GNB INDUSTRIAL POWER
A Division of Exide Technologies

AT10.1 SERIES CHARGERS

I & O MANUALS

Section 94.30
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JA0128-02

INSTALLATION & OPERATING INSTRUCTIONS FOR AT10.1 SERIES BATTERY CHARGER GROUP II (30-100 ADC OUTPUT)

HOW TO READ THE AT10.1 MODEL NUMBER

GROUP II RATINGS (30-100 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	L	M	N	P

	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	030	30 Adc
		040	40 Adc
		050	50 Adc
		075	75 Adc
		100	100 Adc
D	FILTERING	U	UNFILTERED
		F	FILTERED
		E	ELIMINATOR
E	AC INPUT VOLTAGE	120	120 Vac 60 Hz
		208	208 Vac 60 Hz
		240	240 Vac 60 Hz
		480	480 Vac 60 Hz
		220	220 Vac 50/60 Hz
		380	380 Vac 50/60 Hz
		416	416 Vac 50/60 Hz
	DESCRIPTION	CODE	FEATURE

	DESCRIPTION	CODE	FEATURE
F	AC CIRCUIT BREAKER RATING (SEE TABLE)	S	STANDARD
		M	MEDIUM AIC
		H	HIGH AIC
		0	NO AC BREAKER
G	AC FUSES (200 kAIC)	F	SUPPLIED
		X	NOT SUPPLIED
H	DC CIRCUIT BREAKER RATING (SEE TABLE)	S	STANDARD
		M	MEDIUM AIC
		H	HIGH AIC
		0	NO DC BREAKER
J	DC FUSES (20 kAIC)	F	SUPPLIED
		X	NOT SUPPLIED
K	AUX ALARM RELAY BOARD	A	SUPPLIED
		X	NOT SUPPLIED
L	GROUND BUS	G	SUPPLIED
		X	NOT SUPPLIED
M	LIGHTNING ARRESTOR	L	SUPPLIED
		X	NOT SUPPLIED
N	FUNGUS PROOFING	F	APPLIED
		X	NOT APPLIED
P	STATIC PROOFING	S	APPLIED
		X	NOT APPLIED
	DESCRIPTION	CODE	FEATURE

INPUT AND OUTPUT INTERRUPTING CAPACITY RATINGS

ORDER CODE	CIRCUIT BREAKER TYPE	AC CIRCUIT BREAKER RATINGS (208/240/480 Vac) *	DC CIRCUIT BREAKER RATINGS (125/250 Vdc)	OPTIONAL AC FUSE RATING (208-600 Vac)	OPTIONAL DC FUSE RATING (12/24/48/130 Vdc)
S	STANDARD	5,000 AIC	5,000 AIC	200,000 AIC	20,000 AIC
M	MEDIUM AIC	25,000 AIC	10,000 AIC		
H	HIGH AIC	65,000 AIC	25,000 AIC		

* Contact your sales representative for 500-600 Vac circuit breaker AIC ratings.

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/wall/rack mounting brackets
- ☐ NEMA-2 type drip shield
- ☐ NEMA-4/12/13 type enclosure
- ☐ cabinet heater strips
- ☐ pad/key lock for front panel door
- ☐ analog ac voltmeter
- ☐ analog ac ammeter
- ☐ zero-center ground detection meter w/test switch
- ☐ end of discharge alarm relay
- ☐ battery discharge alarm relay
- ☐ barrier type auxiliary alarm terminal block(s)
- ☐ external temperature compensation probe
- ☐ DNP3 Level 2 / Modbus communications module
- ☐ forced load sharing signal 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, featuring an itemized internal component layout, electrical schematic with component ratings, and a full connection diagram. If the standard drawings and wire list 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, 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 II Cabinets (**Style-5017** / **Style-5018**)

Output Voltage	Ampere Rating				
	30 Adc	40 Adc	50 Adc	75 Adc	100 Adc
12 Vdc	Style-5017 140 lbs 63 kg	Style-5017 155 lbs 70 kg	Style-5017 170 lbs 77 kg	Style-5018 220 lbs 100 kg	Style-5018 280 lbs 127 kg
24 Vdc	Style-5017 150 lbs 68 kg	Style-5017 180 lbs 82 kg	Style-5017 190 lbs 86 kg	Style-5018 250 lbs 113 kg	Style-5018 320 lbs 145 kg
48 Vdc	Style-5017 170 lbs 77 kg	Style-5017 220 lbs 100 kg	Style-5017 240 lbs 109 kg	Style-5018 340 lbs 154 kg	Style-5018 440 lbs 200 kg
130 Vdc	Style-5017 220 lbs 100 kg	Style-5018 300 lbs 136 kg	Style-5018 320 lbs 145 kg	Style-5018 440 lbs 200 kg	n/a

