OWNER'S MANUAL 193111-084

Revised July 19, 2010

IMPORTANT: Read these instructions before installing, operating, or servicing this system.

AC1000

CHARGE CONTROL

DO NOT DESTROY

AMETEK/PRESTOLITE POWER , TROY, OHIO 45373-1099, U.S.A.

INTRODUCTION

How To Use This Manual

IMPORTANT: It is especially important that all charger internal components be kept clean and dry, and all electrical connections tightened. Replace any precautionary or instruction label that cannot be easily read.

To ensure safe operation, read the entire manual, including the chapter on Safety Instructions and Warnings.

Throughout this manual, the words **WARNING**, **CAUTION**, and **NOTE** may appear. Pay particular attention to the information provided under these headings. These special annotations are easily recognized as follows:

WARNING gives information regarding possible personal injury. Warnings will be enclosed in a box such as this.

CAUTION refers to possible equipment damage. Cautions will be shown in bold type.

NOTE offers helpful information concerning certain operating procedures. Notes will be shown in italics.

Equipment Identification

The unit's identification number (specification, model, serial number) usually appears on a name-plate attached to the front panel.

Receipt Of Equipment

When you receive the equipment, check it against the invoice to make sure it is complete and inspect the equipment for possible damage due to shipping. If there is any damage, notify the carrier immediately to file a claim. Furnish complete information concerning damage claims or shipping errors to the company shown on the cover of this manual. Include all equipment identification numbers and group part numbers (if any) as described above along with a full description of the parts in error.

Move the equipment to the site of installation before uncrating. Use care to avoid damaging the equipment when using bars, hammers, etc., to uncrate the unit.

Additional copies of this manual may be purchased by contacting the company shown on the cover of this manual. Include the Owner's Manual number and equipment identification numbers. Electronic copies are available for no charge at www.prestolitepower.com

SAFETY INSTRUCTIONS AND WARNINGS

FOR OPERATION OF BATTERY CHARGING EQUIPMENT

IMPORTANT – READ AND UNDERSTAND THESE INSTRUCTIONS. DO NOT LOSE THEM. ALSO READ OPERATING/INSTRUCTION MANUAL BEFORE INSTALLING, OPERATING, OR SERVICING THIS EQUIPMENT.

A. General

Battery charging products can cause serious injury or death, or damage to other equipment or property, if the operator does not strictly observe all safety rules and take precautionary actions.

Safe practices have developed from past experience in the use of charging equipment. These practices must be learned through study and training before using this equipment. Anyone not having extensive training in battery charging practices should be taught by experienced operators.

Only qualified personnel should install, use, or service this equipment.

B. Shock Prevention

Bare conductors, or terminals in the output circuit, or ungrounded, electrically-live equipment can fatally shock a person. To protect against shock, have competent electrician verify that the equipment is adequately grounded and learn what terminals and parts are electrically HOT.

The body's electrical resistance is decreased when wet, permitting dangerous current to flow through the body. Do not work in damp area without being extremely careful. Stand on dry rubber mat or dry wood and use insulating gloves when dampness or sweat cannot be avoided. Keep clothing dry.

1. Installation and Grounding of Electrically Powered Equipment – Electrical equipment must be installed and maintained in accordance with the National Electrical Code, NFPA 70, and local codes. A power disconnect switch must be located at the equipment. Check nameplate for voltage and phase requirements. If only 3-phase power is available, connect *single-phase* equipment to only two wires of the 3-phase line. DO NOT CONNECT the equipment grounding conductor (lead) to the third live wire of the 3-phase line as this makes the equipment frame electrically HOT, which can cause a fatal shock.

   If a grounding lead (conductor) is part of the power supply cable, be sure to connect it to a properly grounded switch box or building ground. If not part of the supply cable, use a separate grounding lead (conductor). Do not remove a ground prong from any plug. Use correct mating receptacles. Check ground for electrical continuity before using equipment.

   The grounding conductor must be of a size equal to or larger than the size recommended by Code or in this manual.

2. Charging Leads – Inspect leads often for damage to the insulation. Replace or repair cracked or worn leads immediately. Use leads having sufficient capacity to carry the operating current without overheating.

3. Battery Terminals – Do not touch battery terminals while equipment is operating.

4. Service and Maintenance – Shut OFF all power at the disconnect switch or line breaker *before* inspecting, adjusting, or servicing the equipment. Lock switch OPEN (or remove line fuses) so that the power cannot be turned ON accidentally. Disconnect power to equipment if it is to be left unattended or out of service.

   Disconnect battery from charger.

   Keep inside parts clean and dry. Dirt and/or moisture can cause insulation failure. This failure can result in high voltage at the charger output.

C. Burn and Bodily Injury Prevention

The battery produces very high currents when short circuited, and will burn the skin severely if in contact with any metal conductor that is carrying this current. Do not permit rings on fingers to come in contact with battery terminals or the cell connectors on top of the battery.

Battery acid is very corrosive. Always wear correct eye and body protection when near batteries.

D. Fire and Explosion Prevention

Batteries give off explosive flammable gases which easily ignite when coming in contact with an open flame or spark. Do not smoke, cause sparking, or use open flame near batteries. Charge batteries only in locations which are clean, dry, and well ventilated. Do not lay tools or anything that is metallic on top of any battery. All repairs to a battery must be made only by experienced and qualified personnel.

E. Arcing and Burning of Connector

To prevent arcing and burning of the connector contacts, be sure the charger is OFF before connecting or disconnecting the battery. (If the charger is equipped with an ammeter, the ammeter should not indicate current flow.) Always connect battery before turning charger ON.

F. Medical and First Aid Treatment

First aid facilities and a qualified first aid person should be available for each shift for immediate treatment of electrical shock victims.

EMERGENCY FIRST AID: Call physician and ambulance immediately. Use First Aid techniques recommended by the American Red Cross.

