equalize after** screen. Go to step 6.
  - To enable Periodic Equalize, go to step 8.
6. At the **AC Fail Equalize after** screen, press UP to set the timer (1-7200 minutes). Press SEL. The equals sign will stop flashing.
7. Press DN to display the **AC Fail Equalize duration** screen. Press SEL. The equals sign will flash. Press UP to set the time (1-150 hours). Press SEL. The equals sign will stop flashing.
8. Press DN until the **Periodic Equalize** screen appears.
  - To enable Periodic Equalize, Press SEL. The equals sign will flash. Press UP to display enable Periodic Equalize and display the **Periodic Equalize every** screen. Go to step 9.
  - To exit Auto Equalize, go to step 11.
9. At the **Periodic Equalize every** screen, press UP to set the time (168 to 8760 hours). Press SEL.
10. Press DN to display the **Periodic Equalize duration** screen. Press SEL. The equals sign will flash. Press UP to set the time (1-150 hours). Press SEL.
11. Press ESC to return to the **Auto-Equalize** screen. Either press UP or DN to move to another *Setup Select Screen* or press ESC until the **Home** screen appears.

AUTO EQUALIZE  
SEL to setup

AC Fail Equalize  
= DISABLED

Periodic Equalize  
= DISABLED

To disable AC Fail-Equalize:

1. At the **Home** screen, press UP or DN until CHARGER SETUP appears. Press SEL.
2. At the **System Setpoints** screen, press UP or DN until the **Auto-Equalize** screen appears.



3. At the **Auto-Equalize** setup screen, press SEL. The **AC Fail Equalize after** screen will appear.
4. Press SEL. The equals sign will flash. Press DN until **DISABLED** appears. Press SEL.
5. Press ESC to return to the **Auto-Equalize** screen. Either press UP or DN to move to another *Setup Select Screen* or press ESC until the **Home** screen appears.

To disable Periodic Equalize:

1. At the **Home** screen, press UP or DN until **CHARGER SETUP** appears. Press SEL.
2. At the **System Setpoints** screen, press UP or DN until the **Auto-Equalize** screen appears.
3. At the **Auto-Equalize** setup screen, press SEL. Press UP or DN until the **Periodic Equalize** screen appears.
4. Press SEL. The equals sign will flash. Press DN until **DISABLED** appears. Press SEL.
5. Press ESC to return to the **Auto-Equalize** screen. Either press UP or DN to move to another *Setup Select Screen* or Press ESC until the **Home** screen appears.

#### 4.3.4.4 Load Share

There are two Load Share modes: Load Share Standard and Load Share Legacy. Select Standard when two or more *Micro ARE-Ms*, the chargers described in this manual, are to share a load. Legacy is used when a *Micro ARE-M* is to share a load with an earlier model ARE.

To enable Load Share:

1. From the **Home** screen, press UP or DN until **CHARGER SETUP** appears. Press SEL.
2. From the **Load Share** screen press SEL. The **Load Share Disabled** screen will appear.
3. Press UP to display the Load Share statuses: press UP for Load Share Standard; press UP again to display Load Share Legacy.
4. Press SEL to store the new status.
5. Press ESC to return to the **Load Share** screen. Either press UP or DN to move to another *Setup Select Screen* or Press ESC until the **Home** screen appears.

To disable Load Share:

1. At the **Load Share** screen press SEL. The **Load Share Enabled** screen will appear.
2. Press DN until **DISABLED** appears.
3. Press SEL to store the new status and go to the **Load Share** screen. Either press UP or DN to move to another *Setup Select Screen* or Press ESC until the **Home** screen appears.

Note: Refer to section 4.3.4.9 for additional Load Share setup information.

#### 4.3.4.5 Password

Password protection allows only authorized personnel to change parameter values in the **Operating Mode** menu (Figure 4-3) and **Charger Setup** menu (Figure 4-4). While password protection is disabled by default, enabling password protection is recommended.

Anyone with access to the charger front panel can view alarms and parameter values in the **Active Alarms** screen and the **Charger Status** menu (Figure 4-2). Password protection is not needed since these are read-only displays.

When password protection is enabled, you will be asked for your password only once during a setup session, regardless of the number of setup changes made. After 5-6 minutes of no keypad activity, your setup session will time-out and you will again be asked for your password to change a parameter value.

Any number between 00002 and 65500 can be used as the password. Select a password that is easy to remember but difficult for others to guess. As with any password, secrecy is required for meaningful security. If the password is forgotten, contact UNIPOWER Field Service.

#### A. Enabling and Setting a Password:

1. At the **Home screen**, press UP or DN until the CHARGER SETUP appears. Press SEL.
2. At the **System Setpoints** screen, press UP or DN until the **Password** screen appears.
3. At the **Password** screen, press SEL to display the **Old Password** screen.
 

Enter Old Password  
None (disabled)
4. Press SEL to display the **New Password** screen. Press UP to enable protection. Press UP or DN until the desired password number (00002-65500) is displayed. If UP or DN is pressed and held, the numerical display will scroll.
 

Enter New Password  
None (disabled)
5. With the desired password displayed, press SEL to store the password and return to the **Password** screen. Either press UP or DN to move to another *Setup Select Screen* or press ESC until the **Home** screen appears.

#### B. Changing a Password:

1. At the **Password** screen, press SEL to display the **Old Password** screen.
 

Enter Old Password  
None (disabled)
2. Press UP until your old (present) password is displayed and then press SEL.
3. At the **New Password** screen, press UP and then either UP or DN to display your new password.
 

Enter New Password  
(New password)
4. With the new password displayed, press SEL to return to the **Password** screen. Either press UP or DN to move to another *Setup Select Screen* or press ESC until the **Home** screen appears.

#### C. To Disable Password Protection:

1. At the **Password** screen, press SEL to display the **Old Password** screen.
 

Enter Old Password  
None (disabled)
2. Press UP and then either UP or DN until your old (present) password is displayed and then press SEL.
3. At the **New Password** screen, press DN until “disabled” appears.
 

Enter New Password  
(password)
4. Press SEL to return to the **Password** screen. Either press UP or DN to move to another *Setup Select Screen* or press ESC until the **Home** screen appears.

#### 4.3.4.6 Factory Defaults

Pressing SEL from the Factory Defaults screen will replace any customer setup entries with the factory default values shown in Table 4-1.

1. At the **Home screen**, press UP or DN until the CHARGER SETUP appears. Press SEL.
2. At the **System Setpoints** screen, press UP or DN until the **Factory Defaults** screen appears. Press SEL.

3. At the **Power On Defaults** screen, press SEL to return to the factory defaults or press ESC to return to the **System Setpoints** screen.

#### 4.3.4.7 Factory Calibration

Factory Calibration is intended for use by factory personnel and is not field accessible. Contact UNIPOWER Service for additional information.

#### 4.3.4.8 Field Calibrations

The only user adjustment on the Interface Board (A1) is load share adjustment R63. No other settings are field adjustable. All other field adjustments are described previously in this chapter.

#### 4.3.4.9 Field Connection and Calibration of Loadshare

Load sharing allows two or more ARE Series and ARE-M Series units connected in parallel to share the load in proportion to their ratings. The power supplies will share the load within 5% of the rating of the largest unit between 10% and 100% of their ratings. The load sharing is connected through the no charge alarm, which disconnects the load sharing should one charger be shut off.

### Connections

For load sharing, connect all units which are to share the load to the system bus using equal lengths of properly sized cables. Connect #18 AWG insulated wire from TB2-3 or 4 (LOADSHARE) on the Interface Board (A1) of charger A to TB2-3 or 4 (LOADSHARE) on the Interface Board (A1) of charger B.

### Adjustment

The loadshare is set at the factory and normally does not require any adjustment. If adjustment is needed, follow the procedure below.

- A. For each unit, turn on only one unit at a time and adjust the output voltage to the desired level.
- B. Connect a digital voltmeter positive lead to the power supply positive output and the negative lead to TB2-3 or 4 (LOADSHARE) on the Interface Board (A1). No other connections should be made to these terminals on the interface board.
- C. Adjust potentiometer R63 on the interface board for 5.0VDC at zero output current.

### For Two Power Supplies

- A. Turn on both units. Verify Load sharing is enabled on both units. (See 4.3.4.4)
- B. Add some load to the system and adjust R63 on the unit with lower output current to match the output current of the other unit. For best results, the load should be between 50% and 100% of the combined rating of the two units.

### For More Than Two Power Supplies

Start by adjusting two of the units then add the rest of the units one at a time, adjusting R63 on each added unit until all units are sharing the load.

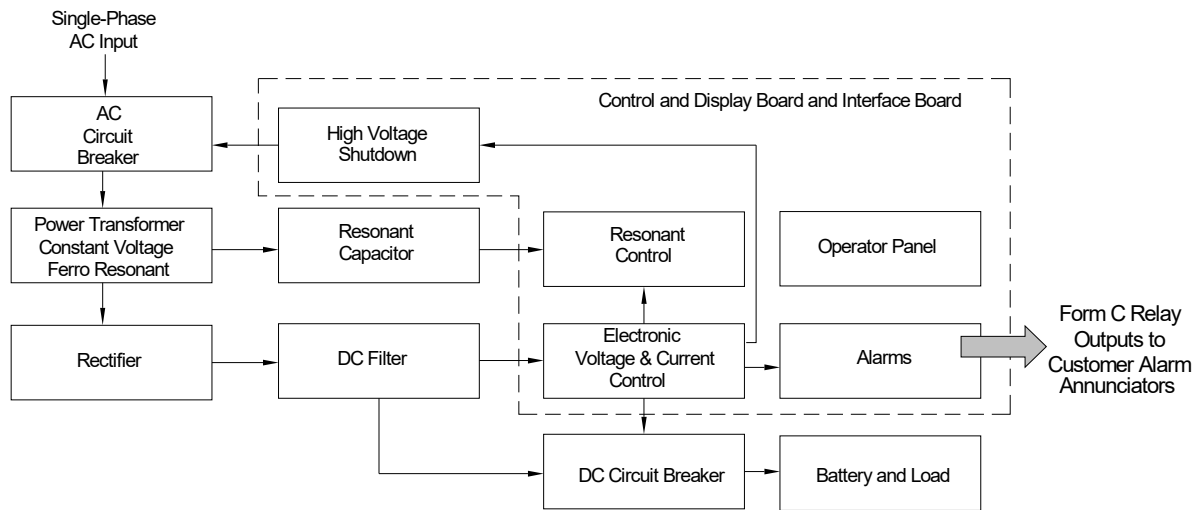
**Operational Notes**

1. Load sharing is not intended to be effective below 10% of rated output. Operation below 10% may result in unequal outputs or loss of output current from one of the units. It is recommended that where paralleled units are being used to float a battery before the system load is installed, only one unit be left operating.
2. Minor changes in the displayed output current may occur when paralleled units are operated at light loads. This is an indication of the transfer of small currents between units and does not show up at the load.
3. It is possible for hunting to occur if the output voltages are misadjusted. Repeat step A under "Adjustment".

## 5.0 CIRCUIT DESCRIPTION

Figure 5-1 is a functional block diagram of a *Micro ARE-M* series float charger. AC input power is applied through the input circuit breaker to the power transformer. The circuit breaker provides over-current and fault protection in case of malfunction or a short circuit in the input side of the equipment.

The power transformer in a *Micro ARE-M* Series power supply is of the ferroresonant type. This class of transformer has the output coil on the same leg of the core as the resonant winding. This winding, together with the resonant capacitor, maintains the core at a high level of saturation, resulting in a constant output voltage against changes in the input voltage. The high reactance of this type of transformer provides protection against overload and short circuit of the output.



**FIGURE 5-1 BLOCK DIAGRAM, TYPICAL MICRO ARE-M FLOAT CHARGER**

To improve the output voltage regulation against changes in load and input frequency, the chargers employ a ferroresonant transformer and UNIPOWER controlled-ferro technique, which controls the level of core saturation.

This is accomplished by shunting the resonant circuit with a triac in series with an inductor. The electronic voltage/current control senses the start of the resonant capacitor charge cycle. It also senses the output voltage level, which it compares with a reference voltage. The error signal that results determines the instant the triac turns on to interrupt the capacitor charge cycle and maintain the core saturation at the desired level.

