Operating and Service Instructions

AT10.1 SERIES

MICROPROCESSOR-CONTROLLED

FLOAT BATTERY CHARGER

SINGLE PHASE INPUT

GROUP I

(6-25 Adc OUTPUT)

ALCAD

STANDBY BATTERIES

3 Powdered Metals Drive
North Haven, CT 06473-3209
Tel.: (203) 985-2500
Fax: (203) 985-2539
www.alcadusa.com

HOW TO READ THE ALCAD AT10.1 MODEL NUMBER

GROUP I RATINGS (6-25 Adc)

Your **AT10.1** model number is coded to describe the options that are included. Please find the model number on the data nameplate and write it in the spaces provided below. Then follow the chart to determine the configuration of your battery charger.

AT10	-		-		-							
A		B		C		D	E	F	G	H	J	K

	DESCRIPTION	CODE	FEATURE
A	SERIES	AT10	AT10.1 CHARGER
B	NOMINAL DC OUTPUT VOLTAGE	012	12 Vdc
		024	24 Vdc
		048	48 Vdc
		130	130 Vdc
C	NOMINAL DC OUTPUT CURRENT	006	6 Adc
		012	12 Adc
		016	16 Adc
		020	20 Adc
		025	25 Adc
D	AC INPUT VOLTAGE	0	120/208/240 Vac 60 Hz [1]
		1	480 Vac 60 Hz [2]
		2	220 Vac 50/60 Hz [3]
		3	380 Vac 50/60 Hz [3]
		4	416 Vac 50/60 Hz [3]
E	CIRCUIT BREAKER RATING (SEE TABLE)	1	STANDARD
		2	MEDIUM AIC
		3	HIGH AIC
	DESCRIPTION	CODE	FEATURE

	DESCRIPTION	CODE	FEATURE
F	FILTERING	0	UNFILTERED
		1	FILTERED
		2	BATT ELIMINATOR
G	ALARMS	2	STANDARD (NO AUX BOARD)
		3	AUX RELAY BOARD, STANDARD BKRS.
		4	AUX RELAY BOARD, MED/HI AIC BKRS.
H	LIGHTNING ARRESTOR	0	NOT SUPPLIED
		1	SUPPLIED
J	GROUND BUS	0	NOT SUPPLIED
		1	SUPPLIED
K	SPECIAL TREATMENTS	0	NONE
		1	FUNGUS PROOFING
		2	STATIC PROOFING
		3	FUNGUS & STATIC PROOFING
	DESCRIPTION	CODE	FEATURE

1 - 120/208/240 Vac multi-tap input - Unit is wired and shipped from factory at specified voltage.
2 - 480 Vac input requires addition of medium or high ampere interrupting capacity circuit breakers.
3 - Special order - Please consult factory for availability.

INPUT AND OUTPUT CIRCUIT BREAKER INTERRUPTING RATINGS

CODE E	TYPE	AC RATINGS (ALL INPUT VOLTAGES)	DC RATINGS (125 Vdc)
1	STANDARD	240 Vac: 10,000 AIC	10,000 AIC [4] 5,000 AIC [5]
2	MEDIUM AIC	240 Vac: 25,000 AIC 480 Vac: 18,000 AIC	10,000 AIC
3	HIGH AIC	240 Vac: 65,000 AIC 480 Vac: 25,000 AIC	25,000 AIC

4 - Rating applies to 130Vdc 16-25 Adc units.
5 - Approximate rating applies to all other units.

NOTE:

The model number listed on the charger data nameplate does not include any field-installed options. Also, certain accessories are not included in the model number, even if they are shipped with the charger. Check off below any accessories that were included, or that you install yourself.

- ☐ floor/rack mounting brackets
- ☐ NEMA-2 type drip shield assembly
- ☐ NEMA-4/12/13 type enclosure
- ☐ cabinet heater assembly
- ☐ pad lock for front panel door
- ☐ zero-center ground detect meter
- ☐ analog ac voltmeter (penthouse-mounted)
- ☐ analog ac ammeter (penthouse-mounted)
- ☐ barrier type auxiliary alarm terminal block
- ☐ external temperature compensation probe
- ☐ DNP3 Level 2 / Modbus communications module
- ☐ forced load sharing interconnection cable

Please find the serial number on the data nameplate and record it here: _____

PLEASE READ AND FOLLOW ALL SAFETY INSTRUCTIONS

1. Before using this equipment, read all instructions and cautionary markings on: A) this equipment, B) battery, and C) any other equipment to be used in conjunction with this equipment.
2. This manual contains important safety and operating instructions, and therefore should be filed for easy access.
3. Remove all jewelry, watches, rings, etc. before proceeding with installation or service.
4. Do not touch any uninsulated parts of this equipment, especially the input and output connections, as there is the possibility of electrical shock.
5. During normal operation, batteries may produce explosive gas. Never smoke, use an open flame, or create arcs in the vicinity of this equipment or the battery.
6. Maintain at least 6in / 152mm clearance from all obstructions on the top, bottom and sides of this equipment. Allow sufficient clearance to open the front panel for servicing.
7. Turn this equipment off before connecting or disconnecting the battery to avoid a shock hazard and/or equipment damage.
8. Connect or disconnect the battery only when the battery charger is off to prevent arcing or burning.
9. De-energize all ac and dc inputs to the battery charger before servicing.
10. Do not operate battery charger if it has been damaged in any way. Refer to qualified service personnel.
11. Do not disassemble battery charger. Only qualified service personnel should attempt repairs. Incorrect reassembly may result in explosion, electrical shock, or fire.
12. Do not install the battery charger outdoors, or in wet or damp locations unless specifically ordered for that environment.

PLEASE READ AND FOLLOW ALL SAFETY INSTRUCTIONS

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**** Note:** A **customized record drawing package** is available for your AT10.1 battery charger, featuring an itemized internal component layout, electrical schematic with component ratings, and a full connection diagram. If the standard drawings featured in this manual are not sufficient, please contact your Sales Representative for drawing availability from the battery charger manufacturer.*

1. RECEIVING THE AT10.1

1.1. STORING THE AT10.1

If you store the AT10.1 for more than a few days before installation, you should store it in its original shipping container, and in a temperature controlled, dry climate. Ambient temperatures of 32 to 122° F / 0 to 50° C are acceptable. Storage should not exceed 2 years due to the limited shelf life of the dc filter capacitors when they are not in service.

1.2. REPORTING SHIPPING DAMAGE

If, on delivery of the AT10.1 or related goods, you discover any damage or shortage, make notation on all copies of delivering carrier's delivery receipt before signing, and notify the delivery person of your findings. If loss or damage is discovered after delivery, notify delivering carrier immediately and request an inspection. The manufacturer does not assume any liability for damage during transportation or handling.

Should the goods require an inspection by or return to the manufacturer, please contact your sales representative for further instructions. Any returned material must be properly packed in compliance with shipping regulations. It is preferable to use the original shipping materials if possible. Mark the outside of the shipping container with the Return Material Authorization (RMA) number issued by the manufacturer.

1.3. UNPACKING AND INSPECTING THE AT10.1

Carefully remove all shipping materials from the AT10.1. Remove the AT10.1 from the shipping pallet for inspection. Save all shipping materials until you are sure that there is no shipping damage.

Once the AT10.1 is unpacked, inspect the unit for possible shipping damage, using the checklist below. If shipping damage has occurred, please refer to Section 1.2 on this page for proper reporting.

INSPECTION CHECKLIST

- ☐ Enclosure exterior and interior are not marred or dented.
- ☐ There is no visible damage to exterior or interior components.
- ☐ All internal components are secure.
- ☐ Printed circuit boards are firmly seated on their standoffs.
- ☐ All hardware is tight.
- ☐ All wire terminations are secure.
- ☐ The User's Manual is included.
- ☐ You received all items on the packing list.

1.4. MOVING THE AT10.1

Once you have established that the AT10.1 is undamaged, identify the enclosure style and weight of your unit. Refer to the table below.

AT10.1 Enclosure Type And Shipping Weight Table
Group I Cabinets (**Style-586** / **Style-594**)

Output Voltage	Ampere Rating				
	6 Adc	12 Adc	16 Adc	20 Adc	25 Adc
12 Vdc	Style-586 44 lbs 20 kg	Style-586 44 lbs 20 kg	Style-586 67 lbs 30 kg	Style-586 67 lbs 30 kg	Style-586 67 lbs 30 kg
24 Vdc	Style-586 44 lbs 20 kg	Style-586 58 lbs 26 kg	Style-586 75 lbs 34 kg	Style-586 75 lbs 34 kg	Style-586 75 lbs 34 kg
48 Vdc	Style-586 58 lbs 26 kg	Style-586 75 lbs 34 kg	Style-594 110 lbs 50 kg	Style-594 110 lbs 50 kg	Style-594 110 lbs 50 kg
130 Vdc	Style-586 80 lbs 36 kg	Style-594 147 lbs 67 kg	Style-594 193 lbs 88 kg	Style-594 193 lbs 88 kg	Style-594 193 lbs 88 kg

NOTE: Actual unit is approximately 20 lbs / 9kg below listed shipping weight in table.

The **Style-586** & **594** enclosures do not feature lifting eyes for moving. Instead, whenever possible move the unit with a forklift truck using the supplied shipping pallet. To hoist the unit into a wall-mount or rack-mount location, use a heavy-duty sling applicable to the enclosure size and unit weight. To relocate the **Style-586** & **594** enclosures, use the aforementioned sling on a hoist or forklift truck.

1.5. MOUNTING THE AT10.1

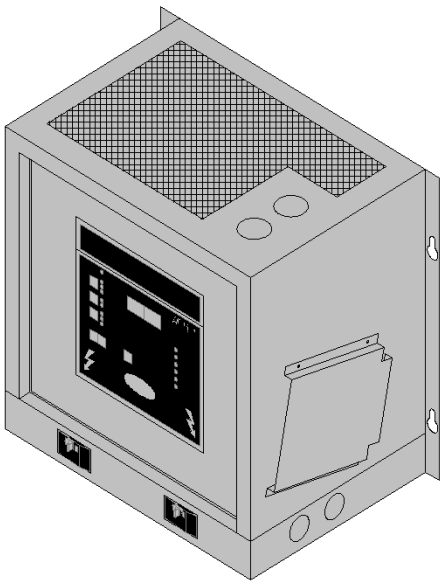
Chose the mounting method for the unit enclosure from the table below.

MANUAL SECTION	MOUNTING METHOD	ENCLOSURE	
		Style-586	Style-594
1.5.1	Wall-Mounting	**STANDARD**	**STANDARD**
1.5.2	Floor-Mounting	OPTIONAL	OPTIONAL
1.5.3	19in / 483mm Rack-Mounting	OPTIONAL	N/A
	23-24in / 584-610mm Rack-Mounting	OPTIONAL	OPTIONAL

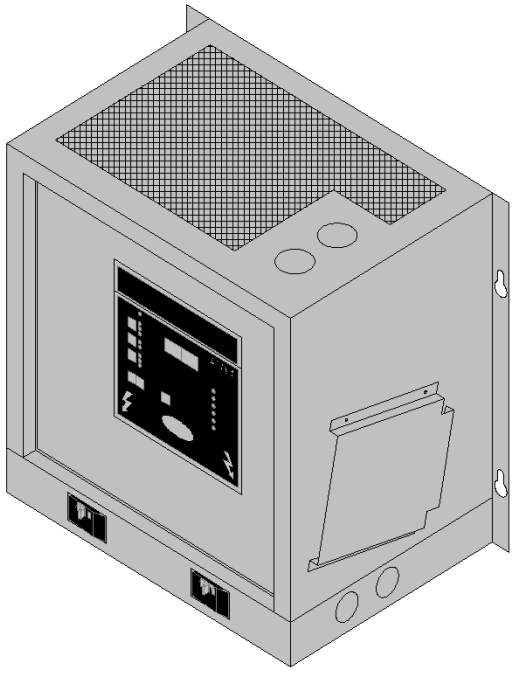
1.5.1. Wall-Mounting the AT10.1

Wall-mounting the AT10.1 battery charger is the standard way to install the Group I enclosures (Style-586/594). In planning for wall mounting of the AT10.1 consider the following:

1. The wall must be strong enough to properly support the weight of the AT10.1. See the Weight Table located in Section 1.4 on page 3. The weight of your AT10.1 may be different from the table value, depending on options or accessories you ordered.
2. Select conduit entrances carefully. Use of the pref-fab knockouts on the sides or bottom of the enclosure will allow removal of the cabinet shroud (and internal access for servicing) without removal of unit from the wall.
3. The location:
   - Should be free of drips and splatter. If dripping liquids are a problem, install a drip shield kit (EI0191-00). For kit availability, see ordering information in Appendix B on page 71.
   - Should be between 32 and 122 °F / 0 and 50 °C, with relative humidity between 5 and 95% non-condensing.
   - Must be free of explosive materials.
4. Maintain at least 6in / 152mm of free air on top, bottom and both sides for cooling air.
5. Allow 36in / 914mm front clearance for operation and maintenance.



Style-586 Enclosure

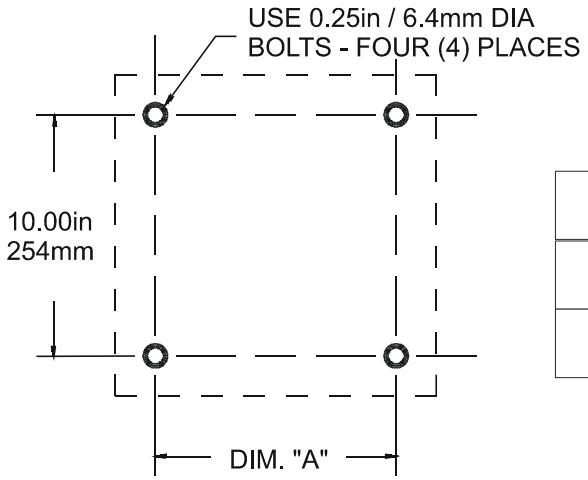


Style-594 Enclosure

PROCEDURE

To wall-mount the AT10.1, install four (4) .25in / 6.4mm bolts on the wall rated to support the charger weight plus a safety factor of at least two (2) times. Place the AT10.1 on the bolts, add appropriate mounting hardware and tighten. Refer to the graphics below for mounting dimensions and specifications.

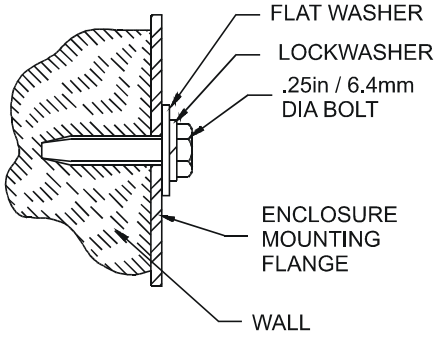
WALL-MOUNTING THE AT10.1 - GRAPHICS



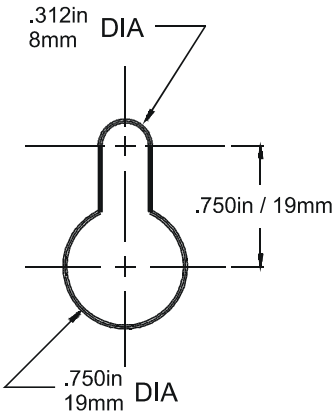
MOUNTING BOLT PATTERN

AT10.1 MOUNTING DIMENSION

ENCLOSURE	DIM. "A"
Style-586	15.00in / 381mm
Style-594	18.25in / 464mm



RECOMMENDED MOUNTING HARDWARE LOADING



KEYHOLE SLOT USED ON AT10.1 MOUNTING FLANGE

NOTE:

1. For further AT10.1 standard cabinet information, see the outline drawings for the Style-586 (**JE5023-03**) and Style-594 (**JE5024-03**) enclosure in Appendix C on pages 72 and 73.

1.5.2. Floor-Mounting the AT10.1

To floor mount the AT10.1, you must use the floor mounting accessory kit (EI0192-00). For kit availability, see ordering information in Appendix B on page 71. The kit contains brackets that elevate the top of the AT10.1 approximately 47in / 1194mm above floor level, with provision for floor anchoring. The kit includes an instruction sheet (JA0083-00) showing assembly dimensions and mounting details.

You must locate the anchor-bolt holes at least 4.25in / 108mm from any wall, to allow clearance for the charger enclosure behind the mounting brackets. In addition, you must consider the following:

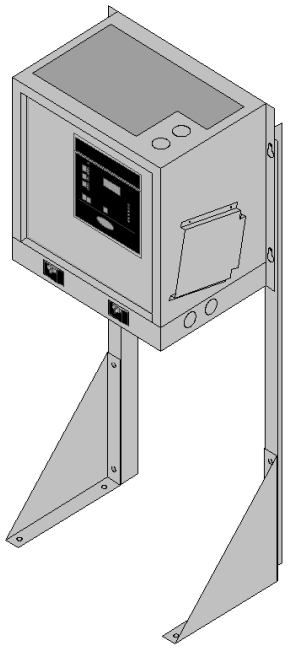
1. Placement of conduit entrances (use the knockouts on the sides or bottom of the charger to allow access for servicing without removing the unit from the mounting brackets).
2. The location:
   - Should be free of drips and splatter. If dripping liquids are a problem, install a drip shield kit (EI0191-00). For kit availability, see ordering information in Appendix B on page 71.
   - Should be between 32 and 122 °F / 0 and 50 °C, with relative humidity between 5 and 95% non-condensing.
   - Must be free of explosive materials.
3. Maintain at least 6in / 152mm of free air on top, bottom and both sides for cooling air.
4. Allow 36in / 914mm front clearance for operation and maintenance.

PROCEDURE

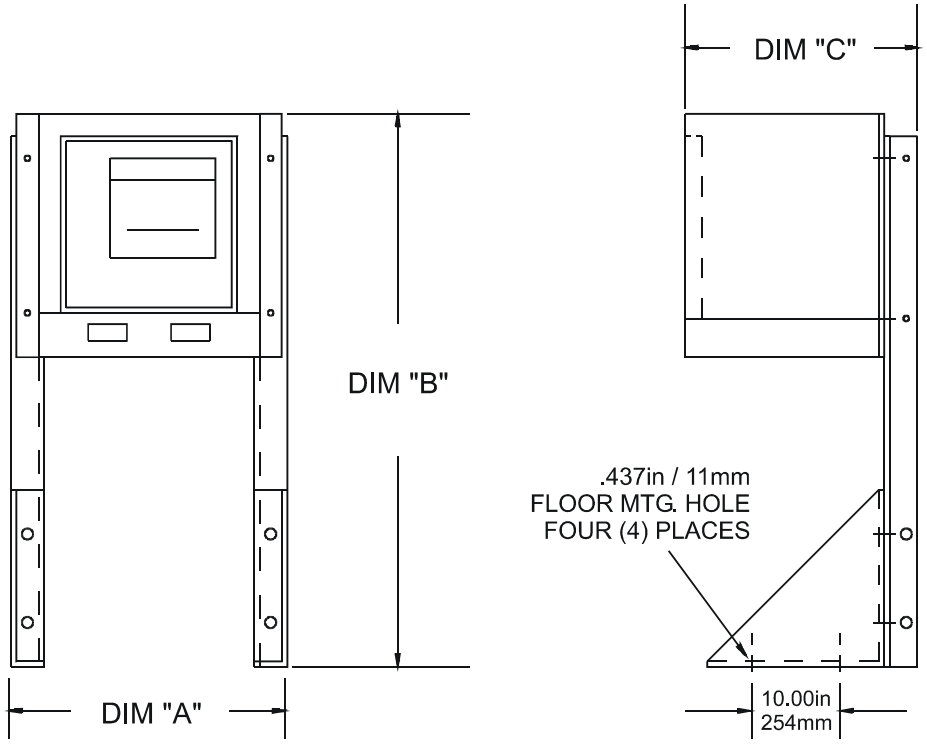
To floor-mount the AT10.1, follow the directions featured in instruction sheet (JA0083-00), included with your floor-mounting kit (EI0192-00). These instructions showing assembly dimensions and mounting details.

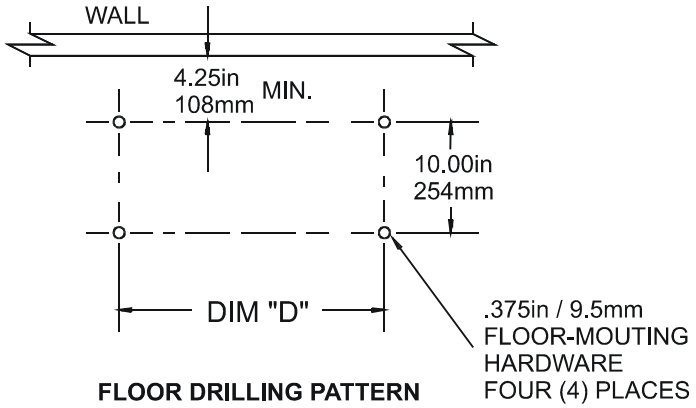
Place the AT10.1 assembly on the mounting bolts, add appropriate mounting hardware and tighten.

Reference the graphics on the next page.



FLOOR-MOUNTING THE AT10.1 - GRAPHICS





FLOOR DRILLING PATTERN

ENCLOSURE	DIMENSION (in / mm)			
	A	B	C	D
Style-586	16.50 / 419	46.63 / 1184	11.75 / 298	15.00 / 381
Style-594	19.75 / 502	47.75 / 1213	14.25 / 361	18.25 / 463

1.5.3. Rack-Mounting the AT10.1

The AT10.1 can be installed in most relay racks with standard EIA hole spacing (see the table below for the allowable combinations). The rack mounting kit (EI0193-00), includes mounting brackets and the necessary hardware to install one AT10.1 battery charger. The kit includes an instruction sheet (JA0091-00) showing installation details. For kit availability see ordering information in Appendix B on page 71.

When rack mounting the AT10.1, you must consider the following:

1. The rack must be strong enough to properly support the weight of the AT10.1. See the Weight Table located in Section 1.4 on page 3.
2. Placement of conduit entrances (be sure the knockouts on the sides or bottom of the charger are accessible after the charger is rack-mounted).
3. The location:
   - Should be free of drips and splatter. If dripping liquids are a problem, install a drip shield kit (EI0191-00). For kit availability, see ordering information in Appendix B on page 71.
   - Should be between 32 and 122 °F / 0 and 50 °C, with relative humidity between 5 and 95% non-condensing.
   - Must be free of explosive materials.
4. Maintain at least 6in / 152mm of free air on top, bottom and both sides for cooling air.
5. Allow 36in / 914mm front clearance for operation and maintenance.

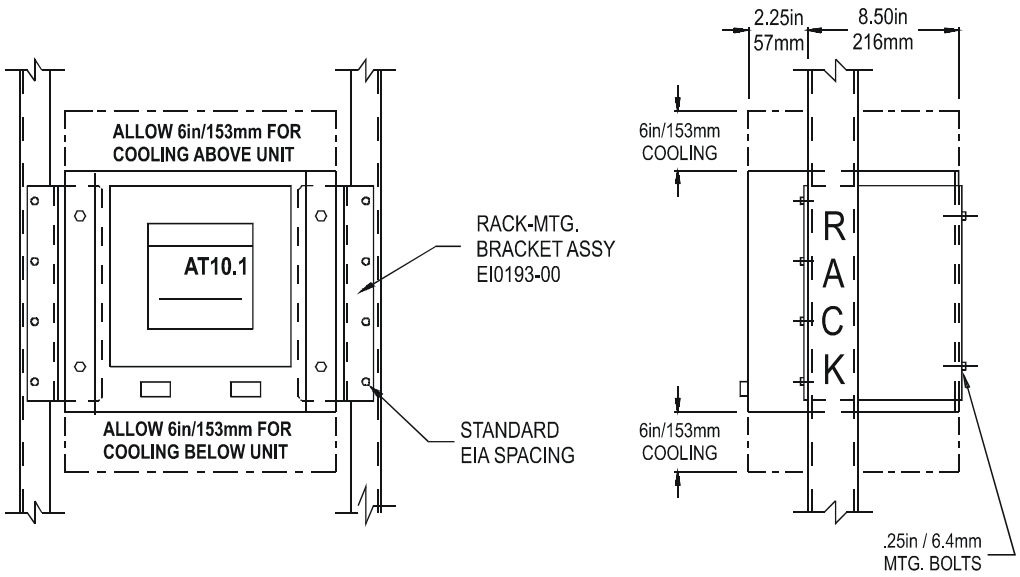
PROCEDURE

To rack mount the AT10.1, first install the brackets onto the rack. Second, mount the AT10.1 onto the rack-mounting brackets using the hardware supplied. Provide at least 6in / 152mm of air space above and below the AT10.1 in the rack for cooling. You do not need to modify the AT10.1 enclosure. Rack-mount outline dimensions are shown on the next page.

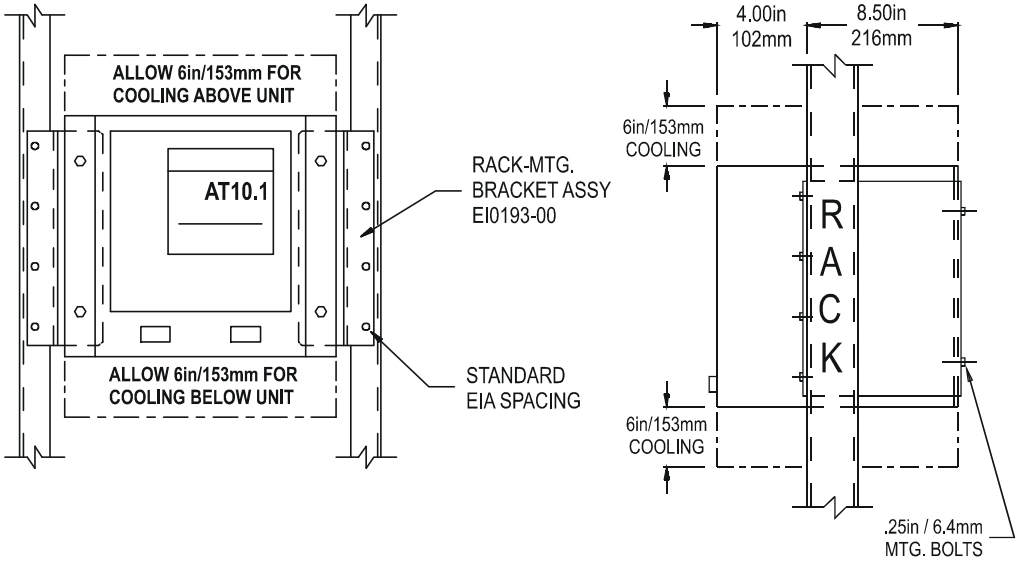
CHARGER RATING		RACK WIDTH		
Vdc	**Adc**	19in / 483mm	23in / 584mm	24in / 610mm
12 Vdc	all	Yes	Yes	Yes
24 Vdc	all	Yes	Yes	Yes
48 Vdc	6-12 Adc	Yes	Yes	Yes
48 Vdc	16-25 Adc	**No**	Yes	Yes
130 Vdc	6 Adc	Yes	Yes	Yes
130 Vdc	12-25 Adc	**No**	Yes	Yes

RACK-MOUNTING THE AT10.1 - GRAPHICS

Style-586 Enclosure



Style-594 Enclosure



NOTES:

1. Units are installed from the front.
2. Units shown above without penthouse enclosure. If penthouse is used, add 7in / 178mm to top of enclosure.
3. Refer to the outline drawings in Appedix C for enclosure dimensions.

1.6. CHANGING TRANSFORMER TAPS

Before you wire ac power to the AT10.1, check the wiring of the main transformer (T1), to be sure it is connected for your ac input voltage. The AT10.1 accepts standard input voltages of 120, 208 or 240 Vac by changing jumpers on T1. No other changes are required. *The AT10.1 is wired at the factory for 240 Vac, except on special order.* Models for 220, 380 or 416 Vac at 50/60 Hz are available on special order.

EXCEPTION: An AT10.1 battery charger rated for 480 Vac input uses a special transformer that has no taps or jumpers. The 480 Vac transformer cannot be used for any other input voltage.

Before changing the T1 taps, be sure that ac and dc supplies to the AT10.1 are turned off and locked out. Verify that no voltage is present by using a voltmeter at terminals TB1-L1 and TB1-L2 (ac), TB1(+) and TB1(-) (dc) and remote sense terminals (dc). Note that turning off the ac and dc circuit breakers on the AT10.1 *does not* eliminate live voltages inside the enclosure. Also de-energize any external wiring to the alarm relay contacts.

Verify that all voltages within the enclosure are de-energized and locked out. See Section 3.5 for necessary steps to follow when accessing internal components within the AT10.1. Change the jumpers on T1 as shown in the table on the next page. All transformers have (2) jumpers; always use both as specified in the table. The transformers used in the small enclosure (586) use piggyback quick-connect terminals. The transformers in the larger enclosure (594) use 10-32 stud terminals.

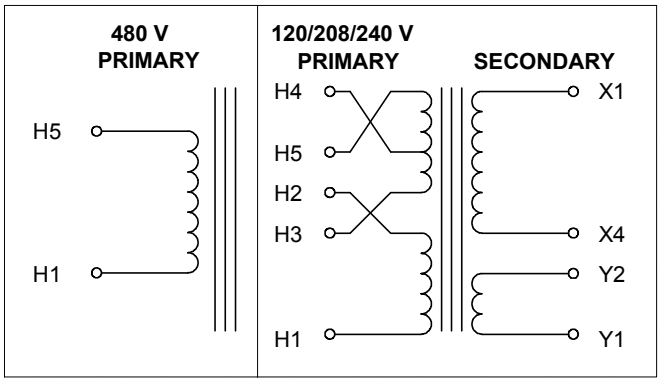
Models designed for 220 Vac, 50/60 Hz have no jumpers, and can be used only for that voltage. Models designed for 380 or 416 Vac also have no jumpers, and can be operated on either voltage.