DANGER: ELECTRICAL SHOCK CAN BE FATAL. If person is unconscious and electric shock is suspected, do not touch person if he or she is in contact with charging leads, charging equipment, or other live electrical parts. Disconnect (open) power at wall switch and then use First Aid. Dry wood, wooden broom, and other insulating material can be used to move cables, if necessary, away from person. IF BREATHING IS DIFFICULT, give oxygen. IF NOT BREATHING, BEGIN ARTIFICIAL BREATHING, such as mouth-to-mouth. IF PULSE IS ABSENT, BEGIN ARTIFICIAL CIRCULATION, such as external heart massage.

IN CASE OF ACID IN THE EYES, flush very well with clean water and obtain professional medical attention immediately.

G. Equipment Warning Labels

Inspect all precautionary labels on the equipment. Order and replace all labels that cannot be easily read.

INITIAL SET-UP

See Location Diagram of Selector Switches included in this manual on page 6-1.

For proper operation, the AC1000 Control must be set to match the charger in which it is installed.

Cell Size Selection

From the data plate on the charger, note the number of cells. Place the corresponding DIP switch (S2) on the AC1000 Control in the "closed" position.

S2-1	6 Cells
S2-2	12 Cells
S2-3	18 Cells
S2-4	24 Cells
S2-5	36 Cells
S2-6	40 Cells or Unique Part Number

Only one of the above DIP switches should be in the "closed" position at any one time.

Full Scale Digital Ammeter Selection

From the data plate on the charger, note the DC output per circuit – Max. Amps. Set S1-10 and S1-11 for the proper value per the following chart.

DC Output per Circuit Max. Amps	Full Scale Current	S1-10 100A	S1-11 400A
0 – 76	100	On	Off
77 – 171	200	Off	Off
172 – 320	400	Off	On

STANDARD OPERATION

WARNING: Do not disconnect a battery from this charger while the charge in progress LED is lit; otherwise, a battery explosion may result. BATTERIES PRODUCE EXPLOSIVE GASES. Keep sparks, flame, and cigarettes away. Ventilate when charging in an enclosed area. Always shield eyes when working near batteries.

1. Insure that battery size matches charger (Number of cells and ampere hour capacity are within nameplate information).

2. Connect AC power to charger.

3. Connect the battery to the charger.

4. After a five second downcount, the charger will turn on and the “Charge in Progress” LED will light. The digital display will indicate output current.

5. The “80% Charged” LED will light when the battery voltage reaches the gassing point (Standard = 2.37 volts/cell).

6. When the charge termination point is reached, the charger will turn off. The “Charge Complete” LED will light and the “Equalize” LED will be lit if this was an equalize charge. The display will show the number of hours since the Charge Complete occurred.

AC1000 CONTROL FEATURES

Main Features

1. 30 Minute pT/dV/dT Charge Termination
2. Digital Display
3. Four LEDs for Status Display; LED lamp test provided
4. Manual Stop Capability
5. Review of Charge Cycle Information
   - Amp hours returned during charge cycle
   - Start to 80% point timer
   - 80% to pT/dV/dT point timer
   - Open circuit voltage
   - Start current
   - Start voltage
   - Finish current
   - Finish voltage
   - Charge termination code
6. Automatic, Push-to-Start, or Fault Lock-out Operation
7. Manual or Automatic Equalize Operation
8. Dual Back-up Timer Shutdowns
9. One Part Number Control is User/Factory programmable for 6-12-18-24-36 Cells and 100-200-400 Amp Digital Ammeter
10. 8-99 Hour Programmable Refresh Charge
11. Voltage Time Feature (pT/dV/dT Disable)
12. “Cell Forming” Feature
13. Digitally Adjustable 80% Point
14. Programmed Features maintained for a minimum of 10 Years.
15. 3 Programmable Start Modes
    – Automatic Start (5 Second Delay)
    – Push-To-Start
    – Delayed Start
16. Programmable “Extra Run Time”
17. AC Reset Option for Hard Wired Battery Operation

Description of Features

Charge Termination — The standard AC1000 utilizes a patented pT/dV/dT technique in order to determine the charge termination point. This technique returns approximately 107% of the amp hours removed from a battery (regardless of the state of discharge) and prevents variations in the incoming AC line voltage from affecting the amount of energy returned to the battery. The minimum time required for a pT/dV/dT charge termination on the AC1000 Control is ten minutes. The AC1000 Control can be programmed to utilize a voltage-time charge termination technique. If the pT/dV/dT charge termination is disabled, the control will terminate the charge cycle three hours after the battery reaches the “80% Charged” point.

Digital Display — A seven segment, four digit display is standard on the AC1000 Control. The characters are a minimum of .56 inches tall, making the information on the digital display legible at distances exceeding ten feet. The left hand decimal of the digital display is used to indicate when programmable features are selected. The decimal will flash at a 50% duty cycle rate when any programmable feature has been changed from factory settings. A blank display is utilized for AC power fail indication.

Status Display LEDs — The “Charge In Progress” LED (Amber) is illuminated whenever the charger is flowing current to the battery. There are four status LEDs provided to indicate the present operating status of the charger and battery (see Figure 5-1). A lamp test feature is provided. All Status LEDs and Display segments illuminate when the control is first powered on.

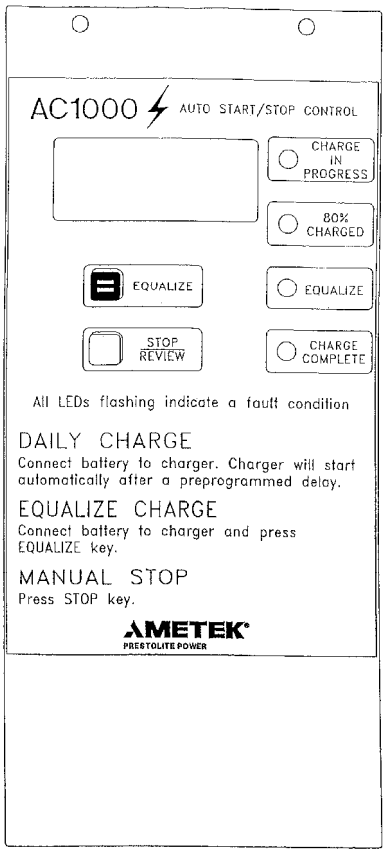

Figure 5-1 Status LEDs

Review of Charge Cycle — When the charge has been terminated, either by the AC1000 Control, the operator, or the removal of battery, the charge cycle history can be automatically reviewed by pressing the "Stop/Review" key. After displaying the information from memory, the unit will return to the normal (AC1) display. Nine functions are displayed during the charge cycle review. This feature can greatly aid in the analysis of charge data and in situations where troubleshooting is required. See the Troubleshooting chapter in this manual.