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

The **Style-5017** & **5018** 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-5017** enclosure, use the aforementioned sling on a hoist or forklift truck. To relocate the **Style-5018** enclosure, use a forklift truck by lifting the unit through the 3in / 76mm gap located between the mounting legs.

1.5. MOUNTING THE AT10.1

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

MANUAL SECTION	MOUNTING METHOD	ENCLOSURE	
		Style-5017	Style-5018
1.5.1	Wall-Mounting	**STANDARD**	OPTIONAL
1.5.2	Floor-Mounting	OPTIONAL	**STANDARD**
1.5.3	19in / 483mm Rack-Mounting	OPTIONAL	N/A
	23-24in / 584-610mm Rack-Mounting	OPTIONAL	OPTIONAL

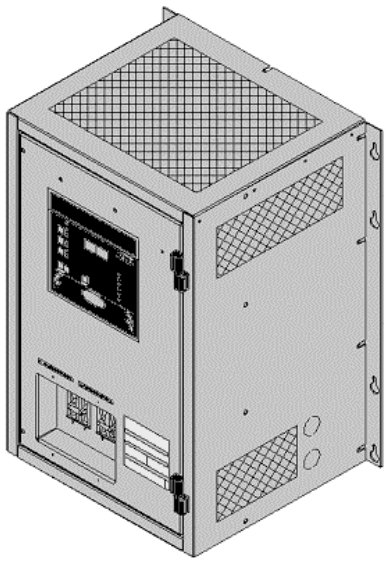
1.5.1. Wall-Mounting the AT10.1

In planning for wall mounting of the AT10.1 consider the following:

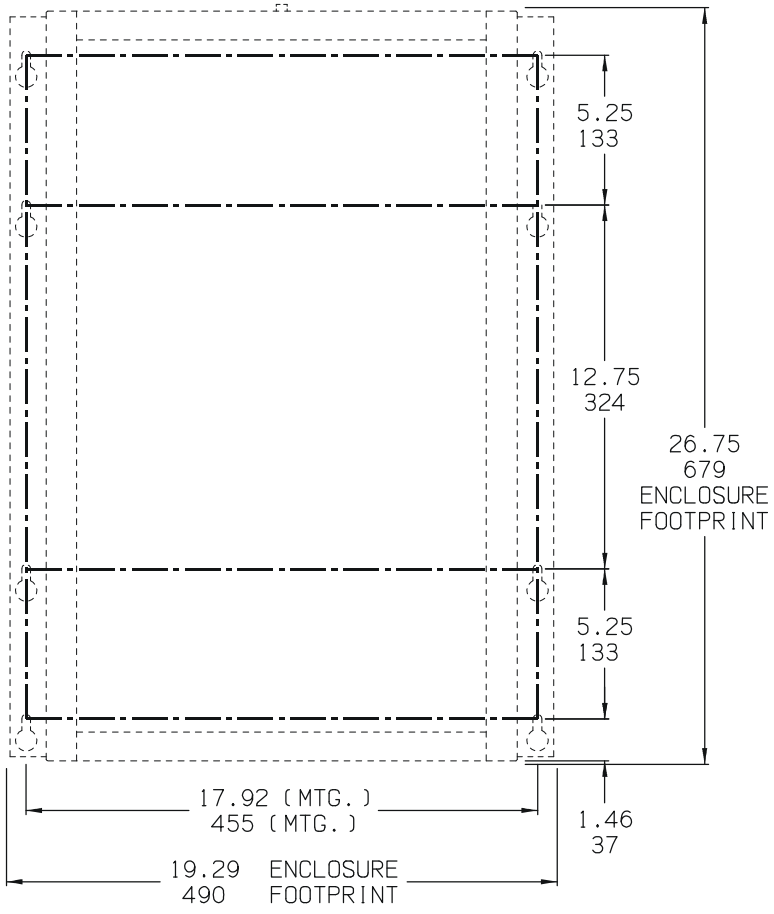
1. Wall-mounting the Style-5017 enclosure is standard. If you are wall-mounting a charger in the Style-5018 enclosure, you need the wall mounting bracket kit (part number **EI5008-00**). For kit availability see ordering information in Appendix B on page 71. The kit includes dimensions and instructions for locating the wall mounting holes.
2. The wall must be strong enough to properly support the weight of the AT10.1. The weight of your AT10.1 may be different from the table value, depending on options or accessories you ordered. See the Weight Table located in Section 1.4 on page 3.
3. Placement of conduit entrances. Note the standard pre-fab conduit knockouts located on the sides of the charger. See outline drawings in Appendix C.
4. The location:
   - Should be free of drips and splatter. If dripping liquids are a problem, install a drip shield kit. 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 flammable or explosive materials.
5. Maintain at least 6in / 152mm of free air on top, bottom and both sides for cooling air.
6. Allow 36in / 914mm front clearance for access to the charger for operation and maintenance.