*NOTE: This procedure refers **only** to Group I AT10.1 battery chargers (**rated 6-25 Adc**). A different procedure exists for Group II AT10.1 battery chargers (**rated 30-100 Adc**). Please refer to the Operating and Service Instructions specific to the Group II AT10.1 battery charger for changing the transformer taps on these larger units. Otherwise, damage to your charger and equipment may occur.*

CHANGING TRANSFORMER TAPS - GRAPHICS

T1 CONNECTION TABLE

INPUT VAC	JUMPERS
120	H1-H3, H2-H5
208	H2-H4 (2) JUMPERS
240	H2-H3 (2) JUMPERS
480	NONE



TRANSFORMER SCHEMATIC

PROCEDURE:

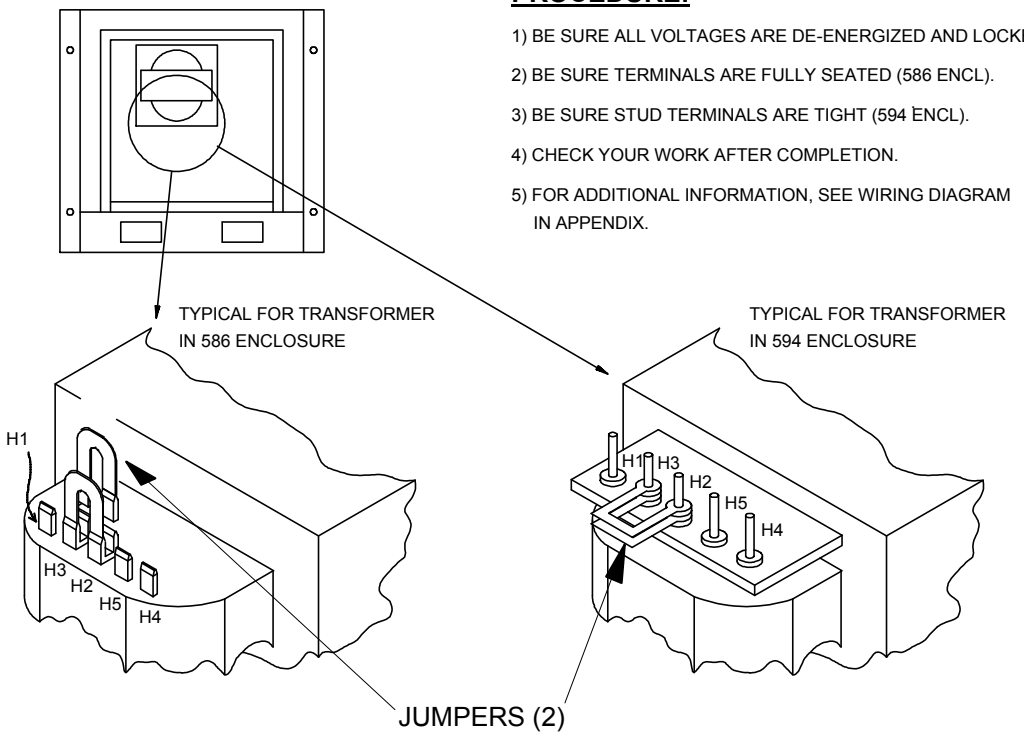
1) BE SURE ALL VOLTAGES ARE DE-ENERGIZED AND LOCKED OUT.

2) BE SURE TERMINALS ARE FULLY SEATED (586 ENCL).

3) BE SURE STUD TERMINALS ARE TIGHT (594 ENCL).

4) CHECK YOUR WORK AFTER COMPLETION.

5) FOR ADDITIONAL INFORMATION, SEE WIRING DIAGRAM IN APPENDIX.



F1-5R2

1.7. MAKING THE AC INPUT CONNECTIONS

Follow these steps to connect ac power to the AT10.1:

1. Be sure the AT10.1 main transformer (T1) is properly connected for your ac input voltage. See Section 1.6 for details.
2. Use a branch circuit breaker or fused disconnect switch, properly sized for the maximum input current of the AT10.1, as shown in the table below. This device should have lockout capability so that the ac input can be de-energized and locked out for maintenance. A time delay circuit breaker or slow-blow fuse is recommended.
3. Size the ac input wiring per the National Electric Code (NEC) and local codes for the rating of the branch circuit breaker or fused disconnect switch.
4. Do not run external ac and dc power wiring, feeding the battery charger, through the same conduit.
5. All specific requirements of your facility take precedence over these instructions.

PROCEDURE

1. Remove the safety cover.
2. Run the ac wiring to terminals TB1-L1, TB1-L2 and TB1-GND on the I/O panel in the enclosure. Compression lugs accepting wire sizes #14-6 AWG wire are supplied for your convenience. To make these connections, strip the insulation .50in / 13mm on the incoming wires and connect the wires to the appropriate lugs as shown on the next page.
3. Using a flat-head screwdriver, securely tighten the compression screws on the lugs to 35-45 in-lb / 4.0-5.1 Nm.
4. Reinstall the safety cover after you have made and checked all connections.

MAXIMUM INPUT CURRENT AT 120 Vac[1]

OUTPUT CURRENT	OUTPUT VOLTAGE			
	12	24	48	130
6	2	4	8	14
12	3	7	14	**30**
16	4	9	18	32
20	5	11	23	39
25	6	14	29	49

Example (shaded):
A 130 Vdc/12 Adc battery charger draws **30** Aac at 120 Vac.

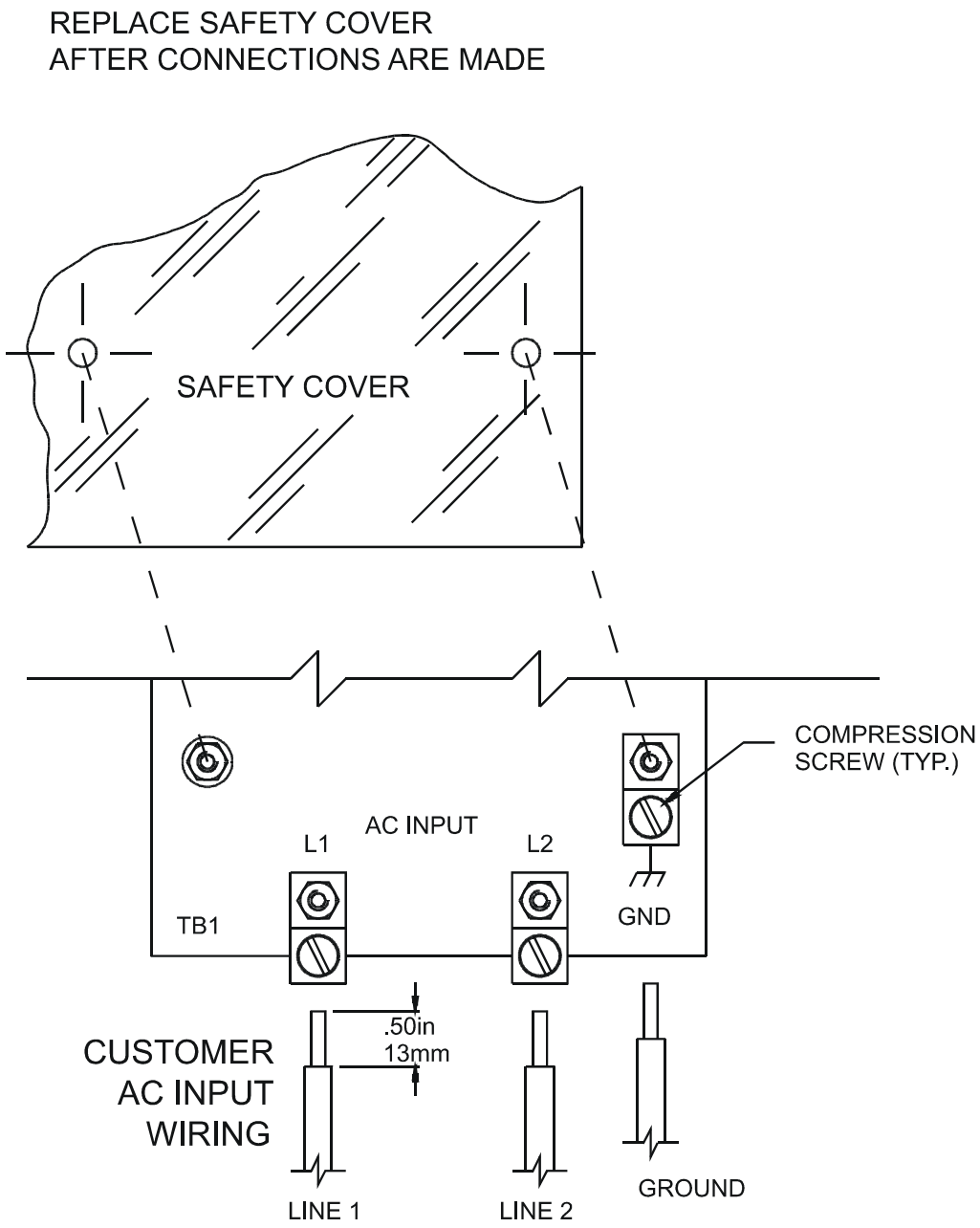
All currents shown are ±10%.

[1] To determine the input current, I_{ac}, for other input voltages, use the formula:

$$I_{ac} = I_T \times \frac{120}{V_{ac}}$$

where V_{ac} is the new input voltage, and I_T is the input current from the table above.

MAKING THE AC INPUT CONNECTIONS - GRAPHICS



NOTES:

1. The drawing above does not show other components mounted to the I/O panel. Be careful not to disconect any other component leads.
2. Always use a proper ground.
3. Use copper or aluminum conductors only.
4. On 120 Vac input, connect the neutral leg to the terminal L2.

1.8. MAKING THE DC OUTPUT CONNECTIONS

Follow these steps to connect the battery to the AT10.1:

1. Size the dc wiring to minimize voltage drop. The acceptable wire size depends on your installation. As a guideline, the voltage drop should not exceed 1% of nominal output voltage at full current. Refer to the table below to determine the voltage drops for various wire sizes, currents and distances.

WIRE SIZING CHART

VOLTAGE DROP PER 100ft / 30.5m OF WIRE (FOR COPPER AT 68° F / 20° C)

WIRE SIZE (AWG)	**DC CURRENT** (AMPERES)				
	6	**12**	**16**	**20**	**25**
#16	2.5V	5.0V	6.7V	8.2V	10.5V
#14	1.6V	3.2V	4.2V	5.3V	6.6V
#12	1.0V	2.0V	2.6V	3.3V	4.2V
#10	0.63V	1.3V	1.7V	2.1V	2.6V
#8	0.40V	0.80V	1.1V	1.3V	1.7V
#6	0.25V	0.50V	0.66V	0.83V	1.1V
#4	0.16V	0.32V	0.42V	0.52V	0.65V

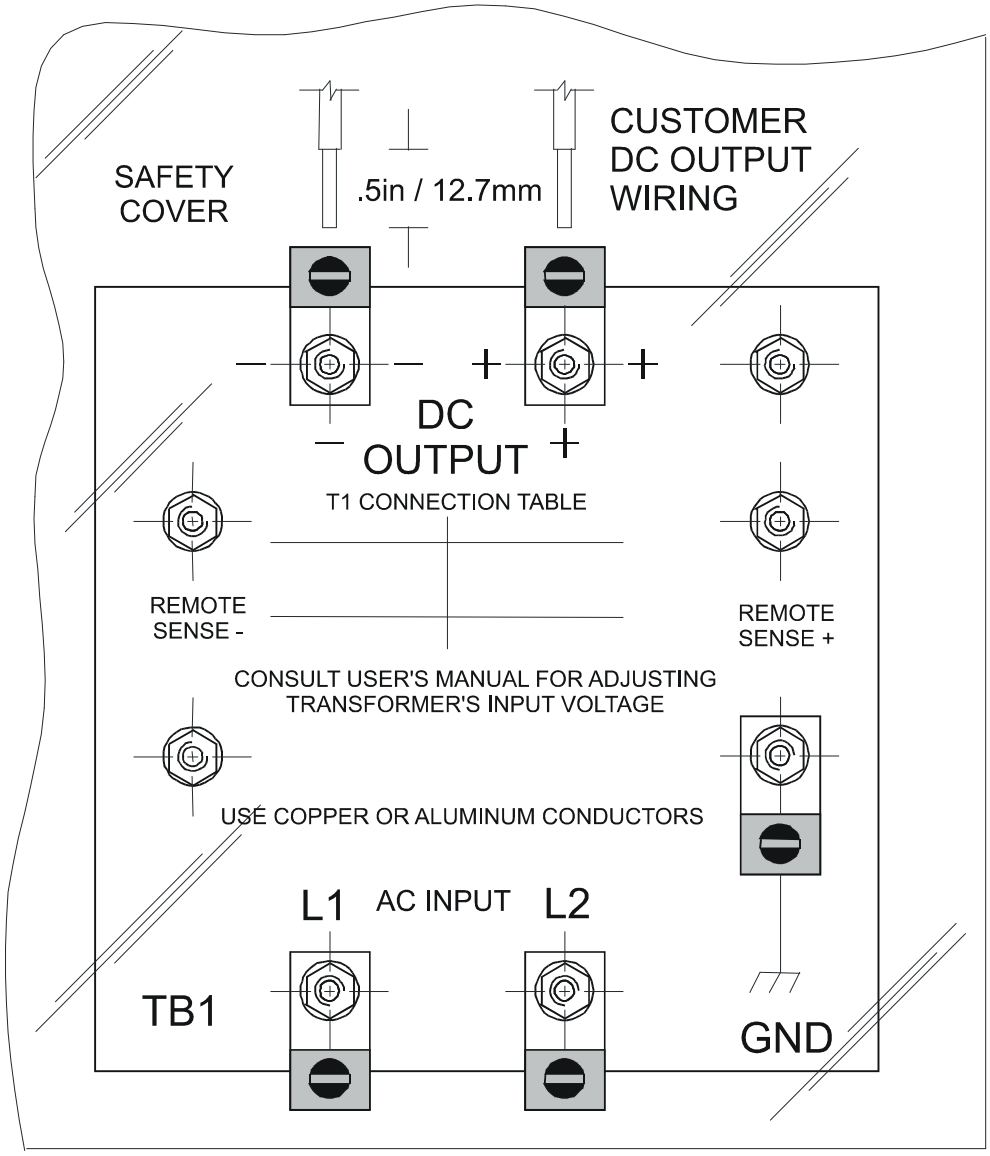
EXAMPLE: 100ft / 30.5m of #8 AWG wire at 16A has a 1.1V drop.

2. The AT10.1 is factory wired to regulate output voltage at the output terminals. If the total voltage drop is greater than 1% (e.g., 1.3V for a 130 Vdc system), remote sense wiring is recommended, see Section 1.9.
3. Do not run external ac and dc power wiring, feeding the battery charger, through the same conduit.
4. All specific requirements of your facility take precedence over these instructions.

PROCEDURE

1. Use a dc disconnect switch or circuit breaker between the AT10.1 and dc bus. This device should have lockout capability to allow the AT10.1 to be disconnected from the dc bus for maintenance.
2. Remove the safety cover.
3. Run the dc wiring to terminals TB1(+) and TB1(-) on the I/O panel in the enclosure. Compression lugs, accepting wire sizes #14-6 AWG, are supplied for your convenience. To make these connections, strip the insulation .50in / 12.7mm on the incoming wires. Connect the wires to the appropriate lugs as shown on the next page.
4. Using a flat-head screwdriver, securely tighten the compression screws on the lugs to 35-45 in-lb / 4.0-5.1 Nm.
5. Reinstall the safety cover after you have made and checked all connections.

MAKING THE DC OUTPUT CONNECTIONS - GRAPHICS



NOTES:

1. The drawing above does not show other components mounted to the I/O panel. Be careful not to disconect any other component leads.
2. Always use a proper ground.
3. Use copper or aluminum conductors only.

1.9. WIRING THE AT10.1 FOR REMOTE SENSING

You can wire the AT10.1 to regulate the output voltage at the battery terminals, instead of at the charger output terminals. Remote sensing does the following:

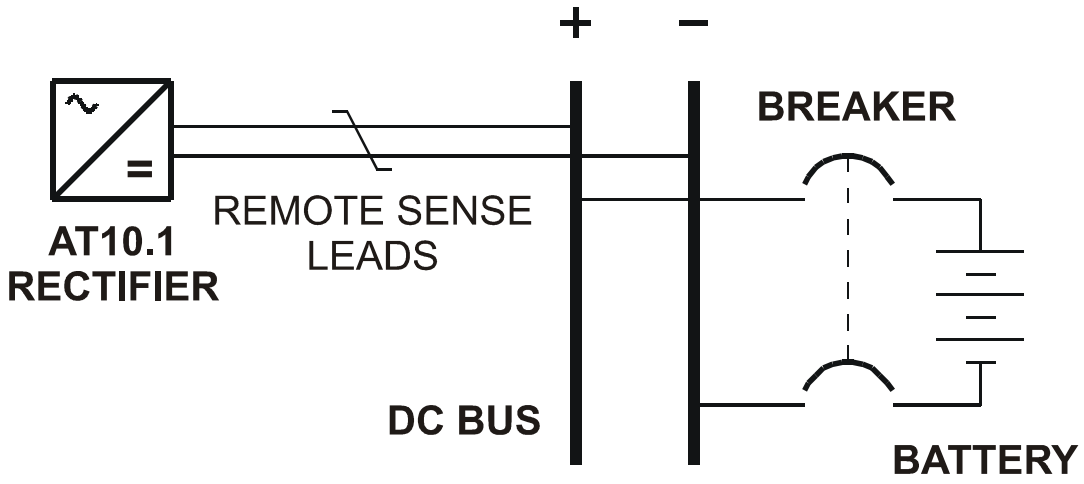
1. Compensates for voltage drop in the dc wiring between the AT10.1 and the battery.
2. Directly monitors the battery or dc bus voltage. The front panel meter displays the actual voltage on the battery or dc bus.

You wire the AT10.1 for remote sensing by installing twisted pair cabling from the AT10.1 remote sense terminals to the battery terminals. The AT10.1 control circuitry then measures the dc voltage at the battery terminals, and controls the output of the charger to maintain the battery voltage at the desired float or equalize voltage.

*NOTE: If the remote sense wiring fails, the AT10.1 detects the fault, and displays **E 06** on the front panel meter. See Section 3.2 for details.*

CAUTION: The AT10.1 cannot protect against short circuits in the remote sense wiring. You should install a 1.0A fuse at the battery or dc bus end of the remote sense cable.

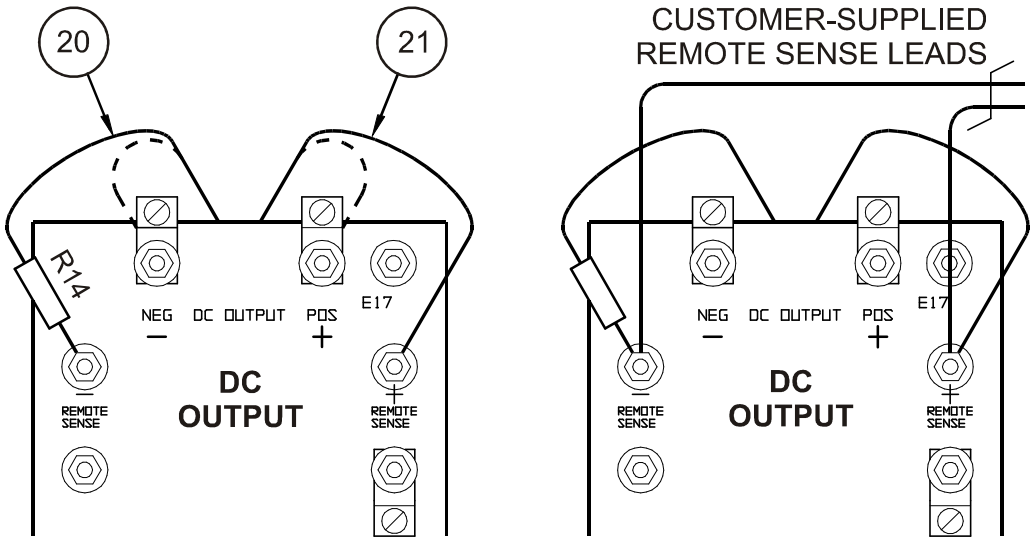
SCHEMATIC



PROCEDURE

1. De-energize and lock out all ac and dc voltages within the AT10.1 enclosure. Check with a voltmeter.
2. Remove safety shield.
3. Remove the two (2) dc output CU-AL compression lugs.
4. Move lugged end of R14 (with wire # **20**) from TB1(-) to REM SENSE(-).
5. Move wire # **21** from TB1(+) to REM SENSE (+).

6. Connect user-supplied external remote sense leads from the battery or dc bus to the remote sense terminals on the I/O panel.



7. Replace the two (2) dc output CU-AL compression lugs and tighten all hardware.
8. Check your work thoroughly. Replace the safety shield before reeneregizing the AT10.1.
9. Restart the AT10.1 according to the instructions in Section 2.1.

NOTES:

1. Use #16 AWG twisted pair wire.
2. Maximum current is 150 mA.
3. Run leads in their own conduit.
4. Fuse the wiring at the battery or dc bus.

DISABLING REMOTE SENSE

If you ever need to disable remote sense, follow the steps below:

- De-energize and lock out all ac and dc voltages to the AT10.1. Check with a voltmeter.
- Disconnect the remote sense wires from the battery or dc bus terminals first.

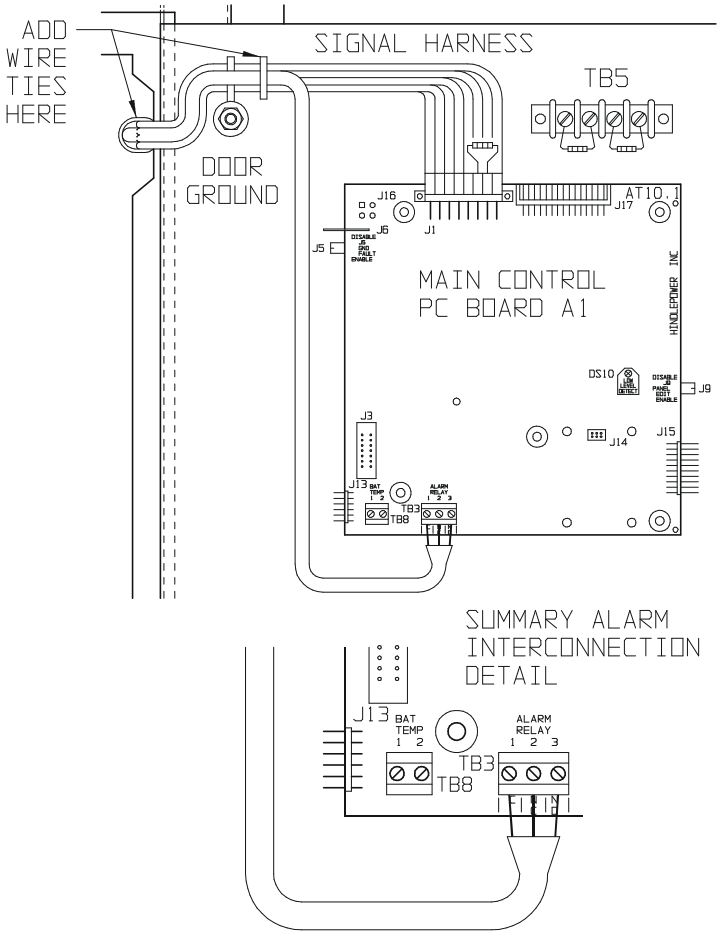
CAUTION: You must do the steps above first.

- Remove the remote sense leads from the remote sense (+) and (-) terminals on the I/O panel. Insulate each lead separately. Coil up the wires and leave them in the bottom of the charger, in case you want to wire for remote sense again in the future.
- Reconnect the lugged end of R14 (with wire # **20**) to TB1(-).
- Reconnect wire # **21** to TB1(+).
- Restart the AT10.1 according to the instructions in Section 2.1.

1.10. WIRING TO THE REMOTE ALARM CONTACTS

Built-in common alarm relay

The Primary Alarm functions are included as standard equipment with the AT10.1. The Summary Alarm relay, located on the Main Control pc board (A1), provides one (1) form-C summary (common) alarm contact (TB3) that transfers for any alarm. Follow the procedure below to wire a remote annunciator to this contact. See Section 2.2.7 for a description of the alarm functions.



PROCEDURE

1. Allow 30in / 762mm of wire inside the enclosure (excess will be trimmed).
2. Route wires to front door by following the existing harness through the door hinge as shown. Use two (2) wire ties and allow a 4-6in / 102-153mm loop for the hinge.
3. Trim wires to the proper length for connecting to TB3. Strip 0.25in / 6.4mm of insulation from the wires. Make the connections at TB3, and securely tighten the screws.

NOTES:

1. Alarm contacts are rated at 0.5A / 125 Vac or Vdc.
2. Summary Alarm relay terminal block (TB3) is compression type, accepting wire sizes #22-14 AWG.
3. Terminals are labeled in non-alarm condition.

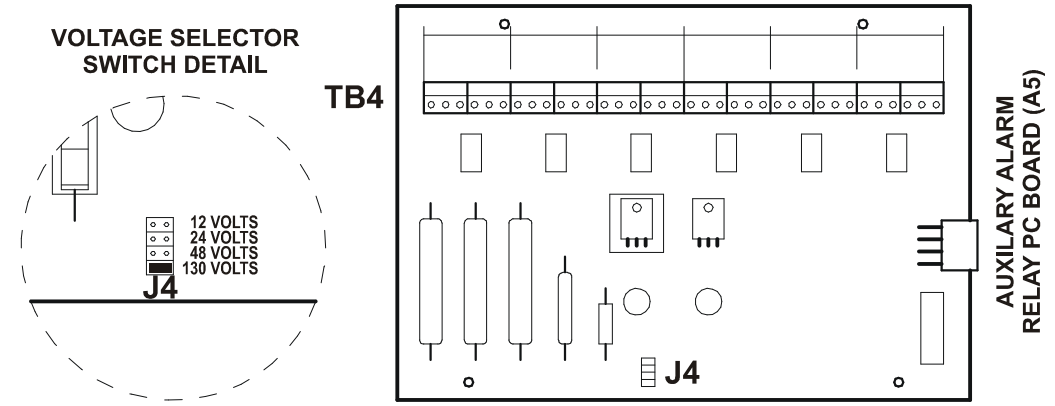
Auxiliary Relay Board *(optional)*

The optional Auxiliary Alarm Relay PC Board (A5), mounted inside the separate top enclosure (penthouse), provides two (2) form-C contacts (TB4-1 through TB4-36) for each of the following individual alarms:

- High DC Voltage
- Low DC Voltage
- DC Output Failure
- AC Failure
- Ground Fault Detection (positive or negative)
- Summary (common) Alarm

Alarm contacts (TB4) are as follows, shown in non-alarm condition:

HVDC	HVDC	LVDC	LVDC	DC OUTPUT FAILURE	DC OUTPUT FAILURE	AC FAIL	AC FAIL	GROUND DETECT	GROUND DETECT	SUMMARY	SUMMARY
C, NC, NO	C, NC, NO	C, NC, NO	C, NC, NO	C, NC, NO	C, NC, NO	C, NC, NO	C, NC, NO	C, NC, NO	C, NC, NO	C, NC, NO	C, NC, NO
1 2 3	4 5 6	7 8 9	10 11 12	13 14 15	16 17 18	19 20 21	22 23 24	25 26 27	28 29 30	31 32 33	34 35 36



Follow the procedure below to wire annunciators to one or more of these remote alarm contacts.

PROCEDURE

1. Remove the top panel from the penthouse enclosure (on top of the main charger enclosure).
2. Route your remote annunciator wiring into the penthouse enclosure through one of the unused knockouts in the side of the enclosure.
3. Connect the annunciator wiring (use #22-14 AWG) to the appropriate terminals of TB4 on the back wall of the penthouse enclosure (as shown in the figure above). Strip each wire 0.25in / 6.4mm, and securely tighten the terminal screws. Terminals are labeled in the non-alarm condition.
4. Replace the top panel on the penthouse enclosure.

NOTES:

1. Alarm contacts are rated at 0.5A / 125 Vac or Vdc.
2. Auxiliary Alarm Relay terminal block (TB4) is compression type, accepting wire sizes #22-14 AWG.
3. Terminals are labeled in non-alarm condition.

1.11. INSTALLING TEMP. COMPENSATION ASSEMBLY (OPTIONAL)

The temperature compensation assembly consists of a probe containing a temperature-dependent resistor in an epoxy module that you install near your battery. There are three steps in installing the assembly:

1. Mounting the probe assembly near the battery.
2. Installing an interconnection cable from the probe assembly to the AT10.1.
3. Wiring the charger end of the cable to a terminal block on the main control circuit board.

The actual tempco probe is the same for all battery types and all output voltages of the AT10.1. The kit part numbers differ depending on cable length ordered. See the tables in Appendix B on page 71 for ordering information. Each kit contains detailed installation instructions (JA5015-00). The main elements of the installation are outlined below.

WARNING:

High voltages appear at several points inside the battery charger. Use extreme caution when working inside the charger. Do not attempt to work inside the charger unless you are a qualified technician or electrician.

Disconnect and lock out all power to the battery charger before starting to remove or replace any components. Turn the ac power off at the distribution panel upstream from the battery charger. Disconnect the battery from the charger output terminals.

PROCEDURE

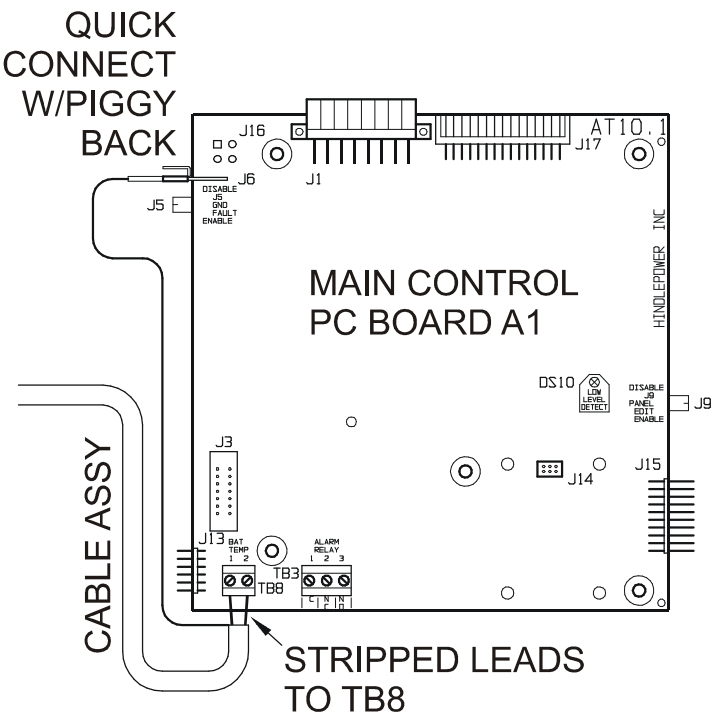
1. De-energize and lock out all ac and dc voltage sources to the AT10.1. Check with a voltmeter before proceeding.
2. Mount the probe on a clean, dry surface as close to the battery as possible, such as the battery rack. ***Do not*** mount the probe:
   - on the battery itself
   - on unpainted wood or bare galvanized metal.
   - on plastic surfaces
3. To apply the probe, clean the mounting surface with isopropyl alcohol, and allow to dry thoroughly. Remove the protective backing from the double-faced adhesive tape on the probe, and securely press it onto the surface.
4. Install the cable supplied with the temperature compensation probe kit:
   - Start at the AT10.1. The end of the cable with two stripped wires and one lead with a quick-connect terminal will be connected inside the enclosure. Leave 30in / 762mm of cable inside the enclosure, and route the other end to the probe at the battery.

- Run the cable though a conduit if possible, but not through a conduit containing any power wiring.
- Route the other end to the probe at the battery and coil up excess cable.

NOTE: If the standard (25ft / 7.6m) cable isn't long enough, longer cable assemblies are available in lengths of 50, 100 & 200ft / 15.2, 30.5 & 61.0m. See Appendix B on page 71 for ordering information.

- Be sure your wiring conforms to the NEC and your facility requirements.

5. Attach the interconnection cable to the AT10.1 as shown in the figure below:
   - Route the cable within the AT10.1 enclosure so that it runs with the wire harness to the back of the front panel, and easily reaches the main control circuit board.
   - At the main control circuit board, insert one of the bare wires from the cable into each terminal of TB8. Polarity is not important.