Function	Description
1	Amp-Hours Returned
2	Start to 80% Time
3	80% to Termination Time
4	Battery Open Circuit Voltage
5	Start Current
6	Start Volts/Cell
7	Finish Current
8	Finish Volts/Cell
9	Charge Termination Code

Figure 5-2 List of Functions 1-9

Automatic , Push-to-Start Operation, or Fault Lock-out — In the automatic start mode, the charger will start five seconds after the battery is connected. The digital display will count down during this five second period (i.e., 5-4-3-2-1). In the push-to-start mode, the charger will not start the charge cycle until the "Stop/ Review" key is pressed. When fault lockout is selected, the charger will not start until the "Stop/Review" key has been pressed.

Manual or Automatic Equalize — An equalize charge is a prolonged charge cycle (by 3 hours) used to correct any inequalities of voltage and specific gravity which may have developed between the cells during service. AC1000 Controls are shipped from the factory with the automatic equalize feature set to every fifth cycle.

When a battery is not connected to the charger, the Equalize function can be programmed to equalize from every 1–30 cycles. When the automatic equalize feature is active, the "Equalize" key on the front panel is disabled. When automatic equalize is disabled, an equalize charge is requested by pressing the "Equalize" key on the front panel of the AC1000 Control after a battery is connected to the charger. If this key is pressed again during the charge cycle, the equalize request will be canceled.

Back-Up Timer Shutdown — The standard AC1000 Control has two back-up timers. The charger will shutdown and the display will show 0-80 and all LEDs will flash if ten hours has passed since the start of a charge cycle and the battery has not reached the gassing voltage (80% charged). If five hours has passed since the battery has reached gassing voltage, and a pT/dV/dT charge termination has not occurred, the display will show 80-E and all leds will flash. If the pT/dV/dT feature has been disabled, only the 10-hour back-up timer is active.

One Part Number Control — The standard AC1000 Control is user/factory programmable for 6, 12, 18, 24, 36 and 40 cell Accu-Chargers with 100, 200, and 400 amp shunts. Any combination of the above cell sizes and current shunt sizes can be selected by DIP switches on the P.C. boards and programming the control. This feature reduces the quantity of spare parts inventory. See the Initial Set-Up chapter for further information.

Refresh Charge Feature — A refresh charge is a charge given to charged and wet batteries which are either in storage or inactive for periods. A refresh charge replaces losses due to local action and insures that every cell is brought periodically to a full state of charge.

The AC1000 Control has an 8 to 99 hour programmable refresh charge timer which starts with a normal charge complete, either pT/dV/dT or voltage time. If a battery is left connected to the charger for the programmed number of hours after a charge complete, the control will automatically begin a refresh charge cycle.

The control will start automatically even if programmed for delayed start or push-to-start operation. The refresh charge cycle will not count as a charge cycle if the control is programmed to provide an equalize charge by number of cycles. Charge cycle data (Functions #1-9) is not affected by a refresh charge. The charge termination technique for a refresh charge will be pT/dV/dT regardless of how the control is user programmed, and the 0-80% back-up timer will be five hours during a refresh charge. This feature will insure that any battery left connected to the charger for extended periods of time will not be damaged due to self-discharge, and will be kept in a fully charged state.

Finish Cell Forming Feature — The AC1000 Control can be programmed to provide voltage-time charge termination and disable the low current shutdown feature for a limited number of charge cycles. The number of cycles programmed in the control will be decremented each time a charge complete condition is reached. The number of forming cycles selected can be from 0 to 30 charge cycles.

WARNING: Enabling the Finish Cell Forming feature will cause the charger to continue to run for a period of time if the battery has been disconnected before Charge Complete or pressing the Manual Stop switch. This condition will continue until the programmed number of cycles have been completed. The battery should never be disconnected while a charge is in progress.

WARNING: Care should be exercised when disabling the low current shutdown feature as the charger will continue to run if a battery is disconnected without first pressing the stop switch when the low current shutdown is disabled.

80% Charged Point — A standard AC1000 Control will light the “80% Charged” LED and enable the charge termination routine when the battery voltage reaches 2.37 volts/cell. The 80% charged point can be programmed from 2.31 to 2.59 V/C, in 0.02 V/C steps. This allows the user to alter the battery’s time on charge when utilizing the voltage-time charge termination method.

Battery Voltage Discrimination —— An AC1000 Control will not initiate a charge cycle if the open circuit voltage of the battery is less than 1.75 volts/cell or greater than 2.30 volts/cell. The low battery discrimination feature can be overridden by simultaneously pressing the “Stop/Review” and the “Equalize” pushbuttons for two seconds while the “Lo B” status is displayed. This feature aids in the prevention of charger operation on mismatched batteries and chargers.

CAUTION: Care should be exercised when overriding the low battery discrimination feature as the charger will run for ten hours if a battery is connected to the charger with a lower number of cells than the charger is rated for.

Data Retention — The AC1000 Control uses EEPROM for all data retention. User programmed information and charge cycle data are stored in EEPROM for a minimum data retention time of ten years.

Delayed Start — The AC1000 Control can be programmed to delay the start of a charge cycle for a specific period of time. Any time period from 0 minutes to 23 hours and 45 minutes, in 15 minute increments, can be used for the delayed start period. When a AC1000 is programmed for delayed start, and a battery is connected to the charger, the display alternates between ds and —. This feature can be used to save on energy costs, provide a battery cool down period, or to prevent opportunity charging.

A standard AC1000 Control, when programmed for delayed start can be manually overridden by pressing the “Stop/Review” pushbutton while the start of the charge cycle is being automatically delayed by the control. The manual override feature allows the operator to start a charge cycle immediately if a battery is needed sooner than the delayed start time would allow.