PROCEDURE

To wall-mount the AT10.1, install eight (8) 0.25in / 6.4mm bolts onto the wall, rated to support the AT10.1 weight plus a safety factor of at least 2 times. Place the AT10.1 on the bolts, add appropriate mounting hardware, and tighten securely. See the diagram below for the Style-5017 enclosure footprint and wall-mounting pattern. Dimensions are in/mm.



Style-5017 Enclosure



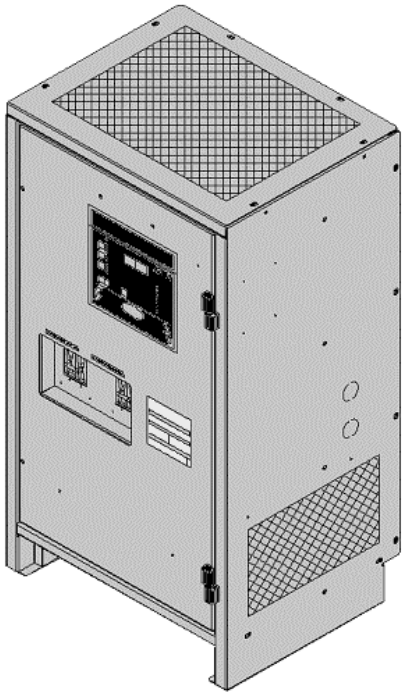
1.5.2. Floor-Mounting the AT10.1

To floor mount the AT10.1, you must consider the following:

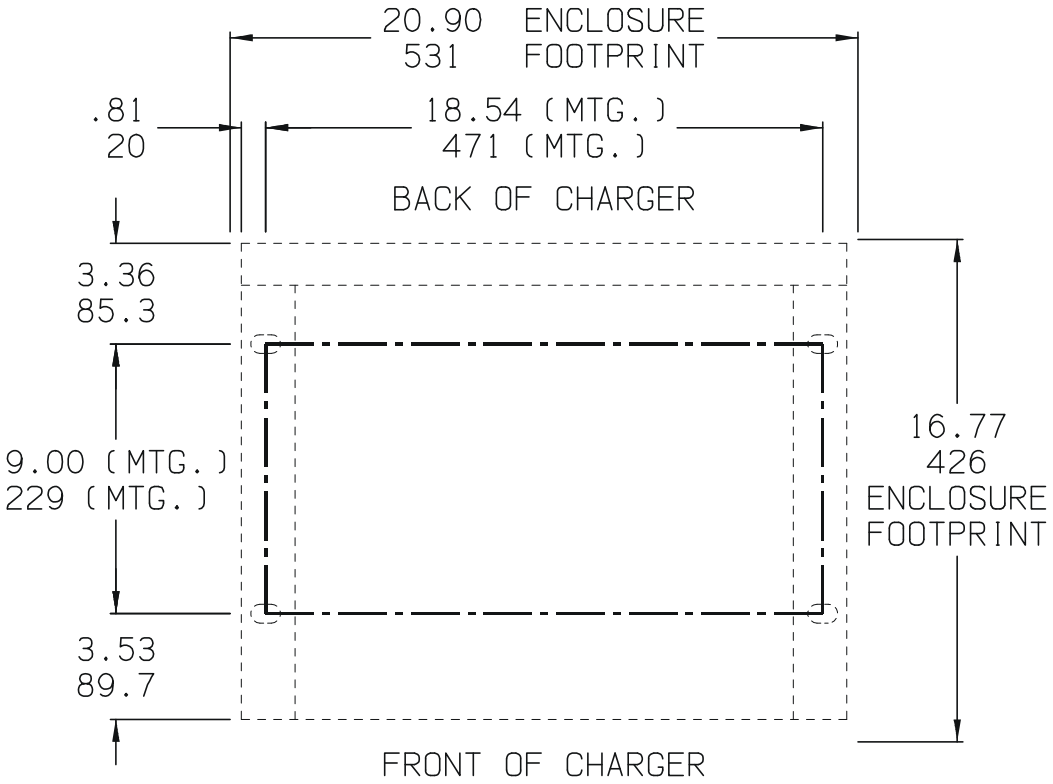
1. Floor-mounting the Style-5018 enclosure is standard. If you are floor mounting a charger in the Style-5017 enclosure you will need the floor-mount kit (part number **EI0192-00**). For kit availability see ordering information in Appendix B on page 71. The kit contains brackets that elevate the top of the AT10.1 approximately 47in / 1194mm above floor level, with provisions for floor anchoring. The kit includes dimensions and instructions for locating the floor mounting holes.
2. Placement of conduit entrances. Note the standard pre-fab conduit knockouts located on the sides of the charger. See outline drawings in Appendix C.
3. The location:
   - Should be free of drips and splatter. If dripping liquids are a problem, install a drip shield. 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 flammable or 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 access to the charger for operation and maintenance.