   - Unplug the harness ground wire **# 30** from terminal J6 on the left edge of the main control circuit board. Plug the connector at the end of the nylon-shielded wire of the cable assembly onto J6. Reconnect the ground wire # **30** from the system harness onto the piggy-back connector featured at the end of the nylon-shielded wire.
   - Using plastic wire ties, tie the interconnection cable loosely to the existing wire harness. Be especially sure that the cable conforms to the service loop at the hinge end of the door.
6. At the battery, connect the quick-connect terminals to the temperature compensation probe. Polarity is not important. Coil up any excess wire and tape or tie it together to prevent damage.

7. Check your work. Be sure that:
   - All connections are secure.
   - The shield is connected to ground *at the charger end only* (on the main circuit board).
   - The cable is connected to TB8 on the circuit board. Other terminal blocks may look similar.
8. Restart the AT10.1 using the startup procedure in Section 2.1. During startup, the AT10.1 displays **LEAD** on the front panel, indicating that the temperature compensation is set up for lead-acid batteries. While this is being displayed, you can press any front panel key to change the display to read **NICD**, to change the temperature compensation setup for nickel cadmium batteries. The choice you make is saved internally, and will be used again by the AT10.1 the next time it starts.
9. Adjust the output float and equalize voltages to the battery manufacturer's recommended values, using the AT10.1's front panel meter, as described in Section 2.3.2.

*NOTE: If the temperature compensation probe, or the wiring from the probe to the AT10.1, is damaged and becomes an open circuit, the AT10.1 detects the damage and displays **E 08** on the display. The charger then reverts to normal non-temperature-compensated operation until the probe or wiring is repaired. Once the probe is repaired, you must restart the AT10.1 to activate the probe, as described in Section 2.1.*

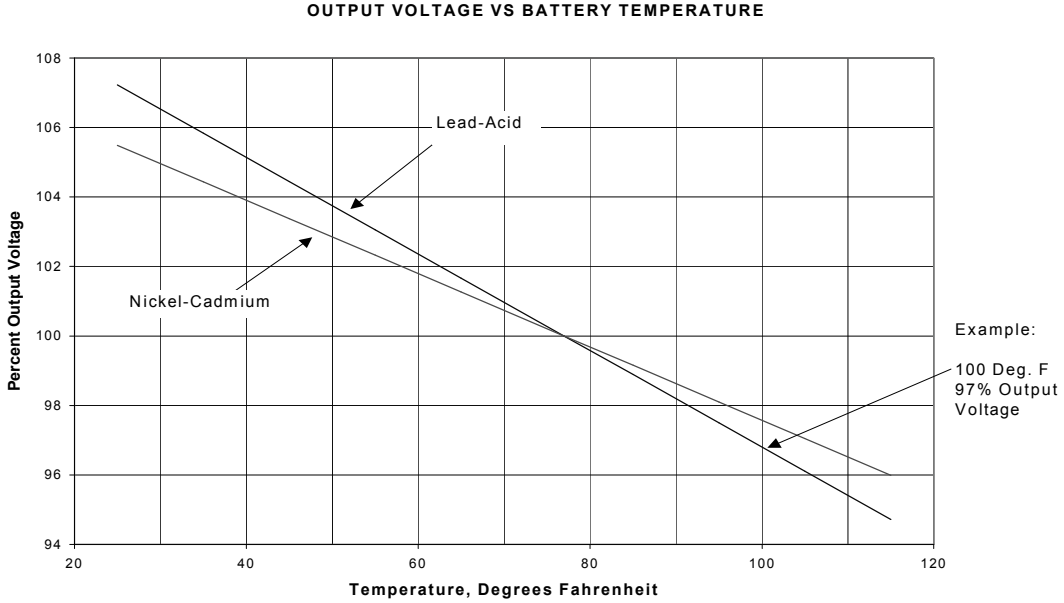
Using temperature compensation

Whenever an electric storage battery is being charged, the terminal voltage of the battery changes a small amount whenever the battery temperature changes. As the battery temperature increases, its terminal voltage decreases. When the battery is being charged with a float type charger, with a constant output voltage, the float current increases when the temperature increases. This results in overcharging the battery, which can result in damage to the materials, or at least the need for more frequent maintenance.

When the AT10.1 is equipped with a temperature compensation probe, it is able to adjust the output voltage applied to the battery to keep the float current constant, thereby avoiding overcharging. The probe senses the ambient temperature at the battery, and adjusts the output float/equalize voltages to compensate for variations in temperature. If the ambient temperature increases, the AT10.1 output voltage decreases.

Please note the following:

- You should set the Float and Equalize voltages to the values recommended by your battery manufacturer for 77° F (25° C).
- When you enter the Edit mode to adjust the Float or Equalize voltage (see Section 2.3.2), the front panel meter shows the 77° F (25° C) value for the Float or Equalize voltage, even if the battery is warmer or cooler than 77° F (25° C).
- The actual output voltage of the AT10.1 may be different from the value shown on the front panel meter, if the battery is warmer or cooler than 77° F (25° C).
- Use a digital meter to measure the actual output voltage of the AT10.1. If you know the temperature at the temperature compensation probe, you can use the graph below to determine that the output voltage is correct.
- If the battery temperature goes below 32° F (0° C), there will be no further increase in charger output voltage. Likewise, if the battery temperature goes above 122° F (50° C), there is no further decrease in output voltage.



EXAMPLE: Suppose you have a lead-acid battery whose temperature is 100° F / 37.8° C. As shown on the graph, the output voltage should be approximately 97% of the 77° F voltage. If the float voltage is set on the front panel to 132 Vdc, the actual output voltage will be:

132 x 0.97 = ***128 Vdc***

1.12. INSTALLING FOR REMOTE COMMUNICATION (OPTIONAL)

Please see separate *Operating Instructions* (JA5026-00).

1.13. INSTALLING FOR FORCED LOAD SHARING (OPTIONAL)

Please see Appendix F on page 90.

2. OPERATING THE AT10.1 BATTERY CHARGER

2.1. STARTING THE AT10.1

2.1.1. Understanding the startup sequence

The AT10.1 is set up at the factory to work with most common batteries and loads without further adjustment. When you start the AT10.1 for the first time, the factory settings (float voltage, equalize voltage, etc.) control the operation of the charger. You can change the settings after you start the charger. The **FACTORY SETTINGS** are shown in table on page 25.

The AT10.1 startup routine takes about five seconds. The microprocessor that controls the AT10.1 initializes the charger by reading the settings that are stored internally. The control circuit then "soft starts" the charger, and the dc output voltage and current increase gradually to the rated value.

2.1.2. Checking the installation

Be sure that you have followed the installation instructions carefully. Check the ac input supply voltage and the battery voltage, and be sure that they match the information on the AT10.1 nameplate. *Verify that the jumpers on the main transformer T1 are correct for your ac supply voltage.* Open the front panel, and check the battery polarity at the TB1 (+) and (-) terminals.

Using the Digital Meter

When you first start the AT10.1, the meter display alternates between dc output voltage and dc output current. Each reading is held for two seconds; lights to the left of the display indicate whether the meter is displaying voltage or current.

If you want to "freeze" the meter to display only voltage, press the **METER MODE** key on the front panel. To freeze the meter to display only current, press the key again. Press the key twice more to revert to the alternating display.

2.1.3. Starting the AT10.1

When you are sure that all connections to the AT10.1 are properly made, follow these steps to start up the AT10.1:

- Turn on the front panel dc circuit breaker. The digital meter indicates the battery voltage only. If the meter display doesn't light, *do not proceed*. Turn off the dc breaker, and check all connections and the battery polarity again. Also check the battery voltage. It must be above 50% of nominal voltage to turn on the display. If you can't find the problem, refer to the *Troubleshooting Procedure* in Section 3.1 on page 44.

CAUTION: If you try to turn on the dc circuit breaker with the battery connected in reverse polarity, the circuit breaker will immediately trip. Do not try to close the dc breaker again, since this may damage the battery charger. Correct the battery polarity before proceeding.

- If you have an optional temperature compensation probe installed, the front panel displays **LEAD** during startup, indicating that the temperature compensation is set up for lead-acid batteries. While this is being displayed, you can press any front panel key to change the display to read **NICD**, to change the temperature compensation setup for nickel cadmium batteries. The choice you make is saved internally, and will be used again by the AT10.1 then next time it starts.
- Turn on the front panel ac circuit breaker. The digital meter displays the output voltage and current. See *Using the Digital Meter* on page 24. You should hear a soft hum from the AT10.1 as the output current increases.

  NOTE: If you turn on the ac breaker before the dc breaker, and you have a filtered model of the AT10.1, there is a possibility that the dc breaker will trip when you try to turn it on. This is caused by the filter capacitors discharging into the battery. To get around this problem, turn off the ac breaker. Restart the AT10.1 by turning on the dc breaker first.
- The green **FLOAT** indicator lights. Press the CHRG MODE key on the front panel. The **FLOAT** indicator goes off, and the yellow **EQLZ** indicator lights. Press the CHRG MODE key again to return the charger to the float mode.

The table below shows the normal factory settings for float and equalize voltages, equalize time, current limit setting, and alarm settings. If your purchase order specified other float or equalize voltage settings, a tag attached to the front panel of the AT10.1 lists the actual voltage settings.

FACTORY SETTINGS FOR ALL PARAMETERS

Parameter	Nominal Vdc			
	12	24	48	130
Float Voltage	13	26	52	131
Equalize Voltage	14	28	56	139
HVDC Alarm	14.4	28.8	57.6	144
LVDC Alarm	12	24	48	120
Equalize Time	24 Hours			
Equalize Method	Manual Timer			
Current Limit	110% of nominal output current			
HVDC Shutdown	Disabled			

2.2. USING THE AT10.1 FRONT PANEL FEATURES

2.2.1. If the meter displays an error message

When you apply power to the AT10.1 for the first time, the micro-processor control circuit performs a diagnostic check of the system. If it finds anything wrong, it writes an error code to the display, such as **E 01**.

Below is a list of the error codes. See Section 3.2 for a full explanation of each error code.

Error Code	Explanation
E 01	resistor R2 is open or defective
E 02	short circuit on dc output
E 03	high dc voltage shutdown has occurred
E 04	internal memory failure
E 05	*not used*
E 06	failure in remote sense wiring
E 07	dc breaker is open, or internal or external output wiring is defective
E 08	defective temperature compensation probe
E 09	misadjusted current limit
E 10	open internal feedback loop
E 14	forced load sharing not working properly
A 02	equalize mode is inhibited

2.2.2. Selecting the meter mode

- Press the **METER MODE** key to change the meter display mode. The digital meter has four operating modes:
    1. Alternating between output voltage and output current. When the charger is in a timed equalize mode, the meter alternates between output voltage, output current, and equalize hours remaining.
    2. Displaying output voltage only. The **DC Volts** indicator lights.
    3. Displaying output current only. The **DC Amps** indicator lights.
    4. Displaying equalize hours remaining only. The **EQLZ HRS REMAINING** indicator lights. If the AT10.1 is not in a timed equalize mode, the meter displays the full programmed equalize time.
- When the charger starts initially, the meter alternates, showing output voltage and output current. The **DC Volts** and **DC Amps** indicators light alternately to indicate what is being displayed.

2.2.3. Selecting the Float or Equalize mode

The AT10.1 has 2 output voltage settings, Float and Equalize. Use the Float mode for all normal battery charging and to operate your dc system. Use the Equalize mode if it is necessary to balance the level of charge among the cells of the battery. Consult your battery data sheets for information on equalize-charging your battery.

- Press the **CHRG MODE** key to change to the equalize mode.

If the equalize method is set to manual timer or auto-equalize timer, the charger will revert to the float mode at the end of the selected equalize time.

- You can press the **CHRG MODE** key at any time to change back to the float mode.

2.2.4. Choosing the Equalize method

Press the **EQLZ MTHD** key to choose the desired equalize method. The indicator next to the desired equalize method will light. Three equalize methods are available in the AT10.1:

- Manual Timer
- Manual Equalize
- Auto-Equalize Timer

These equalize methods are described below.

Manual Timer Method

Choose the manual timer method if you perform regularly scheduled equalize charging, or if you base your equalize charging on regular readings of the specific gravity of each cell of your battery (for lead-acid batteries). When your battery requires equalize charging, adjust the manual timer to 1-2 hours for each 100 AH of battery capacity (see Section 2.3.3 to learn how to adjust the equalize time). The battery manufacturer can help you determine the best equalizing schedule for your battery.

After you select the manual timer method, press the **CHRG MODE** key to put the charger into the equalize mode. The **EQLZ** indicator will light. When the equalize timer is finished, the charger reverts automatically to the float mode, and the **FLOAT** indicator lights.

At any time during the equalize charge, you can switch the charger back to float mode by pressing the **CHRG MODE** key. The **FLOAT** indicator will light.

If there is an ac power failure during a timed equalize charge, the AT10.1 remembers the remaining equalize time. When ac power is restored, it resumes the equalize charge where it left off.

Manual Equalize Method

Choose the manual equalize method when you want to equalize charge the battery, but only when you are able to monitor the battery voltage and gassing rate. After you select the manual equalize method, press the CHRG MODE key to put the charger into the equalize mode. The **EQLZ** indicator will light.

Press the CHRG MODE key again to return the charger to the float mode. The **FLOAT** indicator will light.

NOTE: Never leave the AT10.1 unattended in the equalize mode with the manual equalize method selected, because a sustained overcharge may cause permanent damage to the battery.

Auto-Equalize Timer Method

Choose the auto-equalize timer method if you have a *flooded* (non-sealed) battery that is subject to infrequent discharges, or when the battery will be discharged by at least half of its rated capacity during an ac power failure. When ac power is restored to the charger, it turns on in the equalize mode automatically, and the **EQLZ** indicator lights. At the end of the equalize charging-time that you select, the charger reverts automatically to the float mode, and the **FLOAT** indicator lights. At any time during the equalize charge, you can switch the charger back to float mode by pressing the CHRG MODE key. The **FLOAT** indicator will light.

Consult your battery manufacturer's instructions before using the auto-equalize timer method with sealed (valve-regulated) lead-acid batteries.

Whenever the ac supply fails for 12 seconds or longer, the auto-equalize timer is enabled. For shorter periods, the timer behaves as shown below:

Mode before ac failure		AC falure duration		Mode after ac failure
FLOAT	→	less than 12 seconds	→	FLOAT
EQUALIZE	→	less than 12 seconds	→	Resume EQUALIZE with time remaining
FLOAT or EQUALIZE	→	12 seconds or greater	→	EQUALIZE with full time

Switching to Equalize Mode with Auto-Equalize Timer Method Selected

You can start an equalize charge at any time.

- Press the CHRG MODE key. The **EQLZ** indicator lights.

When the equalize timer is finished, the charger reverts automatically to the float mode, and the **FLOAT** indicator lights.

2.2.5. Testing the front panel indicators

- Press the DOWN key. This is also the LAMP TEST key.

The meter will display **8888**, and all status & alarm indicators will light.

The LAMP TEST key does not test the **AC ON** indicator. The **AC ON** indicator lights whenever ac power is present, and the ac circuit breaker is turned on. The LAMP TEST key does not operate when ac power is off.

To test the action of the summary alarm relay, press and hold the LAMP TEST key for four seconds. The relay transfers. If you are monitoring the relay with a remote annunciator, it detects the alarm condition.

2.2.6. Testing the Auxiliary Relay Board (optional)

If you have the optional Auxiliary Relay Board installed, you can test the action of the alarm relays. Press and hold the LAMP TEST key for four seconds. The six auxiliary alarm relays on the Auxiliary Relay Board transfer. Remote annunciators connected to these relays will indicate this.

2.2.7. Interpreting the alarm indicators

There are six alarm indicators at the right side of the front panel. An indicator lights for each of the following alarm conditions:

- **HIGH DC VOLTAGE**: lights whenever the dc output voltage exceeds the specified alarm voltage setting. See Section 2.3.4 to learn how to adjust the HVDC alarm setting.
- **LOW DC VOLTAGE**: lights whenever the dc output voltage is below the specified alarm voltage setting. See Section 2.3.4 to learn how to adjust the LVDC alarm setting.
- **DC OUTPUT FAILURE**: lights whenever the charger cannot provide its full rated output voltage *or* its full rated output current. You cannot adjust this alarm setting.
- **AC INPUT FAILURE**: lights whenever the ac power supply to the charger is interrupted.
- **POS GND**: lights whenever leakage current from the battery positive terminal to ground exceeds a specified threshold (see note).
- **NEG GND**: lights whenever leakage current from the battery negative terminal to ground exceeds a specified threshold (see note).

NOTE: You can adjust the sensitivity of the ground fault detection from 5K to 50k ohms. Adjusting the ground fault sensitivity affects the positive and negative ground fault sensitivities equally.

The indicators light immediately when an alarm occurs. The AT10.1 also has a summary alarm relay with one form C contact, rated 0.5A @ 125 Vac/Vdc. If an alarm condition lasts for 30 seconds or longer, the summary alarm relay contact transfers. When the alarm condition is corrected, the relay and all indicators reset automatically.

2.3. SETTING PARAMETERS IN THE AT10.1

2.3.1. Understanding Parameter Settings

You can change the settings of the AT10.1 while the charger is operating, using the front panel controls. The changes you make take effect immediately, and are saved internally. If the charger is taken out of service, and then later returned to service, it restarts using the last values you set. You can adjust the following parameters:

- Float voltage
- Equalize voltage
- Equalize timer (in hours)
- High dc voltage alarm setting
- Low dc voltage alarm setting
- Current limit value (in Amperes)
- High dc voltage shutdown feature (on or off)

Your choice of equalize method is also saved internally.

When you want to change any parameter, press the **EDIT/ENTER** key to put the AT10.1 into ***EDIT*** mode. The meter display flashes about once per second, and the status indicators prompt you to adjust the respective parameter. You adjust each parameter by pressing the **UP** or **DOWN** key until the reading you want shows on the meter display. You can make the display scroll up or down continuously by pressing and holding the **UP** or **DOWN** key.

You cannot exceed certain upper and lower limits for the operating parameters. To see what the limits are for your charger, refer to the AT10.1 Specifications in Appendix A on page 70.

When you first press the **EDIT/ENTER** key, the AT10.1 prompts you to adjust the first parameter in the list above (float voltage). When you obtain the value you want on the display, press the **EDIT/ENTER** key again. The AT10.1 saves the new setting internally, and then prompts you to adjust the second parameter. You continue this way to adjust the first six parameters in the list above. If you want to skip adjusting any parameter, just press the **EDIT/ENTER** key again. The AT10.1 moves to the next parameter.

When you are finished adjusting the sixth parameter (current limit), press the **EDIT/ENTER** key again. The AT10.1 saves all adjustments you made internally, and reverts to normal operation. The new settings take effect immediately.

Edit mode ends automatically if you don't press any front panel key within 25 seconds, and any change you made to the last setting is not saved.

2.3.2. Setting the Float and Equalize voltages

- Press the EDIT/ENTER key.

The **FLOAT** and **DC VOLTS** indicators light, and the display flashes the present value of the float voltage. Press and release the UP or DOWN key to increase or decrease the value in the display by one count, or press and hold the UP or DOWN key to scroll the value in the display upward or downward. When the display shows the float voltage you want to set, release the UP or DOWN key. If you go past the voltage you want, press the UP or DOWN key again to reach the voltage you want to set.

- Press the EDIT/ENTER key. The new float voltage setting is saved internally.

The **EQLZ** and **DC VOLTS** indicators light, and the display flashes the present value of the equalize voltage. Press and release the UP or DOWN key to increase or decrease the value in the display by one count, or press and hold the UP or DOWN key to scroll the value in the display upward or downward. When the display shows the equalize voltage you want to set, release the UP or DOWN key. If you go past the voltage you want, press the UP or DOWN key again to reach the voltage you want to set.

- Press the EDIT/ENTER key. The new equalize voltage setting is saved internally.

If you want to adjust the equalize timer duration, skip to Section 2.3.3.

OR

If you want to exit the Edit mode now, press the EDIT/ENTER key four more times until the charger returns to normal operation.

Edit mode ends automatically if you don't press any front panel key within 25 seconds, and any change you made to the last setting is not saved.

2.3.3. Setting the Equalize Timer

- Press the EDIT/ENTER key until the **EQLZ HRS REMAINING, MANUAL TIMER** and **AUTO EQLZ TIMER** indicators light, and the display flashes the present value of the equalize timer duration in hours.

Press and release the UP or DOWN key to increase or decrease the value in the display by one count, or press and hold the UP or DOWN key to scroll the value in the display upward or downward. When the display shows the equalize time, in hours, that you want to set, release the UP or DOWN key. If you go past the number of hours you want, press the UP or DOWN key again to reach the number you want to set.

If you set the equalize time to zero hours, the equalize mode is disabled.

- Press the EDIT/ENTER key. The new equalize timer duration is saved internally. The timer setting works for both the manual timer and the auto-equalize timer.

If you want to adjust the alarm settings, skip to Section 2.3.4.

OR

If you want to exit the Edit mode now, press the EDIT/ENTER key three more times until the charger returns to normal operation.

2.3.4. Setting the Alarms

After you save the equalize timer setting, the Edit mode automatically prompts you to adjust the high dc voltage and low dc voltage alarms. There is a red indicator on the front panel of the AT10.1 for each of the following alarm conditions:

- High DC Voltage
- Low DC Voltage
- DC Output Failure
- AC Input Failure
- Ground Fault Detection (+)
- Ground Fault Detection (-)

The indicators light immediately when an alarm occurs. The AT10.1 also has a summary alarm relay with one form C contact rated 0.5A / 125 Vac/Vdc. If an alarm condition lasts for 30 seconds or longer, the summary alarm relay contact transfers. When the alarm condition is corrected, the relay and all indicators reset automatically. The relay contact also transfers if the AT10.1 detects certain errors, and displays **E 03**, **E 06, E 07** or **E 10** on the front panel meter.

Setting the High DC Voltage Alarm

- Press the EDIT/ENTER key until the **HIGH DC VOLTAGE** indicator flashes, and the display flashes the present value of the high dc voltage alarm.

Press and release the UP or DOWN key to increase or decrease the value in the display by one count, or press and hold the UP or DOWN key to scroll the value in the display upward or downward. When the display shows the high dc voltage alarm point that you want to set, release the UP or DOWN key. If you go past the voltage you want, press the UP or DOWN key again to reach the voltage you want to set.

- Press the EDIT/ENTER key. The new high dc voltage alarm setting is entered into permanent memory.

Setting the low DC Voltage Alarm

- Press the EDIT/ENTER key until the **LOW DC VOLTAGE** indicator flashes, and the display flashes the present value of the low dc voltage alarm.

Press and release the UP or DOWN key to increase or decrease the value in the display by one count, or press and hold the UP or DOWN key to scroll the value in the display upward or downward. When the display shows the low dc voltage alarm point that you want to set, release the UP or DOWN key. If you go past the voltage you want, press the UP or DOWN key again to reach the voltage you want to set.

- Press the EDIT/ENTER key. The new low dc voltage alarm setting is entered into permanent memory.

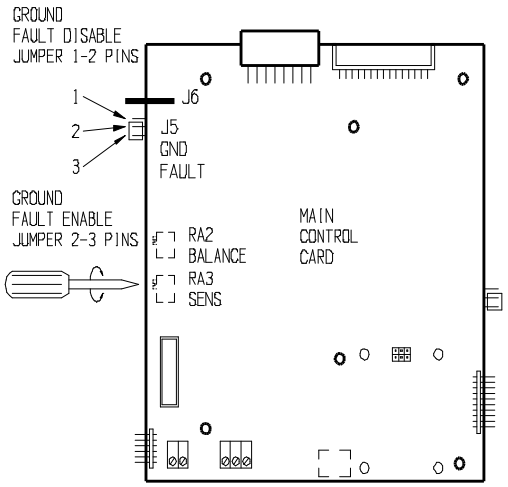
If you want to adjust the current limit setting, skip to Section 2.3.5.

OR

If you want to exit the Edit mode now, press the EDIT/ENTER key again to return the charger to normal operation.

Adjusting Ground Detection Sensitivity

You can adjust the sensitivity of the ground detection alarm circuit. You must have a test resistor whose value is the sensitivity you want. You can adjust the sensitivity from 5 to 50 kΩ.

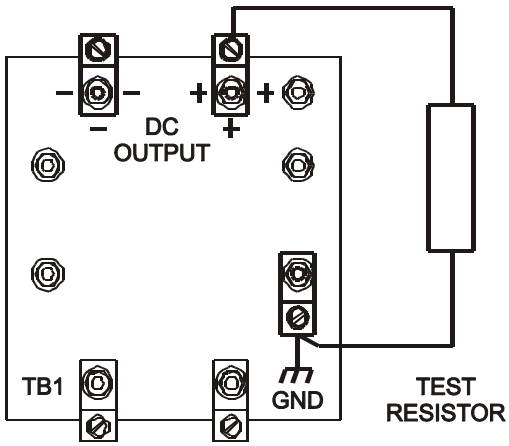


The potentiometer for adjusting ground detection circuit sensitivity is located on the main control circuit board. It is the lower of the two potentiometers labeled **RA3 SENS**, as shown in the figure at the right.

*NOTE: Do not try to adjust the upper potentiometer labeled **RA2 BALANCE**. This adjustment is made at the factory for proper circuit operation.*

CAUTION: Before connecting or disconnecting a test resistor, de-energize and lock out all ac and dc voltage sources to the AT10.1. Check with a voltmeter before proceeding. Restart the AT10.1 only when necessary to make the sensitivity adjustment. If your battery is grounded, do not attempt this procedure.

Remove the safety cover. Connect the test resistor between **TB1(+)** and chassis ground, as shown to the right. Adjust **RA3** counterclockwise until the front panel indicator goes out, then adjust slowly clockwise until the **POS GND** indicator just lights.



Make this adjustment slowly; the indicator is updated once in every four seconds. De-energize and lock out power to the AT10.1, then remove the test resistor and verify that the indicator goes out.

Now connect the test resistor between **TB1(-)** and chassis ground. Verify that the **NEG GND** indicator lights. If not, adjust **RA3** clockwise until it does. Remove the test resistor.

Using Ground Detection in Charger Standby Mode

If you put the AT10.1 into standby mode by opening the dc circuit breaker (CB2), the ground detection circuit will send an erroneous negative ground alarm. There are two ways to work around this:

- Disable the ground detection circuit while the charger is in standby, as described below.
- Put the charger into standby by opening the ac input circuit breaker (CB1), and leaving the dc circuit breaker closed.

Operating the charger with the ac breaker (CB1) closed and the dc breaker (CB2) open is an abnormal condition, and is not recommended.

Disabling the Ground Detection Alarm

You can disable the ground detection alarm circuit, and isolate the circuit from chassis ground. If your battery is normally grounded, or you want to defeat the alarm for any other reason, follow these steps:

- De-energize and lock out all ac and dc voltage sources to the AT10.1. Check with a voltmeter before proceeding. This includes remote sense wires if they were installed.
- Open the AT10.1 front panel, and locate jumper **J5** at the top left of the Control Circuit Board (shown on the previous page). Move the jumper to the **DISABLE** position. The **POS GND** and **NEG GND** indicators and the summary alarm relay will not respond to a ground fault.

Restart the AT10.1, following the instructions in Section 2.1.

2.3.5. Setting the current limit value

The AT10.1 automatically limits its dc output current in case of overload or battery discharge. You can adjust the value of the current limit from 50% to 110% of rated current. The factory setting is 110%.

The current limit adjustment is the last step in the normal Edit sequence. If the AT10.1 is not in the Edit mode, press the **EDIT/ENTER** key five times, until the meter display flashes the value of current limit, *in Amperes*. Press and release the **UP** or **DOWN** key to increase or decrease the value in the display by one count, or press and hold the **UP** or **DOWN** key to scroll the value in the display upward or downward. When the display shows the current limit value that you want to set, release the **UP** or **DOWN** key. If you go past the number you want, press the **UP** or **DOWN** key again to reach the number you want to set.

- Press the **EDIT/ENTER** key. The new current limit setting is saved internally.

Edit mode ends automatically if you don't press any front panel key within 25 seconds, and any change you made to the last setting is not saved.

2.3.6. Enabling the High DC Voltage shutdown feature

The AT10.1 has a built-in high dc voltage shutdown feature. In case of any maladjustment or internal failure that results in a continuous output voltage that is too high, the AT10.1 shuts down after 30 seconds to protect the battery. The digital display reads **E 03,** and the summary alarm relay contact transfers.

The AT10.1 is shipped with the high dc voltage shutdown feature disabled.

You can adjust the high dc voltage shutdown (the setting is the same as the high dc voltage alarm setting). Refer to Section 2.3.4.

The charger must be in normal operation (not the Edit mode) to enable the high dc voltage shutdown.

To enable the shutdown feature:

- Press and hold the UP key, then
- Press the CHRG MODE key.

The **HIGH DC VOLTAGE** indicator lights, and the display flashes **ON**. You can toggle the shutdown feature **OFF** and **ON** by pressing the CHRG MODE key repeatedly.

If you don't press any key within 4 seconds, the last state indicated (**ON** or **OFF**) is saved internally. Note that you *don't* use the EDIT/ENTER key for this feature.

If the AT10.1 shuts down because of a high dc voltage, the meter display shows error code **E 03**. Reset the charger by turning the ac breaker off, then on again.

Parallel Operation

If two (or more) AT10.1 chargers are connected in parallel, both sense the output voltage. If one charger runs away, it will supply all the output current; the other has zero output current. The high dc voltage shutdown does not operate in a charger with zero output current, so that only the defective charger (of two or more in parallel) shuts down. The other charger continues to supply the load normally.

2.3.7. Adjusting the Voltmeter Accuracy

The AT10.1 voltmeter is adjusted at the factory to display the actual output voltage within ±1%. If you replace any component that affects meter accuracy, such as the main control circuit board or R4, you should readjust the meter. This adjustment procedure is different from all others, because the meter reading remains constant, while the output voltage of the charger changes. Do this adjustment with a fully charged battery and with no load connected.

First, use the *Edit* procedure to adjust the float voltage to the desired value. See Section 2.3.2 for instructions on setting the float voltage. Second, press and hold the UP key, then press the EQLZ MTHD key.

The **DC VOLTS** METER MODE indicator will light, and the meter display flashes the output voltage reading. Measure the output voltage of the AT10.1 using a dc meter accurate to ±0.25% or better.

While watching the meter connected to the AT10.1 output (not the front panel meter), press the UP or DOWN key until the actual output voltage matches the float setting on the front panel meter.

Each time you press UP or DOWN, you change the AT10.1 output voltage by a small amount. Continue to press UP or DOWN until the actual output voltage agrees with the front panel reading within ±1%

NOTE: Allow one or two seconds for the output voltage to stabilize each time you press the UP or DOWN key.