Programmable Cool Down Time — A programmable cool down feature allows the battery to cool down for 0 to 8 hours before the charger signals charge complete. During the cool down period the alphanumeric display reads “Cool” . This feature allows the battery to cool down before being returned to use and can be used to minimize the battery maximum temperature during operation.

Extra Run Time —– The charge time can be extended past the normal charge termination point (pT/dV/dT or VT) from 0 to 60 minutes. If equalize has been selected, any extra run time programmed will not be added. This feature may be useful in some abnormal charging situations such as cold storage.

AC Reset Option - The charger can be set to automatically start a charge cycle whenever the AC power is removed and reconnected. This is useful for hard wired battery applications.

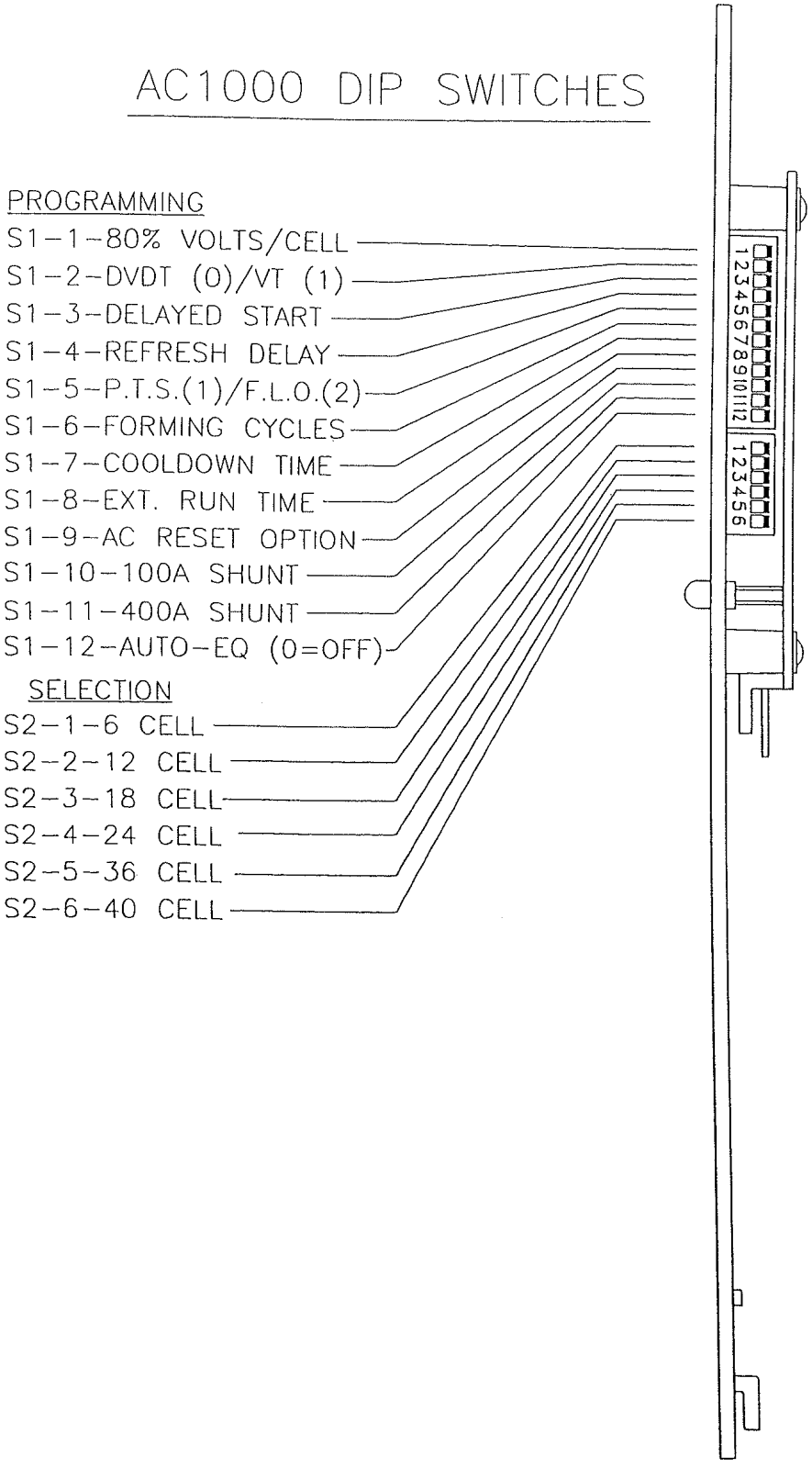
AC1000 DIP SWITCHES
PROGRAMMING
S1-1-80% VOLTS/CELL
S1-2-DVDT (0)/VT (1)
S1-3-DELAYED START
S1-4-REFRESH DELAY
S1-5-P.T.S.(1)/F.L.O.(2)
S1-6-FORMING CYCLES
S1-7-COOLDOWN TIME
S1-8-EXT. RUN TIME
S1-9-AC RESET OPTION
S1-10-100A SHUNT
S1-11-400A SHUNT
S1-12-AUTO-EQ (0=OFF)
SELECTION
S2-1-6 CELL
S2-2-12 CELL
S2-3-18 CELL
S2-4-24 CELL
S2-5-36 CELL
S2-6-40 CELL
1 2 3 4 5 6 7 8 9 10 11 12
1 2 3 4 5 6

Figure 6-1

Programming Your AC1000 Control

The AC1000 programming function allows 10 functions to be programmed to customize your AC1000 Control to your particular charging application. Programming is not available during an active charge cycle, and can only be accessed when no battery is connected to the charger. With no battery connected, the display will read "AC1" and DIP switches S1-1 thru S1-12 can be independently closed to program a particular charge parameter. The display will indicate the initial value of the parameter that is selected. The user can then press the "Equalize" or "Stop/Review" keys to increment or decrement the parameter to the desired value. The DIP switch is then returned to it's original position and the new parameter value is stored in the control.