PROCEDURE

To floor-mount the AT10.1, install four (4) 0.25in / 6.4mm bolts into the floor. Place the AT10.1 on the bolts, add appropriate mounting hardware, and tighten securely. See the diagram below for the Style-5018 enclosure footprint and floor-mounting pattern. Dimensions are in/mm.



Style-5018 Enclosure



1.5.3. Rack-Mounting the AT10.1

All ratings of the AT10.1 can be installed in most relay racks with standard EIA hole spacing. A relay rack-mounting kit is required. For kit availability see ordering information in Appendix B on page 71. Order the appropriate rack mounting kit for your charger, as shown in the following table.

CHARGER RATING		RACK WIDTH	
Voltage	Current	19in / 483mm	23-24in / 584-610mm
12 Vdc	30-50 Adc	EI0193-01	EI0193-02
12 Vdc	75-100 Adc	N/A	EI0193-03
24 Vdc	30-50 Adc	EI0193-01	EI0193-02
24 Vdc	75-100 Adc	N/A	EI0193-03
48 Vdc	30-40 Adc	EI0193-01	EI0193-02
48 Vdc	50-100 Adc	N/A	EI0193-03
130 Vdc	30 Adc	EI0193-01	EI0193-02
130 Vdc	40-75 Adc	N/A	EI0193-03
		MOUNTING KIT	

Each kit includes mounting brackets, hardware and the necessary instructions to install one AT10.1 battery charger. The kit also includes dimensions and detailed instructions for rack-mounting.

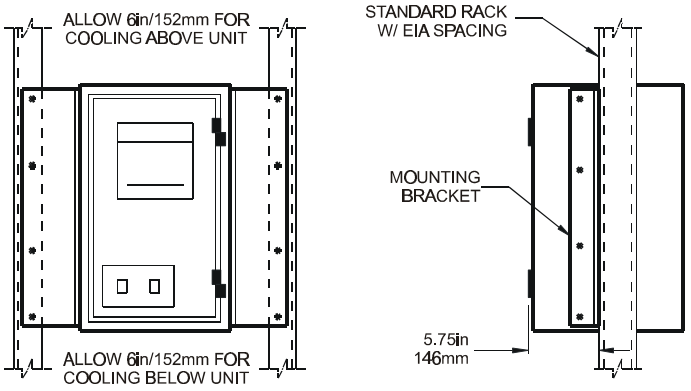
When rack mounting the AT10.1, you must consider the following:

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 between 32-122° F / 0-50° C, with relative humidity between 5 and 95% non-condensing.
   - Must be free of flammable or 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 access to the charger for operation and maintenance.