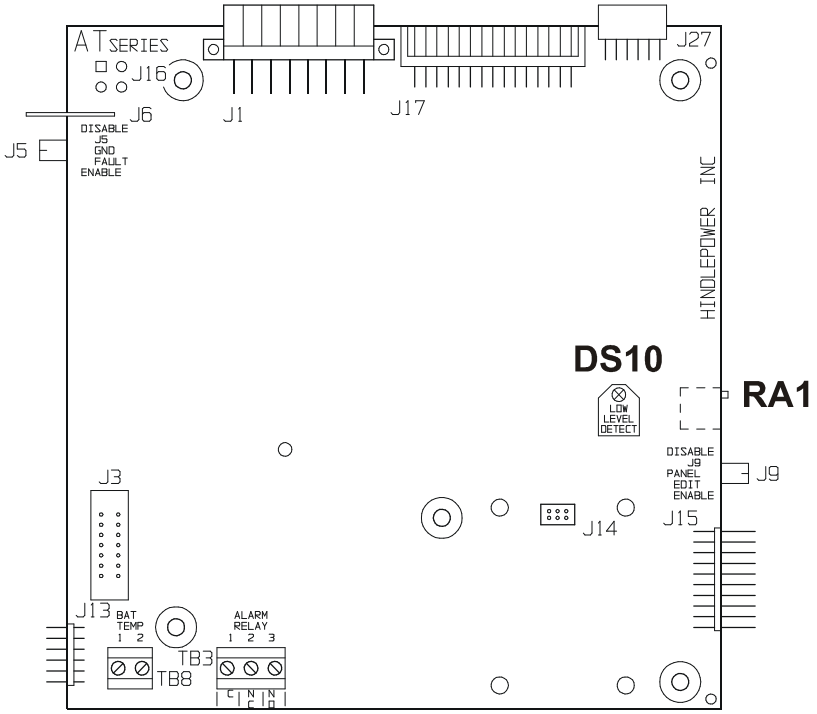
When you are finished adjusting the output voltage, the AT10.1 waits 5 seconds, then the display returns to normal operation.

2.3.8. Using the Low Level Detector (LLD)

The AT10.1 battery charger is equipped with a summary alarm safety override circuit. This feature forces the summary alarm (common alarm) relay contact to transfer, sending an alarm, even if there is a catastrophic failure of the charger's control circuitry. A low battery voltage triggers the safety circuit.

Main control circuit board hardware, not software, maintains the low level detect circuit. Therefore, to remotely monitor this alarm, user connections must be made at TB3. The summary alarm contacts on the auxiliary alarm relay pc board at TB4 will not signal a low level detect alarm.

If you have a dc power supply, you can adjust the battery voltage that triggers the alarm. On the back of the main control circuit board, find the potentiometer **RA1**, as shown in the figure below.



Disconnect all ac and dc power sources from the AT10.1, and connect your dc power supply to the dc output terminals of the charger (positive to positive and negative to negative). Adjust the power supply to the voltage at which you want to activate the alarm.

NOTE: You need at least 50% of the nominal output voltage to power the AT10.1 control circuit board.

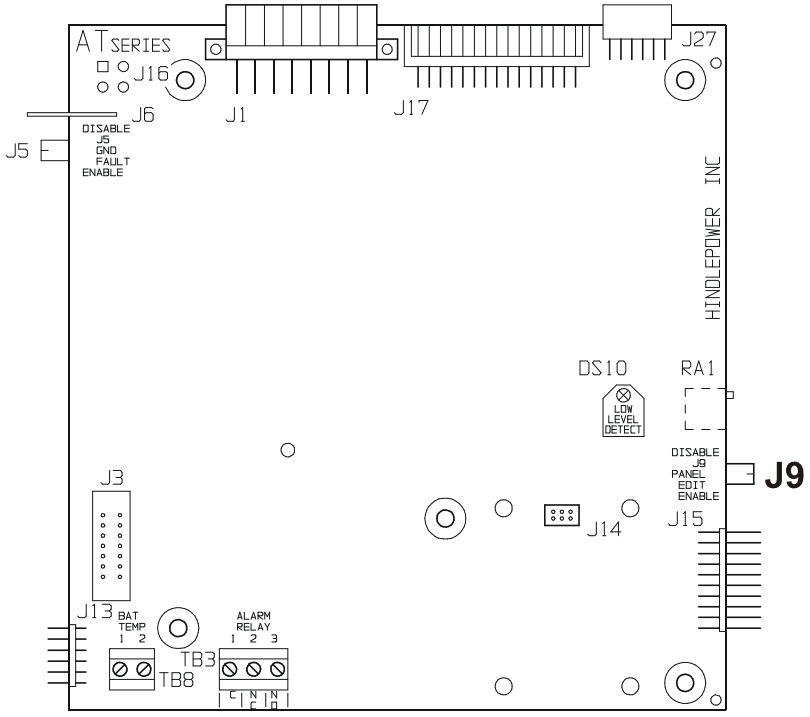
Adjust **RA1** with a small jeweler's screwdriver clockwise until the alarm just activates. A red LED indicator (**DS10**) next to **RA1** indicates when the alarm is active.

2.3.9. Using the front panel security feature

The AT10.1 charger is shipped with all the front instrument panel keys enabled. You can disable the following front panel functions:

- Selecting Equalize method
- Changing settings using the **EDIT/ENTER** key
- Toggling the high dc voltage shutdown feature

To disable the front instrument panel keys, open the AT10.1 door and locate the small plastic jumper **J9** on the right side of the main control circuit board. See the figure below.



Move the jumper up to the **DISABLE** position (pins 2 and 3). With this setting, only the front panel **METER MODE** and **CHRG MODE** keys will function. All indicators will still work normally. Return the jumper down to the **ENABLE** position (pins 1 and 2) to return all front panel key functionality.

2.4. Performing routine maintenance

WARNING:

High voltages appear at several points inside the battery charger. Use extreme caution when working inside the charger. Do not attempt to work inside the charger unless you are a qualified technician or electrician.

Disconnect and lock out all power to the battery charger before starting any maintenance procedures. Turn the ac power off at the distribution panel upstream from the battery charger. Disconnect the battery from the charger output terminals.

2.4.1. Keep it clean

The AT10.1 charger is cooled by natural convection. At least once a year, vacuum the vents at the top and bottom of the enclosure to ensure that there is an adequate supply of cooling air. If you have an extremely dusty environment (especially if airborne dust is conductive), *carefully* vacuum out the interior. Be sure to clean surfaces of circuit boards, and around electrical terminals.

The AT10.1 is rated for operation up to 122° F / 50° C. If your charger is in a warmer environment, or at an elevation over 3000ft / 914m, contact your sales representative for operating information.

2.4.2. Check power and signal connections

Check the tightness of all field connections inside the charger, and connections to the battery. A loose or corroded connection at the battery terminals can be a fire or explosion hazard, and may cause erroneous operation of the AT10.1 charger.

2.4.3. Check remote sense wiring (optional)

If you wired the AT10.1 charger for remote sense, check the signal connections to the battery or load, and check the wiring to be sure the insulation is in good condition. If there is a failure of the remote sense signal wiring, the AT10.1 charger displays the error code **E 06**, and goes back to local control, sensing the output voltage at the charger output terminals.

2.4.4. Check temperature compensation probe (optional)

If you are using the optional temperature compensation probe, be sure that the probe is securely installed. Be sure the connectors and the wiring from the probe to the AT10.1 charger are in good condition.

If there is a failure of the temperature compensation probe, or the wiring, the AT10.1 charger displays the error code **E 08**.

2.4.5. Measuring the output ripple voltage (filtered models only)

If your AT10.1 charger is a filtered model, at least once a year measure the ac ripple voltage at the battery terminals. Use an rms responding ac voltmeter.[1] The ripple voltage should be no higher than shown in the specifications in Appendix A on page 70, if the battery ampere-hour capacity is at least 4 times the output current rating of the charger.

If you suspect that the output ripple voltage is too high, see "Output ripple voltage too high" of the *Troubleshooting Chart* in Section 3.4, page 53.

2.4.6. Viewing the voltage and alarm settings

You can review the parameter settings in the AT10.1 charger by pressing the EDIT/ENTER key on the front panel. Each time you press the key, a different parameter displays, in the following order:

- Float voltage
- Equalize voltage
- Equalize time (in hours)
- High dc voltage alarm setting
- Low dc voltage alarm setting
- Current limit, in Amperes

[1] Don't use a dc voltmeter. The ripple voltage on a battery is a very small ac voltage.

SAMPLE PREVENTIVE MAINTENANCE PROCEDURE

AT10.1 BATTERY CHARGER

Suggested frequency: every 6 months

Maintenance date _____ Performed by _____

Step (standard features)	Instructions	Results
Clean battery charger	• All vents clean and open. • Remove dust and debris from inside of unit.	☐ OK ☐ OK
Check all electrical connections and wiring	• TB1 connections all tight. • Internal wiring connections tight, slip-on connectors fully seated. Wire and lug insulation in good condition. • Terminations at battery or bus are tight and corrosion free.	☐ OK ☐ OK ☐ OK
Check ac input voltage	• Measure between TB1-L1 and TB1-L2 using an ac voltmeter. Value must be within +10%, -12% of nominal voltage.	Input _____ Vac
Check dc output voltage	• Measure at TB1(+) and TB1(-) using a dc voltmeter. Value should agree with front panel voltmeter within 1%, and must be correct values for your battery. If the AT10.1 is using a temperature compensation probe, see the graph on page 23 to determine correct battery voltage. You need to know the battery temperature for this step.	Float _____ Vdc Equalize _____ Vdc
Check ripple voltage	• Measure at battery terminals using an ac voltmeter set to the milliVolts scale. Check against specification in Appendix A on page 70.	Ripple _____ mVac
Test font panel indicators	• Press **LAMP TEST** key on front panel.	☐ OK
Test common alarm relay	• Press **LAMP TEST** key and hold for 4 seconds. Common alarm relay will transfer.	☐ OK

Exercise front panel controls	• Switch from float to equalize, then back to float. • Turn off the dc circuit breaker. **E 07** may appear on display (requires at least 5% of rated output current). Reset breaker.	☐ OK ☐ OK
	• Cycle through meter modes.	☐ **VOLTS** OK ☐ **AMPS** OK ☐ **HOURS** OK
	• Cycle through equalize methods.	☐ **MANUAL TIMER** OK ☐ **MANUAL EQLZ** OK ☐ **AUTO EQLZ TIMER** OK
	• Turn off ac circuit breaker. The **AC INPUT FAILURE** indicator should light. Reset breaker.	☐ Alarm OK
Check voltage and alarm settings	• Use **EDIT/ENTER** key to scroll through settings. See page 30.	☐ **FLOAT** OK ☐ **EQUALIZE** OK ☐ **HVDC** alarm OK ☐ **LVDC** alarm OK Current limit _____ Adc
Final checks	• Make sure plexiglas safety cover is in place. • Restore charger to normal operation. • Close latch on front panel.	☐ OK ☐ OK ☐ OK

Step (optional features)	**Instructions**	**Results**
Test auxiliary alarm relays	• Press **LAMP TEST** key and hold for 4 seconds. Alarm relays will transfer.	☐ OK
Check integrity of remote wiring	• Remote sense wiring. See page 16. • Temperature compensation wiring. See page 20. • Temperature compensation probe. See page 20.	☐ OK ☐ OK ☐ OK
Final checks	• Close padlock or key lock.	☐ OK

A downloadable worksheet of this Preventive Maintenance Procedure (JD0064-00) is available online (http://www.ATSeries.net/PDFs/JD0064-00.pdf).

3. SERVICING THE AT10.1

3.1. A STEP-BY-STEP TROUBLESHOOTING PROCEDURE

The AT10.1 battery charger is fully tested and calibrated at the factory and should work for years with a minimum of attention. If you do encounter trouble, there are three steps you should take to find the problem and return the charger to service.

1. Check the front panel meter for an error code. The AT10.1 is able to diagnose common problems with the battery charger, or with the application or installation. If the front panel displays an error code, see Section 3.2, *Interpreting Front Panel Error Messages,* for help in interpreting the code and solving the problem.
2. If the charger does not work properly, but there is no front panel error code, turn off the front panel circuit breakers (or disconnect ac and dc power externally). Then turn the dc and ac power back on. This will return the charger to normal operation as long as there is no internal component failure.

   Note: Do this only once. If the charger does not resume normal operation, go to the next step.

3. If the charger still does not work properly, make a list of the symptoms that you observe, then turn to *Using the troubleshooting chart* in Section 3.3. The troubleshooting chart relates common trouble symptoms to their causes, and gives the proper procedures for correcting the problem.
4. If the symptom doesn't appear on the troubleshooting chart, or if the recommended repair doesn't work, consult your sales or service representative to arrange for on-site or factory service.

3.2. INTERPRETING FRONT PANEL ERROR MESSAGES

If the AT10.1 control circuit detects a hardware or wiring problem, it may display an error code on the front panel. To solve the problem, use the table starting below, which lists the error codes and the procedures to use.

WARNING:

High voltages appear at several points inside the battery charger. Use extreme caution when working inside the charger. Do not attempt to work inside the charger unless you are a qualified technician or electrician.

Disconnect and lock out all power from the battery charger before starting to remove or replace any components. Turn the ac power off at the distribution panel upstream from the battery charger. Disconnect the battery from the charger output terminals.

Error Code	Meaning	Repair Procedure
E 01	Resistor R2 open or defective	Resistor R2 is installed at the back of the front panel, in the control circuit board input connector. R2 is measured by the control circuit on startup, and is used to determine some of the AT10.1 charger's parameters, such as the float voltage. If the AT10.1 finds that R2 is defective, it must be replaced. See Section 3.6 for parts ordering information. When you have completed the repair, restart the charger according to Section 2.1.
E 02	Short circuit on output	You may get this error code if the battery is discharged to less than 6 volts. When the battery charges to greater than 6 volts, the error code disappears. If you have a seriously discharged battery, allow the charger to run for 24 hours and check the battery voltage again. If it has not increased to the normal voltage rating, consult the battery manufacturer for help. If the battery voltage is normal, then check the wiring at the dc output terminals for a short circuit. If the battery voltage is normal and all external wiring is OK, check the dc breaker on the charger. If it is tripped, try once to reset it. If it trips again immediately, there may be an internal short circuit in the charger. Check the internal wiring. If the charger is filtered, check the dc filter capacitors and the polarity diode. The AT10.1 normally recovers automatically from an **E 02** condition. If you have shut down the charger for service, restart it according to Section 2.1.
E 03	High DC Voltage Shutdown	To restart the charger, turn the ac breaker off, then on. Check the Equalize voltage and High DC Voltage alarm settings. The alarm setting must be higher than the Equalize voltage setting. If you get another High DC Voltage shutdown after a few minutes of operation, there may be an internal component failure. See *Charger output not controllable* of the troubleshooting chart in Section 3.4.

Error Code	Meaning	Repair Procedure
E 04	internal memory failure	Any parameters that you set, such as Float or Equalize voltage, are saved internally. The internal memory is tested on startup. If the memory test fails, **E 04** appears on the front panel display. The error may also appear if the controller was trying to write to the memory while a power failure occured. If an **E 04** appears, try restarting the AT10.1 by turning the ac and dc breakers off, then on. If the charger restarts normally, you must reenter any changes you made to the factory settings (float voltage, etc.). If **E 04** appears repeatedly, the internal memory has been damaged. You must replace the control circuit board. See Section 3.6 for parts ordering information.
E 05	*not used*	This error code was formerly used to indicate a reverse battery connection. It is not available in the AT10.1.
E 06	R4 or R14 is defective, or remote sense wiring has failed	Locate R4 mounted on TB5, on the back of the front panel. Remove the resistor and measure its value with an Ohmmeter (see table 3-1 for the correct value). If the resistor is not within 1% of the specified value, it must be replaced. Locate R14 inside the enclosure, connected to TB1(-). Remove the lugged end and measure the resistor's value with an Ohmmeter (see table 3-1 for the correct value). If the resistor is not within 1% of the specified value, it must be replaced. If you are using remote sense wiring from the battery to the AT10.1, the wiring may have failed. The usual failure is an open circuit; a short circuit will usually be indicated by smoke or fire in the wiring. The AT10.1 charger displays the error code if it detects this wiring failure. You should respond to this problem quickly to be sure that the AT10.1 regulates the output voltage properly. Wire an annunciator (buzzer, e.g.) to the summary alarm relay TB3 to get a remote indication of any charger problem, or monitor the charger operation using the optional DNP-3/MODBUS communications board. If you have a failure in remote sense wiring, the AT10.1 regulates its output voltage locally until you correct the problem, see Section 1.9. The locally controlled voltage may not reflect the true requirements of the battery. When you complete the repair, restart the charger as described in Section 2.1.
E 07	DC breaker open, or internal wiring failure	If the dc breaker is open, open the ac breaker, then reclose the dc and ac breakers. If the dc breaker trips again, see the troubleshooting chart in Section 3.4. If the dc breaker is closed, but you have an **E 07** display, check your battery. If the battery is disconnected, and you then disconnect the load, the charger may display an **E 07** code. Restart the charger according to Section 2.1. If the battery and load are OK, see the troubleshooting chart in Section 3.4 for help in locating the problem.

Error Code	Meaning	Repair Procedure
E 08	defective temperature compensation probe	If a temperature compensation probe is connected to the AT10.1, the control circuit detects the probe on startup, and uses the temperature measured by the probe to control the output voltage of the charger. To understand temperature compensation, see Section 1.11. If the temperature compensation probe, or the wiring that connects it to the AT10.1, fails during normal operation, the AT10.1 detects the failure, and shows **E 08** on the front panel meter. Disconnect the wiring from the probe, and measure the resistance of the probe with an Ohmmeter. The resistance should be approximately 10,000 Ohms at normal room temperature (77° F / 25° C). If the probe reads open or shorted, it needs to be replaced. If the probe checks good, examine the wiring between the probe and the AT10.1. Also check the connection of the cable to the control circuit board on the back of the front panel. If the wiring is OK, then the probe needs to be replaced. Once you have replaced the probe, you must restart the AT10.1 to activate temperature compensation.
E 09	misadjusted current limit	The output current limit is set at the factory to 110% of the rated output current (e.g., for a 20 Adc charger, the current limit is set to 22 Adc). You can adjust the current limit downward to as low as 50% of the output current, if you have special requirements such as limited ac power available. You should do this only if the normal dc load on the system is smaller than the current limit. If you do reduce the current limit setting below 100% of rated current, your connected load might require more current than the charger can deliver. If this happens, the battery will not charge properly. If this occurs, the front panel displays the error code **E 09**. You should increase the current limit setting so that the charger can supply all the current required by the load, and still charge the battery. The current limit should be set to at least 5% greater than the maximum continuous dc load current. *NOTE: The common alarm relay is not set for this condition.*
E 10	open internal feedback loop	A redundant internal feedback loop (control loop) is provided as redundancy, to increase reliability when remote sensing is used. If there should be a problem with the internal loop wiring, the charger displays **E 10**. Check the internal wiring in the signal harness, especially wire **# 33**. Also check the harness connector on the main control circuit board.
E 14	forced load sharing not working properly	See Appendix F on page 90. Verify both chargers are functioning properly. Ensure that the forced load sharing interconnection cable assembly is not broken, is properly installed, and that the connector for the Secondary charger has the jumper as described. Ensure that both chargers are connected to the same ac supply and that source phase rotation is the same for both chargers.
A 02	equalize mode inhibited	If you set the equalize timer to zero hours, the equalize mode is inhibited. When you try to put the charger into equalize mode with a front panel control, the display shows the message **A 02**. If you want to enable the equalize mode, set the equalize timer to 1 or more hours.

3.3. USING THE TROUBLESHOOTING CHART

WARNING:

High voltages appear at several points inside the battery charger. Use extreme caution when working inside the charger. Do not attempt to work inside the charger unless you are a qualified technician or electrician.

Disconnect and lock out all power from the battery charger before starting to remove or replace any components. Turn the ac power off at the distribution panel upstream from the battery charger. Disconnect the battery from the charger output terminals.

Before you try to use the troubleshooting chart, be sure that you have followed the steps in Section 3.1.

The troubleshooting chart that begins on the next page is divided into three columns. To use the chart:

1. Make a list of the charger's condition, including the trouble symptoms.
2. Find the symptom(s) in the first column of the chart.
3. The middle column contains common causes for the problem you observe, in order of probability.
4. Follow the action described in the right-hand column to correct the problem and return the charger to normal service.

Determining the condition of the charger:

- Is the front panel **AC ON** indicator lit?
- What is the ac voltage at the input terminals (measured with an ac voltmeter)?
- What is the dc voltage at the output terminals (measured with a dc voltmeter)?
- Does the meter on the front panel display any voltage or current?
- Are any alarm indicators lit?
- Do the front panel status indicators work (Charge Mode, for example)?
- Can you change the charger to the Equalize mode and back to Float?
- Is the charger making any noise? Is it unusually loud?
- Is there any sign or smell of smoking or burning?

Refer to the wiring diagrams and parts layout drawings in Appendix C while using the chart. For instructions on replacing components, see Section 3.5.