The output current sensing and current limit operation is located on the Interface and Control/Display boards. The output current is sensed by measuring the voltage across a resistive shunt. The Interface and Control/Display boards convert the shunt signal into an output current value. When the output current exceeds the preset level, the current limit control overrides the voltage control to reduce the output current to the preset value.

Over-voltage protection is located on the Interface and Control/Display boards. If a fault occurs that result in the charger output going to an excessively high output voltage, a high voltage shutdown is initiated. The high voltage shutdown trips the input breaker via the input breaker's shunt trip coil to turn the unit off. If the excessive high voltage condition persists, a second protection circuit, independent from the first, operates to trip the input breaker and to turn the triac on.

The power rectifier converts the AC voltage from the transformer into a DC voltage. It consists of silicon diodes arranged in a half-wave circuit. The output of the rectifier is filtered and supplied to the battery and the load through the DC circuit breaker.

The front panel consists of a 2-line digital display, a 4-button keypad, and LEDs (On/Off and Alarm). The display and LEDs are mounted directly to the Control and Display Board. The keypad adheres to the metal front panel of the charger and is connected to the Control and Display Board by short ribbon cable.

Alarm connections for external annunciation of alarms are provided on the Interface Board. The standard board has three alarm relays and the multiple alarm board has nine alarm relays. All outputs are dry-contact form C relays.

Each relay has three connections: common, normally open, and normally closed. The normally open (NO) and normally closed (NC) labels are for an un-powered charger.

## 6.0 MAINTENANCE



This chapter provides preventive maintenance procedures and troubleshooting procedures. Cabinet assembly drawings, schematics, and parts lists for all standard charger models are included in this chapter.

Refer to the replacement parts lists in Table 6-2 when ordering on-hand spare parts and service replacement parts.

<p><b>WARNING</b></p> <p><b>Electrical shock hazard</b></p> <p>Hazardous voltage can cause death or serious injury. Remove AC input power before servicing. Always use insulated tools. Disconnect battery string before servicing. Battery voltage is on the Interface Board whenever a battery string is connected.</p>	<p><b>AVERTISSEMENT</b></p> <p><b>Risque de choc électrique</b></p> <p>Les tensions dangereuses peuvent causer la mort ou des blessures graves. Coupez l'alimentation de tous les fils et les bornes avant de travailler sur les équipements. Toujours utiliser des outils isolés. Débranchez la batterie avant l'entretien. La tension de la batterie se retrouve sur la carte d'interface quand la batterie est branchée.</p>
<p><b>WARNING</b></p> <p><b>Arcing hazard</b></p> <p>Arcing can cause equipment damage, load interruptions, and personal injury. Remove watch and jewelry. Use insulated tools and extreme caution when working with a battery string. Disconnect the battery string before servicing. Carefully insulate unterminated battery cable ends. Discharge filter capacitors before servicing. See Figure 6-1.</p>	<p><b>AVERTISSEMENT</b></p> <p><b>Risque d'arc</b></p> <p>Un arc électrique peut causer des dommages sur les équipements, des interruptions de charge, et des blessures. Retirez vos montres et bijoux utilisés des outils isolés et une prudence extrême lorsque vous travaillez avec des batteries. Débranchez la batterie avant l'entretien. Isoler les extrémités des câbles de batterie. Décharger les condensateurs avant l'entretien. Voir la figure 6-1.</p>

### 6.1 VOLTAGE CHANGES

Input voltage settings on multiple input voltage units may be changed in the field. To change the voltage, change the jumpers on the terminal blocks as indicated on the wiring diagram for the model. For models with a column for CB1 ratings with the jumper settings, the input circuit breaker, CB1, must be changed if the breaker rating does not match the breaker in the unit. If the model does not have a CB1 rating column, the circuit breaker does not need to be changed. The parts list will allow you to identify a needed circuit breaker. Circuit breakers may be ordered through your UNIPOWER representative. For assistance in finding your UNIPOWER representative, contact Customer Service. For technical assistance in making an input voltage setting change, contact Field Service.

### 6.2 PREVENTIVE

1. Ensure that a generous supply of cool, dry air is free to circulate through the charger. See Chapter 2 Installation.
2. Clean the equipment. Dust and dirt impeded heat dissipation. Blow out the charger with low-pressure dry air to remove accumulated dust, dirt and any other contaminants.

3. Check that all connections are clean and tight. Discoloration of terminals or wires is an indication of loose or corroded connections.
4. Check capacitors (both AC and DC) for leakage, case or seal rupture, etc. All screw connections should be checked and tightened as needed. DC capacitors over five years old or showing signs of degradation should be removed and checked for excessive leakage and/or replaced.
5. Check the float voltage, equalize voltage, and other configurable settings, using the front panel controls. See Chapter 4 Setup and Operation.

### 6.3 TROUBLESHOOTING

Table 6-1 is a troubleshooting chart designed to help a qualified technician diagnose the cause of a charger malfunction. While troubleshooting, refer to the cabinet assembly drawing and the schematic diagram for the charger model at hand. These aids can be found in this chapter. Also provided is a section describing the testing of various electrical components.

For efficient troubleshooting, gather as much information as possible about the malfunction.

1. Read the front panel display and note charger output voltage and current
2. Note whether the front panel On/Off and Alarm LEDs are lighted
3. Note whether the AC or DC breaker trips
4. Measure the AC source voltage
5. Check AC, DC, and alarm wiring
6. Check configurable parameter values to be sure an unintended setup change is not interfering with equipment operation
7. Note environmental conditions before and at the time of the malfunction (e.g. excessive ambient temperature, water intrusion, excessive foreign material accumulated on heat sensitive components)
8. Review the equipment's service history

After gathering data concerning the malfunction, scan the symptoms in the left column of the Troubleshooting Chart, Table 6-1. When the observed symptom is located, read across the table for a possible cause and solution.

The circuits and functions on the Control and Display board and the Interface board are highly integrated making it difficult to isolate a problem to one of these boards. Board replacement is recommended to repair a control or display related problem.

#### 6.3.1 Service Access

For access to the Interface board, Control and Display board, AC and DC circuit breakers, and connection terminal blocks, loosen two captive screws and open the hinged front panel.

To replace a component inside the charger, such as the transformer or a filter capacitor, remove the top cover. Additional access is provided on 12" cabinets by removing the interface board panel.

#### 6.3.2 Circuit Board Handling

Semiconductors such as ICs (integrated circuits), diodes, and transistors must be protected against damaging electrostatic discharge. A properly grounded wrist strap must be worn whenever a circuit board is handled or touched. A service kit with a wrist strap and static dissipative work mat is available from both mail order and local electronic supply companies.



Always store circuit boards in anti-static bags.

### 6.3.3 ARE-M Display Codes

Code	Description
STARTING	Displays anytime charger resets and starts walking up to the set point voltage
OPEN BREAKER	DC breaker is open. Takes $\approx 1/4 - 1/2$ amp to clear
MAXIMUM OUTPUT	The charger's control is delivering the maximum possible output power.
Over Current	The charger current output is above the current limit set point. This code could be produced by a large load change, or a deeply discharged battery.
Current Limit	The charger is holding the output current at the current limit set point and the voltage is below the output voltage set point. This code could be produced by a large load current, or deeply discharged batteries.
Ending Current Limit	The charger is current limiting, but increasing the output voltage to get to the float voltage set point.
CANNOT REGULATE	The output voltage is above the chargers voltage set point. The charger is trying to regulate the voltage output, but does not sense the output voltage drop. Parallel chargers w/o proportional load sharing could cause this code.
EQ Current Limit	When the charger is changing from float to equalize, the increase in voltage is causing the charger to go into current limit. The charger will slowly increase voltage as the load current (typically batteries) decreases.
OC-Cancel Equalize	Equalization has caused the charger's output to exceed the current limit set point. The charger will attempt to decrease the output voltage to lower the output current. If the charger is unsuccessful, the charger will terminate the equalization mode and return to float. This can be caused by a step load change while in equalization mode
Remote Equalize	The charger's external equalization input is shorted, so the charger is in Equalization mode.
HIGH VOLTAGE SHUTDOWN	The charger voltage sense was above the High Voltage Shutdown set point. The charger went into a high voltage shutdown mode to protect the load(s).
SEL to Reset	The charger can be reset from a High Voltage Shutdown mode from the keypad by pressing the SEL button. If the interface board has triggered an HVSD, generated by the interface board, the wiring harness connected to J5 on the interface board may have to be removed for 5 seconds then replaced to clear the fault.
AC Fail	No AC line input to the charger is currently being detected.

**TABLE 6-1 TROUBLESHOOTING CHART**

Symptom	Possible Cause(s)	Solution(s)
A. AC breaker trips	1. Short circuit in AC power circuit.	Inspect primary wiring for possible shorts or grounded connections.
	2. Input connected for lower voltage.	a. Check position of jumpers. Consult connection diagram. b. Measure input voltage.
	3. High voltage shutdown operating.	Remove load and check for high voltage.
	4. Input voltage outside ANSI range.	Measure input voltage.
	5. Frequency of supply less than 57 Hz.	Check input frequency.
	6. Short in transformer winding.	Visually inspect power transformer primary coils for signs of overheating.
B. No DC output.	1. AC power outage.	Check for AC voltage on both sides of the breaker.
	2. Short circuit in DC power circuit.	a. Inspect secondary power wiring and terminals for shorts or grounded connections. b. Check power charger diodes. c. Check for shorted DC filter capacitors.
	3. Open circuit.	Check all wiring for open or loose connections.
C. Low DC output voltage.  Check voltage at DC output terminals with a portable meter.	1. Short in resonant circuit.	a. Check triac. b. Check resonant capacitor. c. Check resonant circuit wiring.
	2. Open sensing leads.	Check wiring for continuity.
	3. Unit in current limit.	Adjust current limit setting.
	4. Component failure in interface board.	Replace interface board.
	5. Component failure in control board.	Replace control board.
	6. Defective ribbon cable.	Replace ribbon cable.
	7. Out of adjustment.	Adjust float voltage.
D. High DC output voltage.	1. Open triac in resonant circuit.	Check triac.
	2. Open sensing leads.	Check for DC voltage across Control Board Pins J5-3 and J5-6
	3. Interface board failure.	Replace interface board.
	4. Control board failure.	Replace control board.
E. DC breaker trips.	1. Battery connection reversed.	Check polarity of battery connections.
	2. Short circuit in DC power circuit.	a. Inspect secondary power wiring and terminals for possible shorts or grounded connections. b. Check power charger diodes and DC filter capacitors.

Symptom	Possible Cause(s)	Solution(s)
F. Excessive output current.	No current limit.	a. Current limit control improperly set. b. Component failure in Control or Interface board. Replace. c. Check connections from shunt to interface board.
G. Excessive electrical noise or ripple.	1. Loose filter connections.	Check wiring and bus bars for loose or corroded connections.
	2. Open filter capacitor.	Check filter capacitors.
	3. Open power diode.	Check power diodes.
	4. DC cable routing (excessive noise).	Check broken cable ties.
	5. Improperly sized battery.	Check battery rating.
	6. Preload resistors ON with unit OFF.	Replace Interface board.
H. Oscillations or poor regulation.	1. Loose connection.	Inspect circuit boards, connectors, and wiring for loose contacts.
	2. Defective triac.	Replace triac.
	3. Component failure in Control and Display board.	Replace Control and Display board.
	4. Open power diode.	Check power diodes. Replace as required.
	5. Resonant capacitor not grounded.	Check AC capacitor case to ground with ohmmeter.
I. Low output current. Check with portable meter.	1. Loose connection.	Inspect wiring.
	2. Open power diode.	Check power charger diodes. Replace as required.
	3. Unit in current limit.	a. Current limit control improperly set. b. Defective Control and Display board. Replace.
J. Acoustic noise.	1. Loose laminations.	Check air gap areas of power transformer and control reactor with insulated screwdriver.
	2. Cabinet vibration.	Check welds and bolted joints.
K. No 2-line digital display or keypad activity. DC output OK.	1. Control and Display board	Replace part
	2. Interface board	Replace part
	3. Ribbon cable	Replace part
L. Configuration (setup) not saved.	Control Board	Replace part

## 6.4 CHECKING COMPONENTS

This section describes methods that can be employed to determine whether a component has failed. A failed component must be replaced with a UNIPOWER approved part. See Table 6-2 Parts List, for component descriptions and UNIPOWER part numbers.