Table 6-1 contains the programming steps required to change the number of automatic equalize cycles from the factory setting of 05 to 00 (automatic equalize Disabled). Descriptions of the programmable functions are listed after Table 6-1. If a programmable feature is modified by the user to a value other than the factory setting, then the **left-most decimal point on the display will blink on and off,** indicating the change. The factory settings for all of the features are also included below.

STEP	CONTROL DISPLAY READING
1.) Make sure that the battery is disconnected from charger.	"AC1"
2.) Close DIP switch S1-12	"05"
3.) Press the "Stop/Review" button until the display reading is "00".	"00"
4.) Open DIP switch S1-12	"AC1" - Left-most decimal point flashing
5.) Operation complete	"AC1" - Left-most decimal point flashing

Table 6-1
AC1000 Control Programming Example

80% Voltage (volts/cell) — The 80% voltage is adjustable from 2.31 to 2.59 volts/cell by 0.02 volts/cell steps. The setting is adjusted by closing DIP switch S1-1 with no battery connected to the charger, and using the "Equalize" and "Stop/Review" keys to set the desired volt/cell setting. Closing the DIP switch to the original "off" position will store the setting in the control memory. The factory setting is 2.37 volts/cell.

pT/dV/dT — To disable the factory pT/dV/dT charge termination setting, close DIP switch S1-2 to the "on" position with no battery connected to the charger, and using the "Equalize" and "Stop/Review" keys to select pT/dV/dT or VT (Voltage time Termination). The current setting will be displayed as listed below.

pT/dV/dT = dudt
VT = Lt

Closing the DIP switch to the original "off" position will store the setting in the control memory. The control is factory set to pT/dV/dT Termination.

Delayed Start — The time from battery connection to the start of a charge sequence is programmable from 0 minutes to 23 hours and 45 minutes in fifteen minute increments. The delay time is programmed by closing DIP switch S1-3 with no battery connected to the charger. The control is shipped from the factory with the delayed start time set to 0.

Refresh Delay — The time from a normal charge Termination to the start of a refresh charge is adjustable from 8 to 99 hours in 1 hour increments. The refresh delay time is programmed by closing DIP switch S1-4 with no battery connected to the charger. The control is shipped from the factory with the refresh delay time set to 72 hours.

Start mode — "Push to Start" or "Fault Lockout" modes of operation can be selected by closing DIP switch S1-5 to the "on" position, and using the "Equalize" and "Stop/Review" keys to select either mode of operation. The current setting will be displayed as listed below:

Normal (Auto Start) = AS
Push to Start = PS
Fault Lockout = FL

Closing the DIP switch to the original "off" position will store the setting in the control memory. The control is factory set to "Normal" start mode.

Forming Cycles — To select any number of forming cycles from 0 to 30, close DIP switch S1-6 to the "on" position, and using the "Equalize" and "Stop/Review" keys to select the number of forming cycles desired. Closing the DIP switch to the original "off" position will store the setting in the control memory.

Cool Down Delay — The battery cool down delay time is adjustable from 0 to 8 hours in 1 hour increments. The parameter is adjusted by closing DIP switch S1-7 with no battery connected to the charger and using the "Equalize" and "Stop/Review" keys to enter the desired cool down delay. The factory setting is 0 hours.

Extra Run Time — 0 to 60 minutes of extra charger run time after normal charge complete can be selected by closing DIP switch S1-8 to the "on" position, and using the "Equalize" and "Stop/Review" keys to select the desired number of minutes. Closing the DIP switch to the original "off" position will store the setting in the control memory. The control is factory set to 0 minutes of extra runtime after charge complete.

AC Reset Option - New charge cycle start after an AC Power failure can be selected by closing Dip Switch S1-9 to the "on" position and using the "Equalize" and "Stop/Review" keys to select "1" to turn it on and "0" to turn the function off.

Auto-Equalize Cycles — The number of complete charge cycles between equalize charges. This setting is programmed by closing DIP switch S1-12 with no battery connected to the charger. Setting this parameter to 0 disables the auto-equalize feature and equalize charge requests are performed by pressing the "Equalize" push-button on the control front panel. When the auto-equalize function is enabled (programmed to a value other than 0), then the "Equalize" push-button cannot be used to request an equalize charge. The AC1000 Control is shipped from the factory with the auto-equalize feature set for every five cycles.

TROUBLESHOOTING

Troubleshooting Table

SYMPTOM	PROBABLE CAUSES	ACTION	
		PARAGRAPH	PAGE
No Display And No LED's	(1) No AC Voltage To Charger	7.01	7-5
	(2) Input Fuse (s) Blown	7.02	7-5
	(3) Control Trans. Breaker Tripped	7.03	7-5
	(4) Bad Control Transformer	7.04	7-5
	(5) Wrong Control Trans. Connection	7.05	7-5
	(6) Bad Harness/Connection – Loose or Incorrect	7.06	7-5
	(7) Bad Control Board	7.07	7-5
Bad Lamp Test	(1) Bad Control Board	7.07	7-5
Display Illegible	(1) Noisy Environment	7.08	7-5
	(2) Low Input Voltage	7.09	7-5
	(3) Bad Control Transformer	7.04	7-5
	(4) Bad Control Board	7.07	7-5
Charger Doesn't Respond To Battery Being Connected	(1) Output Fuse Bad	7.10	7-5
	(2) Bad Harness/Connections – Loose Or Incorrect	7.06	7-5
	(3) Bad Control Board	7.07	7-5
	(4) Output Cables Reversed	7.11	7-6
	(5) Bad Output Connector	7.12	7-6
Control Not Responding (Locked Up)	(1) Noisy Environment	7.08	7-5
	(2) Low Input Voltage	7.09	7-5
	(3) Power Interruption	7.08	7-5
Battery has Low S.G.'s	(1) Reading Not Temperature Corrected	7.13	7-6
	(2) Bad Battery	7.14	7-6
	(3) Bad Equalize Schedule	7.15	7-6
Battery Doesn't Last Full Shift	(1) Faulty Lift Interrupt	7.16	7-6
	(2) Manual Disconnect	7.17	7-7
	(3) A.H. Required > Battery Nameplate	7.18	7-6
	(4) Battery Not Providing Nameplate Rating	7.14	7-6
	(5) Bad Equalize Schedule	7.15	7-6