3.4. TROUBLESHOOTING CHART

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
Front panel meter **displays all segments** "On" or all segments "Off." AT10.1 may have no output.	1. An external surge has interrupted operation of the microprocessor or the display controller.	1A. Soft Reset of control board by pressing S7 reset switch. S7 is located inside the AT10.1, on the control board's right edge (as viewed from the rear of the front panel). This will restart the control board without modifying any settings. 1B. Hard Reset of control board by pressing and holding the "UP" button on the front panel, and simultaneously pressing S7 reset switch. This will restart the control board and restore all settings to factory default. Reset parameters per Section 2.3 of this manual. 1C. Remove all power from AT10.1 to allow control board to discharge all voltages. This can be done by opening the AC circuit breaker and disconnecting the control board plug(s). Keep power removed for approximately 5 minutes to allow voltages to discharge.
AC breaker trips immediately	1. Shorted rectifier diode or SCR	1. Test by disconnecting wire **# 12** from the rectifier assembly. Measure resistance between the two top rectifier terminals (labeled "AC" on the wiring diagram); it should be at least 100,000 Ohms (check both polarities). Replace rectifier assembly if resistance is low in either direction.
	2. Defective wiring to T1 or to the rectifier heat sink assembly	2. Check spacing of terminals; check wiring for signs of insulation damage, burns, etc. Repair as necessary.
	3. Defective transformer T1	3. Test by disconnecting wires from X1, X4, Y1 and Y2. If ac breaker still trips, replace T1.
AC breaker trips after a few minutes	1. Loose connection to breaker	1. Check and tighten connections as required.
	2. Wrong ac voltage, or T1 taps miswired	2. Be sure the T1 primary taps are wired correctly for your input voltage. See Section 1.6 for details.
	3. Open SCR	3. Use a clamp-on ammeter to measure the current in wire **# 11** or **# 12**. If it less than 70% of the dc output current, one of the SCRs or diodes is defective. Replace the rectifier module.
	4. SCR not controllable	4. Disconnect wire **# 24** from terminal E3 of the rectifier assembly (near the left front of the enclosure). Restart the AT10.1. If You are able to measure output current, one of the SCRs is defective. Replace the rectifier module.
DC breaker trips immediately	1. Battery connected with reverse polarity	1. Check and correct battery wiring if necessary.
	2. Defective rectifier bridge (if unfiltered charger)	2. Test by disconnecting wire **# 12** from the rectifier assembly. Measure resistance between the two top rectifier terminals (labeled "AC" on the wiring diagram); it should be at least 100,000 Ohms (check both polarities). Replace rectifier assembly if resistance is low in either direction.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
DC breaker trips immediately *(continued)*	3. Defective free-wheeling diode in SCR module A16	3. Remove wire # **13** from the rectifier control pc board A3. Test the SCR module's internal free-wheeling diode by measuring the resistance from E2 to E10 on A3 with an Ohmmeter. The reading should be at least 100,000 Ohms in one polarity, and less than 1,000 Ohms in the other polarity. Replace the entire A16 SCR module if it is defective.
	4. Defective polarity diode (if filter assembly is installed)	4. Remove wire # **15** from terminal E14 on the CR1 heat sink. Measure the resistance from the heat sink to E8 on the rectifier control pc board at the left front of the AT10.1 (check both polarities). If the resistance is less than 1,000 Ohms in both directions, replace the filter assembly.
	5. Defective wiring	5. Check spacing of terminals; check wiring for signs of insulation damage, burns, etc. Repair as necessary.
DC breaker trips after a few minutes	1. Loose connection to breaker	1. Check and tighten connections as required.
	2. Open SCR	2. Use a clamp-on ammeter to measure the current in wire # **12** or # **11**. If it less than 70% of the dc output current, then one of the SCRs or diodes is defective. Replace the rectifier module.
	3. SCR not controllable	3. Disconnect wire # **24** from terminal E3 of the rectifier assembly (near the left front of the enclosure). Restart the AT10.1. If You are able to measure output current, one of the SCRs is defective. Replace the rectifier assembly.
	4. Defective Main Control circuit board A1	4. If the front panel meter shows more than 110% of rated dc current, the control board may be defective. Disconnect wire # **24** as above. If the output current goes to zero, replace the control board.
No output current, but ac and dc breakers are on; **AC ON** lamp is out	1. AC supply failure	1. If **AC ON** indicator is out, check feeder circuit breaker or fuse.
	2. Input fuse F1 is blown (480 Vac input only)	2. Remove F1 from its fuseholder (located on the bottom of the enclosure) and check with an Ohmmeter or fuse tester. Replace if required. NOTE: If the new fuse blows, see the sections titled "AC breaker trips immediately" and "AC breaker trips after a few minutes" for further troubleshooting hints.
	3. Defective wiring	3. Check terminals and wiring between T1 and the rectifier assembly, inductor L1, dc filter (if present), the dc breaker, and the output terminals. Check wire # **29** from T1-Y1 and wire # **28** from T1-Y2 to the control circuit board connector J1. Repair as necessary.
	4. Defective transformer T1	4. Use an ac voltmeter to measure the ac voltage from T1-X1 to X4. It is normally 50% to 80% higher than the rated dc output voltage. If it is too low, check the wiring of the primary taps. See Section 1.6 for details. If it is zero, replace T1.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
No output current, but ac and dc breakers are on; **AC ON** lamp is on	1. Battery is fully charged	1. This is normal operation in a system with little or no dc load. As long as the AT10.1 maintains Float voltage, it is operating normally.
	2. Float or Equalize voltage set too low	2. Check the Float and Equalize voltages and adjust them if necessary. Consult your battery manufacturer for the proper voltage settings.
	3. Wrong ac input voltage, or T1 taps mis-wired	3. Be sure the T1 primary taps are wired correctly for your input voltage. See Section 1.6 for details.
	4. Defective wiring	4. Check terminals and wiring between T1 and the rectifier assembly, inductor L1, dc filter (if present), the dc breaker, and the output terminals. Repair as necessary.
	5. Defective rectifier bridge	5. Use an ac voltmeter to measure the voltage between terminals E3 and E4 of the rectifier circuit board (A3). If you measure about 1.0 Vrms, but there is no output current, replace the rectifier assembly.
	6. Defective control circuit board A1	6. If you do not measure any ac voltage in step 5 above, and the battery voltage is less than the Float voltage setting, replace the control circuit board.
	7. Defective transformer T1	7. Use an ac voltmeter to measure the ac voltage from T1-X1 to X4. It is normally 50% to 80% higher than the rated dc output voltage. If it is too low, check the wiring of the primary taps. See Section 1.6 for details. If it is zero, replace T1.
	8. Defective inductor L1 or L2	8. Disconnect the wiring from L1 and measure the resistance between the terminals. If it is an open circuit, replace L1. Repeat for L2 if the optional dc filter is installed.
	9. Defective CR2	9. Disconnect wire **# 52** from L1 to CR2, then check CR2 with an Ohmmeter (check both polarities). If CR2 is open, replace the filter assembly. This is a very rare occurrence.
	10. Defective dc breaker	10. Disconnect the battery, and connect a light dc load to the AT10.1. Measure the dc voltage from the input terminal to the output terminal of the circuit breaker, with the breaker on. It is normally no more than 50 millivolts. If it is near the rated output voltage, replace the breaker.
Front panel is dead; ac and dc voltages are present at TB1	1. Control circuit board A1 is not connected	1. Make sure the connector at the top edge of the control circuit board is firmly seated.
	2. Defective control circuit board A1	2. If the **AC ON** indicator is lit, but the rest of the front panel is dead, replace the control circuit board.
	3. Defective wiring	3. Check the harness wiring to the control circuit board connector for signs of insulation damage, burns, etc. Be sure all wires are securely crimped in the connector.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
Front panel dies during ac power failure; dc voltage is present at TB1	1. Defective power resistor R3	1. Use a dc voltmeter to measure the dc voltage from E17 on the I/O panel to TB1(-). It is normally 12 Vdc when the rated output voltage is at TB1(+) and TB1(-). Remove all power from the AT10.1, and measure the resistance from TB1(+) and E17. See the table in Section 3.6 for the proper resistance values. If the resistance is not within 10% of the table value, replace R3.
	2. Defective wiring	2. Remove the enclosure shroud, and check the wiring to and from TB1 and the control circuit board for signs of insulation damage or burns. Repair any damaged wiring.
AT10.1 output voltage too high, not controllable	1. Defective SCR	1. Disconnect wire **# 24** from terminal E3 of the rectifier assembly (near the left front of the enclosure). Restart the AT10.1. If You are able to measure output current, one of the SCRs is defective. Replace the rectifier assembly.
	2. R4 or R14 is defective, or wrong value	2. Remove one end of R4 from TB5 (on the back of the front panel). Repeat for R14 connected to TB1(-). Measure their values with an Ohmmeter. See the table in Section 3.6 for resistance values. If either resistor is not within 1% of the specified value, it must be replaced.
	3. Defective temperature compensation probe (optional)	3. Remove the leads from the probe and measure its resistance. At 77° F / 25° C the resistance should be about 10,000 Ohms. If it is not, replace the probe assembly.
	4. Defective control circuit board A1	4. If the front panel meter shows more than 110% of rated dc current, the control board may be defective. Disconnect wire **# 24** from terminal E3 of the rectifier assembly (near the left front of the enclosure). Restart the AT10.1. If the output current goes to zero, replace the control board.
Output voltage does not agree with front panel meter	1. Temperature compensation probe is installed	1. If the optional temperature compensation probe is installed, the output voltage may be different from the selected float or equalize voltage. The difference in the voltages depends on the probe temperature. The front panel meter always displays the proper voltage for 77° F / 25° C.
	2. Circuit board or another component may have been replaced	2. Recalibrate meter as described in Section 2.3.7.
	3. R4 or R14 is defective, or wrong value	3. Remove one end of R4 from TB5 (on the back of the front panel). Repeat for R14 connected to TB1(-). Measure their values with an Ohmmeter. See the table in Section 3.6 for resistance values. If either resistor is not within 1% of the specified value, it must be replaced.
	4. Defective control circuit board A1	4. Turn off both front panel circuit breakers. Then turn on the dc breaker, followed by the ac breaker. If the AT10.1 still has the wrong output voltage, replace the control circuit board.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
AT10.1 never reaches float (or equalize) voltage (within 1%)	1. Current limit set too low	1. If the AT10.1 is not in the Edit mode, press the **EDIT/ENTER** key five times, until the meter display flashes the current limit value (in Amperes). If the current limit is less than 110%, adjust it to 110% as described. See *Setting the Current Limit Value*, Section 2.3.5 for details.
	2. Defective battery or dc load, or load is too great	2. Check each cell of the battery. If one or more cells are shorted, the AT10.1 may not be able to reach the Float voltage. You may have the same problem if the normal load current is more than the rated output current of the charger.
	3. Wrong ac input voltage, or voltage too low, or T1 wired incorrectly	3. Make sure the T1 primary taps are wired correctly for your input voltage. See *Changing Transformer Taps*, Section 1.6 for details. The actual ac input voltage must be at least 88% of the rated value for the charger to produce full output power.
	4. Defecive rectifier bridge	4. Use a clamp-on ammeter to measure the current in wire **# 12** or **# 11**. If it less than 70% of the dc output current, one of the SCRs or diodes is defective. Replace the rectifier module.
	5. Defective control circuit board A1	5. Turn off both front panel circuit breakers. Then turn on the dc breaker, followed by the ac breaker. If the AT10.1 output current is below the current limit value, but it still has the wrong output voltage, replace the control circuit board.
Input current too high	1. Wrong ac input voltage, or transformer T1 wired incorrectly	1. Be sure the T1 primary taps are wired correctly for your input voltage. See *Changing Transformer Taps*, Section 1.6 for details. The actual ac input voltage must be at least 88% of the rated value for the charger to produce full output power.
	2. Defective rectifier bridge	2. Disconnect wire **# 24** from terminal E3 of the rectifier assembly (near the left front of the enclosure). Restart the AT10.1. If You are able to measure output current, one of the SCRs is defective. Replace the rectifier assembly.
	3. Defective T1	3. Test by disconnecting wires from X1, X4, Y1 and Y2. If ac input current is still too high, replace T1.
Output ripple voltage too high	1. Charger is unfiltered	1. Verify by checking nameplate against the ordering code on the inside front cover. Order and install filter option if necessary.
	2. Battery is disconnected or defective	2. Be sure battery is connected. Inspect battery according to the manufacturer's instructions.
	3. Battery too small for charger rating	3. Check the measured ripple against the specification for your AT10.1 model on page 70. The ripple rating is for a battery whose Ampere-hours are four (4) times the charger Ampere rating. For a smaller battery, ripple voltage may be higher.
	4. One or more defective filter capacitors, C1 or C2	4. Test with capacitance meter; replace as necessary.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
AT10.1 very noisy	1. Loose hardware or enclosure panel	1. Remove the enclosure shroud. Check and tighten all component mounting hardware. Replace the shroud, being sure all assembly hardware is secure.
	2. Defective rectifier bridge	2. Use a clamp-on ammeter to measure the ac current in wire **# 11** or **# 12** (connected between T1 and the rectifier assembly). If it less than 70% of the dc output current, one of the SCRs or diodes is defective. Replace the rectifier module.
Meter readings are erratic	1. Defective or disconnected battery	1. Turn off the AT10.1. With a light dc load connected to the battery, be sure each cell reads the nominal cell voltage (2.0V for lead-acid; 1.25V for Ni-Cd). Restart the AT10.1. Each cell should now read the nominal Float voltage (2.2V for lead-acid; 1.35V for Ni-Cd).
	2. Defective scaling resistor R4 or R14	2. Remove one end of R4 from TB5 (on the back of the front panel). Repeat for R14 connected to TB1(-). Measure their values with an Ohmmeter. See the table in Section 3.6 for resistance values. If either resistor is not within 1% of the specified value, it must be replaced.
	3. Defective control circuit board A1	3. If the output voltage is constant, replace the control circuit board.
Lamp test key does not work, or some lamps don't light	1. No Vac	1. The lamp test key doesn't work during an ac power failure.
	2. Control circuit board A1 is not secured to front panel	2. Open the front panel, and be sure that the control circuit board is securely mounted on the standoffs on the back of the panel. All indicators should extend about 0.125in / 3.2mm through the front of the panel.
	3. Defective control circuit board A1	3. When you press the **LAMP TEST** key, if some but not all of the indicators light, or the digital meter does not display all 8's, replace the control circuit board.
One or more front panel keys don't work	1. Front panel is locked	1. Open the front panel, and be sure that jumper J9 on the main control circuit board is in the **ENABLE** position.
	2. Control circuit board A1 is not secured to front panel	2. Open the front panel, and be sure that the control circuit board is firmly seated on the standoffs on the back of the panel. Front panel keys must operate freely.
	3. Defective control circuit board A1	3. Turn off both front panel circuit breakers. Then turn on the dc breaker, followed by the ac breaker. If some of the front panel keys still do not work, replace the control circuit board.
Two AT10.1s connected in parallel, but only one has output current	1. If the forced load sharing option is not supplied, check for normal operation of both chargers	1. Multiple AT10.1s are not designed to share load current, without the optional forced load sharing cable installed. When two or more AT10.1s are connected in parallel without this option, it is normal for one of the units to have no output current. You can check the operation of the "off" charger by increasing its Float voltage until it starts to deliver output current. When you have finished the test, be sure both AT10.1s are set to the same Float and Equalize voltages.
	2. EJ5126-## option	2. See Appendix F on page 90 for troubleshooting of Forced Load Sharing feature.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
HIGH DC VOLTAGE indicator is on	1. High DC Voltage alarm and Equalize voltage settings are mismatched	1. Be sure that the High DC Voltage alarm setting is higher than the Equalize voltage setting. See Sections 2.3.2 and 2.3.4.
	2. Defective rectifier bridge	2. Disconnect wire **# 24** from terminal E3 of the rectifier assembly (near the left front of the enclosure). Restart the AT10.1. If You are able to measure output current, one of the SCRs is defective. Replace the rectifier assembly.
	3. Defective control circuit board A1	3. Turn off both front panel circuit breakers. Then turn on the dc breaker, followed by the ac breaker. If the charger output voltage is normal, but the **HIGH DC VOLTAGE** indicator is still on, replace the control circuit board.
No alarm, but output voltage is above High DC Voltage setting	1. Output current is below 2%	1. Output current must be greater than 2% of rated current to produce a High DC Voltage alarm. See *Parallel Operation* in Section 2.3.6.
	2. Defective control circuit board A1	2. Turn off both front panel circuit breakers. Then turn on the dc breaker, followed by the ac breaker. If the charger output voltage is above the alarm setting, but the **HIGH DC VOLTAGE** indicator still doesn't light, replace the control circuit board.
LOW DC VOLTAGE indicator is on, but ac and dc breakers are closed; ac input voltage is normal; there is output current	1. Battery is discharged	1. After an ac power failure, or a battery discharge for any other reason, it may take several hours to recharge the battery. It is normal for the **LOW DC VOLTAGE** indicator to be on until the battery voltage is above the Low DC Alarm voltage.
	2. Low DC Voltage alarm and Float voltage settings are mismatched	2. Be sure that the Low DC Voltage alarm setting is lower than the Float voltage setting. See Sections 2.3.2 and 2.3.4.
	3. Defective rectifier bridge	3. Use a clamp-on ammeter to measure the current in wire **# 11** or **# 12**. If it less than 70% of the dc output current, one of the SCRs or diodes is defective. Replace the rectifier assembly.
	4. Defective control circuit board A1	4. Turn off both front panel circuit breakers. Then turn on the dc breaker, followed by the ac breaker. If the charger output voltage is normal, but the **LOW DC VOLTAGE** indicator is still on, replace the control circuit board.
	5. Defective dc breaker	5. Disconnect the battery, and connect a light dc load to the AT10.1. Measure the dc voltage from the input terminal to the output terminal of the circuit breaker, with the breaker on. It is normally no more than 50 millivolts. If it is near the rated output voltage, replace the breaker.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
DC OUTPUT FAILURE indicator is on, but ac and dc breakers are closed; ac input voltage is normal	1. Defective rectifier bridge	1. Use a clamp-on ammeter to measure the current in wire # **12** or # **11**. If it is less than 70% of the dc output current, one of the SCRs or diodes is defective. Replace the rectifier module.
	2. Defective control circuit board A1	2. Turn off both front panel circuit breakers. Then turn on the dc breaker, followed by the ac breaker. If the charger output voltage and current are normal, but the **DC OUTPUT FAILURE** indicator is still on, replace the control circuit board.
	3. Defective transformer T1	3. Use an ac voltmeter to measure the ac voltage from T1-X1 to X4. It is normally 50% to 80% higher than the rated dc output voltage. If it is too low, check the wiring of the primary taps. See Section 1.6 for details. If it is zero, replace T1.
	4. Defective dc breaker	4. Disconnect the battery, and connect a light dc load to the AT10.1. Measure the dc voltage from the input terminal to the output terminal of the circuit breaker, with the breaker on. It is normally no more than 50 millivolts. If it is near the rated output voltage, replace the breaker.
AC INPUT FAILURE indicator is on	1. AC power failure	1. If the ac input power fails, the front panel **AC ON** indicator goes out, and the **AC INPUT FAILURE** indicator goes on.
	2. Upstream feed breaker/fuse is tripped	2. Be sure the front panel ac circuit breaker is closed. Measure the ac voltage at TB1-L1 and L2. If it is zero, check upstream distribution breakers and fuses.
	3. Defective wiring	3. Measure ac voltage at T1-H1 and T1-H5. It should be the same as the ac supply voltage.
	4. Defective control circuit board A1	4. Turn off both front panel circuit breakers. Then turn on the dc breaker, followed by the ac breaker. If the **AC ON** indicator is on, but the **AC INPUT FAILURE** indicator is still on, replace the control circuit board.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
POS GND or **NEG GND** indicator is on	1. Ground fault on external dc bus	1. Disconnect the AT10.1 from the battery and dc bus, and check the battery and dc bus for a ground fault.
	2. DC circuit breaker is open and **NEG GND** indicator is on	2. If the AT10.1 has been placed into standby by opening the dc breaker (CB2), the ground detection circuit gives an erroneous alarm. Close the dc breaker and the alarm should end. If you want the AT10.1 to be in standby, open the ac circuit breaker (CB1).
	3. Alarm needs calibration	3. Calibrate the ground detection sensitivity. See Section 2.3.4.
	4. Defective wiring	4. Disconnect the AT10.1 from the battery and dc bus. Turn the AT10.1 back on, and measure the voltage from **TB1(+)** to chassis, and from **TB1(-)** to chassis. The voltage readings should be equal, each approximately half of the total output voltage. If there is more than a 10% imbalance, turn off the AT10.1, and inspect all wiring from **TB1(+/-)** to the dc circuit breaker (CB2), and the rectifier bridge to the dc filter inductor (L1). Look for evidence of insulation damage, insufficient spacing between terminals and chassis, or wires run too close to metal edges.
	5. Defective Main Control circuit board A1	5. Turn off both front panel circuit breakers (CB1/CB2). Turn on the dc breaker, followed by the ac breaker. Wait one minute before returning the dc connection, followed by the ac connection If you are sure there is no ground fault on the external bus or within the AT10.1, but the **POS GND** or **NEG GND** indicator is still on, replace the main control circuit board (A1).
Summary alarm relay is in alarm mode, but no front panel alarm indicator is on	1. Defective Main Control circuit board A1	1. Turn off both front panel circuit breakers (CB1/CB2). Then turn on the dc breaker, followed by the ac breaker. Wait one minute before returning the dc connection, followed by the ac connection. If the relay remains in alarm mode, check the Low Level Detect indicator on main control circuit board. See Section 2.3.8. If no other alarm is on, replace the main control circuit board (A1).

3.5. REPLACING DEFECTIVE COMPONENTS

WARNING:

High voltages appear at several points inside the battery charger. Use extreme caution when working inside the charger. Do not attempt to work inside the charger unless you are a qualified technician or electrician.

Disconnect and lock out all power from the battery charger before starting to remove or replace any components. Turn the ac power off at the distribution panel upstream from the battery charger. Disconnect the battery from the charger output terminals.

NOTE: Refer to the standard drawings in Appendix C while performing the following procedures.

Removing the safety shield

Some of the repair procedures described below require you to remove the clear plastic safety shield over the I/O (input/output) panel inside the front panel. You remove the shield by taking off the wing nuts on the front. Don't lay the shield on the top of the charger; the top vents are needed for cooling.

CAUTION: Hazardous ac and dc voltages are present on the I/O panel terminals and several internal components.

Removing the enclosure shroud

You may need to remove the enclosure shroud in order to make some internal measurements, and to replace or repair some components. ***Remove all power from the charger.*** Remove the eleven screws that hold the shroud on the rear and bottom of the enclosure, then the two screws on the left side that hold the rectifier heat sink assembly. Support the front panel and lift the shroud straight up to remove it. Be sure to save the plastic washers from the door hinge.

The heat sink assembly is supported from the rear panel. Avoid putting any mechanical stress on the heat sink.

Replacing the enclosure shroud

Lower the shroud onto the enclosure base. Install and tighten the eleven screws that hold the shroud on the rear and bottom of the base before you install the two screws that support the heat sink assembly on the left side wall. Remember to reinstall the plastic washers on the door hinge.

Replacing the control circuit board (A1)

CAUTION: A1 is sensitive to damage from static discharges. Leave the circuit board in its anti-static bag until you are ready to install it. Ground yourself before handling the board by touching the ground stud on the back of the door. Handle the board only by the edges.

Turn off all power to the charger. Disconnect the battery from the output terminals. If the optional temperature compensation probe is installed, disconnect the leads from TB8. Remove the harness plug from the upper left edge of the control circuit board, and unplug wire **# 30** from the quick-connect terminal near the upper left corner of the board.

The board is mounted on six plastic standoffs. Compress the tab on each standoff, and pull the board toward you until it clears all the standoffs. Put the replacement board in place with the same orientation, and push it onto the standoffs. Be sure that the board is fully seated on the standoffs. Replace wire **# 30** on the quick-connect terminal, and connect the harness plug to the board at the top edge. Replace any optional wiring, such as the temperature compensation probe. See Section 2.1 for the steps to restart the charger.

If your charger parameters (float voltage, etc.) are different from the factory preset values, you should program in the new values now. See Section 2.3. You should also recalibrate the dc voltmeter according to Section 2.3.7.

Replacing the rectifier heat sink assembly (A6)

Refer to the customer instruction supplement JD5009-00 supplied with your replacement rectifier heat sink assembly (EJ1243-00).

Deenergize and lock out all ac and dc voltage sources to the AT10.1. This includes remote sense wires if they were installed. Check with a voltmeter before proceeding. Remove the enclosure shroud as described in the previous section. Make sure the rectifier heat sink has cooled and remove the entire assembly by the front edge. Remove all wires attached to the rectifier control pc board as you pull the assembly out of the enclosure.

Hold the replacement rectifier assembly in front of the AT10.1 (in the same orientation as the old), and reconnect all wires removed from the old assembly as you insert it into the enclosure. To ensure correct replacement, see the wiring diagrams in Appendix C of this manual or the customer instruction supplement JD5009-00, supplied with the replacement heat sink assembly. When you are done, check to ensure all wires are connected to the proper terminals, and all lugs are fully seated. If any lug does not fit snugly, disconnect it, carefully tighten the ears of the lug using long-nosed pliers, and reconnect.

Rotate the rectifier assembly into position in the enclosure. Line up the metal tab with the mounting hole on the back wall of the charger and slide the assembly into position. Replace the shroud as described in the previous section. Tighten all screws and restart the AT10.1.

Replacing the optional dc filter assembly (A7)

The dc filter assembly consists of a diode heat sink, inductor L2, and one or two capacitors installed on a single bracket.

Turn off all power to the charger. Disconnect the battery from the output terminals. Remove the safety shield.

Find the flying lead from the inductor L2 (wire **# 50**) and disconnect the other end from the center terminal of inductor L1 (at the upper right corner of the rear panel). Disconnect wire **# 15** from the quick-connect terminal at the top center of the diode heat sink, and remove wire **# 54** from terminal E7 on the front circuit board on the rectifier assembly. Carefully note which terminal the wire is connected to. Remove the four screws at the top of the dc filter bracket. The bracket and the inductor will both fall forward, away from the rear panel.

Lift the filter bracket up about .25in / 6.4mm to release it from the clips at the bottom of the bracket. Swing the filter assembly outward to the left, rotating it so that the heat sink comes out first and the capacitor(s) last.

Install the replacement filter assembly by inserting the capacitor end first, and rotating the assembly inward so that the heat sink is last to go in. Push the bottom edge of the bracket into the clips in the rear panel, and install the four screws at the top of the bracket.

Connect wire **# 15** to the quick-connect terminal at the top center of the diode heat sink. Route the flying lead from the inductor L2 (wire **# 50**) and connect it to the center terminal ("2") of the inductor L1. Reconnect wire **# 54** to terminal E7 of the front circuit board on the rectifier assembly. Replace the shroud and the safety shield.

Replacing the ac input or dc output circuit breaker (CB1, CB2)

Deenergize and lock out all ac and dc voltage sources to the AT10.1. Check with a voltmeter before proceeding. This includes remote sense wires if they were installed. Remove the two circuit breaker mounting screws on the front panel, and carefully rotate the circuit breaker upward and pull it out of the charger. Remove the wires from the terminals, one at a time, and transfer the wires to the terminals of the replacement breaker. *Be sure the terminal screws are tight*. Install the replacement breaker into the front panel, rotating it downward into place. Install the two mounting screws.

Replacing the main transformer (T1)

Deenergize and lock out all ac and dc voltage sources to the AT10.1. Check with a voltmeter before proceeding. This includes remote sense wires if they were installed. Remove the enclosure shroud and the safety shield. Disconnect the harness wires **# 28** and **# 29** from the upper row of transformer terminals. Disconnect wires **# 11** and **# 12** from the top of the rectifier heat sink. Disconnect harness wires **# 3** and **# 4** from the lower row of terminals; leave both jumpers in place on the lower row.

Remove the four screws or nuts that secure the transformer to the rear panel. Support the transformer by the top of the core and lift it up to get the bottom bracket off the rear panel. Remove the transformer from the charger.

Check the jumpers on the bottom row of terminals of the replacement transformer. Make sure they are connected to the same terminals as the jumpers on the transformer you just removed from the charger. For details see Section 1.6, *Changing the Transformer Taps*.

Hold the replacement transformer with the terminals labeled H1 through H5 at the bottom, facing you. Place the transformer against the rear panel, and slide the bottom of the transformer bracket into the slots on the rear panel. Install the four screws or nuts onto the mounting bracket of the transformer. Rewire the transformer, following the steps above in reverse. Refer to Section 1.6, and verify that the transformer is properly connected for your input voltage.

Replacing the ac surge suppressors (VR2, VR4 or VR5)

Turn off all power to the charger. Disconnect the battery from the output terminals. Remove the safety shield.

For **VR2**, remove the hardware from the input terminal L1, and remove the lead of the ac surge suppressor. Install one lead of the replacement surge suppressor onto the L1 terminal. Replace the other wires and the hardware. Repeat procedure for the L2 terminal. Tighten all hardware.

For **VR4**, remove the hardware from the input terminal L1, and remove the lead of the ac surge suppressor. Install one lead of the replacement surge suppressor onto the L1 terminal. Replace the other wires and the hardware. Repeat procedure for the ***left*** ground stud. Tighten all hardware.

For **VR5**, repeat procedure for the ac surge suppressor connected to the L2 terminal and the ***right*** ground terminal. Tighten all hardware.

NOTE: The surge suppressors are not polarized.

Replacing the dc surge suppressor (VR1)

Turn off all power to the charger. Disconnect the battery from the output terminals. Remove the safety shield.

Remove the hardware from the output terminal TB1(+), and remove the lead of the dc surge suppressor. Install one lead of the replacement surge suppressor. Replace the other wires and the hardware. Repeat for the output terminal TB1(-). Tighten all hardware.

NOTE: The surge suppressor is not polarized.

Replacing the dc surge suppressor networks (VR6/C4, VR7/C5)

Replace these networks as assemblies; do not replace individual parts.

Turn off all power to the charger. Disconnect the battery from the output terminals. Remove the safety shield.

To replace the network VR6/C4, remove the hardware from the output terminal TB1(-), and remove the lead of the network. Cut the plastic wire ties holding the assembly tight against the I/O panel. Install one lead of the replacement network. Replace the other wires and the hardware. Repeat for the other lead of the network on the ground terminal. For the VR7/C5 network, use the above procedure, but start with the lead on TB1(+). Tighten all hardware. Replace cut wire ties if possible.

NOTE: The surge suppressor networks are not polarized.

Replacing the power (ballast) resistor (R3)

Turn off all power to the charger. Disconnect the battery from the output terminals. Remove the safety shield.

Locate the power resistor R3 behind the I/O panel. In 12 & 24 Vdc units, R3 is installed at the top right corner of the I/O panel. In 48 Vdc units, R3 is mounted on the bracket behind the I/O panel. In 130 Vdc units, R3 is comprised of an assembly of two (2) resistors connected in series, mounted to the bracket behind the I/O panel.

Disconnect the lead of R3 connected to TB1(+), and replace it with the corresponding lead of the replacement power resistor. Remove the other lead of R3 from terminal E17 on the I/O panel and replace it with the remaining lead of the replacement power resistor. Tighten all hardware.

In 12 & 24 Vdc units, tuck the new R3 behind the I/O panel so that the leads are properly spaced. In 48 & 130 Vdc chargers, remove the screws that mount the old resistor(s), and replace with the new resistor(s). Tighten all mounting hardware.

For further instructions, refer to service instructions (JD5010-00).

Replacing the positive scaling resistor (R4)

Locate the scaling resistor R4 on TB5 on the back of the front panel, just above the control circuit board. The resistor (R4 is the one on the left) is mounted on two quick-connect terminals. Remove the resistor by grasping the terminals by the plastic insulation, and pulling out and downward. Install the replacement resistor by pushing the terminals firmly onto the quick-connect blades on the terminal block.

Replacing the voltage crowbar resistor (R6)

Locate the resistor R6 on TB5 on the back of the front panel, just above the control circuit board. The resistor (R6 is the one on the right) is mounted on two quick-connect terminals. Remove the resistor by grasping the terminals by the plastic insulation, and pulling out and downward. Install the replacement resistor by pushing the terminals firmly onto the quick-connect blades on the terminal block.

Replacing the negative scaling resistor (R14)

Turn off all power to the charger. Disconnect the battery from the output terminals. Remove the safety shield.

The scaling resistor R14 is connected to TB(-) with a ring lug. The other lead of the resistor is soldered to wire **# 20**.

Remove the insulating sleeving from the soldered joint to wire **# 20** (you may have to remove a harness tie) and cut the resistor lead near the solder joint. Disconnect the lugged-end of **R14** from TB1(-) and discard the old resistor.

Using a soldering iron no larger than 35 Watts, solder the bare lead of the new **R14** to wire **# 20**. Insulate the joint with plastic electrical tape. Crimp a similar ring lug to the other lead of the new resistor. Connect the lugged end of the new scaling resistor **R14** to TB1(-).

3.6. ORDERING REPLACEMENT PARTS

All AT10.1 Series battery chargers ship with a supplemental parts data package, itemizing all components within the unit. Contact your sales representative to place an order for spare or replacement parts. Please provide the following information for each component:

- Circuit symbol, factory part number and description from the supplied Parts Data Package report
- Model number and serial number of your AT10.1 Series battery charger
- Quantity required

Note: Some of the factory part numbers listed on the Parts Data Package report may differ from the standard replacement part numbers listed in this manual. Custom parts may have replaced standard parts to satisfy your specification. In that case, you should order the part number(s) listed on the report. The following table may specify part replacement kits that include other materials, such as installation instructions and packaging materials. You may order spare parts using either part number. To be sure of getting the complete kit, specify "Complete Kit" on your order, and the factory will make the necessary adjustments.

Please refer to the table below for the most common items.

Table 3-1: REPLACEMENT PARTS

Symbol	Description	Factory Part Number				Rec. Spare
		12 Vdc	24 Vdc	48 Vdc	130 Vdc	
A1	Main Control pc board assembly	EJ1243-10				Y
A3	Rectifier Gate Driver control pc board assy	EJ5093-00				
A5	Auxiliary Alarm Relay pc board assembly	EJ1243-03				Y
A6	Rectifier / Heat Sink assembly (A3 + A16)	EJ1243-00				Y
A7	DC Output Filter assembly	See Table 3-2				
A8	Battery Eliminator Filter assembly (requires filtered charger) 6Adc	EJ1155-00			EJ1155-01	
	12-25Adc				EJ1155-02	
A10	Temperature Compensation Probe assembly	See Appendix B, Table 2				
A16	Rectifier SCR module	EJ5094-00				
C1	DC Output Filter capacitor	RP0019-09			RP0019-08	Y
C2	Battery Eliminator Filter capacitor	RP0019-09			RP0019-08	Y
C4	EMI filter capacitor	See VR6/C4				
C5	EMI filter capacitor	See VR7/C5				
CB1	AC breaker (standard) 120/208/240 Vac	See Table 3-3				
CB1	AC breaker (medium AIC) 120/208/240 Vac	See Table 3-4				
CB1	AC breaker (high AIC) 120/208/240 Vac	See Table 3-5				
CB1	AC circuit breaker (medium AIC) 480 Vac	RE0171-00				
CB1	AC circuit breaker (high AIC) 480 Vac	RE0043-00				
CB2	DC circuit breaker (standard)	See Table 3-6				
CB2	DC circuit breaker (medium AIC)	See Table 3-7				
CB2	DC circuit breaker (high AIC)	See Table 3-8				

Symbol	Description	Factory Part Number				Rec. Spares
		12 Vdc	24 Vdc	48 Vdc	130 Vdc	
CR1	Polarity diode	EJ1243-04				Y
CR2	Blocking diode	EJ1243-05				
F1	480 Vac AC Input Fuse	See Table 3-14				Y
L1	Main Inductor	See Table 3-9				
L2	DC Filter Inductor	See Table 3-13				
P5	Jumper for disabling Ground Detection circuit	RC0100-00				
P7	Jumper for voltage selection on Auxiliary Alarm Relay circuit board (A5)	RC0100-00				
P9	Jumper for front panel lockout feature on A1	RC0100-00				
R2	Rating resistor	See Table 3-10				
R3	Power Supply (Ballast) Resistor	EJ1127-00 12Ω 2W	EJ1127-01 68Ω 11W	EJ1127-02 150Ω 50W	EJ1127-03 (note 1)	Y
R4	Scaling resistor (positive side)	EJ1134-00 3160 Ω	EJ1134-01 6980 Ω	EJ1134-02 14.0 kΩ	EJ1134-03 38.3 kΩ	
R6	Voltage crowbar resistor	EJ1135-00	EJ1135-01	EJ1135-02	EJ1135-03	
R9	Filter capacitor (C1) bleed resistor	EJ1137-00	EJ1137-00	EJ1137-01	EJ1137-02	
R14	Scaling resistor (negative side)	EJ1222-00 3160 Ω	EJ1222-01 6980 Ω	EJ1222-02 14.0 kΩ	EJ1222-03 38.3 kΩ	
T1	Main transformer (120/208/240 Vac)	See Table 3-11				
T1	Main transformer (480 Vac)	See Table 3-12				
TB1-X	I/O terminal box lug for #14-6 AWG	RC0056-04				
TB6	Terminal block for Medium and High AIC circuit breakers	terminal section RC0014-00 (8 req'd) end section RC0014-01 (1 req'd)				
VR1	Output Surge Suppressor	EJ1132-01				Y
VR2	Input Surge Suppressor (120/208/240 Vac)	EJ1132-01				Y
VR2	Input Surge Suppressor (480 Vac)	EJ1132-02				Y
VR3	Input Lightning Arrestor	EJ1074-00				
VR4, VR5	Input Surge Suppressor (120/208/240 Vac)	EJ1132-01				Y
VR4, VR5	Input Surge Suppressor (480 Vac)	EJ1132-02				Y
VR6/C4	EMI Filter Network	EJ5021-01				
VR7/C5	EMI Filter Network	EJ5021-01				

Note 1: In 130 Vdc units, a 500Ω 50W power supply resistor (R3), mounted behind the I/O panel, may be comprised of an assembly of two (2) 250Ω resistors connected in series.