### CAUTION

**Do Not** press this button if either circuit breaker is **On**

### ATTENTION

**Ne pas** appuyer sur ce bouton si les disjoncteurs sont ouverts.

Before performing any of the following tests:

1. Disconnect both the AC power and battery power by switching both circuit breakers **off**. Note that battery power will still be supplied to CB2, the DC circuit breaker, and to the Control and Display board and Interface board.
2. Press the Capacitor Discharge button located behind the front panel (door) to discharge filter and resonant capacitors, if required. See Figure 6-1 for a typical location of the button.

**CAUTION** – For Service Only: AC and DC breakers must be open before pressing button.

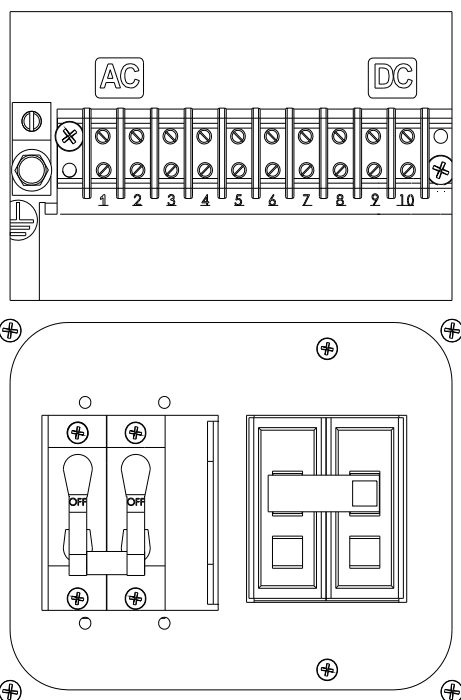
**ATTENTION** - Pour l'entretien seulement: Les disjoncteurs AC et DC doivent être ouverts avant d'appuyer sur le bouton.

Capacitor Discharge:  
Press button for 60  
seconds.

See the Cabinet  
Assembly drawings  
for button location in  
other models.

CAPACITOR DISCHARGE PRESS  
BUTTON FOR 60 SECONDS /  
DECHARGE DE CONDENSATEUR  
APPUIER SUR LE BOUTON  
PENDANT 60 SECONDES

CAUTION: FOR SERVICE ONLY  
AC/DC BREAKERS MUST BE OPEN  
BEFORE PRESSING BUTTON /  
ATTENTION: POUR LE SERVICE  
UNIQUEMENT LES DISJONCTEURS  
AC & DC DOIT ETRE OUVERT  
AVANT D'APPUIER SUR LE BOUTON



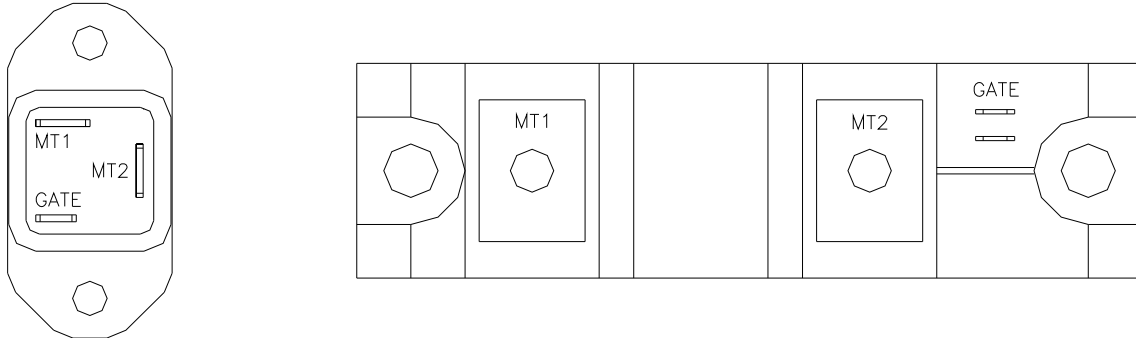
**FIGURE 6-1 Capacitor Discharge Button**

**Diodes** - First, remove at least one connection to the diode, and then check using an analog ohmmeter to measure resistance, first cathode to anode and then anode to cathode. A good diode will show low resistance one direction and very high resistance the other direction. A shorted diode will show no or very low resistance both ways. An open diode will show a very high resistance both ways. Suggested scales for these checks are either X10 or X100.

Alternatively, a digital meter with a “diode check” function can be used to test a diode.

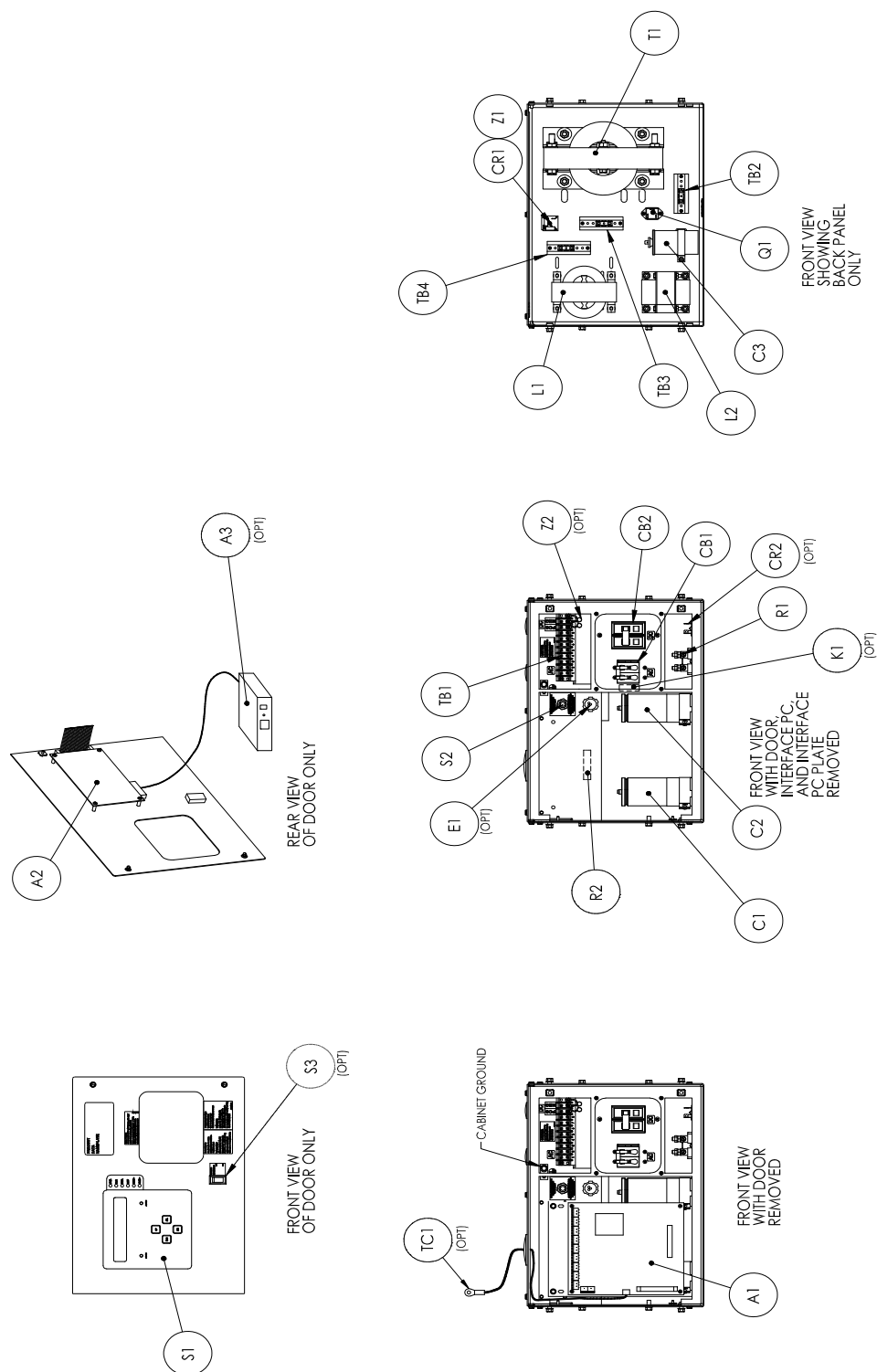
**Capacitors** - First, isolate capacitors and then check with an ohmmeter. Proper scale range will vary as to type of meter and capacitor size. Start with highest range and work down. Reverse leads each time. If the capacitor is good, it will show a deflection towards zero resistance initially, then a steady increase toward infinite resistance. If, however, the capacitor is shorted, it will show zero resistance. If the capacitor is open, it will read infinite resistance.

**Resonant Triac** - Remove either the MT1 or MT2 triac connection, being careful not to remove gate wire, and check with an ohmmeter. See the drawing below for triac terminals. A good triac will indicate high resistance in both directions.



To check for turn on of the triac, with one lead still disconnected, connect the positive lead of an analog ohmmeter to the anode of the triac (MT2) and the negative lead to the cathode (MT1). The triac should read open or high resistance. Connect the gate to the anode with a jumper. A low resistance reading indicates that the triac is turning on.