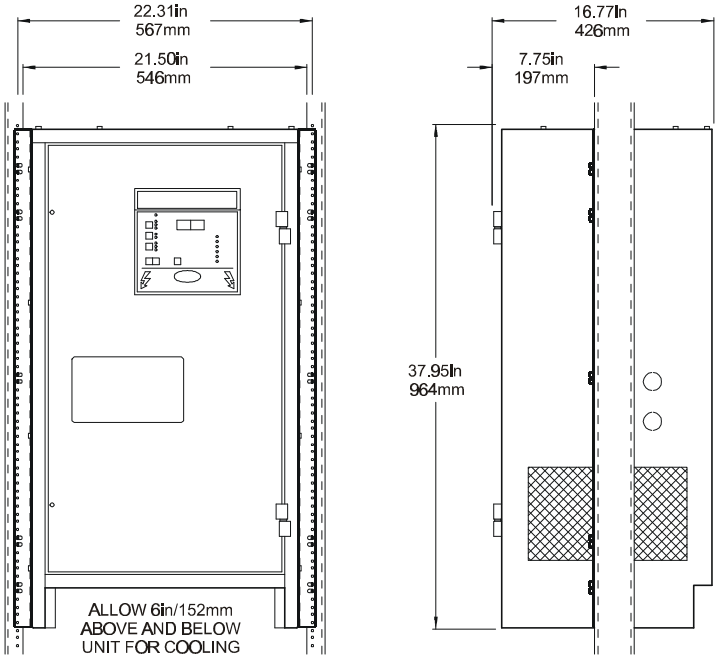
PROCEDURE

To rack mount the AT10.1, first install the brackets into the rack using the supplied hardware. Second, install the AT10.1 onto the brackets. Tighten all hardware securely. Provide at least 6in / 152mm of free air space above and below the AT10.1 enclosure in the rack for cooling. You do not need to modify the AT10.1 enclosures for standard rack-mounting. See the diagrams below for the Group II enclosure rack-mounting configurations.

Style-5017 Rack-Mounting



Style-5018 Rack-Mounting



NOTES

1. Units are installed from the front.
2. Refer to the outline drawings in Appedix C for enclosure dimensions.

1.6. CHANGING THE TRANSFORMER TAPS

IMPORTANT: AT10.1 Group II battery chargers (rated 30-100 Adc) are designed for a single ac input supply voltage. Note the ac voltage listing on the data nameplate, and tag attached to the ac circuit breaker.

If your particular site ac supply voltage does not match your AT10.1 ac input requirements, you MUST change the ac input circuit breaker (and/or fuses), and input surge suppressors. In addition, you must replace or rewire the transformer as described below.

Failure to use properly rated components may damage the AT10.1.

NOTE: *If your AT10.1 battery charger was supplied with 480Vac-60Hz input, or 220Vac-50/60Hz input, the transformer will only accept the listed voltage.* ***Do not attempt to rewire these transformers.*** *If a different ac input voltage is desired for the AT10.1, please contact your sales representative for ordering replacement parts.*

Before you wire ac power to the AT10.1, check the wiring of the main transformer (T1), to be sure it is connected for the desired ac input voltage. The main transformer was wired at the factory for the input voltage specified and listed on the data nameplate.

If your AT10.1 was supplied with 120, 208 or 240Vac - 60Hz input, and you need to change the factory-wired input voltage, you do so by changing jumpers on T1. If you are changing from 120Vac to 208/240Vac, or the reverse, you also need to change the input surge suppressors and the input circuit breaker (and/or ac input fuses). See Section 3.6 on page 62 for part requirements.