Table 3-2: DC FILTER ASSEMBLIES (L2/C1/R9/CR1/CR2)

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
6A	EJ1072-00	EJ1072-00	EJ1072-02	EJ1072-03
12A	EJ1072-00	EJ1072-00	EJ1072-02	EJ1072-06
16A	EJ1072-01	EJ1072-01	EJ1072-07	EJ1072-04
20A	EJ1072-01	EJ1072-01	EJ1072-07	EJ1072-04
25A	EJ1072-01	EJ1072-01	EJ1072-07	EJ1072-05

Table 3-3: STANDARD AC CIRCUIT BREAKERS (CB1) - 120/208/240 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
6A	RE0159-11	RE0159-11	RE0159-11	RE0159-13
12A	RE0159-11	RE0159-11	RE0159-13	RE0159-16
16A	RE0159-11	RE0159-12	RE0159-13	RE0159-19
20A	RE0159-11	RE0159-12	RE0159-14	RE0159-20
25A	RE0159-11	RE0159-12	RE0159-15	RE0159-20

Table 3-4: MEDIUM INTERRUPTING CAPACITY AC BREAKERS (CB1) - 120/208/240 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
6A	RE0171-00	RE0171-00	RE0171-00	RE0171-01
12A	RE0171-00	RE0171-00	RE0171-01	RE0171-04
16A	RE0171-00	RE0171-00	RE0171-01	RE0171-07
20A	RE0171-00	RE0171-00	RE0171-02	RE0171-08
25A	RE0171-00	RE0171-00	RE0171-03	RE0171-08

Table 3-5: HIGH INTERRUPTING CAPACITY AC BREAKERS (CB1) - 120/208/240 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
6A	RE0043-00	RE0043-00	RE0043-00	RE0043-01
12A	RE0043-00	RE0043-00	RE0043-01	RE0043-04
16A	RE0043-00	RE0043-00	RE0043-01	RE0043-07
20A	RE0043-00	RE0043-00	RE0043-02	RE0043-08
25A	RE0043-00	RE0043-00	RE0043-03	RE0043-08

Table 3-6: STANDARD DC CIRCUIT BREAKERS (CB2)

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
6A	RE0159-01	RE0159-01	RE0159-01	RE0159-12
12A	RE0159-02	RE0159-02	RE0159-02	RE0159-13
16A	RE0159-03	RE0159-03	RE0159-03	RE0159-14
20A	RE0159-04	RE0159-04	RE0159-04	RE0159-15
25A	RE0159-06	RE0159-06	RE0159-06	RE0159-17

Table 3-7: MEDIUM AMPERE INTERRUPTING CAPACITY DC CIRCUIT BREAKERS (CB2)

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
6A	RE0171-00	RE0171-00	RE0171-00	RE0171-00
12A	RE0171-01	RE0171-01	RE0171-01	RE0171-01
16A	RE0171-02	RE0171-02	RE0171-02	RE0171-02
20A	RE0171-03	RE0171-03	RE0171-03	RE0171-03
25A	RE0171-04	RE0171-04	RE0171-04	RE0171-04

Table 3-8: HIGH AMPERE INTERRUPTING CAPACITY DC CIRCUIT BREAKERS (CB2)

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
6A	RE0043-00	RE0043-00	RE0043-00	RE0043-00
12A	RE0043-01	RE0043-01	RE0043-01	RE0043-01
16A	RE0043-02	RE0043-02	RE0043-02	RE0043-02
20A	RE0043-03	RE0043-03	RE0043-03	RE0043-03
25A	RE0043-04	RE0043-04	RE0043-04	RE0043-04

Table 3-9: MAIN INDUCTOR (L1)

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
6A	AP0928-00	AP0928-00	AP0928-00	AP1122-00
12A	AP0928-00	AP0928-00	AP0928-00	AP0930-00
16A	AP0926-00	AP0926-00	AP0926-00	AP0931-00
20A	AP0926-00	AP0926-00	AP0926-00	AP0931-00
25A	AP0926-00	AP0926-00	AP0926-00	AP0931-00

Table 3-10: RATING RESISTOR (R2)

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
6A	EJ1133-00 34.8 kΩ	EJ1133-05 13.0 kΩ	EJ1133-10 5.11 kΩ	EJ1133-15 1.50 kΩ
12A	EJ1133-01 40.2 kΩ	EJ1133-06 15.4 kΩ	EJ1133-11 6.19 kΩ	EJ1133-16 2.21 kΩ
16A	EJ1133-02 53.6 kΩ	EJ1133-07 19.6 kΩ	EJ1133-12 7.50 kΩ	EJ1133-17 2.74 kΩ
20A	EJ1133-03 78.7 kΩ	EJ1133-08 23.7 kΩ	EJ1133-13 9.09 kΩ	EJ1133-18 3.57 kΩ
25A	EJ1133-04 118 kΩ	EJ1133-09 29.4 kΩ	EJ1133-14 11.0 kΩ	EJ1133-19 4.32 kΩ
Connector terminal extraction tool	Molex Part No. **11-03-0044**			

Table 3-11: MAIN TRANSFORMER (T1) - 120/208/240 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
6A	AA0718-00	AA0719-00	AB2023-00	AB1868-00
12A	AA0718-00	AA0719-00	AB2023-00	AB1857-00
16A	AA0720-00	AB1855-00	AB1856-00	AB1858-00
20A	AA0720-00	AB1855-00	AB1856-00	AB1858-00
25A	AA0720-00	AB1855-00	AB1856-00	AB1858-00

Table 3-12: MAIN TRANSFORMER (T1) - 480 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
6A	AA0733-00	AA0734-00	AB2038-00	AB2039-00
12A	AA0733-00	AA0734-00	AB2038-00	AB2032-00
16A	AA0735-00	AB2035-00	AB2036-00	AB2037-00
20A	AA0735-00	AB2035-00	AB2036-00	AB2037-00
25A	AA0735-00	AB2035-00	AB2036-00	AB2037-00

Table 3-13: FILTER INDUCTOR (L2)

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
6A	AP0928-00	AP0928-00	AP0928-00	AP1081-00
12A	AP0928-00	AP0928-00	AP0928-00	AP0928-00
16A	AP0927-00	AP0927-00	AP0926-00	AP0926-00
20A	AP0927-00	AP0927-00	AP0926-00	AP0926-00
25A	AP0927-00	AP0927-00	AP0926-00	AP0926-00

Table 3-14: 480 Vac INPUT FUSE (F1)

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
6A	RE0008-00	RE0008-00	RE0008-02	RE0008-06
12A	RE0008-00	RE0008-02	RE0008-06	RE0008-08
16A	RE0008-02	RE0008-06	RE0008-08	RE0008-09
20A	RE0008-02	RE0008-06	RE0008-08	RE0008-11
25A	RE0008-02	RE0008-06	RE0008-08	RE0008-11

APPENDIX A

SPECIFICATIONS

Except as noted, all specifications apply at:
77° F / 25 °C, nominal ac line voltage & nominal float voltage

Specification	Conditions	12 Vdc	24 Vdc	48 Vdc	130 Vdc
Output voltage regulation	Vac +10%, -12% 0 to 100% load Temp. 32-122° F / 0-50° C Freq. 60 ± 3 Hz	± 0.25% (see product literature for specific data)			
Transient response	20-100% load change, with battery connected	Output voltage change ± 4% maximum Recovery to ± 2.0% in 200 ms Recovery to ± 0.5% in 500 ms			
Efficiency	12 Adc rating, full load (%)	67.00	72.00	78.00	85.00
	25 Adc rating, full load (%)	73.00	77.00	85.00	91.00

Output ripple voltage per **NEMA PE5-1996**	Unfiltered (with battery)	1% rms (typ) at battery terminals	2% rms
	Filtered (with battery)	30 mV rms (max) at battery terminals	100 mV
	Filtered (without battery)	1% rms (typ)	2% rms
	Battery Eliminator Filter Option (without battery)	30 mV rms	100 mV

Current limit	Adjustable	50-110 % of rated output current
Soft start	0 to 100% load	4 seconds

Voltage adjustment ranges	Float (Vdc)	11.0-14.5	22.0-29.5	44.0-58.0	110-141
	Equalize (Vdc)	11.7-15.5	23.4-31.0	46.8-59.0	117-143
	High DC Voltage alarm (Vdc)	12-19	24-38	48-76	120-175
	Low DC Voltage alarm (Vdc)	7-14.5	15-29.5	30-58	80-141
Voltmeter range (Vdc)		0 - 21	0 - 42	0 - 75	0 - 195
Ammeter range (Adc)	All ratings	0 - 30			

Surge withstand capability	Test per **ANSI C37.90.1-1989**	No erroneous outputs
Reverse current from battery	AC input power failure	90 mA maximum
Audible noise	Average for 4 sides, 5ft / 1.5m from charger	Less than 62 dB(A)
Cooling		Natural convection
Ambient temperature	Operating	32-122° F / 0-50° C
Elevation		3000ft / 1000m without derating
Relative humidity		0 to 95% non-condensing

Alarm relay contact rating	120 Vac / 125 Vdc	0.5 A resistive

FIELD INSTALLABLE ACCESSORIES AND OPTIONS

All accessories/options listed below are available in kits for field installation. Kits contain all parts and hardware with detailed installation instructions. To order accessories/options, please provide the following information for each kit:

- Factory part number and description, from the table below
- Model number and serial number of your battery charger
- Quantity required

Contact your sales representative to place an order for accessories/options.

Description	Kit Part Number
standard DC Output Filtering (per NEMA PE5-1996)	see table 3-2
Battery Eliminator Filtering (per NEMA PE5-1996)	see table 3-1
Auxiliary Relay PC Board (A5) for standard circuit breakers	EI0213-00
Auxiliary Relay PC Board (A5) for med/high AIC circuit breakers	EI0213-01
Copper Ground Bus with one (1) box lug for #14-6 AWG	EI0195-00
AC Input Lightning Arrestor (VR3)	EJ1074-00
Floor Mounting Kit for Style-586/594 Enclosure	EI0192-00
Relay Rack Mounting Kit for Style-586/594 Enclosure	EI0193-00
NEMA-2 Type Drip Shield Assembly for Style-586/594 Enclosure	EI0191-00
NEMA-4/12/13 Type Enclosure for Style-586/594 Enclosure	EI0214-XX
Cabinet Heater Assembly for Style-586/594 Enclosure	EJ1223-00
Padlock for Style-586/594 Enclosure Front Panel Door	EI0215-00
Remote Temperature Compensation Probe Assembly (A10)	see below
DNP3 Level 2 / Modbus Communications Module	see Appendix E
Forced Load Sharing Accessory	EJ5126-XX

Remote Temperature Compensation Probe

The temperature compensation assembly consists of two (2) components:

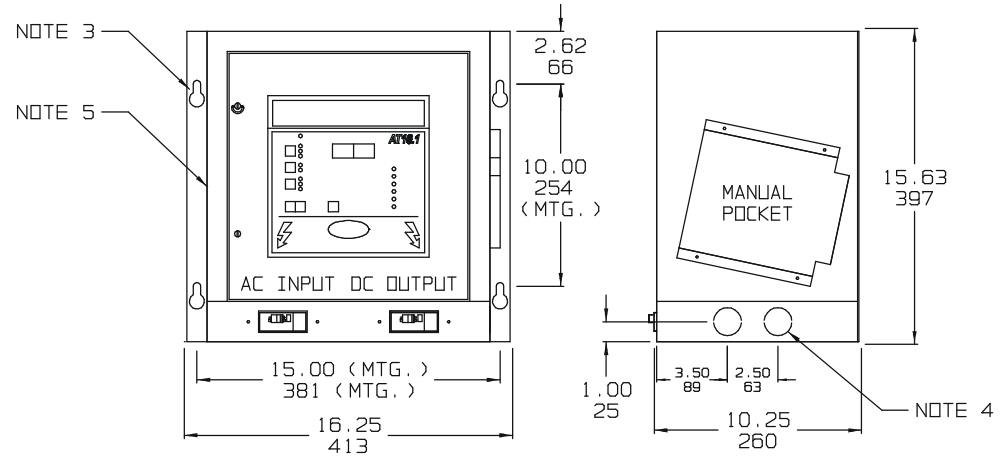
1. To order a replacement probe (or puck), request part number EJ5032-00. This probe is good for all charger output voltages and all battery types.
2. The standard temperature compensation assembly is supplied with a 25ft / 7.6m interconnection cable. If you need a longer cable, order it from the table below, which also shows the ordering part number for a complete probe kit.

Temperature Compensation Probe Kits

Cable Length (feet / m)	Kit Part Number (includes probe)	Replacement Cable Part Number
25 / 7.6	EJ5033-00	EJ5011-00
50 / 15.2	EJ5033-01	EJ5011-01
100 / 30.5	EJ5033-02	EJ5011-02
200 / 61.0	EJ5033-03	EJ5011-03

Use a single cable assembly. Do not try to splice cables together to increase the length.

Outline - AT10.1 Group I Battery Charger: NEMA-1 Style-586 (**JE5023-03**)



NOTES:

1) ENCLOSURE IS A NEMA-1/IP20 TYPE CABINET WITHOUT GASKETS.

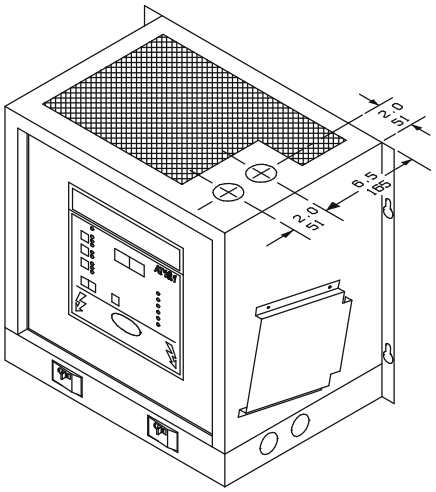
2) ALLOW 6in (152mm) OF FREE AIR (TOP AND FRONT OF CABINET) FOR VENTILATION.

3) FOUR (4) KEY-HOLE SLOTS ARE PROVIDED ON THE BACK OF ENCLOSURE AS SHOWN, FOR WALL-MOUNTING WITH .25in (6.25mm) HARDWARE.

4) FOUR (4) 1.31in/33mm DIA KNOCKOUTS ARE PROVIDED AS SHOWN, WITH TWO (2) ADDITIONAL KNOCKOUTS FEATURED ON BOTTOM PANEL OF ENCLOSURE. USE OF ANY OF THESE FOUR (4) LOWER CONDUIT KNOCKOUTS WILL ALLOW REMOVAL OF THE CABINET SHROUD WITHOUT REMOVAL OF EXTERNAL WIRING.

5) DATA NAMEPLATE WITH CHARGER RATINGS MOUNTED ON LEFT SIDE OF ENCLOSURE.

6) BATTERY CHARGER SHIPPING WEIGHT RANGE: APPROXIMATELY 44-20 lbs. / 80-36 kg.



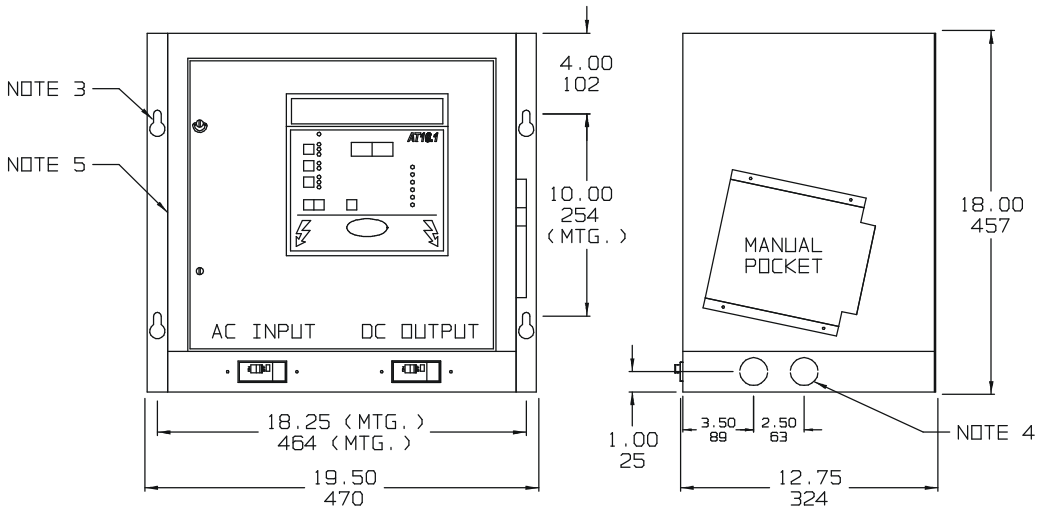
DUAL DIMENSIONS in / mm

				THIRD ANGLE PROJECTION		
				DRAWN BY MCR	012304	TITLE AT10.1 SERIES BATTERY CHARGER OUTLINE: NEMA-1 STYLE-586 ENCLOSURE
				APPROVED		
0	E1542	012304		UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES. TOLERANCES ARE:		DRAWING No JE5023-03 REV 0 A
REV	ECN No	DATE	APP			SCALE NTS PART No JE5023-03 SHEET 1 OF 1

FILENAME [JE5023-03.PRT]

http://www.ATSeries.net/PDFs/JE5023-03.pdf

Outline - AT10.1 Group I Battery Charger: NEMA-1 Style-594 (**JE5024-03**)



NOTES:

1) ENCLOSURE IS A NEMA-1/IP20 TYPE CABINET WITHOUT GASKETS.

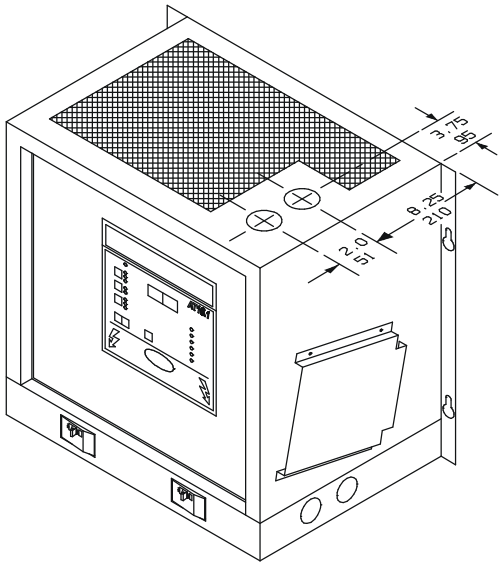
2) ALLOW 6in (152mm) OF FREE AIR (TOP AND FRONT OF CABINET) FOR VENTILATION.

3) FOUR (4) KEY-HOLE SLOTS ARE PROVIDED ON THE BACK OF ENCLOSURE AS SHOWN, FOR WALL-MOUNTING WITH .25in (6.25mm) HARDWARE.

4) FOUR (4) 1.31in/33mm DIA KNOCKOUTS ARE PROVIDED AS SHOWN, WITH TWO (2) ADDITIONAL KNOCKOUTS FEATURED ON BOTTOM PANEL OF ENCLOSURE. USE OF ANY OF THESE FOUR (4) LOWER CONDUIT KNOCKOUTS WILL ALLOW REMOVAL OF THE CABINET SHROUD WITHOUT REMOVAL OF EXTERNAL WIRING.

5) DATA NAMEPLATE WITH CHARGER RATINGS MOUNTED ON LEFT SIDE OF ENCLOSURE.

6) BATTERY CHARGER SHIPPING WEIGHT RANGE: APPROXIMATELY 110-193 lbs. / 50-88 kg.



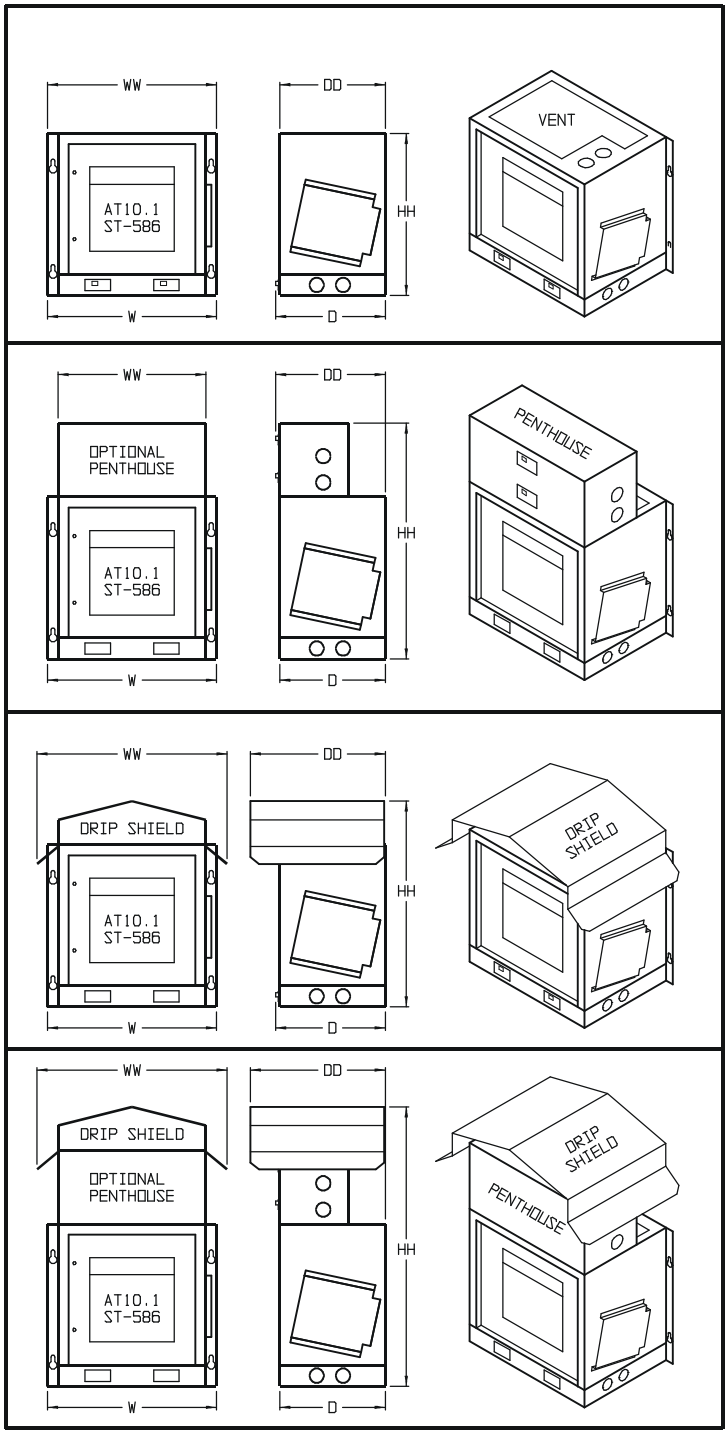
DUAL DIMENSIONS in / mm

				THIRD ANGLE PROJECTION		
				DRAWN BY MCR	012304	TITLE AT10.1 SERIES BATTERY CHARGER OUTLINE: NEMA-1 STYLE-594 ENCLOSURE
				APPROVED		
0	E1542	012304		UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES. TOLERANCES ARE:		DRAWING No JE5024-03 REV 0 A
REV	ECN No	DATE	APP			SCALE NTS PART No JE5024-03 SHEET 1 OF 1

FILENAME [JE5024-03.PRT]

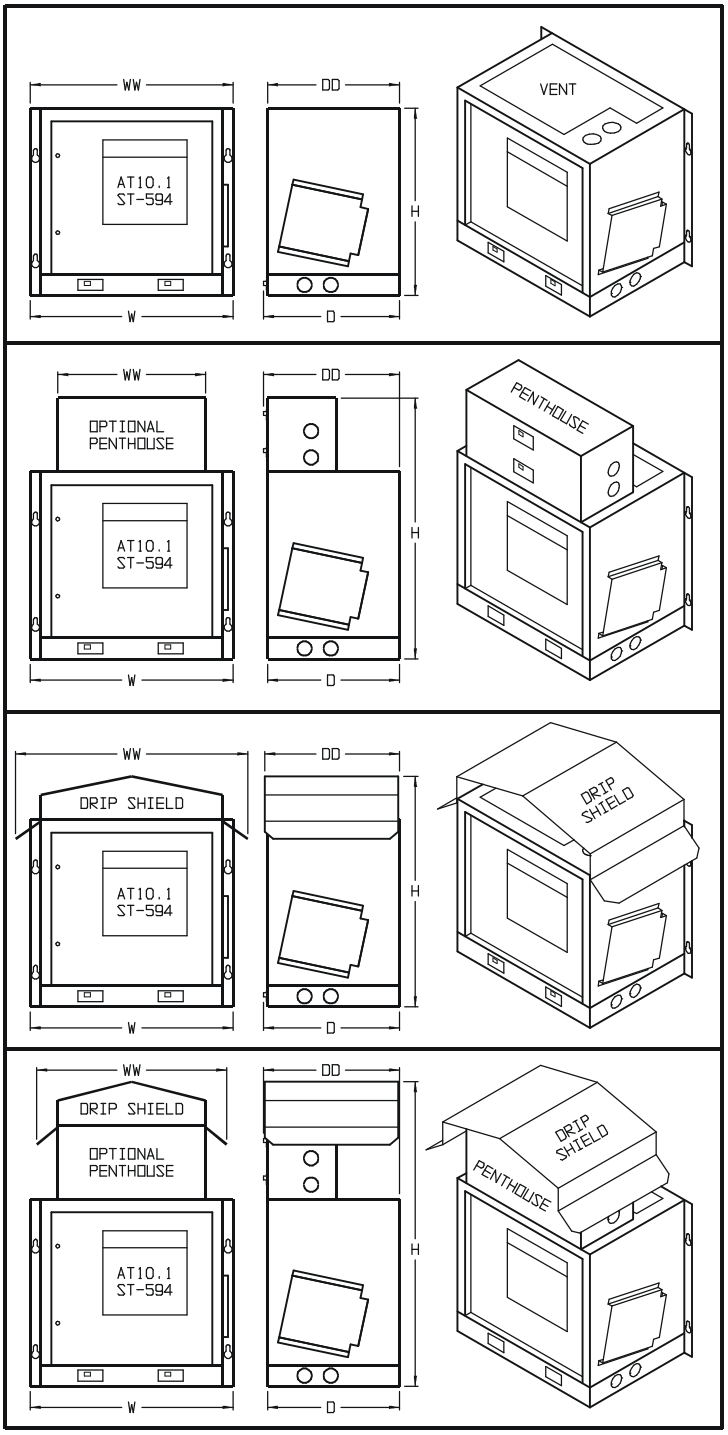
http://www.ATSeries.net/PDFs/JE5024-03.pdf

AT10.1 Optional Enclosure Outline Drawings
Stlye-586 with Penthouse and Drip Shield



DIMENSION	in	mm
Standard		
WW	16.25	495
DD	12.50	324
HH	15.63	457
W	16.25	495
D	10.75	337
with Penthouse		
WW	14.00	356
DD	10.75	337
HH	22.63	572
W	16.25	495
D	10.00	324
with Drip Shield		
WW	18.75	559
DD	12.50	318
HH	19.50	552
W	16.25	495
D	10.75	337
with Penthouse & Drip Shield		
WW	18.75	476
DD	12.50	337
HH	26.50	729
W	16.25	495
D	10.00	324

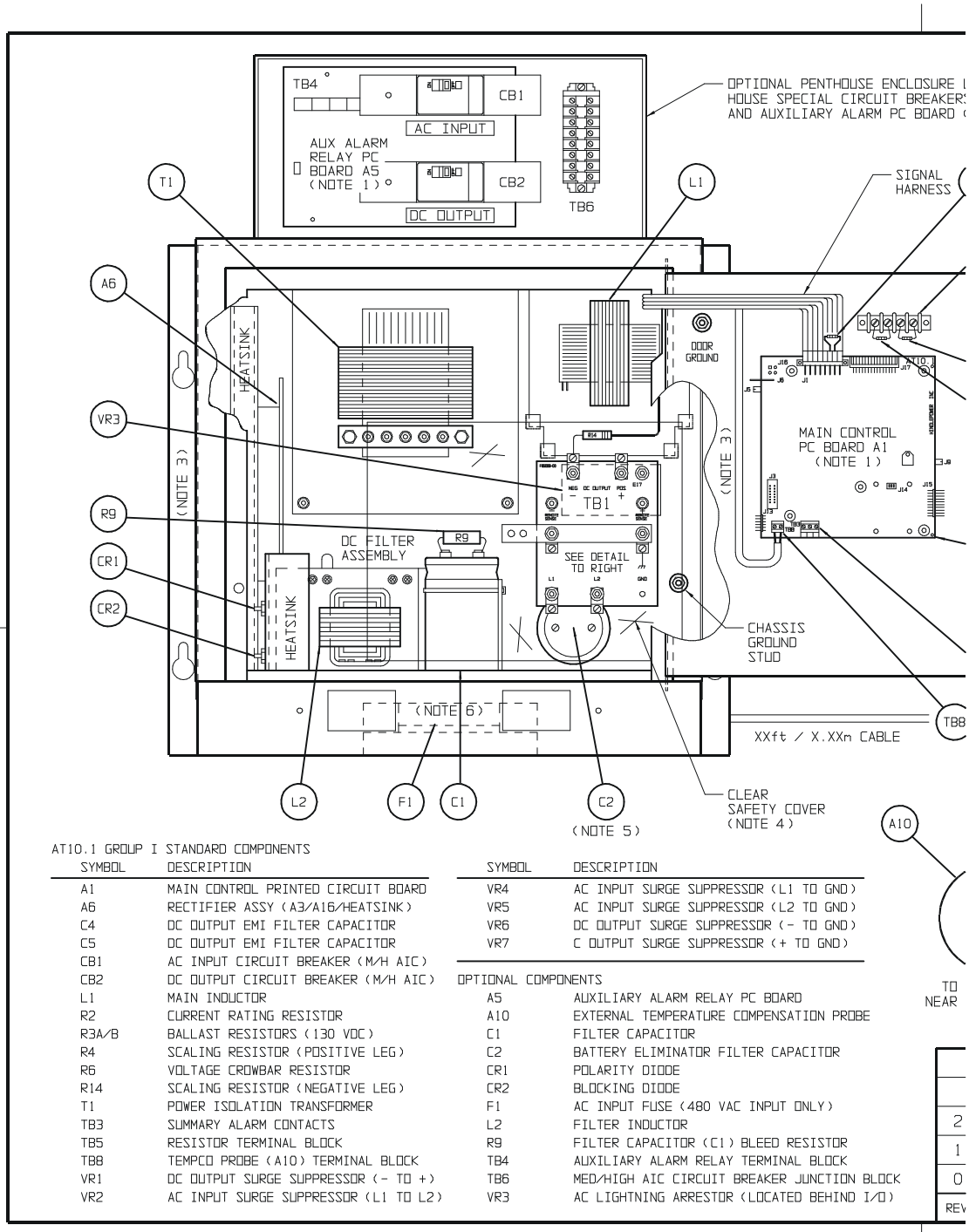
AT10.1 Optional Enclosure Outline Drawings
Stlye-594 with Penthouse and Drip Shield



DIMENSION	in	mm
Standard		
WW	19.50	495
DD	12.75	324
HH	18.00	457
W	19.50	495
D	13.25	337
with Penthouse		
WW	14.00	356
DD	13.25	337
HH	25.00	635
W	19.50	495
D	12.75	324
with Drip Shield		
WW	22.00	559
DD	12.50	318
HH	21.75	552
W	19.50	495
D	13.25	337
with Penthouse & Drip Shield		
WW	18.75	476
DD	13.25	337
HH	28.75	729
W	19.50	495
D	12.75	324

APPENDIX C (Standard Drawings)

Internal Component Layout Detail - AT10.1 Group I Battery Charger w/Common Options (**JE5027-99**)



AT10.1 GROUP I STANDARD COMPONENTS

SYMBOL	DESCRIPTION
A1	MAIN CONTROL PRINTED CIRCUIT BOARD
A6	RECTIFIER ASSY (A3/A16/HEATSINK)
C4	DC OUTPUT EMI FILTER CAPACITOR
C5	DC OUTPUT EMI FILTER CAPACITOR
CB1	AC INPUT CIRCUIT BREAKER (M/H AIC)
CB2	DC OUTPUT CIRCUIT BREAKER (M/H AIC)
L1	MAIN INDUCTOR
R2	CURRENT RATING RESISTOR
R3A/B	BALLAST RESISTORS (130 VDC)
R4	SCALING RESISTOR (POSITIVE LEG)
R6	VOLTAGE CROWBAR RESISTOR
R14	SCALING RESISTOR (NEGATIVE LEG)
T1	POWER ISOLATION TRANSFORMER
TB3	SUMMARY ALARM CONTACTS
TB5	RESISTOR TERMINAL BLOCK
TB8	TEMPCO PROBE (A10) TERMINAL BLOCK
VR1	DC OUTPUT SURGE SUPPRESSOR (- TO +)
VR2	AC INPUT SURGE SUPPRESSOR (L1 TO L2)

SYMBOL	DESCRIPTION
VR4	AC INPUT SURGE SUPPRESSOR (L1 TO GND)
VR5	AC INPUT SURGE SUPPRESSOR (L2 TO GND)
VR6	DC OUTPUT SURGE SUPPRESSOR (- TO GND)
VR7	C OUTPUT SURGE SUPPRESSOR (+ TO GND)

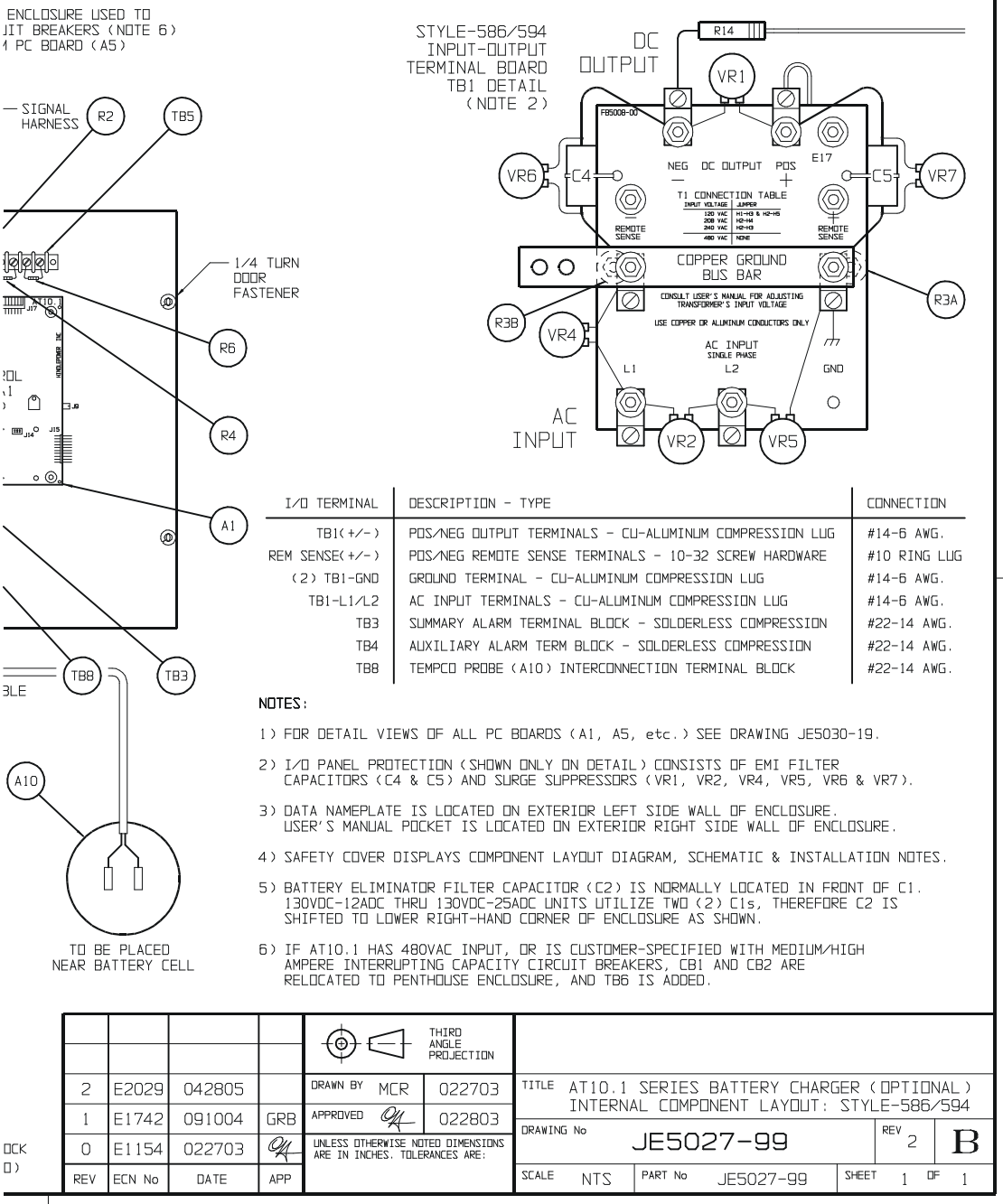
OPTIONAL COMPONENTS

A5	AUXILIARY ALARM RELAY PC BOARD
A10	EXTERNAL TEMPERATURE COMPENSATION PROBE
C1	FILTER CAPACITOR
C2	BATTERY ELIMINATOR FILTER CAPACITOR
CR1	POLARITY DIODE
CR2	BLOCKING DIODE
F1	AC INPUT FUSE (480 VAC INPUT ONLY)
L2	FILTER INDUCTOR
R9	FILTER CAPACITOR (C1) BLEED RESISTOR
TB4	AUXILIARY ALARM RELAY TERMINAL BLOCK
TB6	MED/HIGH AIC CIRCUIT BREAKER JUNCTION BLOCK
VR3	AC LIGHTNING ARRESTOR (LOCATED BEHIND I/O)

REV 2 1 0

Note: This internal component layout drawing (**JE5027-99**) depicts an AT10.1 Series battery charger housed in a Style-586 or Style-594 enclosure, with ALL available options. Standard components (A1 through VR7) are supplied in all such units. Optional components (A5 through VR3) are supplied only in those AT10.1 chargers configured with such options. A custom internal component layout drawing is available for any AT10.1 battery charger, based upon a quote or a manufactured unit. For document availability, please contact your sales representative with the model number, options, features and other specifications for the AT10.1 Series battery charger in question.