## 6.5 12" CABINET ASSEMBLY AND SCHEMATICS



**Note:** See Table 6-2 Parts Lists for reference designators and part numbers.

**FIGURE 6-2 12" Cabinet Assembly**

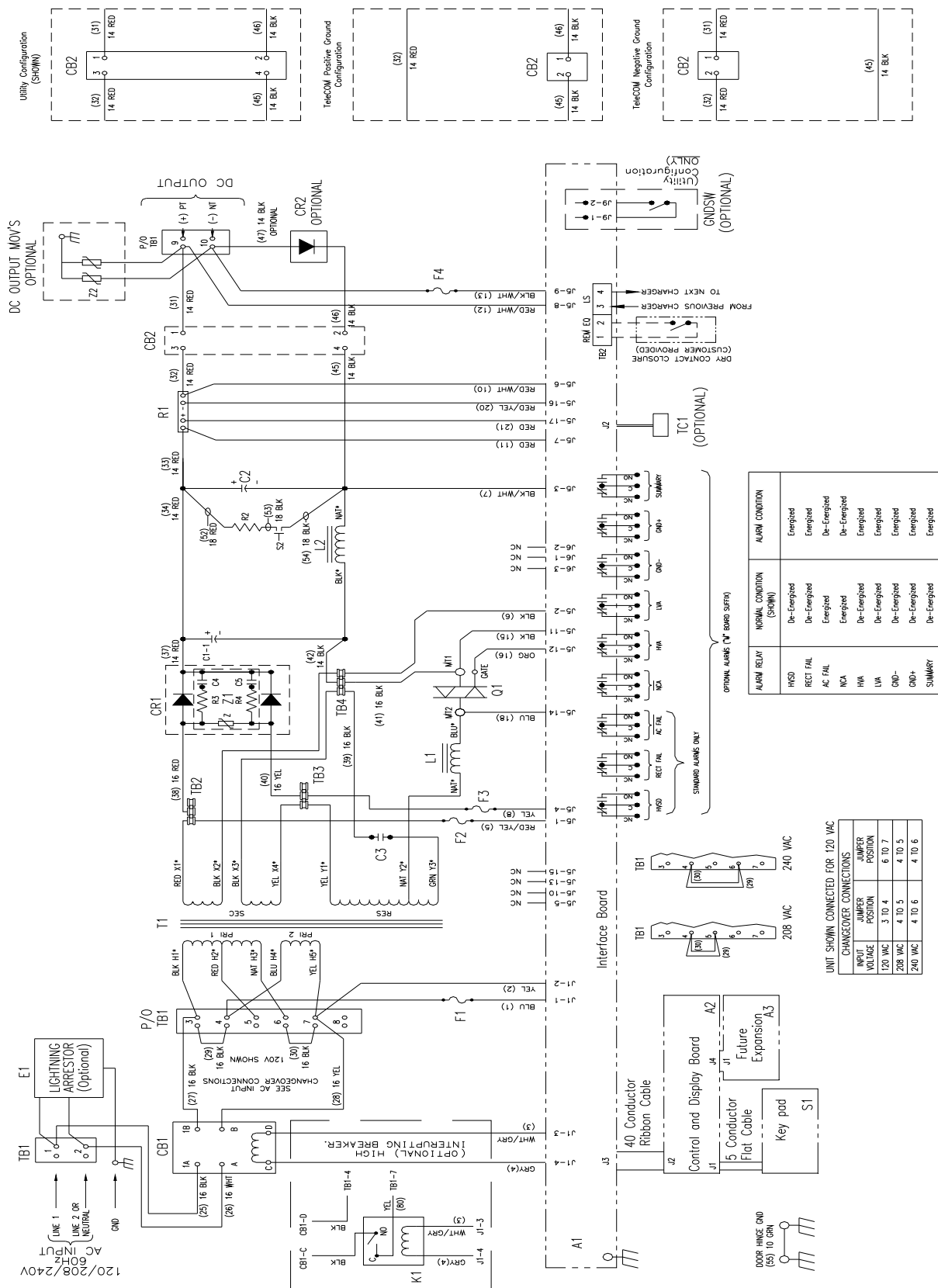


FIGURE 6-3 12" Cabinet Schematic; ARE-M02406, 120/208/240

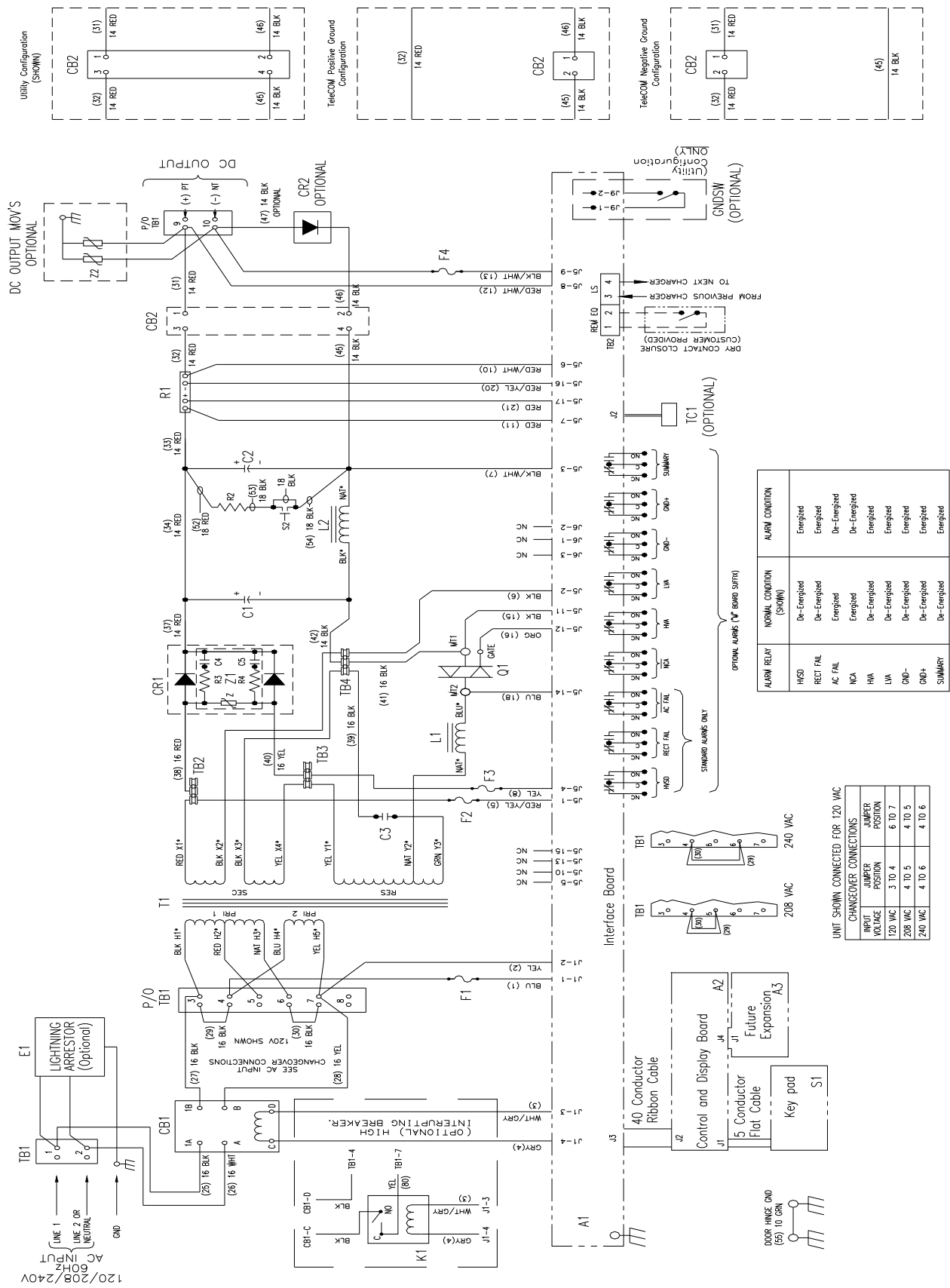
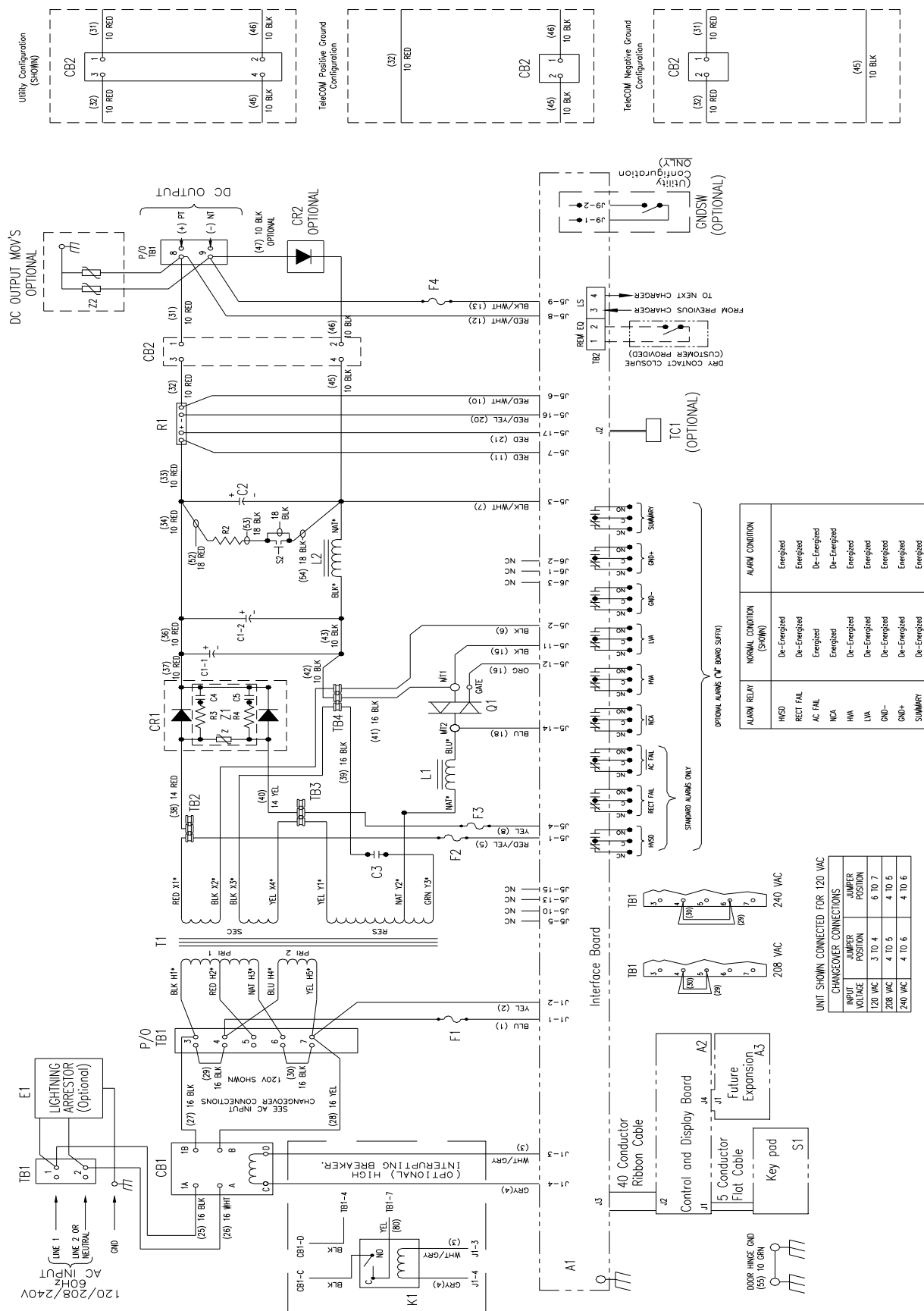


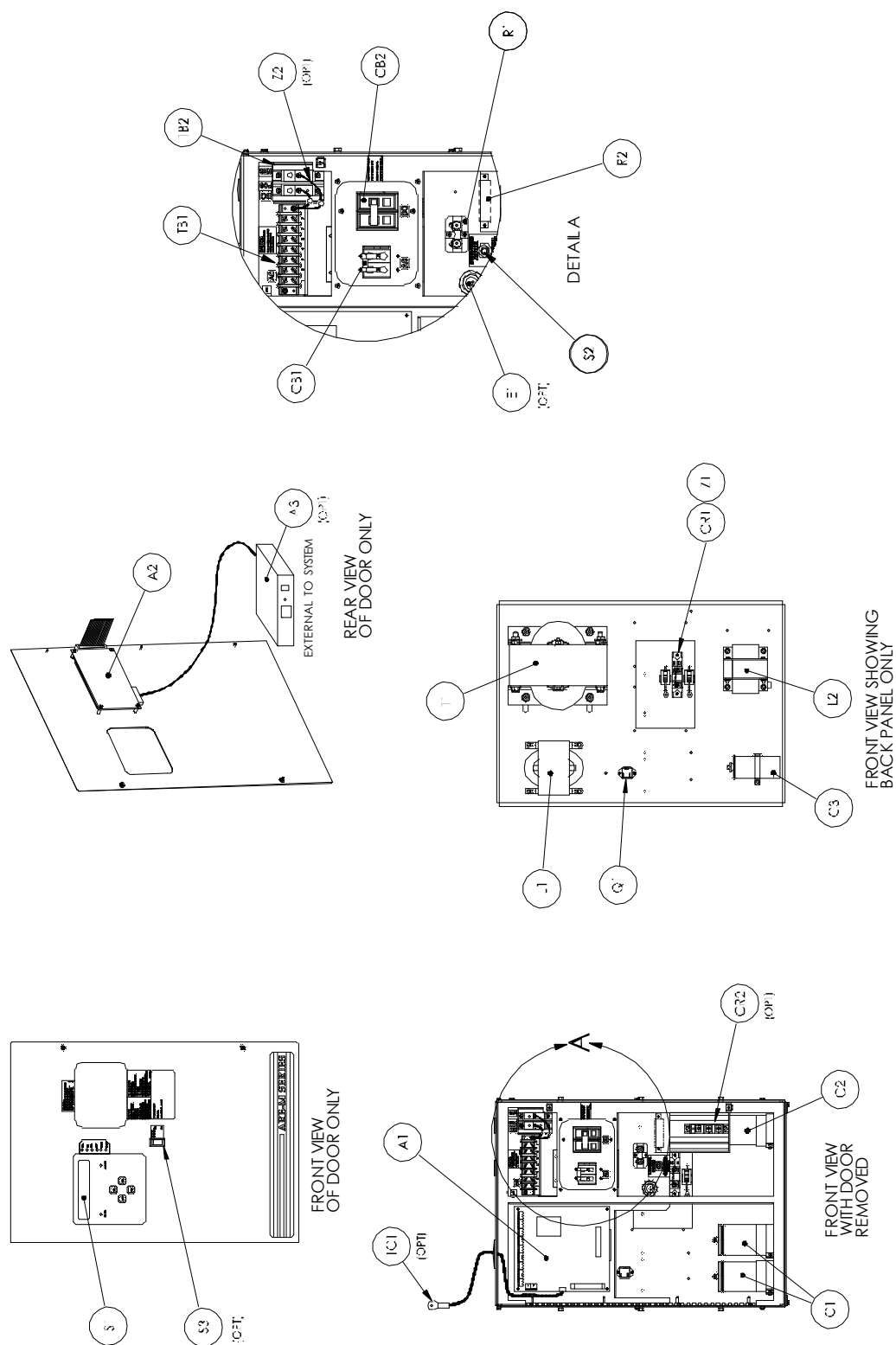
FIGURE 6-4 12" Cabinet Schematic; ARE-M02412, 120/208/240