SYMPTOM	PROBABLE CAUSES	ACTION	
		PARAGRAPH	PAGE
Battery Water Usage Is Too High	(1) Charger Too Large For Battery	7.22	7-6
	(2) Bad Equalize Schedule	7.15	7-6
	(3) Control Set For Voltage/Time	7.19	7-6
Low Number Of A.H.'s Returned To Battery	(1) Faulty Lift Interrupt	7.16	7-6
	(2) Battery Not Fully Discharged	7.20	7-6
	(3) Manual Disconnect	7.17	7-6
	(4) Battery Not Providing Nameplate Rating	7.14	7-6
	(5) Bad Control Board	7.07	7-5
Battery Temperature Too High	(1) Insufficient Cool Down Before And/Or After Charging	7.21	7-6
	(2) Battery Power Demand Too Great	7.18	7-6
	(3) Charger Too Large For Battery	7.22	7-6
	(4) Bad Equalize Schedule	7.15	7-6
	(5) Control Set For Voltage/Time	7.19	7-6
Incorrect Charge Rate	(1) Battery A.H. Not Equal To Charger A.H.	7.22	7-6
	(2) Bad Control Board	7.07	7-5
Charger Doesn't Shutdown When Battery Is Disconnected	(1) Bad Control Board	7.07	7-5
Noisy Unit	(1) Loose Sheet Metal	7.23	7-6
	(2) Bad Contactor	7.24	7-6
	(3) Loose Transformer Mounting	7.25	7-7
	(4) Noisy Transformer	7.26	7-7
	(5) Placed On Rack That Makes Noise	7.27	7-7
Meter Reading Wrong (V/C)	(1) Bad Output Connector	7.12	7-6
	(2) Bad Harness/Connections – Loose or Incorrect	7.06	7-5
	(3) Internal Power Connection	7.28	7-7
	(4) Bad Control Board	7.07	7-5

SYMPTOM	PROBABLE CAUSES	ACTION	
		PARAGRAPH	PAGE
Meter Reading Wrong (V/C)	(1) Bad Output Connector	7.12	7-6
	(2) Bad Harness/Connections – Loose Or Incorrect	7.06	7-5
	(3) Internal Power Connection	7.28	7-7
	(4) Bad Control Board	7.07	7-5
Meter Reading Wrong (Amps)	(1) Control Board Shunt DIP Switch Set Incorrectly	7.29	7-7
	(2) Bad Output Connector	7.12	7-6
	(3) Bad Harness/Connections – Loose or Incorrect	7.06	7-5
	(4) Internal Power Connection	7.28	7-7
	(5) Bad Control Board	7.07	7-5
	(6) Bad/Incorrect Shunt	7.30	7-7
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	(7) Bad Transformer	7.34	7-7
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SYMPTOM	PROBABLE CAUSES	ACTION	
		PARAGRAPH	PAGE
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	(5) Bad Control Board	7.07	7-5

Action

7.01 Refer to the INSTALLATION chapter in the charger manual.

7.02 Disconnect AC power and replace the bad AC fuse. Reapply AC power to the charger. If the fuse (s) blows instantly, check the connections on the input side of the contactor to make sure there are no shorts between any of the input wires . If that's okay, then check or change the control transformer. If the fuse (s) blow after the contactor closes, then check the input wiring from the contactor to the main transformer (s). Refer to the charger manual and locate the diagram for your charger to confirm that the charger is wired correctly. Also check the wires going up to the terminal block on the transformer, the wires will have numbers that correspond to the number on the terminal block. If they are incorrect, change them and start over. If it still blows fuse (s), the transformer will have to be replaced.

7.03 Disconnect AC power and reset the breaker. Disconnect the control and reapply AC power to the charger. Measure to see if 24VAC is on the output side of the control transformer. If there is, the control has failed. If there isn't 24VAC, then replace the control transformer. It is still possible that the control has failed; so once the control transformer is replaced, measure to see if the 24VAC drops once the control is connected.

7.04 Check and see if any input fuses are blown. Visually inspect the control transformer for discoloration on the casing of the input side of the control transformer. Disconnect the control before applying AC power. Once AC power is reapplied, measure the input voltage to the control transformer, it should be the AC supply voltage (208/240/480) (240/480/575). If not, check the control transformer input wiring. If you did read the supply voltage, then measure the output side and you should read 24VAC. If not, replace the control transformer.

7.05 Look at the casing of the control transformer on the input side. Reference the charger manual to determine the input. There will be four pins and each one will be labeled as follows: COM (common), 208 (208VAC), 240 (240VAC), and 480 (480VAC). Some chargers are equipped with higher input voltage control transformers labeled as follows: COM (common), 240 (240VAC), 480 (480VAC), and 575 (575VAC). There should always be a wire on the common terminal no matter what voltage is applied to the charger, and the second wire will go to the pin labeled as the voltage that is applied to operate the charger. Measure the voltage on the output side of the control transformer, it should read approximately 24VAC.

7.06 A bad harness/connection can cause many different problems. The best way to confirm a bad harness/connection problem is to take measurements where the harness is connected to the charger and then follow the wire (s) up the harness to the PC boards and measure there also. The measurement should match what was measured at the charger connection. If it doesn't, check the following: Check the connectors at the square plugs where the control harness connects to the charger harness, the connectors could be pressed out of the plugs. Make sure the connectors look okay inside the edge mount connector at the PC board (s). Make sure the harness connections are tight where they connect to the charger. Make sure the wires are crimped to the terminals tightly and also check to make sure that they are crimped to the bare wire and not to the insulation only.

7.07 To check the Control Board for proper operation, first check the DIP Switch settings of S2. Make sure the proper cell size is set to match the charger. Also make sure the shunt size setting matches the shunt in the charger (See Programming Your AC1000 Control page 6-2). If the control still does not operate properly even though the above settings are correct, the Control Board still may need to be replaced. However, this is unlikely and all other possibilities should be taken before this step.