Internal Component Layout Detail - AT10.1 Group I Battery Charger w/Common Options (**JE5027-99**)



I/O TERMINAL	DESCRIPTION - TYPE	CONNECTION
TB1(+/-)	POS/NEG OUTPUT TERMINALS - CU-ALUMINUM COMPRESSION LUG	#14-6 AWG.
REM SENSE(+/-)	POS/NEG REMOTE SENSE TERMINALS - 10-32 SCREW HARDWARE	#10 RING LUG
(2) TB1-GND	GROUND TERMINAL - CU-ALUMINUM COMPRESSION LUG	#14-6 AWG.
TB1-L1/L2	AC INPUT TERMINALS - CU-ALUMINUM COMPRESSION LUG	#14-6 AWG.
TB3	SUMMARY ALARM TERMINAL BLOCK - SOLDERLESS COMPRESSION	#22-14 AWG.
TB4	AUXILIARY ALARM TERM BLOCK - SOLDERLESS COMPRESSION	#22-14 AWG.
TB8	TEMPCO PROBE (A10) INTERCONNECTION TERMINAL BLOCK	#22-14 AWG.

NOTES:

1) FOR DETAIL VIEWS OF ALL PC BOARDS (A1, A5, etc.) SEE DRAWING JE5030-19.

2) I/O PANEL PROTECTION (SHOWN ONLY ON DETAIL) CONSISTS OF EMI FILTER CAPACITORS (C4 & C5) AND SURGE SUPPRESSORS (VR1, VR2, VR4, VR5, VR6 & VR7).

3) DATA NAMEPLATE IS LOCATED ON EXTERIOR LEFT SIDE WALL OF ENCLOSURE. USER'S MANUAL POCKET IS LOCATED ON EXTERIOR RIGHT SIDE WALL OF ENCLOSURE.

4) SAFETY COVER DISPLAYS COMPONENT LAYOUT DIAGRAM, SCHEMATIC & INSTALLATION NOTES.

5) BATTERY ELIMINATOR FILTER CAPACITOR (C2) IS NORMALLY LOCATED IN FRONT OF C1. 130VDC-12ADC THRU 130VDC-25ADC UNITS UTILIZE TWO (2) C1s, THEREFORE C2 IS SHIFTED TO LOWER RIGHT-HAND CORNER OF ENCLOSURE AS SHOWN.

6) IF AT10.1 HAS 480VAC INPUT, OR IS CUSTOMER-SPECIFIED WITH MEDIUM/HIGH AMPERE INTERRUPTING CAPACITY CIRCUIT BREAKERS, CB1 AND CB2 ARE RELOCATED TO PENTHOUSE ENCLOSURE, AND TB6 IS ADDED.

REV	ECN No	DATE	APP
2	E2029	042805	
1	E1742	091004	GRB
0	E1154	022703	

THIRD ANGLE PROJECTION

DRAWN BY MCR 022703

APPROVED 022803

UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES. TOLERANCES ARE:

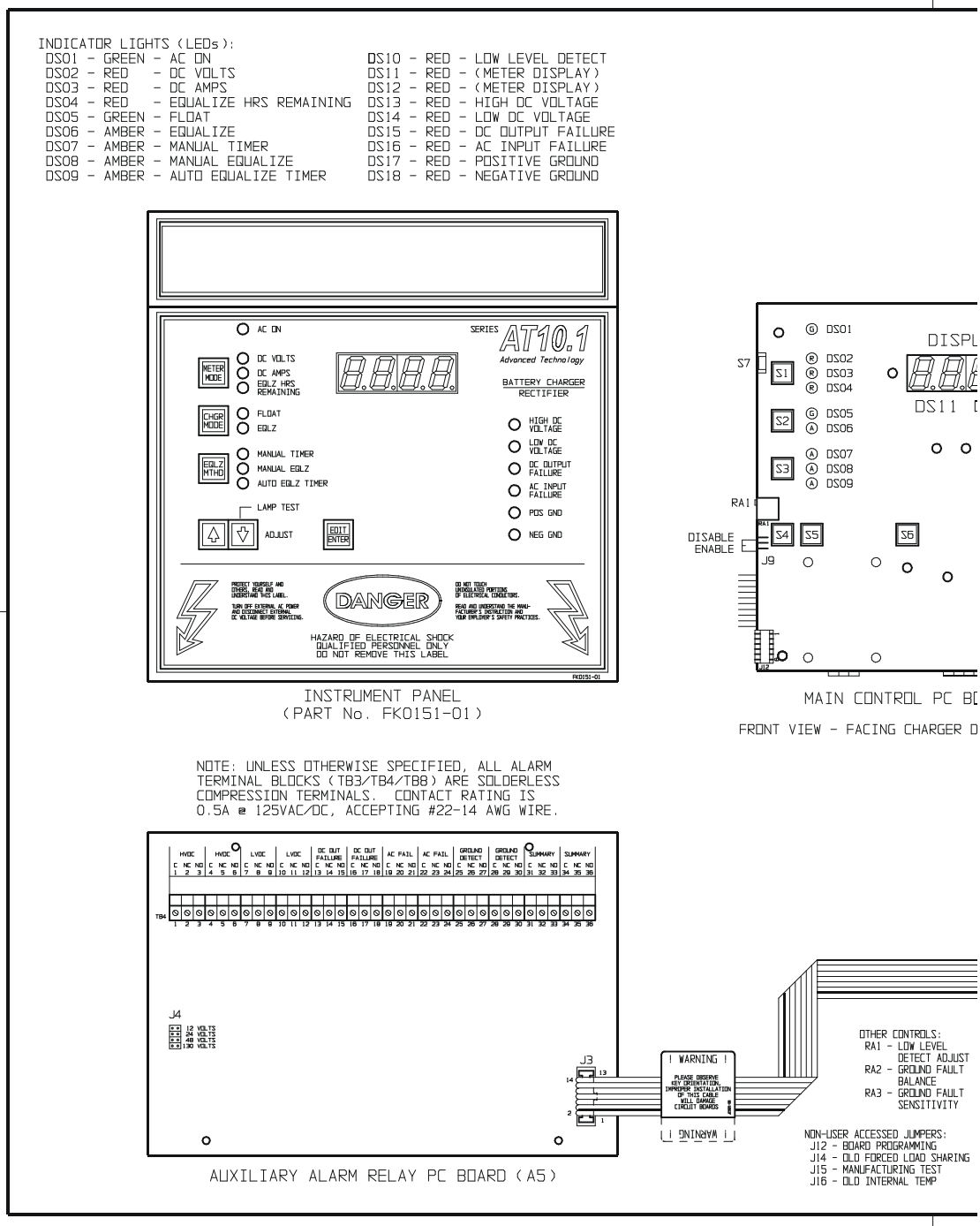
TITLE AT10.1 SERIES BATTERY CHARGER (OPTIONAL) INTERNAL COMPONENT LAYOUT: STYLE-586/594

DRAWING No JE5027-99 REV 2 B

SCALE NTS PART No JE5027-99 SHEET 1 OF 1

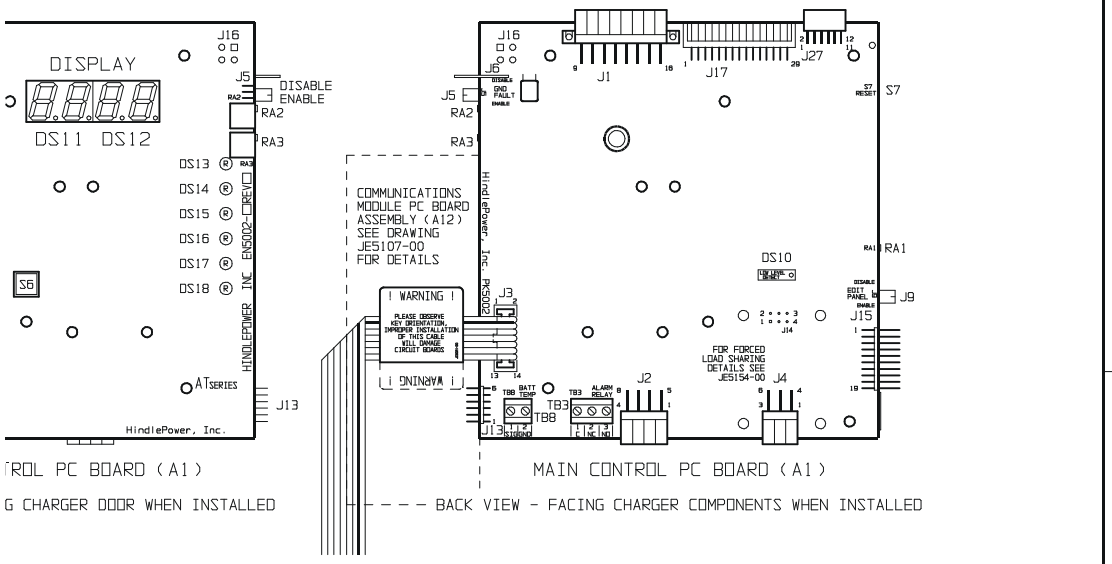
http://www.ATSeries.net/PDFs/JE5027-99.pdf

Instrument Panel Detail - AT10.1 Group I Battery Charger w/Optional Auxiliary Relay PC Board (**JE5030-19**)



Note: This instrument panel drawing (**JE5030-19**) depicts the optional Auxiliary Alarm Relay PC Board (A5), which provides two (2) sets of individual form-c contacts (TB4) for all alarm conditions. Standard AT10.1 battery chargers feature one (1) set of form-c summary (common) alarm contacts (TB3).

Instrument Panel Detail - AT10.1 Group I Battery Charger
w/Optional Auxiliary Relay PC Board (**JE5030-19**)



USER JUMPERS:
- J1 - MAINFRAME SIGNAL HARNESS
- J2 - AUX ALARM RELAY BOARD (A5) SERIAL CONNECTOR
- J3 - AUX ALARM RELAY BOARD (A5) RIBBON CONNECTOR
- J4 - FORCED LOAD SHARING CABLE INTERCONNECTOR
- J5 - GROUND FAULT ENABLE/DISABLE
- J6 - EARTH GROUND CONNECTOR
- J9 - FRONT PANEL ENABLE/DISABLE (LOCKOUT)
- J13 - COMMUNICATIONS PC BOARD (A12) INTERCONNECTOR
- J17 - HD GATE DRIVER PC BOARD (A11) INTERCONNECTOR

- J27 - NOT USED (3PH GATE DRIVER PCB INTERCONNECTOR)
- J29 - (future)

SWITCHES:
- S1 - METER MODE
- S2 - CHARGER MODE
- S3 - EQUALIZE METHOD
- S4 - △ADJUST
- S5 - ▽ADJUST
- S6 - EDIT / ENTER
- S7 - PROCESSOR MANUAL RESET

TERMINAL BLOCKS:
- TB3 - SUMMARY ALARM RELAY CONTACTS
- TB4 - AUX ALARM RELAY CONTACTS
- TB8 - OPTIONAL TEMPCO PROBE (A10) INTERCONNECTOR

CONTROLS:
- LOW LEVEL DETECT ADJUST
- GROUND FAULT BALANCE
- GROUND FAULT SENSITIVITY

ED JUMPERS:
OGRAMMING
ED LOAD SHARING
URING TEST
RNAL TEMP

REV	ECN No	DATE
2	21097	041108
1	E2044	051705
0	E1141	022003

THIRD ANGLE PROJECTION

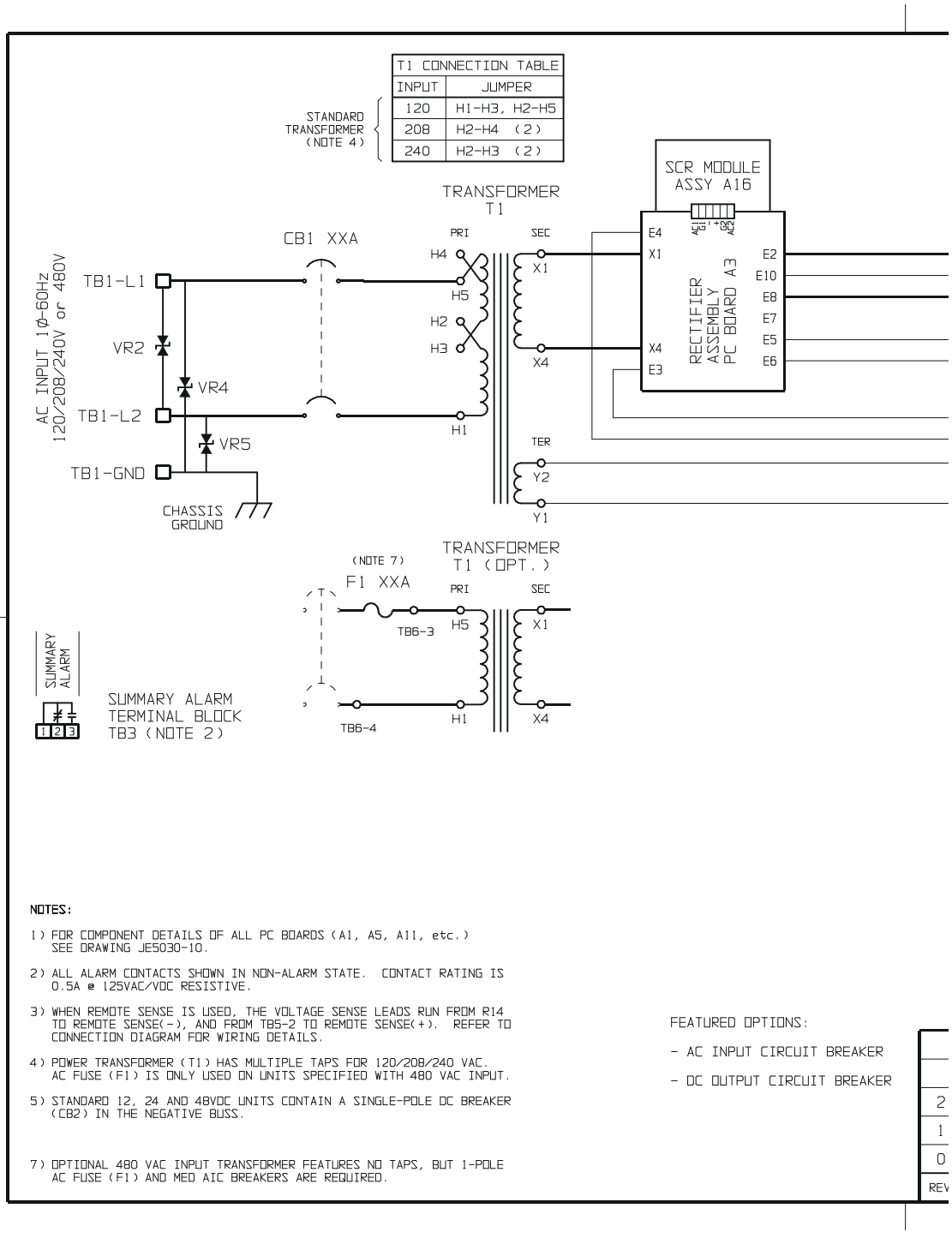
DRAWN BY	MCR	022003
APPROVED		022003

UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES. TOLERANCES ARE:

TITLE	AT10.1 SERIES BATTERY CHARGER (GROUP I) INSTRUMENT PANEL / PC BOARD DETAIL (OPTIONAL)		
DRAWING No	JE5030-19	REV 2	B
SCALE NTS	PART No JE5030-19	SHEET 1	OF 1

http://www.ATSeries.net/PDFs/JE5030-19.pdf

Schematic - AT10.1 Group I Battery Charger
Standard w/o Options (**JE5031-00**)



NOTES:

1) FOR COMPONENT DETAILS OF ALL PC BOARDS (A1, A5, A11, etc.) SEE DRAWING JE5030-10.

2) ALL ALARM CONTACTS SHOWN IN NON-ALARM STATE. CONTACT RATING IS 0.5A @ 125VAC/VDC RESISTIVE.

3) WHEN REMOTE SENSE IS USED, THE VOLTAGE SENSE LEADS RUN FROM R14 TO REMOTE SENSE(-), AND FROM TB5-2 TO REMOTE SENSE(+). REFER TO CONNECTION DIAGRAM FOR WIRING DETAILS.

4) POWER TRANSFORMER (T1) HAS MULTIPLE TAPS FOR 120/208/240 VAC. AC FUSE (F1) IS ONLY USED ON UNITS SPECIFIED WITH 480 VAC INPUT.

5) STANDARD 12, 24 AND 48VDC UNITS CONTAIN A SINGLE-POLE DC BREAKER (CB2) IN THE NEGATIVE BUSS.

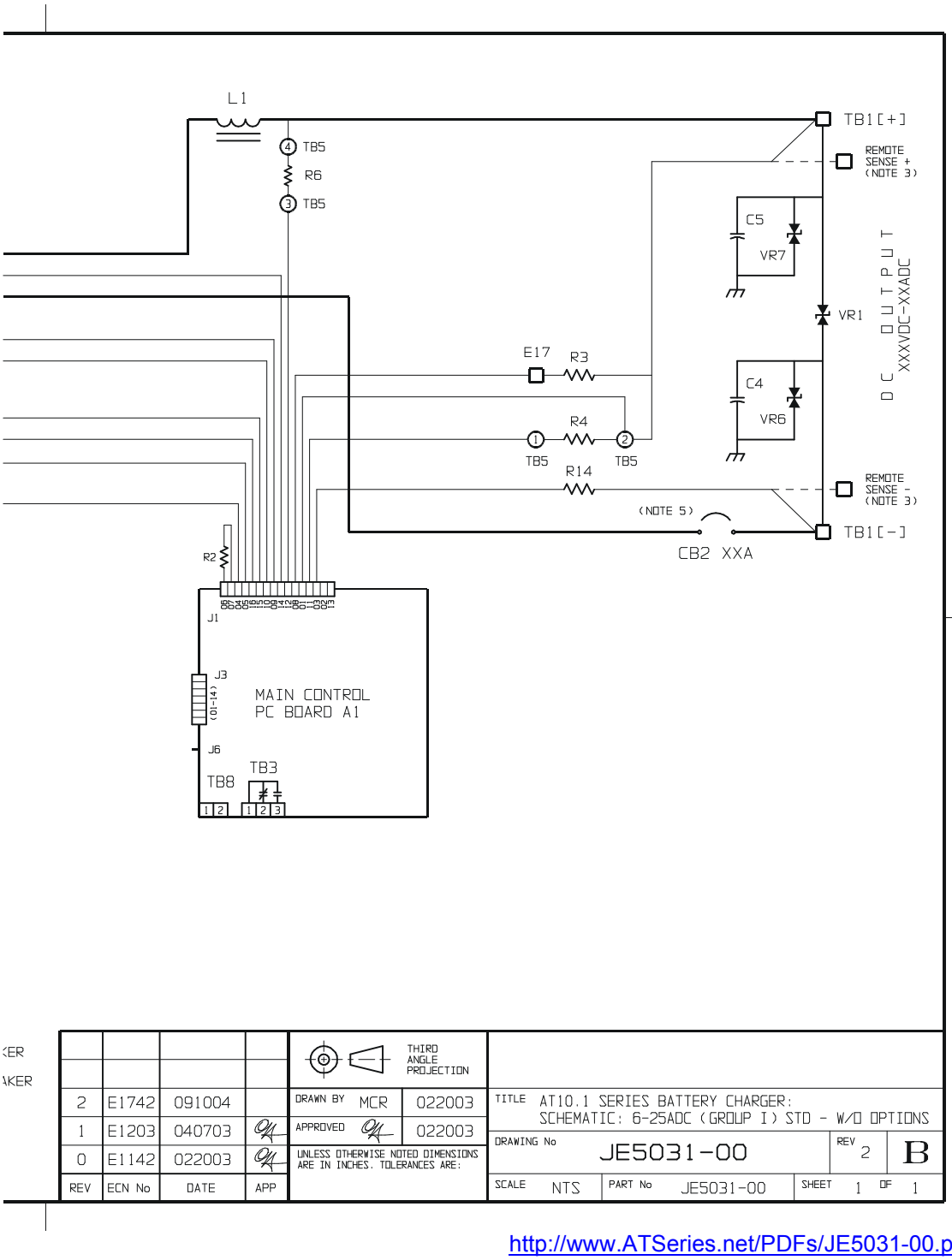
7) OPTIONAL 480 VAC INPUT TRANSFORMER FEATURES NO TAPS, BUT 1-POLE AC FUSE (F1) AND MED AIC BREAKERS ARE REQUIRED.

FEATURED OPTIONS:

- AC INPUT CIRCUIT BREAKER
- DC OUTPUT CIRCUIT BREAKER

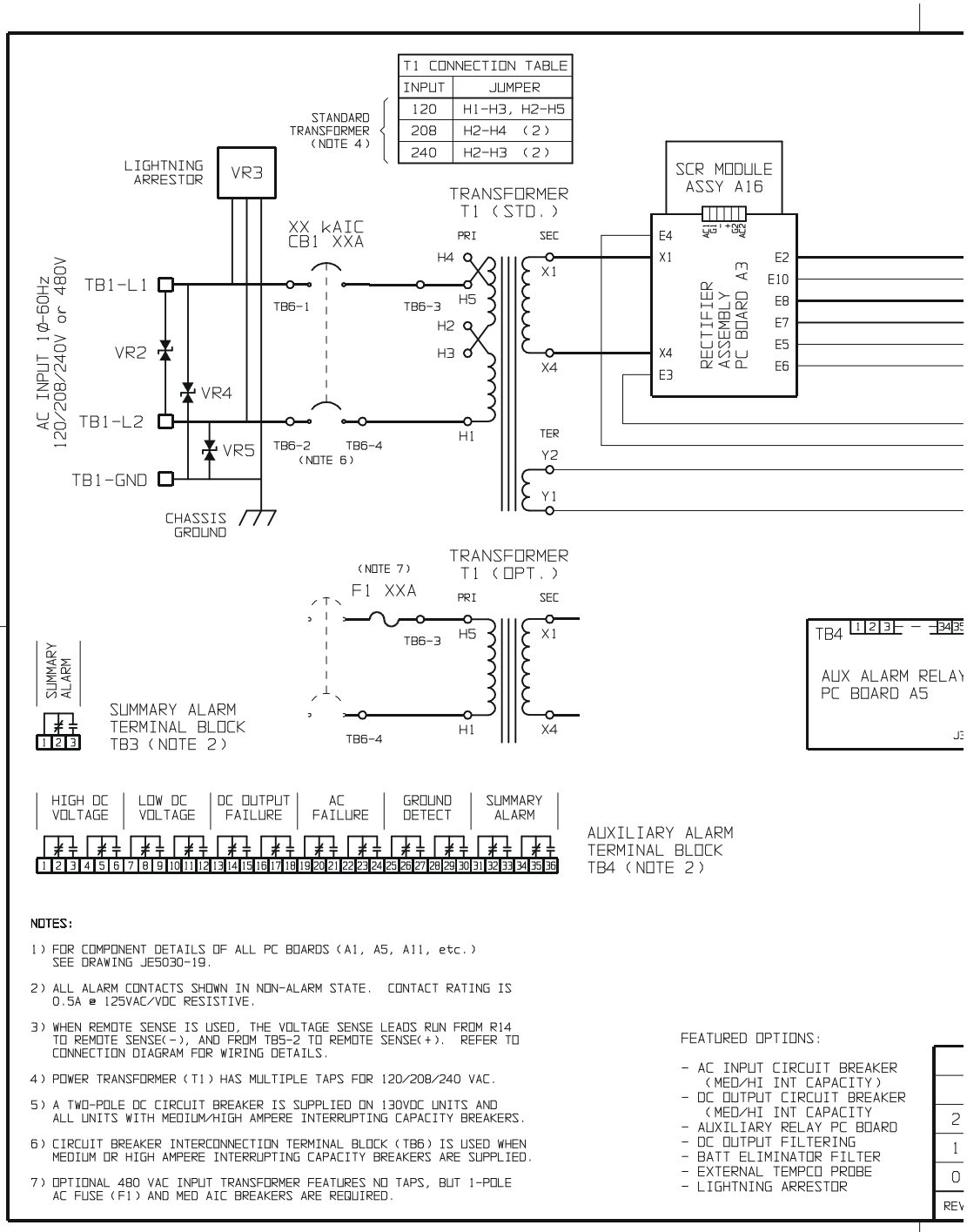
2
1
0
REV

Schematic - AT10.1 Group I Battery Charger
Standard w/o Options (**JE5031-00**)



http://www.ATSeries.net/PDFs/JE5031-00.pdf

Schematic - AT10.1 Group I Battery Charger with Common Options (**JE5031-99**)



NOTES:

1) FOR COMPONENT DETAILS OF ALL PC BOARDS (A1, A5, A11, etc.) SEE DRAWING JE5030-19.

2) ALL ALARM CONTACTS SHOWN IN NON-ALARM STATE. CONTACT RATING IS 0.5A @ 125VAC/VDC RESISTIVE.

3) WHEN REMOTE SENSE IS USED, THE VOLTAGE SENSE LEADS RUN FROM R14 TO REMOTE SENSE(-), AND FROM TB5-2 TO REMOTE SENSE(+). REFER TO CONNECTION DIAGRAM FOR WIRING DETAILS.

4) POWER TRANSFORMER (T1) HAS MULTIPLE TAPS FOR 120/208/240 VAC.

5) A TWO-POLE DC CIRCUIT BREAKER IS SUPPLIED ON 130VDC UNITS AND ALL UNITS WITH MEDIUM/HIGH AMPERE INTERRUPTING CAPACITY BREAKERS.

6) CIRCUIT BREAKER INTERCONNECTION TERMINAL BLOCK (TB6) IS USED WHEN MEDIUM OR HIGH AMPERE INTERRUPTING CAPACITY BREAKERS ARE SUPPLIED.