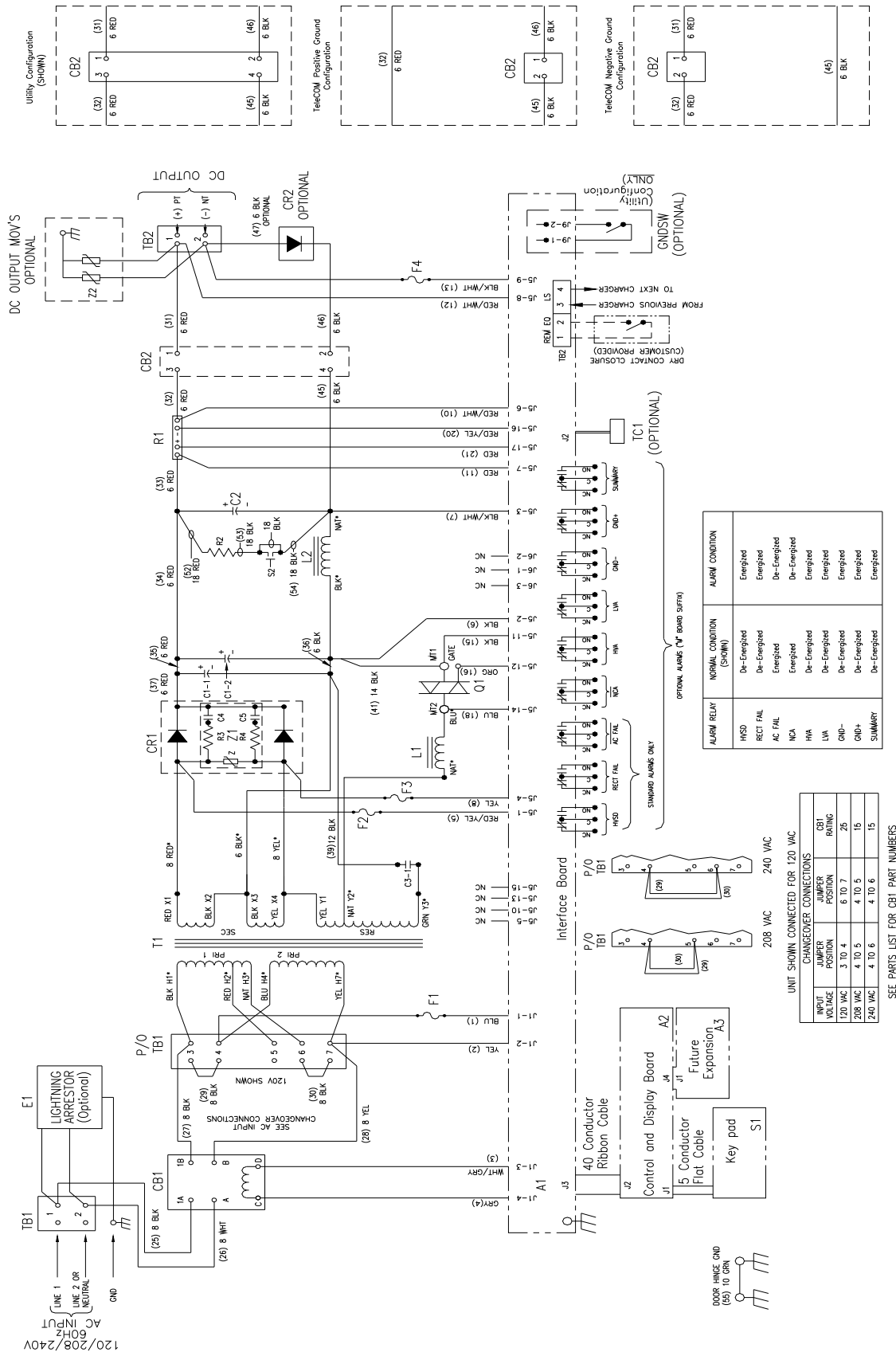
**FIGURE 6-5 12" Cabinet Schematic, ARE-M02425, 120/208/240**

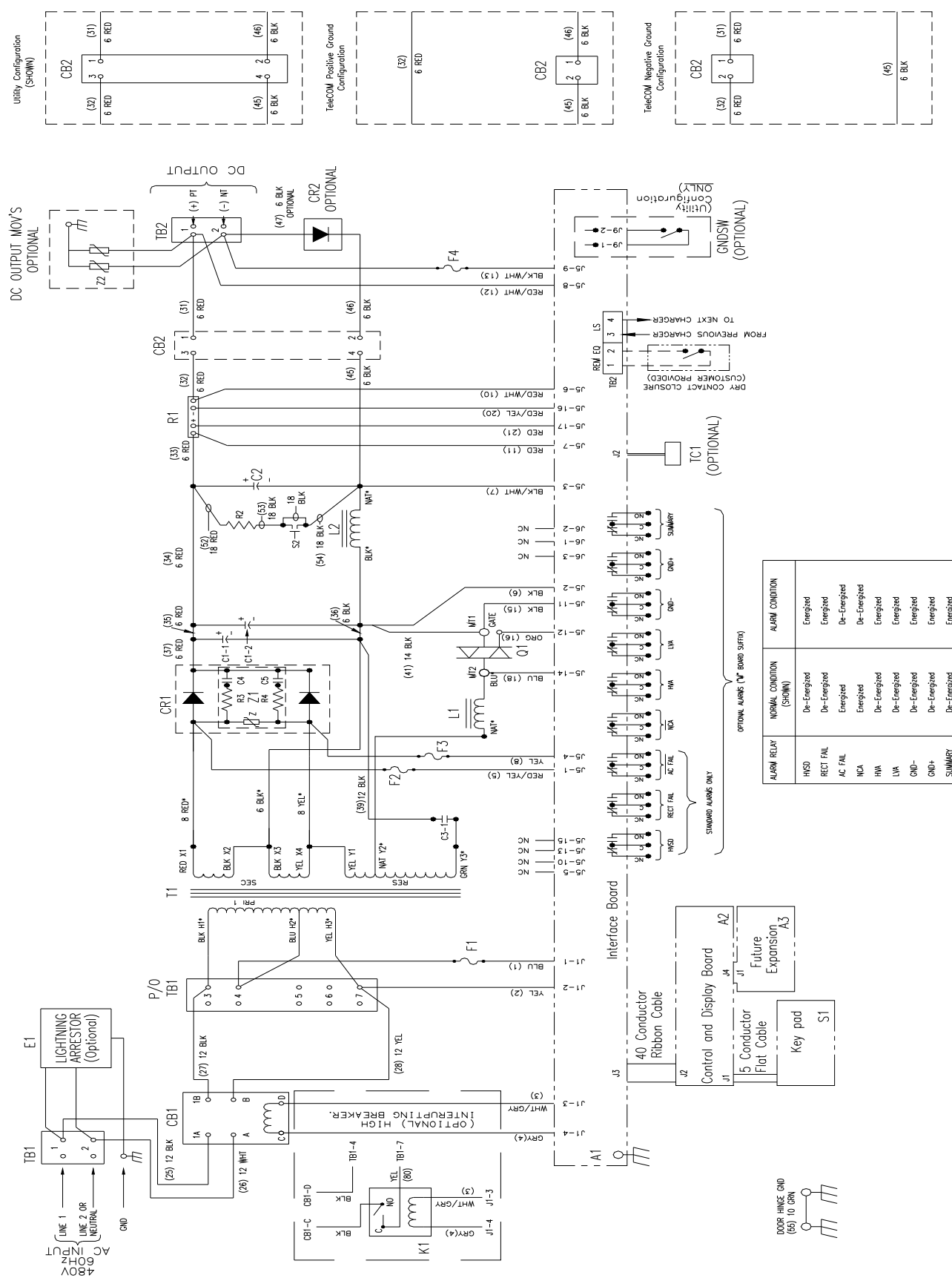
## 6.6 24" CABINET ASSEMBLY AND SCHEMATICS