7.08 Temporarily shut down any equipment on the same voltage supply line and see if the control starts to respond normally. If the control does, then check all grounds going to the equipment that is shut down. If the problems still exist, then return power to all the other equipment and call your local Prestolite Power Representative.

7.09 Measure the AC supply voltage coming into the charger to confirm that it matches the charger input tap settings.

7.10 Use an Ohmmeter and measure directly across the DC Fuse. A good fuse will measure almost (0) Ohms and a bad one will measure a very high resistance, in the megohm range or greater. If for some reason a DC fuse measures somewhere in between, replace the DC fuse and send it in to your local Prestolite Power Representative.

7.11 Refer to the DIAGRAM chapter in the owners manual and locate where the output cables connect to the charger. The black (Negative) output cable goes into the charger and connects to a bus bar on the end of the DC fuse which is located on the left portion of the interior panel. The red (Positive) output cable goes into the charger and connects to the flat heat sink plate at the rear of the charger. The output connector will have a (+) and (-) symbol on it. The (+) terminal should have the red output cable connected to it, and the (-) should have the black output cable connected to it.

7.12 Make sure the output connector does not have any cracks on its casing that could result in a short. Make sure the output cable lugs are making a good connection with the battery connector. You will see traces of pitting on the lug surface from arcing if there isn't a good connection. This could be the result of a weak retainer clip in the connector or lugs that were soldered on incorrectly. If the lugs had too much heat applied to tem when the cables were soldered on, the solder will wick up the cable and make it very stiff. When they are inserted into the connector, the stiff cable forces the retainer clip down and creates poor connection between the battery connector and the charger connector.

7.13 Specific Gravity readings vary with the temperature of the electrolyte. To temperature correct the readings to match the nameplate ratings of the battery, use the following rule of thumb: +1 S.G. point per 3 degrees F. increase of the electrolyte temperature from 77 degrees F.

7.14 Take "Specific Gravity" readings and measure "Cell Voltages". If acid has been spilled or the battery has been extremely heated, it is possible that a battery's capacity could be greatly reduced, and the acid is not capable of increasing to the battery nameplate rating.

7.15 The proper equalize schedule is one that is tailored to the specific battery and charger operation. The AC1000 auto equalize feature can be used to automate the equalize schedule (see the "AC1000 Control Features" chapter of this manual).

7.16 A faulty lift interrupt on a lift truck can cause the battery to be over or under discharged. Check the interrupt voltage of the interrupt following the procedures found in your truck and/or lift interrupt operators' manual (s).

7.17 Repeated manual disconnecting of the battery from the charger before complete can cause long term battery damage and lead to inefficient truck/battery operations. When it is necessary to stop the charge cycle before charge complete, *always terminate the charge cycle by pressing the STOP button before disconnecting the battery from the charger.*

7.18 If the application requires a larger AH battery than is presently in use, the only long term solution is to replace the battery with one of the proper AH rating.

7.19 Set the control to PDV/DT termination (see the "Initial Set-Up" chapter of this manual).

7.20 If fully discharged batteries are desired for efficient operations, lift interrupts can be installed on the trucks to allow the operators to recognize a fully discharged battery.

7.21 A cool down can be programmed into the AC1000 control to add a specified cool down time between charge termination and the signaling of charge complete (see the "Programming Your AC1000 Control" chapter of this manual). A delayed start can be programmed into the AC1000 control to add a specified delay time between battery connection and the start on the charge (see the "Programming Your AC1000 Control" chapter of this manual).

7.22 Check the charger A.H. rating. If it does not match the battery nameplate A.H. rating (it should be within 20% of the battery nameplate rating), then the battery should be charged using a charger with the correct output rating to match the battery rating within 20%.

7.23 Check and tighten all sheet metal fasteners (screws and bolts).

7.24 If the contactor is not functioning properly, then check the voltage across the contactor coil. If the voltage is 24VAC +/- 10%, replace the contactor with a properly functioning part.

7.25 Check and tighten all transformer mounting screws.

7.26 Check transformer for visible damage. Coat the transformer coil with a Prestolite approved (contact Prestolite Service) air dry varnish. If that fails to reduce the noise level, drive a shim of the proper material (contact Prestolite Service) between coil and core.

7.27 Check for and tighten any loose fasteners on the rack. Remove any lightweight loose objects that are on the rack near the charger.

7.28 Check charger internal connection points that visually appear to be poorly connected or heat damaged. Any connections that appear loose or overheated must be re-lugged. Recheck any repaired connections by performing a continuity test.

7.29 Check the shunt size DIP switch setting (see the "Initial Set-Up" chapter in this manual) and ensure that it matches the shunt in the charger.

7.30 Replace damaged and/or incorrect shunt with one of correct size.

7.31 Reconnect transformer primary wiring to match the schematic in the charger manual.

7.32 Reconnect transformer secondary wiring to match the schematic in the charger manual.

7.33 Check the diode as described below. If it tests faulty, replace with a diode of the proper type.

Connect a VOM set on the 1k Ohms scale; positive to diode anode, negative to diode cathode . The VOM should read a low impedance (near short circuit). Reverse the meter leads; in this direction, the meter should read a high impedance ($\geq$ 1K Ohms). (A DVM may be used if it is set to the diode scale.) A high impedance will be indicated by an over range indication (usually OL); a low impedance will be indicated by a low reading of about 1.00 .

7.34 AC fuses are most likely to have failed. Visually inspect the transformer. If a winding has failed, the winding will appear to be burnt or look black. The varnish might be flaking off. Refer to the "Diagram" chapter in the charger manual and locate the diagram for your charger. On the diagram, there will be a winding configuration for the transformer . With power removed, disconnect the diodes from the transformer. Reapply AC to the charger. Measure the transformer secondary voltage. If less than 25 VAC is present, replace the transformer.

7.35 Refer to the "Installation" chapter in the charger manual and reconnect the input primary jumpers to match the input voltage. Be sure to connect the control transformer primary properly.

7.36 Check the charger A.H. rating. If the battery A.H. rating exceeds the charger nameplate rating by more than 20%, then the battery should be charged using a charger with a higher A.H. capacity.