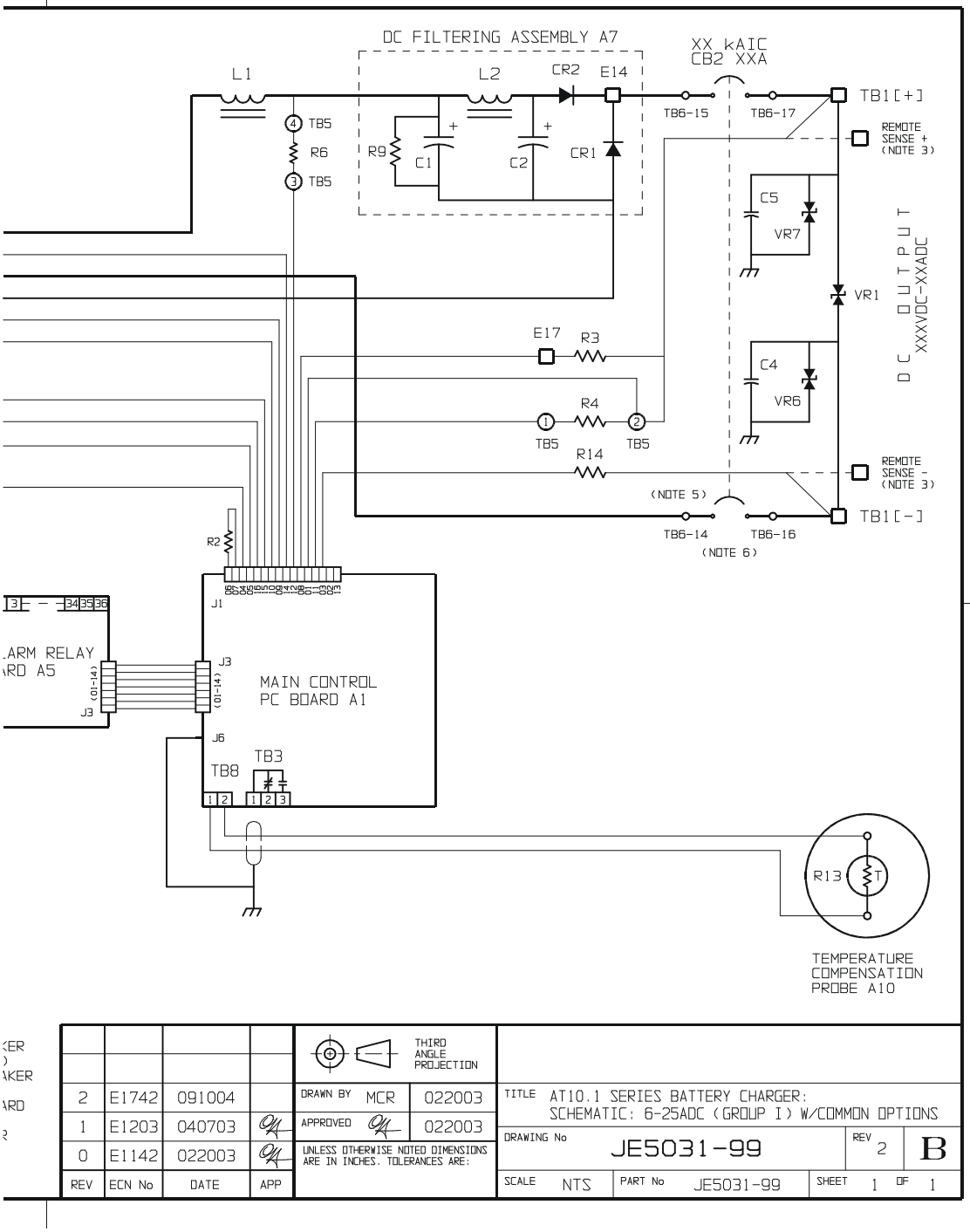
7) OPTIONAL 480 VAC INPUT TRANSFORMER FEATURES NO TAPS, BUT 1-POLE AC FUSE (F1) AND MED AIC BREAKERS ARE REQUIRED.

FEATURED OPTIONS:

- AC INPUT CIRCUIT BREAKER (MED/HI INT CAPACITY)
- DC OUTPUT CIRCUIT BREAKER (MED/HI INT CAPACITY
- AUXILIARY RELAY PC BOARD
- DC OUTPUT FILTERING
- BATT ELIMINATOR FILTER
- EXTERNAL TEMPCO PROBE
- LIGHTNING ARRESTOR

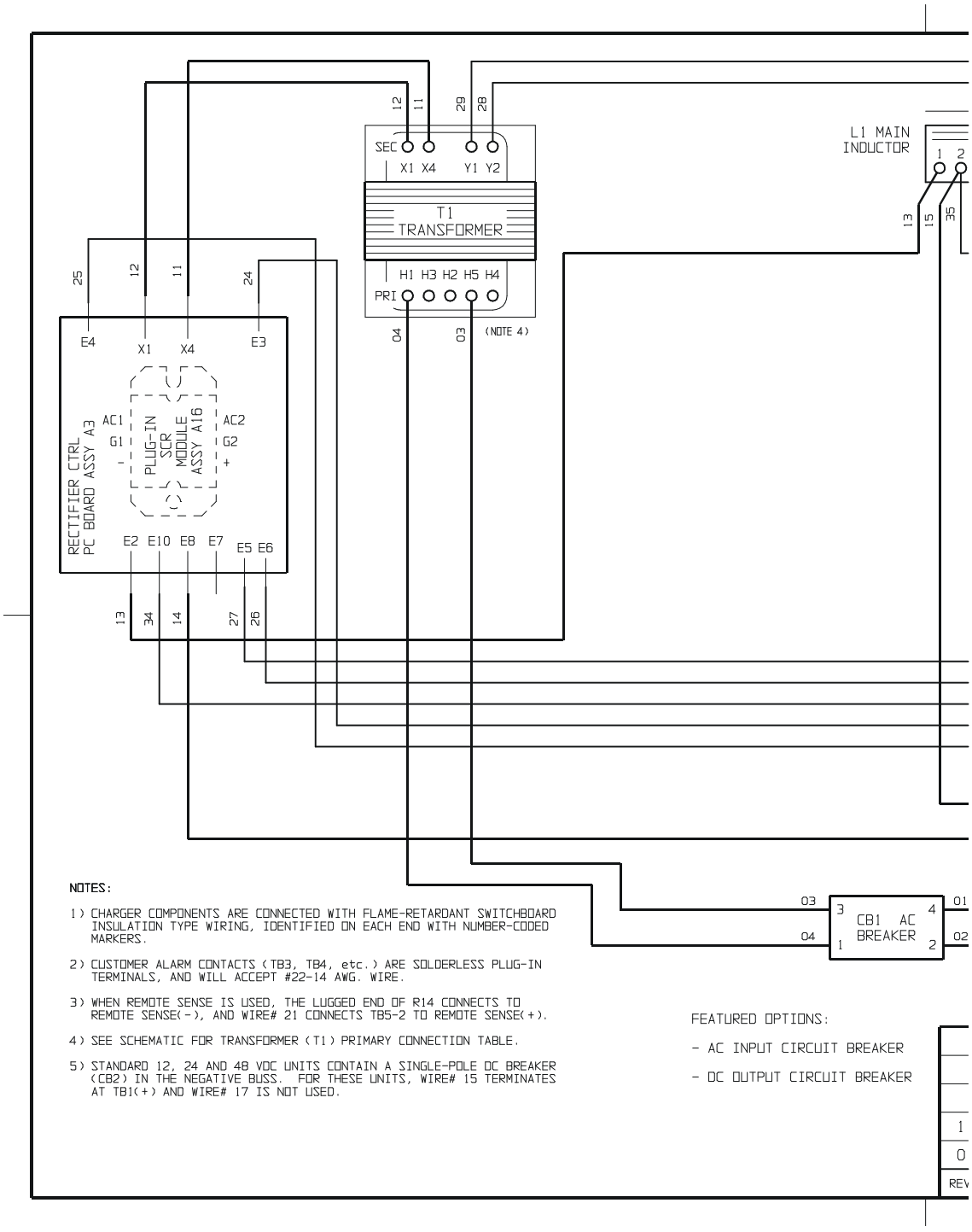
2
1
0
REV

Schematic - AT10.1 Group I Battery Charger
with Common Options (**JE5031-99**)

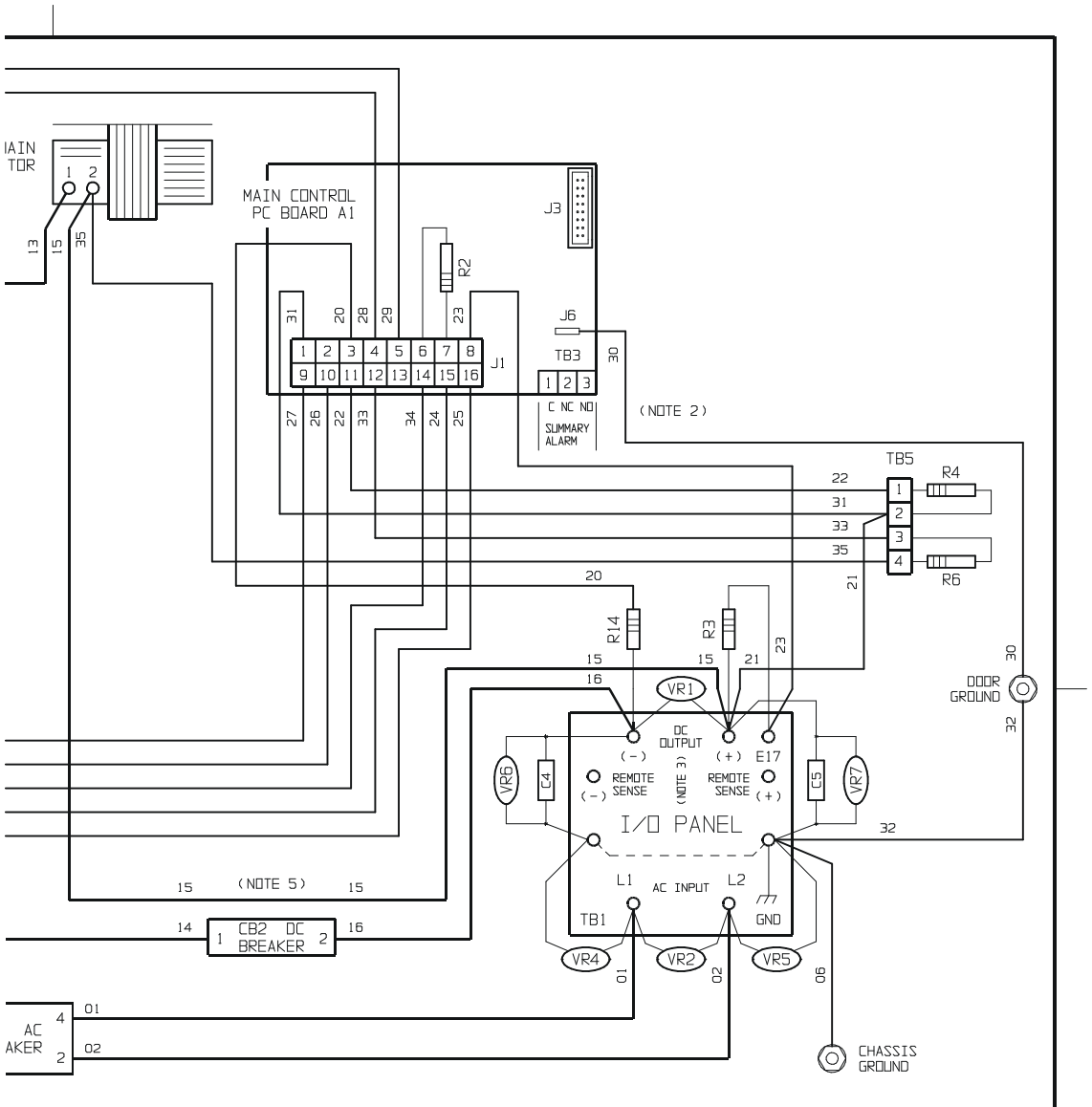


http://www.ATSeries.net/PDFs/JE5031-99.pdf

Connection Diagram - AT10.1 Group I Battery Charger
Standard w/o Options (**JE5033-00**)

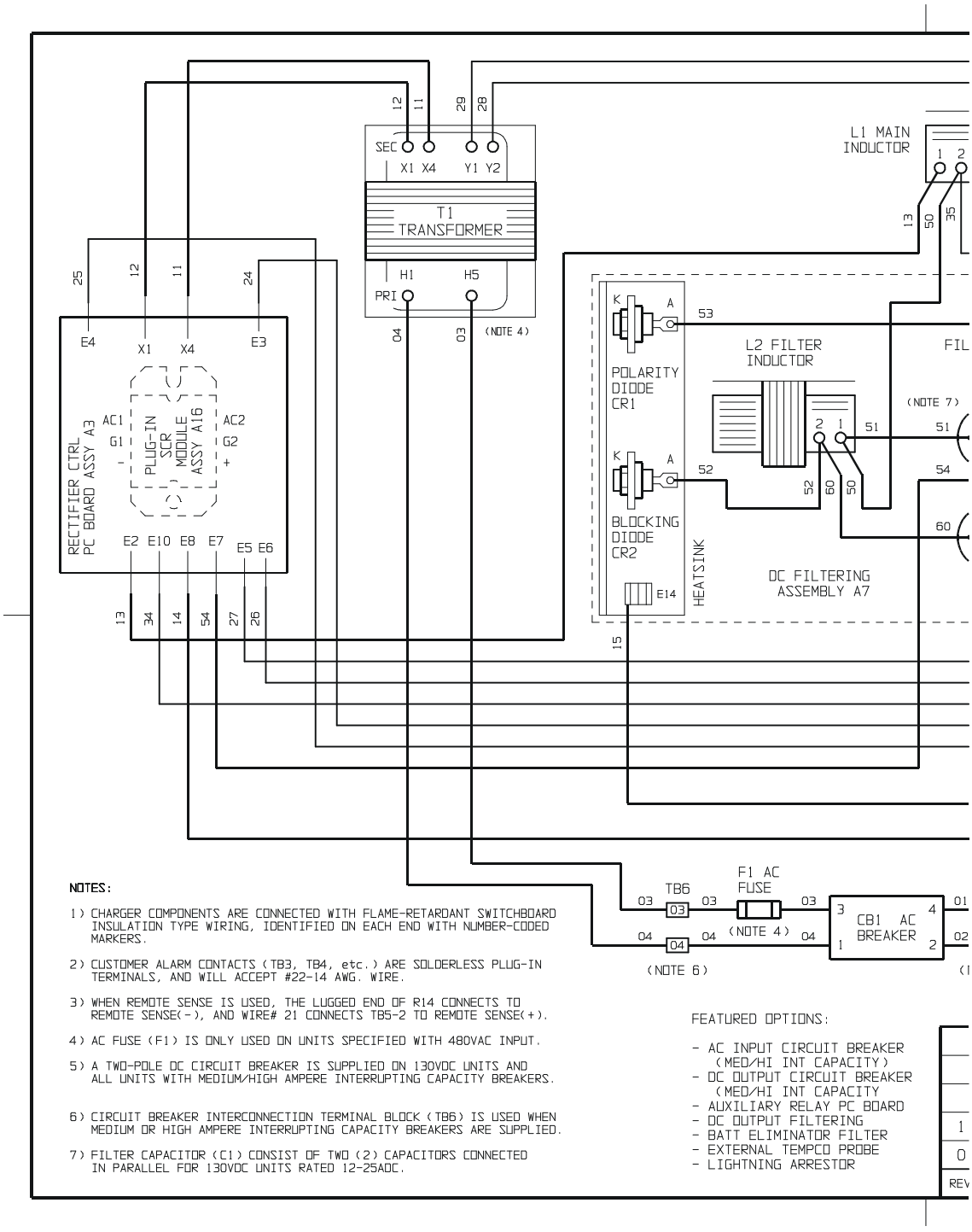


Connection Diagram - AT10.1 Group I Battery Charger
Standard w/o Options (**JE5033-00**)

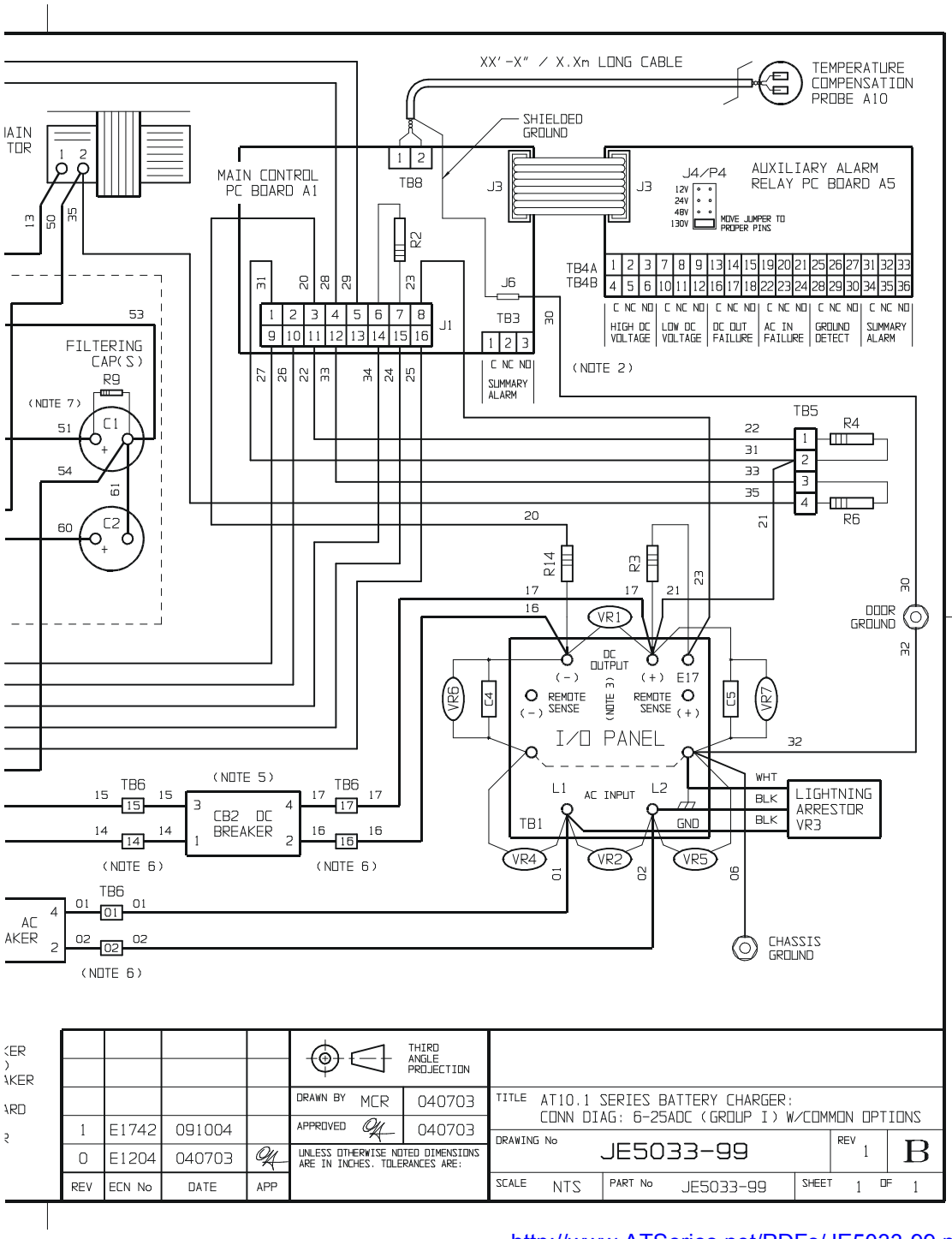


http://www.ATSeries.net/PDFs/JE5033-00.pdf

Connection Diagram - AT10.1 Group I Battery Charger with Common Options (**JE5033-99**)



Connection Diagram - AT10.1 Group I Battery Charger
with Common Options (**JE5033-99**)



http://www.ATSeries.net/PDFs/JE5033-99.pdf

APPENDIX D

RECOMMENDED FLOAT AND EQUALIZE VOLTAGES

This table contains suggested values for commonly used batteries. Consult your battery manufacturer's documentation for specific values and settings for your battery type.

Battery Cell Type		Recommended Float Voltage/cell	Recommended Equalize Voltage/cell
Lead-Acid Types	Antimony (1.215 Sp. Gr.)	2.17	2.33
	Antimony (1.250 Sp. Gr.)	2.20	2.33
	Selenium (1.240 Sp. Gr.)	2.23	2.33 - 2.40
	Calcium (1.215 Sp. Gr.)	2.25	2.33
	Calcium (1.250 Sp. Gr.)	2.29	2.33
	Absorbed / Gelled Electrolyte * (sealed lead acid type)	2.25	*
	Nickel Cadmium	1.42	1.47

* Sealed lead-acid battery types should not be used in ambient temperatures above 95° F / 35° C, and should not normally be equalized. Consult your battery manufacturer's documentation for specific equalizing recommendations.

TEMPERATURE COMPENSATION

If batteries are to see temperature variations during charging, a temperature compensation option (A10) is recommended. If this option is not part of your charger, manual adjustments should be made. Please refer to the equation and table below for temperature-adjusted voltages.

temperature-adjusted voltage = charge voltage x K

Temperature (°F)	Temperature (°C)	**K** (Lead Acid)	**K** (Nickel Cadmium)
35	1.7	1.058	1.044
45	7.2	1.044	1.034
55	12.8	1.031	1.023
65	18.3	1.017	1.013
75	23.9	1.003	1.002
77	25.0	1.000	1.000
85	29.4	0.989	0.992
95	35.0	0.975	0.981
105	40.6	0.961	0.970

COMMUNICATIONS MODULE

Your AT10.1 Microprocessor-controlled Battery Charger has provisions for an optional Communications Module that allows the user to remotely monitor and control the unit over a serial connection. This option supports **DNP3 Level 2** and **Modbus** protocols over **RS-232** or **RS-485** half-duplex. Industry-standard **SCADA** (Supervisory Control And Data Acquisition) systems will be able to control, monitor and log the events of the battery charger when this option is supplied. The system can also be used with a modem for telephone communications. All features of the AT10.1 battery charger's front instrument panel are accessible remotely, using the Communications Module.

The AT Series Communications Module (**EJ5037-xx**) includes the Communication PC Board (A12), external power supply resistor(s) (R29x), an Operating Instructions manual, and a field-retrofit instruction sheet (**JD5008-00**). An unlabeled copy of the Communications Module Operations Manual is available for free online (http://www.ATSeries.net/PDFs/JA0102-04.pdf). A compatible industry-standard modem and modem cable are also available. Contact your sales representative to place an order for the AT Series Battery Charger Communication Module. Refer to the table below for ordering information.

Description	Part No.
Communications Module for **12 Vdc** AT10.1	EJ5037-01
Communications Module for **24 Vdc** AT10.1	EJ5037-02
Communications Module for **48 Vdc** AT10.1	EJ5037-03
Communications Module for **130 Vdc** AT10.1	EJ5037-04
Compatible Modem Option	PM5005-00
10ft / 3.05m Modem Cable	EH5026-00
25ft / 7.62m Modem Cable	EH5026-01
50ft / 15.24m Modem Cable	EH5026-02

APPENDIX F

FORCED LOAD SHARING

INTRODUCTION

Multiple battery chargers are sometimes employed in dc power systems to provide redundancy. Two or more chargers of the same voltage rating can be connected in parallel, each of them capable of powering the connected dc load and charging the battery. If a battery charger should fail during normal operation, the parallel charger can continue to supply the entire required dc load current, and maintain charge on the battery.

When two AT10.1s operate in parallel, they normally will not share the load current equally. Since any two chargers will have slightly different characteristics, one of the two chargers in a system will have a slightly higher dc output voltage, and will therefore assume more of the burden of providing necessary load current. This section describes an optional accessory for the AT10.1 battery charger that system operators can use to force units to share load equally. The accessory consists of an interconnecting cable to provide such communication.

SYSTEM REQUIREMENTS

- The forced load sharing feature is designed only to work with two AT10.1 Series battery chargers. You cannot force load sharing with three or more chargers.
- The units must have the same dc voltage and current rating, and have the same dc filtering level.
- Both chargers must have the same ac input source and the same phase rotation.
- Both chargers must feature **Rev. 6** (or higher) builds of the main control circuit boards (A1), and corresponding (Rev. 6 or higher) software programs.
- We recommend that both chargers use the same program version, since the load sharing option has not been tested using a different program version in each charger. To view the program version, press the **LAMP TEST** button on the front panel of the charger. When you release the button, the version number is shown on the front panel display for two seconds.
- The interconnecting signal cable length should be no more than 50ft (15m).

INSTALLING THE INTERCONNECTION CABLE

The AT Series forced load sharing accessory is normally supplied by the factory with a standard 15ft (4.6m) interconnection cable (EH5041-00). A 25ft (7.6m) long cable (EH5041-01) and a 50ft (15.2m) long cable (EH5041-01) are also available. The interconnection cable is terminated at each end with a 6-pin connector that mates with the plastic connector (J4) on lower-right corner of the main control circuit board (A1). One end of the cable features an extra jumper in the connector, and should be identified for use with the ***Secondary*** charger. The other end of the cable connects to the ***Primary*** charger. Either charger may be selected as Primary or Secondary, but you may wish to choose the charger that is more accessible to be the Primary. The Primary charger controls the dc output voltage of both chargers.

You may run the interconnection cable through conduit if necessary. However, do not run the cable through the same conduit with power wiring. Do not remove the connectors in order to "fish" the cable through the conduit. Maximum pulling tension is 46 lb. (20.9kg). The cable has a plenum-rated outer jacket, and passes the NFPA 262 flame propagation test. Install the cable between the chargers, and anchor it in place at both ends before connecting. Connect each end to the main control circuit boards, inserting the connector into J4 until it is completely seated.

NOTE: DC power cabling for the battery charger, battery, and load interconnection is not supplied with the AT Series Forced Load sharing option. All user-supplied system wiring should meet National Electric Code (NEC) standards, as well as local/site codes. Confirm polarity of all dc cabling before making connections.

OPERATING CHARGERS WITH LOAD SHARING

Restore external power connections to the battery chargers, and restart according to the normal procedure in the AT Series Battery Charger Operating and Service Instructions. After the chargers restart, the Primary charger attempts to establish communication with the Secondary. If communication is successful, the chargers behave as follows:

- The Primary charger displays the message **LS P** (Load Share, Primary) on the front panel, alternating with the normal display of output voltage and current.
- The secondary charger displays the message **LS S** (Load Share, Secondary) on the front panel, alternating with the normal display of output voltage and current.
- The Primary charger controls all voltage settings for both chargers. You may adjust any voltage (float, equalize, alarm settings, etc.) at the front panel of the Primary charger. The front panel of the Secondary charger won't allow any settings to be changed.
- If one charger loses ac power (or is turned off), the remaining charger returns to independent operation, whether it was originally the Primary or Secondary. For this reason, it is important to set up both chargers initially for the same operating voltages. If an alarm condition occurs, both chargers revert to independent operation for the duration of the alarm.
- In the event of a fault in the interconnection, or any other problem with communication, the chargers return to independent operation, and the front panel on each charger displays the message **E 14**, indicating the fault.
- There is a delay of up to 4 seconds for chargers to establish forced load sharing communication. If communication is broken (or power is lost for one charger), there is up to a 4 second delay for the other charger to resume independent operation.
- If you need to interchange the Primary and Secondary chargers, simply reverse the interconnection cable.
- The presence of the interconnection cable (and a good interconnection) forces the two chargers into load sharing. Controlling load sharing from the front panel is neither necessary nor possible.

WHEN TEMPERATURE COMPENSATION IS INSTALLED

- The AT Series forced load sharing feature is compatible with the external tempco probe accessory. However, only tempco for the Primary charger is active. If you interchange the Primary and Secondary chargers, or discontinue load sharing, be sure to check that both temperature compensation probes are working properly.

TROUBLE SHOOTING

If the AT Series Forced Load Sharing option is installed, but the output currents of the chargers are unequal, refer to the following table.

PROBABLE CAUSE	RECOMMENDED ACTION
1. Connection cable missing or installed incorrectly.	1. Ensure that the interconnection signal cable assembly is properly installed, and that the connector for the **Secondary** charger has the jumper as described at the top of page 3.
2. Incorrect connections to ac power sources.	2. Ensure that both chargers are connected to the same ac supply and that source phase rotation is the same for both chargers.
3. Defective or improper Main Control circuit board A1	3. Replace the Main Control circuit board in one charger at a time, noting system requirements, to restore correct load sharing operation.

APPENDIX G

UL DATA

CAUTION

To operate this charger from inputs other than 120 Vac, you must use branch circuit protection. To reduce the risk of fire, use only on circuits provided with the following branch circuit protection in accordance with the National Electrical Code, ANSI/NFPA 70.

Current Rating	Charger Voltage Rating			
	48 Vdc	130 Vdc	48 Vdc	130 Vdc
12 Adc	---	25A	---	20A
16 Adc	15A	25A	12A	20A
20 Adc	20A	30A	15A	30A
25 Adc	25A	40A	20A	35A
	208 Vac Branch Circuit Protection (Amperes)		240 Vac Branch Circuit Protection (Amperes)	

NOTE: This table does not apply to AT10.1 chargers with 480 Vac input.

MANUAL SPECIFICATIONS

DOCUMENT NUMBER:

The text and graphics contained within this manual are controlled by the battery charger manufacturer's internal part number (**JA5023-00**). The revision level and dates of this manual's text and graphics are listed below. These controls supercede all other available dates. The first two and last two pages of this manual are reserved for company-specific front and back cover artwork. Any revision levels, revision dates or document numbers featured on the first two and last two pages of this manual refer to the cover artwork only.

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ON-LINE AVAILABILITY:

An unlabeled version of this operating and service instruction manual is available online at http://www.ATSeries.net/PDFs/JA0102-01.pdf. Other manuals and standard drawings for the AT Series battery charger line are available online at www.ATSeries.net. Saved in Adobe Acrobat Portable Document Format (PDF), they are readily available for downloading and printing. Please contact your sales representative for document availability of private-labeled manuals and/or standard drawings, or visit the web site listed on the back cover of this manual.

PARTS DATA PACKAGE:

Any job-specific customized Parts Data Package report supplied with this battery charger and/or this manual supercedes the information featured in the standard parts list starting on page 64. The data in this document is applicable only to the battery charger featuring the same serial number listed on the Parts Data Package report.

DRAWINGS:

A customized record drawing package is available for your AT10.1, featuring a unit-specific drawing list / data nameplate detail, outline drawing, itemized internal component layout, electrical schematic with component ratings, and a full connection diagram. If the standard drawings featured in this manual are not sufficient, please contact your Sales Representative for drawing availability from the battery charger manufacturer.

Any job-specific custom drawings supplied with this battery charger and/or this manual supercede the standard drawings featured in Appendix C. The standard drawings and corresponding page numbers featured in this section may not be included with custom printed manuals, when job-specific custom drawings are supplied.

QUICK OPERATION

For unpacking and installation instructions, see section 1 on page 2 in this manual

Startup

- Turn on the dc breaker, labeled "**DC OUTPUT**".
- Turn on the ac breaker, labeled "**AC INPUT**".

To learn how to use the equalize timers, see sections 2.2.4 on page 27 and 2.3.3 on page 32

Changing between Float and Equalize Modes

- Press the CHRG MODE key to toggle from Float mode to Equalize mode. Press again to toggle back to Float. The green or yellow indicator identifies the current mode.

For details on setting parameters, see section 2.3 starting on page 30

Setting

Float Voltage
Equalize Voltage
Equalize Timer
High DC Voltage
Low DC Voltage
Current Limit

If you don't press any key for 25 seconds, the AT10.1 resumes normal operation automatically

- Press the EDIT ENTER key. The **DC VOLTS** and **FLOAT** indicators light, and the digital display flashes the present float voltage setting.
- Press the ⬆ or ⬇ key until the digital display indicates the desired float voltage.
- Press the EDIT ENTER key to save the new setting internally.
- The **EDIT** sequence advances to the equalize voltage as shown by the front panel indicators. Repeat the above steps until you have set all parameters.

ALCAD
STANDBY BATTERIES
3 Powdered Metals Drive
North Haven, CT 06473-3209
Tel.: (203) 985-2500
Fax: (203) 985-2539
www.alcadusa.com