**Note:** See Table 6-2 Parts Lists for reference designators and part numbers.

**FIGURE 6-6 24" Cabinet Assembly**





**FIGURE 6-8 24" Cabinet Schematic; ARE-M02450, 480**

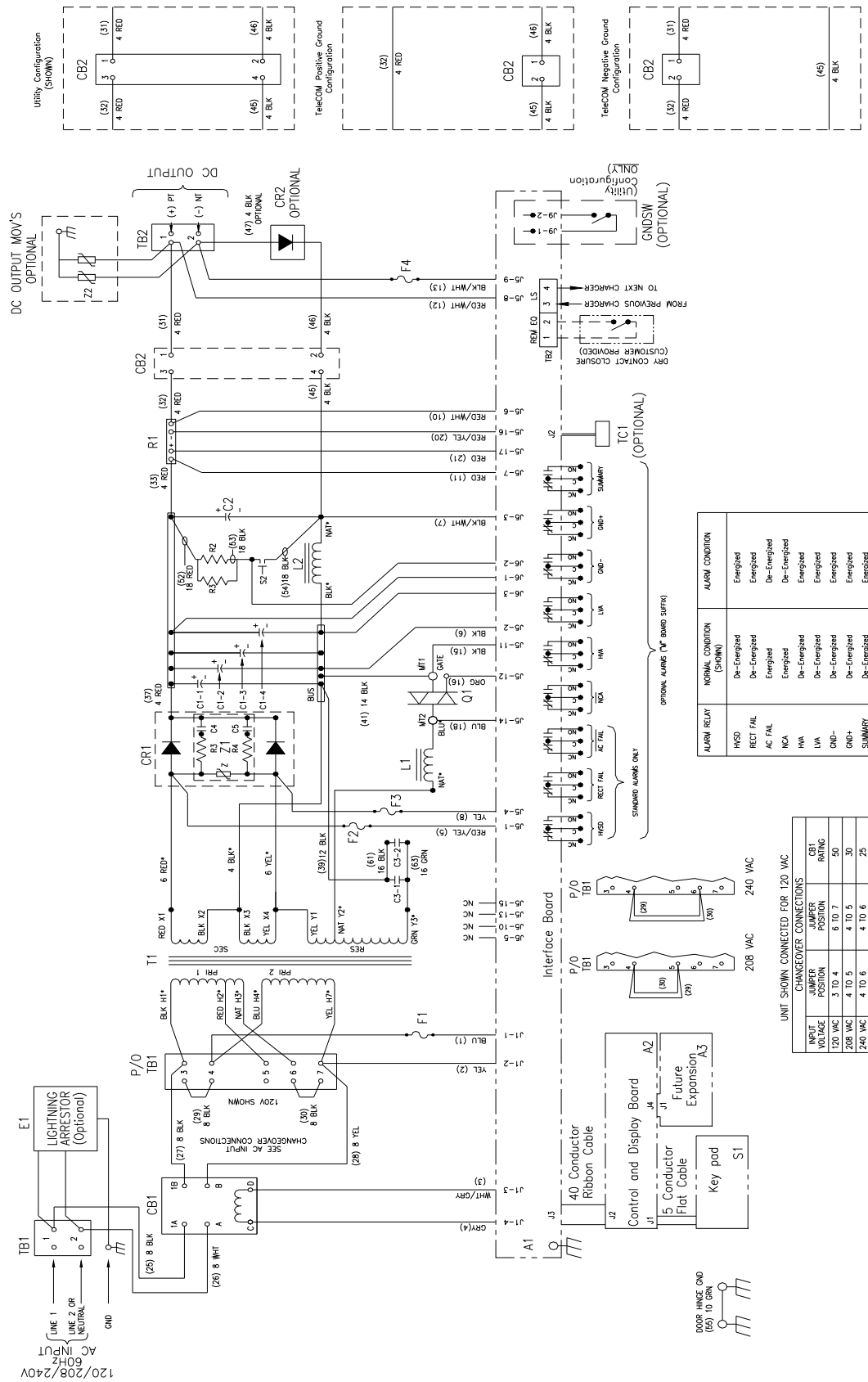


FIGURE 6-9 24" Cabinet Schematic; ARE-M024100, 120/208/240

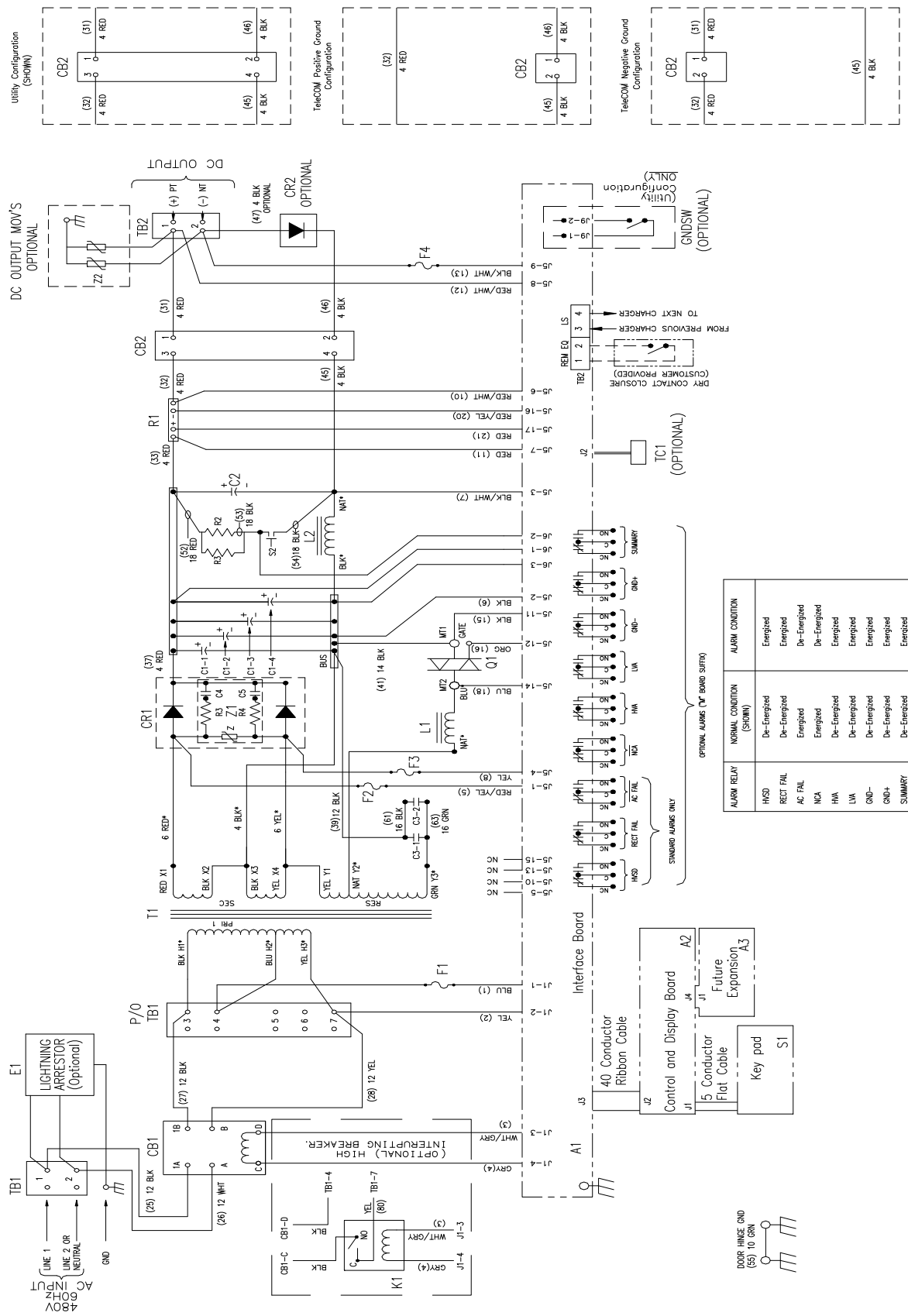


FIGURE 6-10 24" Cabinet Schematic; ARE-M024100, 480

## 6.7 PARTS LIST

This section contains the parts list for each standard charger model.

**TABLE 6-2 12" CABINET REPLACEMENT PARTS LIST; 24 VDC MODELS**

Designator	Description	Model	ARE-M02406	ARE-M02412	ARE-M02425
		Voltage	120/208/240	120/208/240	120/208/240
Designator	Description	Base Unit	102.1041.00A	102.1042.00A	102.1043.00A
			12" Cabinet	12" Cabinet	12" Cabinet
A1 (Utility)	Interface PCB		306.3078.24	306.3078.24	306.3078.24
A1 (Ut) (OPT)	Interface PCB w/RELAYS		306.3078.24M	306.3078.24M	306.3078.24M
A1 (Ut) (OPT)	Interface PCB w/GND SWT		306.3078.24G	306.3078.24G	306.3078.24G
A1 (Ut) (OPT)	Interface PCB w/RELAYS&GND SW		306.3078.24MG	306.3078.24MG	306.3078.24MG
A1 (Telecom)	Interface PCB		306.3078.24T	306.3078.24T	306.3078.24T
A1 (Tel)(OPT)	Interface PCB		306.3078.24TM	306.3078.24TM	306.3078.24TM
A2 (STD)	Control/Display w/o lights		N/A	N/A	N/A
A2 (Utility)	Control/Display w/lights		306.3077.20	306.3077.20	306.3077.20
A2 (Telecom)	Control/Display w/lights		306.3077.10	306.3077.10	306.3077.10
A3 (OPT)	DNP3 Communications		385.8335.00	385.8335.00	385.8335.00
C1	Cap, Filter input		450.1350.00	450.1350.00	450.1350.00
C2	Cap, Filter output		450.0860.00	450.1350.00	450.1350.00
C3	Cap, Resonant		JC00226	JC00062	JC00062
CB1	Circuit Breaker, 120 input		272.0320.00	JR00751	JR00753
CB1	Circuit Breaker, 208 input		272.0320.00	JR00751	JR00753
CB1	Circuit Breaker, 240 input		272.0320.00	JR00751	JR00753
CB1	Circuit Breaker, 480 input		N/A	N/A	N/A
CB1 (Hi Cap)	Circuit Breaker, 120 input		272.0117.05	272.0117.10	272.0117.15
CB1 (Hi Cap)	Circuit Breaker, 208 input		272.0117.05	272.0117.10	272.0117.15
CB1 (Hi Cap)	Circuit Breaker, 240 input		272.0117.05	272.0117.10	272.0117.15
CB1 (Hi Cap)	Circuit Breaker, 480 input		N/A	N/A	N/A
CB2-2 Pole (Std)	Ckt Bkr, output, 2P Utility		JR00209	JR00208	272.0119.35
CB2-2 Pole (Opt)	Ckt Bkr, output, 2P Utility		272.0113.10	272.0113.20	JR00798
CB2-1 Pole (Std)	Ckt Bkr, output, 1 Pole Tel		N/A	N/A	N/A
CB2-1 Pole (Std)	Ckt Bkr, output, 1 Pole Tel		271.0900.10	JR00754	JR00755
CR1	Diode Module		JS00485	JS00485	JS00485
CR2 (OPT)	Blocking Diode		JS00485	JS00485	576.0500.00
E1 (OPT)	Lightning Arrester		JS00885	JS00885	JS00885
F1,F2,F3,F4	Fuse, Control Wiring Protection Kit		385.1040.00	385.1040.00	385.1040.00
K1	Relay, Hi-Cap AC Breaker only		245.4000.30	245.4000.30	245.4000.30
L1	Reactor, Resonant		141.3501.00	141.3510.00	141.3511.00
L2	Choke, Filter		141.3401.00	141.3401.00	141.3406.00
Q1	Triac		JS00826	JS00826	JS00826
R1	Shunt 50mV		JM00247	JM00247	JM00248
R2	Resistor, Cap Discharge		680.0450.00	685.0090.00	685.0090.00
R5,6,7	Resistor, DC Load		N/A	N/A	N/A
S1	Switch, Membrane		225.4550.00	225.4550.00	225.4550.00
S2	Switch, Cap Discharge		JL00038	JL00038	JL00038
S3 (Opt)	Switch, Ground Enable (GNDSW)		240.4130.00	240.4130.00	240.4130.00
T1	Transformer, Power		147.4010.00	147.4011.00	147.4012.00
TB1	Terminal Block		JL00230	JL00230	JL00918
TB2	Terminal Block		N/A	N/A	N/A
TB3	Terminal Block		N/A	N/A	N/A
TB4	Terminal Block		N/A	N/A	N/A
TC1 (OPT)	Thermosensor		385.5627.11	385.5627.11	385.5627.11
Z1	Surge Suppression, CR1		307.2723.01	307.2723.02	307.2723.01

## 12" Cabinet Replacement Parts List; 24VDC Models, Continued...

Designator	Description	Model Voltage Base Unit	ARE-M02450 120/208/240 102.1044.00A 24" Cabinet	ARE-M02450 480 102.1071.00A 24" Cabinet	ARE-M024100 120/208/240 102.1045.00A 24" Cabinet	ARE-M024100 480 102.1072.00A 24" Cabinet
A1 (Utility)	Interface PCB		306.3078.24	306.3078.24	306.3078.24	306.3078.24
A1 (Ut) (OPT)	Interface PCB		306.3078.24M	306.3078.24M	306.3078.24M	306.3078.24M
A1 (Ut) (OPT)	Interface PCB w/GND SW/T		306.3078.24G	306.3078.24G	306.3078.24G	306.3078.24G
A1 (Ut) (OPT)	Interface PCB w/RELAYS&GND SW/T		306.3078.24MG	306.3078.24MG	306.3078.24MG	306.3078.24MG
A1 (Telecom)	Interface PCB		306.3078.24T	306.3078.24T	306.3078.24T	306.3078.24T
A1 (Tel)(OPT)	Interface PCB		306.3078.24TM	306.3078.24TM	306.3078.24TM	306.3078.24TM
A2 (STD)	Control/Display w/o lights		N/A	N/A	N/A	N/A
A2 (Utility)	Control/Display w/lights		306.3077.20	306.3077.20	306.3077.20	306.3077.20
A2 (Telecom)	Control/Display w/lights		306.3077.10	306.3077.10	306.3077.10	306.3077.10
A3 (OPT)	DNP3 Communications		385.8335.00	385.8335.00	385.8335.00	385.8335.00
C1	Cap, Filter input		450.1650.00	450.1650.00	450.1650.00	450.1650.00
C2	Cap, Filter output		450.1650.00	450.1650.00	450.1650.00	450.1650.00
C3	Cap, Resonant		JC00061	JC00061	JC00117 (2)	JC00117 (2)
CB1	Circuit Breaker, 120 input		272.0320.25	N/A	JR00556	N/A
CB1	Circuit Breaker, 208 input		JR00753	N/A	JR00721	N/A
CB1	Circuit Breaker, 240 input		JR00753	N/A	272.0320.25	N/A
CB1	Circuit Breaker, 480 input		N/A	JR00761	N/A	272.0112.15
CB1 (Hi Cap)	Circuit Breaker, 120 input		272.0116.25	N/A	272.0116.50	N/A
CB1 (Hi Cap)	Circuit Breaker, 208 input		272.0116.15	N/A	272.0116.30	N/A
CB1 (Hi Cap)	Circuit Breaker, 240 input		272.0116.15	N/A	272.0116.25	N/A
CB1 (Hi Cap)	Circuit Breaker, 480 input		N/A	272.0118.15	N/A	272.0118.15
CB2-2 Pole (Std)	Ckt Bkr, output, 2P Utility		JR00223	JR00223	JR00801	JR00801
CB2-2 Pole (Opt)	Ckt Bkr, output, 2P Utility		JR00800	JR00800	JR00801	JR00801
CB2-1 Pole (Std)	Ckt Bkr, output, 1 Pole Tel		N/A	N/A	N/A	N/A
CB2-1 Pole (Std)	Ckt Bkr, output, 1 Pole Tel		JR00709	JR00709	JR00812	JR00812
CR1	Diode Module		JS00878	JS00878	JS00548	JS00548
CR2 (OPT)	Blocking Diode		576.0500.00	576.0500.00	JS00548	JS00548
E1 (OPT)	Lightning Arrester		JS00885	594.2041.00	JS00885	594.2041.00
F1,F2,F3,F4	Fuse, Control Wiring Protection Kit		385.1040.00	385.1040.00	385.1040.00	385.1040.00
K1	Relay, Hi-Cap AC Breaker only		245.4000.30	245.4000.30	245.4000.30	245.4000.30
L1	Reactor, Resonant		141.3512.00	141.3512.00	141.3513.00	141.3513.00
L2	Choke, Filter		141.3407.00	141.3407.00	141.3408.00	141.3408.00
Q1	Triac		JS00826	JS00826	JS00826	JS00826
R1	Shunt 50mV		JM00249	JM00249	JM00250	JM00250
R2	Resistor, Cap Discharge		680.0450.00	680.0450.00	680.0450.00	680.0450.00
R5,6,7	Resistor, DC Load		685.0090.00	685.0090.00	685.0090.00	685.0090.00
S1	Switch, Membrane		225.4550.00	225.4550.00	225.4550.00	225.4550.00
S2	Switch, Cap Discharge		JL00038	JL00038	JL00038	JL00038
S3 (Opt)	Switch, Ground Enable (GNDSW)		240.4130.00	240.4130.00	240.4130.00	240.4130.00
T1	Transformer, Power		147.4013.00	147.4030.00	147.4014.00	147.4031.00
TB1	Terminal Block		JL00140	JL00140	JL00140	JL00140
TB2	Terminal Block		JL00898	JL00898	JL00898	JL00898
TB3	Terminal Block		N/A	N/A	N/A	N/A
TB4	Terminal Block		N/A	N/A	N/A	N/A
TC1 (OPT)	Thermosensor		385.5627.11	385.5627.11	385.5627.11	385.5627.11
Z1	Surge Suppression, CR1		307.2723.08	307.2723.08	307.2723.12	307.2723.12
Z2, Z3 (OPT)	DC Output MOVs		JA03079-150V	JA03079-150V	JA03079-150V	JA03079-150V