7.37 If the battery has been over discharged and the open cell voltage is less than 1.75 volts/cell, then the low battery reject feature is enabled. The control will not start the charge until the battery voltage rises or the user overrides the low battery reject mode. See the "AC1000 Control Features" chapter of this manual for details concerning the low battery reject feature. An over discharged battery could be indicative of a faulty lift interrupt.

7.38 The battery connected to the charger may be the wrong cell size for the charger. Check the nameplate on the battery and verify that it matches the cell size of the charger.

7.39 Hold in the "Manual Stop" and "Equalize" buttons simultaneously for two seconds until the display reads "EEEE". Release the two buttons. The control should now function properly.

7.40 Measure the DC voltage between connector pins J3-5 and J3-1 on the control PC board: positive of DMM to J1-5, negative of DMM to J1-3. The measured voltage should be between 1.00 and 1.86 VDC. If the measured voltage is out of range, remove the jumper from the connector and inspect it for loose or damaged connections.

PARTS LIST

ITEM NO.	ITEM DESCRIPTION	PART NUMBER
1	CONTROL PC BOARD	196914-001
2	PLASTIC PRESS RIVET	193101-001

WARRANTY

AMETEK/PRESTOLITE POWER "FERRORESONANT" INDUSTRIAL BATTERY CHARGERS

Ametek/Prestolite Power (hereinafter called "Prestolite") warrants that each new and unused Industrial Battery Charger manufactured and supplied by it is of good workmanship and is free from any inherent mechanical defects, provided that (1) the product is installed and operated in accordance with generally accepted industrial standards and in accordance with the printed instructions of Prestolite, (2) the product is used under normal conditions for which designed, (3) the product is not subjected to misuse, negligence or accident, and (4) the product receives proper care, protection and maintenance under supervision of competent personnel. This warranty is subject to the following provisions:

1. **PRODUCT AND PARTS WARRANTED.** Subject to the exceptions listed below each Industrial Battery Charger is warranted for a specific period of time commencing from the date of it's shipment by Prestolite, provided the charger is used in accordance with Prestolite's published performance rating for the unit involved. The exceptions to this warranty are as follows:

   a) Terms and conditions for warranty coverage:

FERRORESONANT PRODUCTS	ACCU CHARGER	BATTERY MATE 100	BATTERY MATE 80	BATTERY MATE 60
FULL COVERAGE - LABOR, TRAVEL, MILEAGE & PART REPLACEMENT	10-year "full"	10-year "full"	1-year	1-year
PRINTED CIRCUIT BOARD (REPLACEMENT ONLY)				
TRANSFORMER, INDUCTOR, SCR & DIODE (REPLACEMENT ONLY)			9-years additional	9-years additional
TOTAL WARRANTY TERM (YEARS)	10-years	10-years	10-years	10-years

   b) Warranty Expense Limitation: The maximum warranty expense Prestolite will incur for any Battery Charger will be limited to the original purchase price of the Battery Charger.

   c) Primary switch contacts, fuses, bulbs and filters are not warranted unless found to be defective prior to use.

2. **COMMENCEMENT OF WARRANTY TIME PERIODS.** The warranty periods indicated in the Warranty Schedule shall commence on the date of shipment by Prestolite. The ACCU CHARGER and BATTERY MATE 100, 10-year full warranty only applies to chargers manufactured after the 4th quarter of 2004. Units manufactured previous to the 4th quarter will have 1-year full, plus 9-years parts limited coverage.

3. **PERSONS COVERED BY WARRANTY.** Prestolite extends this warranty only to the purchaser of new equipment from Prestolite or one of its authorized distributors. The products purchased under this agreement shall be used exclusively by the buyer and its employees and by no other persons; and therefore there shall be no third party beneficiary to this warranty.

4. **LIMITATION OF REMEDY**. The existence of claimed defects in any product covered by this warranty is subject to Prestolite's factory inspection and judgement. Prestolite's liability is limited to repair of any defects found by Prestolite to exist or, at Prestolite's option, the replacement of the defective product F.O.B. factory after the defective product has been returned by the purchaser at its expense to Prestolite's shipping place. Replacement and exchange parts will be warranted for the remainder of the original Industrial Battery Charger Warranty or for a period of ninety (90) days, whichever is greater.

5. **USE OF DEFECTIVE PRODUCT.** Continued use of an Industrial Battery Charger after discovery of a defect VOIDS ALL WARRANTIES.

6. **ALTERED EQUIPMENT.** Except as authorized in writing, the warranty specified does not cover any equipment that has been altered by any party other than Prestolite.

THIS WARRANTY IS GIVEN AND ACCEPTED IN LIEU OF ALL OTHER WARRANTIES, WHETHER EXPRESS OR IMPLIED, INCLUDING WITHOUT LIMITATION ANY WARRANTIES OF MERCHANTABLILITY OR FITNESS FOR A PARTICULAR PURPOSE, OTHER THAN AS EXPRESSLY SET FORTH HEREIN. IN NO EVENT SHALL PRESTOLITE BE LIABLE FOR ANY ANTICIPATED OR LOST PROFITS, SPECIAL, DIRECT, INDIRECT OR INCIDENTAL DAMAGES, CONSEQUENTIAL DAMAGES, TIME CHARGES OR OTHER COMMERCIAL EXPENSES OR LOSSES, AND BUYER ASSUMES ALL RISK AND LIABILITY RESULTING FROM USE OF THE GOODS. PRESTOLITE DOES NOT AUTHORIZE ANY REPRESENTATIVE OR OTHER PERSON TO ASSUME ON BEHALF OF PRESTOLITE ANY OTHER LIABILITY IN CONNECTION WITH THE SALE OR USE OF THE GOODS SOLD, AND THERE ARE NO ORAL AGREEMENTS OR WARRANTIES COLLATERAL TO OR AFFECTING THIS WRITTEN WARRANTY.

WARNING

At all times, safety must be considered an important factor in the installation, servicing and operation of the product and skilled, qualified technical assistance should be utilized.

AMETEK/PRESTOLITE POWER - TROY, OHIO USA

Data Sheet: 1153
Index: 030105
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