## 6.8 INTERFACE BOARD

This section provides Interface Board troubleshooting and replacement information. The Interface Board can be replaced in the field. There are no user-serviceable parts on the board. The board is shown in Figure 6-11. Use caution when servicing or replacing the board since battery voltage is present on the board whenever the battery string is connected to the charger.

The board is available in a number of versions. A Standard Board (A1), an optional Multiple Alarm Board (A1 OPT), and a switchable ground detection is available. (A Standard Board has 3 alarm outputs while the optional Multiple Alarm Board has 9 alarm outputs.) To order a replacement board, refer to Table 6-2 Parts Lists for the Interface Board part number for the charger model at hand.

### 6.8.1 Board Interchangeability

The Interface Board part number suffix (e.g. 306-3078-24) specifies the compatible charger DC output voltage, 24V in the preceding example. Suffix letters indicate options like multiple alarm relays or switchable ground detection. Install the board in any charger rated for that output voltage, regardless of current output rating. When replacing an Interface Board, set the miniature rotary switch SW1 to the current rating of the charger into which the board will be installed. See Table 6-3.

**IMPORTANT:** DO NOT change the setting of SW2. It is factory set. If inadvertently changed, set SW2 to the board part number suffix at the “position” shown in Table 6-3. SW2 may not be on all boards.

**TABLE 6-3 INTERFACE BOARD SWITCH SETTINGS**

SW1		SW2	
Position	Function	Position	Function
0	30 Amperes	0	Not Valid
1	3 Amperes	1	12 Volts
2	6 Amperes	2	24 Volts
3	12 Amperes	3	48 Volts
4	16 Amperes	4	130 Volts
5	25 Amperes	5	260 Volts
6	35 Amperes	6	Not Valid
7	50 Amperes	7	Not Valid
8	75 Amperes	8	Not Valid
9	100 Amperes	9	Not Valid

### 6.8.2 Troubleshooting

1. If the charger is not working properly, there are test points on the Interface Board that can help locate the problem. TP1 is board common and is used for all other test point voltage measurements. TP2, TP3, and TP4 are the DC-DC power supply outputs. All voltages must be within tolerance for the board to work properly. The board should be replaced if a voltage is incorrect.
  - TP1 to TP2 should read +1260.5Vdc.
  - TP1 to TP3 should read -1260.5Vdc.
  - TP1 to TP4 should read +560.25Vdc.
2. If the power supply is working correctly the following test points can be measured.
  - TP1 to TP6 should read between 0 and 3-4 volts depending on charger load.
    - 0V = no load
    - 3-4V = rated output of charger
  - TP1 to TP7 depends upon the output voltage of the charger.
    - 48V charger: approximately 1.2V
  - TP1 to TP8 should be about the same as TP1 to TP7 (assuming the DC breaker is closed).
  - TP1 to TP9 should be about 2V if there is no ground short.
  - TP1 to TP10 should be about -5V if there is no load share.
3. Check the settings of rotary switches SW1 and SW2.
  - SW1 is set for the DC current output rating of the charger.
  - SW2 is set for the DC voltage output rating of the charger. (SW2 may not be on all boards)

After the switches are changed, the control must be reset by disconnecting and reconnecting the ribbon cable. (See sections 6.8.1 and 6.9)

### 6.8.3 Replacing the Interface Board

Use caution when servicing or replacing the board since battery voltage is present on the board whenever the battery string is connected to the charger.

1. Refer to Chapter 4 Setup and Operation and turn off the charger.
2. Loosen the two quarter-turn captive fasteners and open the front panel.
3. At TB1, label each of the removable plugs with the alarm name printed on the circuit board. Pull each plug up and out of its mating connector.
4. Disconnect the battery temperature sensor from terminal block J2, if present.
5. Disconnect the cabled connectors from the board.
6. Remove the screws securing the board and remove the board. Note the settings of switches SW1 and SW2.
7. On the replacement board, check the settings of SW1 and SW2. See Table 6-5 for proper settings.
8. Fasten the board to the charger using the screws removed above.
9. Install the cabled connectors, alarm plugs, and battery temperature wiring.
10. Turn on the charger and test its operation and setup.

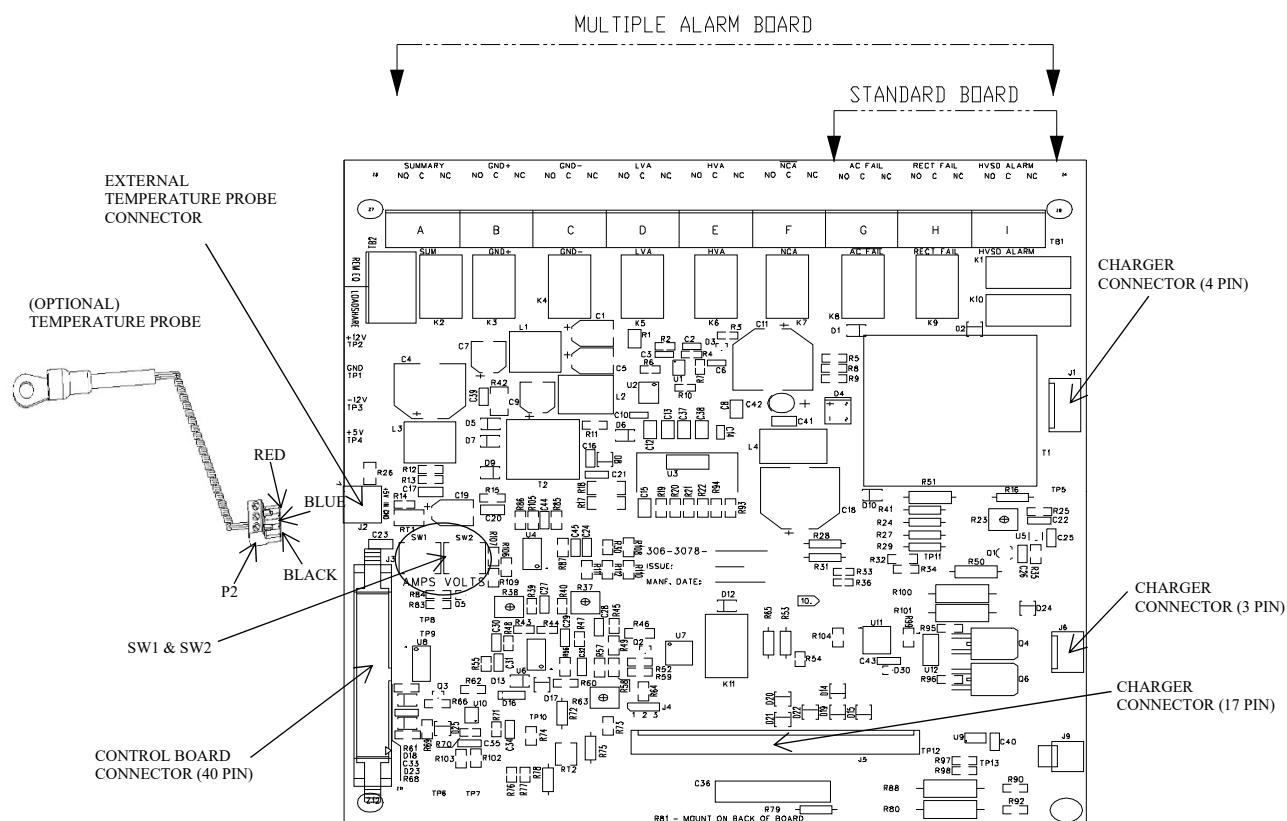
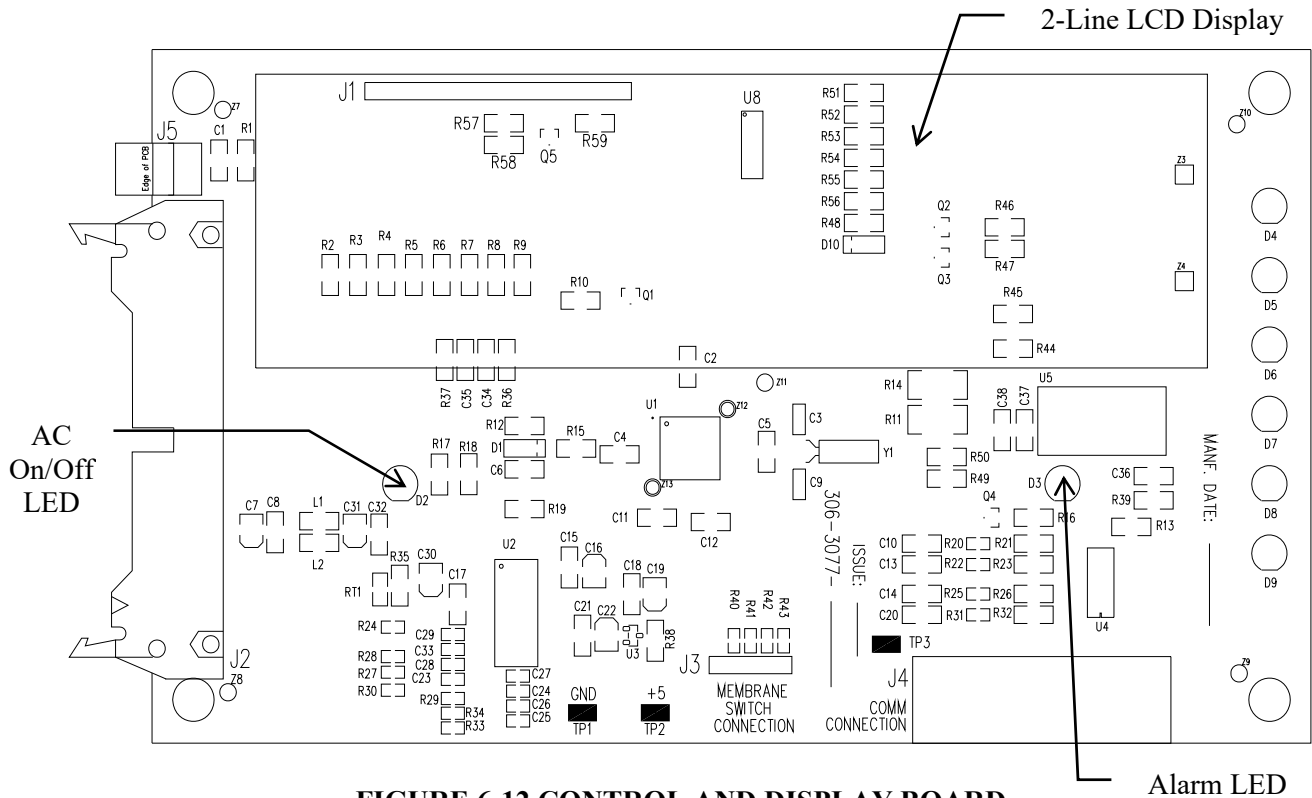


FIGURE 6-11 COMPONENT LOCATIONS, INTERFACE BOARD

## 6.9 CONTROL AND DISPLAY BOARD

Figure 6-12 shows the Control and Display Board. There are no user-serviceable parts on the board. Board substitution is recommended when troubleshooting.



**FIGURE 6-12 CONTROL AND DISPLAY BOARD**

### 6.9.1 Replacing the Board

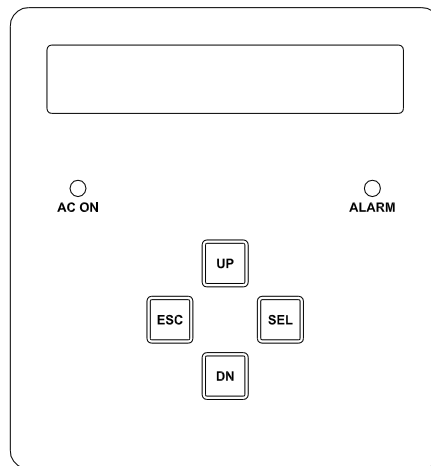
Use caution when servicing or replacing the board since battery voltage is present on the board whenever the battery string is connected to the charger.

1. Refer to Chapter 4 Setup and Operation and turn off the charger.
2. Loosen the two quarter-turn captive fasteners and open the front panel. The board is located on the rear of the front panel.
3. Disconnect the large ribbon cable to the Interface board. Disconnect the smaller ribbon cable to the keypad.
4. Remove the screws securing the board and remove the board.
5. Fasten the board to the rear of the front panel using the screws removed above.
6. Install the ribbon cables disconnected above.
7. Turn on the charger and test its operation and setup.

## 6.10 KEYPAD

The front panel 4-button keypad can be replaced. Be sure a replacement part is on hand before beginning the following procedure.

**IMPORTANT:** Carefully align the replacement keypad with the 2-line LCD display and LEDs before allowing the keypad to contact the front panel. The replacement keypad cannot be repositioned once its adhesive back has contacted the front panel surface.



Minor misalignment will not affect front panel use. A larger misalignment may interfere with reading the 2-line display and LEDs.

To replace the keypad:

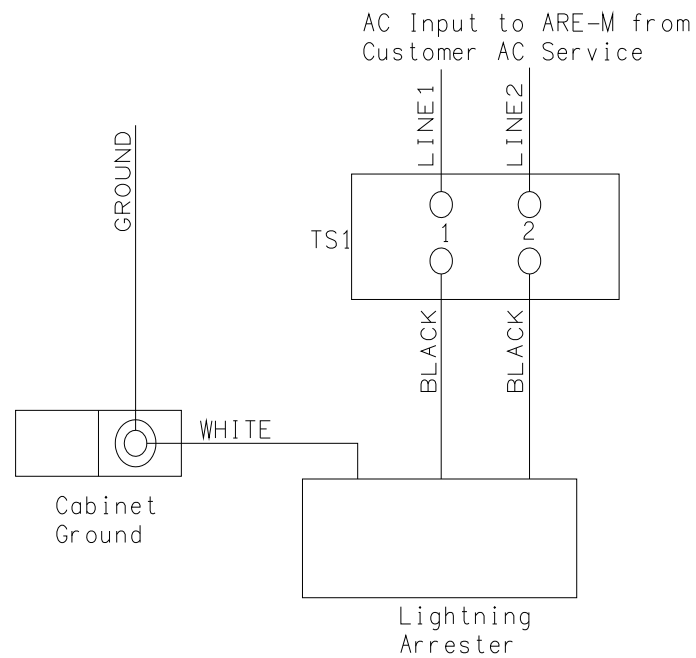
1. Disconnect the keypad ribbon cable from the Control and Display Board.
2. Carefully lift a corner of the failed keypad and peel the keypad from the front panel. (Note: The hole that the ribbon cable went through.) Remove any adhesive residue with denatured alcohol or other compatible solvent.
3. Check the alignment of the replacement keypad with the 2-line LCD display and LEDs. Masking tape can be used to mark the exact location of one edge of the keypad. Achieve vertical and horizontal alignment before proceeding. See the IMPORTANT note above.
4. Peel the protective backing from the replacement keypad.
5. Place the ribbon cable through the hole identified in step 2.
6. Without allowing the keypad to touch the front panel, carefully align the keypad with your alignment indicators and the 2-line LCD display and LEDs. When aligned, press the keypad against the front panel.
7. Gently press all areas of the keypad against the front panel using only your hand. Be sure the four corners and four edges have adhered to the front panel.

## 7.0 OPTIONS AND ACCESSORIES

This chapter contains details about the options and accessories currently available for the charger.

### 7.1 Lightning Arrester

A surge suppression device connected across the AC service to ground prevents high-energy transients from damaging the equipment.



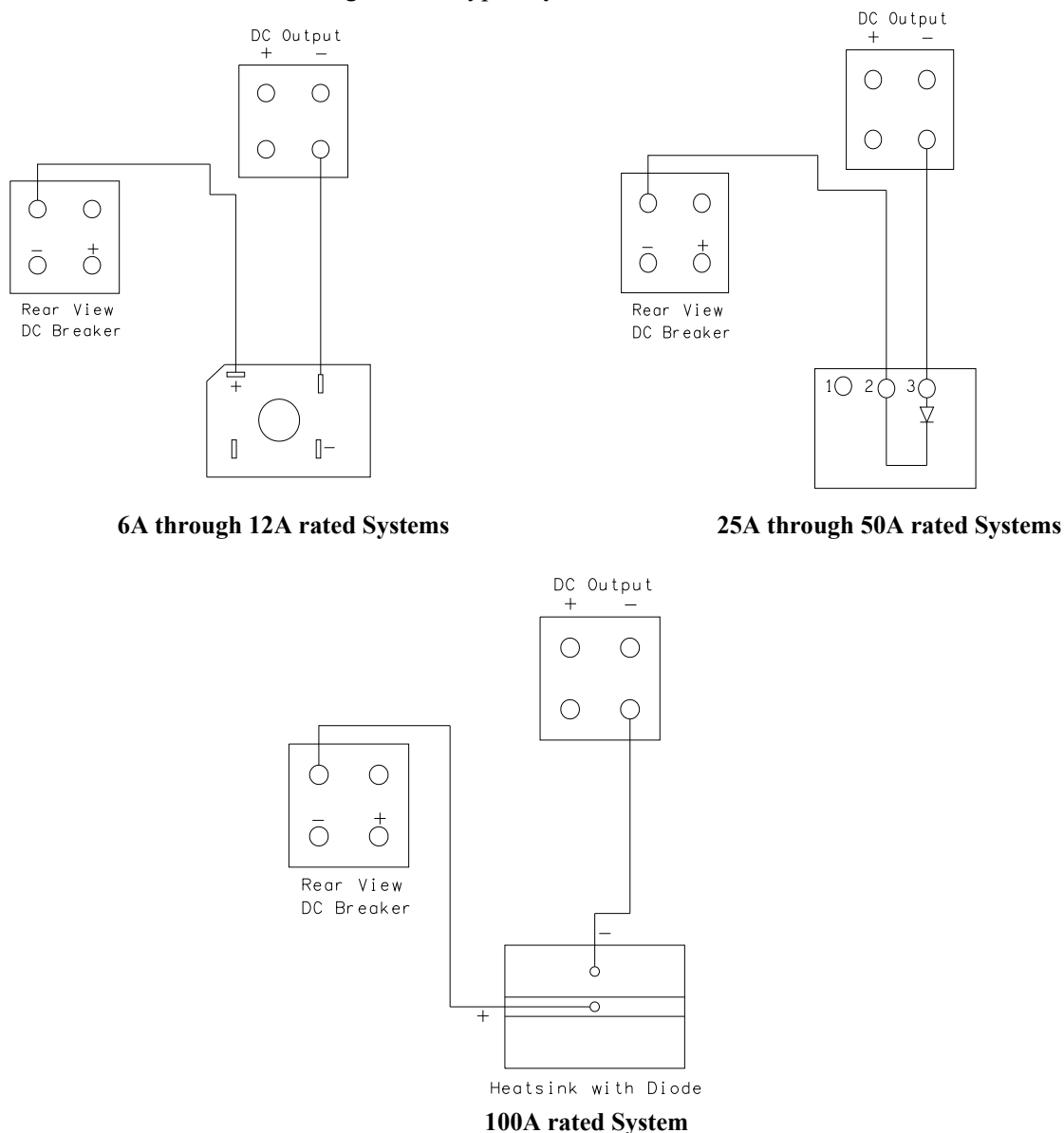
**FIGURE 7-1 LIGHTNING ARRESTER; 120, 208, 240 AND 480 VAC CONNECTIONS**

## 7.2 Blocking Diode

A silicon diode inserted into the negative DC output prevents the flow of reverse current from the battery when the equipment is DC-energized preventing additional battery drain.

For systems with blocking diodes, the Float and Equalize voltage should be set about 0.7 volts above the desired battery voltage to compensate for the diode voltage drop. This offset should be adjusted to obtain the desired output voltage for each installation.

**Note:** Current drain without the blocking diode is typically less than 100 mA.



**Note:** Existing wire for NEG output of DC breaker to NEG DC output terminal is removed and replaced with blocking diode and 2 wires.

**FIGURE 7-2 BLOCKING DIODE ADD ALTERNATIVE**

### 7.3 Output MOVs

The output MOVs protect the charger from externally created voltage transients. The MOVs are connected from each output pole of the charger to the cabinet (earth). If an excessive transient enters the unit on the output cables, the MOVs clamp the voltage to an acceptable level. Repetitive clamping of transients and clamping high energy transients will degrade the MOVs requiring eventual replacement.

### 7.4 Drip Shield

The drip shield is intended to prevent water from dripping into the unit from the overhead structure indoors. When used, nothing should be set on the perforated top screen of the charger or the drip shield. Placing anything on the top screen may create a fire hazard. When the drip shield is used, personnel should avoid contact with the perforated top screen.

### 7.5 Temperature Sensor

The temperature sensor is connected to J2 on the interface board as shown in Figure 2-6 and described in Section 2.4.7. This is required for battery temperature compensation and to annunciate a high battery temperature alarm.

### 7.6 Ground Detection Switch

The Ground Detection Switch is a factory-installed option that allows the operator to easily disable the ground detection by breaking the internal connection from the internal detection system and ground. Breaking the internal ground connection is useful for troubleshooting ground paths on the dc system or eliminating interactions with other ground detection equipment on the system.

Unless other ground detection is in use on the DC system, the ground detection switch should be left in the ON position.

### 7.7 DNP3 Communications

This allows the charger to be controlled and monitored from a remote location over a 10/100Mbit Ethernet network connection using the popular DNP3 protocol. More information about this protocol can be found at [www.dnp.org](http://www.dnp.org). The DNP3 device profile (PM990.1072.00) and installation guide (PM990.1074.00) can be found on UNIPOWER's web site at [www.unipowerco.com](http://www.unipowerco.com).

### 7.8 High interrupt AC breakers

This option gives the charger an enhanced AC line current interrupting rating of at least 10,000 Amps.