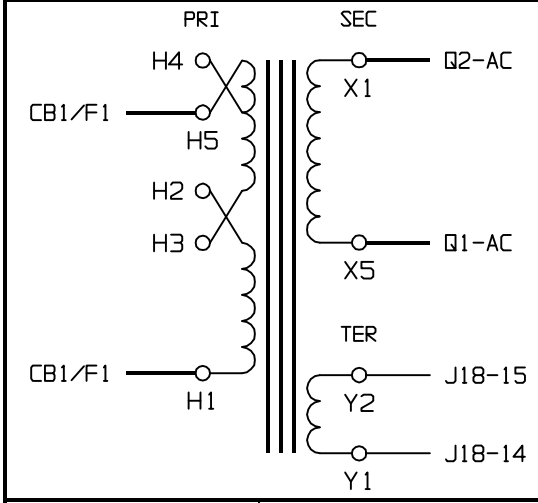
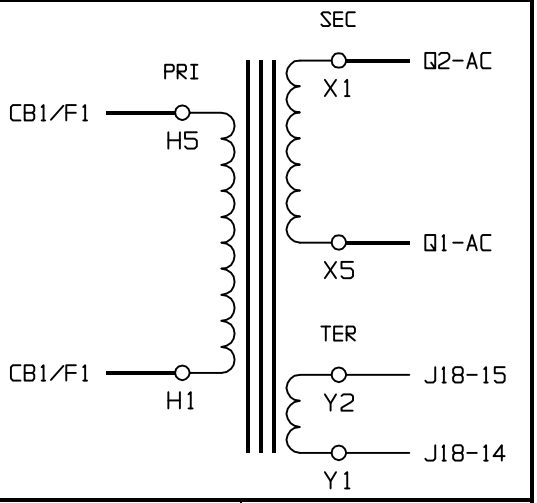
If your AT10.1 was ordered with 380 or 416 Vac - 50/60 Hz, and you need to change the factory-wired input voltage, consult the factory for special instructions.

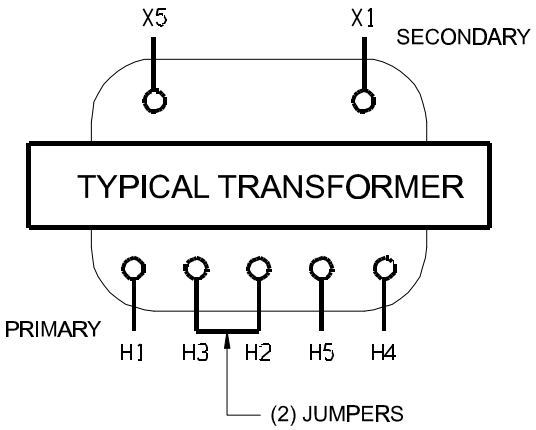
NOTE: *Before starting work, disconnect and lock out all external ac and dc power sources to the AT10.1. Note that just turning off the front panel ac and dc circuit breakers is not sufficient to eliminate live voltages inside the enclosure. Use a voltmeter at the ac terminals TB1-L1 and TB1-L2, the dc terminals TB1(+) & TB1(-), the dc remote sense terminals, and any external wiring to alarm relay contacts, to verify that no voltage is present inside the enclosure.*

PROCEDURE

1. Verify that all voltages whithin the AT10.1 are de-energized and locked out.
2. See Section 3.5 for necessary steps to follow when accessing internal components within the AT10.1.
3. Change the jumpers on the transformer (T1) as shown in the table below.
4. If your transformer is supplied with two (2) jumpers, always use both as specified in the table.
5. Make sure all connections are tight.
6. Check your work before re-energizing the AT10.1.
7. For more information, see the schematics & wiring diagrams in Appendix C.

MAIN POWER TRANSFORMER (T1) CONNECTION TABLE

120/208/240 Vac - 60Hz		480 Vac - 60 Hz	
			
INPUT	**JUMPERS**	**INPUT**	**JUMPERS**
120 Vac - 60 Hz	H1-H3, H2-H5	480 Vac - 60 Hz	NONE
208 Vac - 60 Hz	H2-H4 (2) JUMPERS		
240 Vac - 60 Hz	H2-H3 (2) JUMPERS		



1.7. MAKING THE AC INPUT CONNECTIONS

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

1. 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.

NOTE: If your charger is wired for 480 Vac input, and is equipped with the standard AIC ac circuit breaker (no ac fuses), you need a feeder breaker or fuse rated to interrupt the short-circuit current of your ac supply.

2. 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.
3. Be sure the AT10.1 main transformer (T1) is properly connected for your ac input voltage. See Section 1.6 for details.
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 #14-1/0 AWG, are supplied for your convenience. To make these connections, strip the insulation 0.5in / 12.7mm 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 35-50 in-lb / 4.0-5.7 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**
30	7.2	13	23	54
40	9.6	17	30	**71**
50	12	21	38	89
75	18	32	57	Note 1
100	24	42	75	n/a

Note 1: Not available with 120 Vac input. Input current is 67 Aac at 240 Vac.

Example (shaded):
A 130 Vdc/40 Adc battery charger draws 71 Aac at 120 Vac.

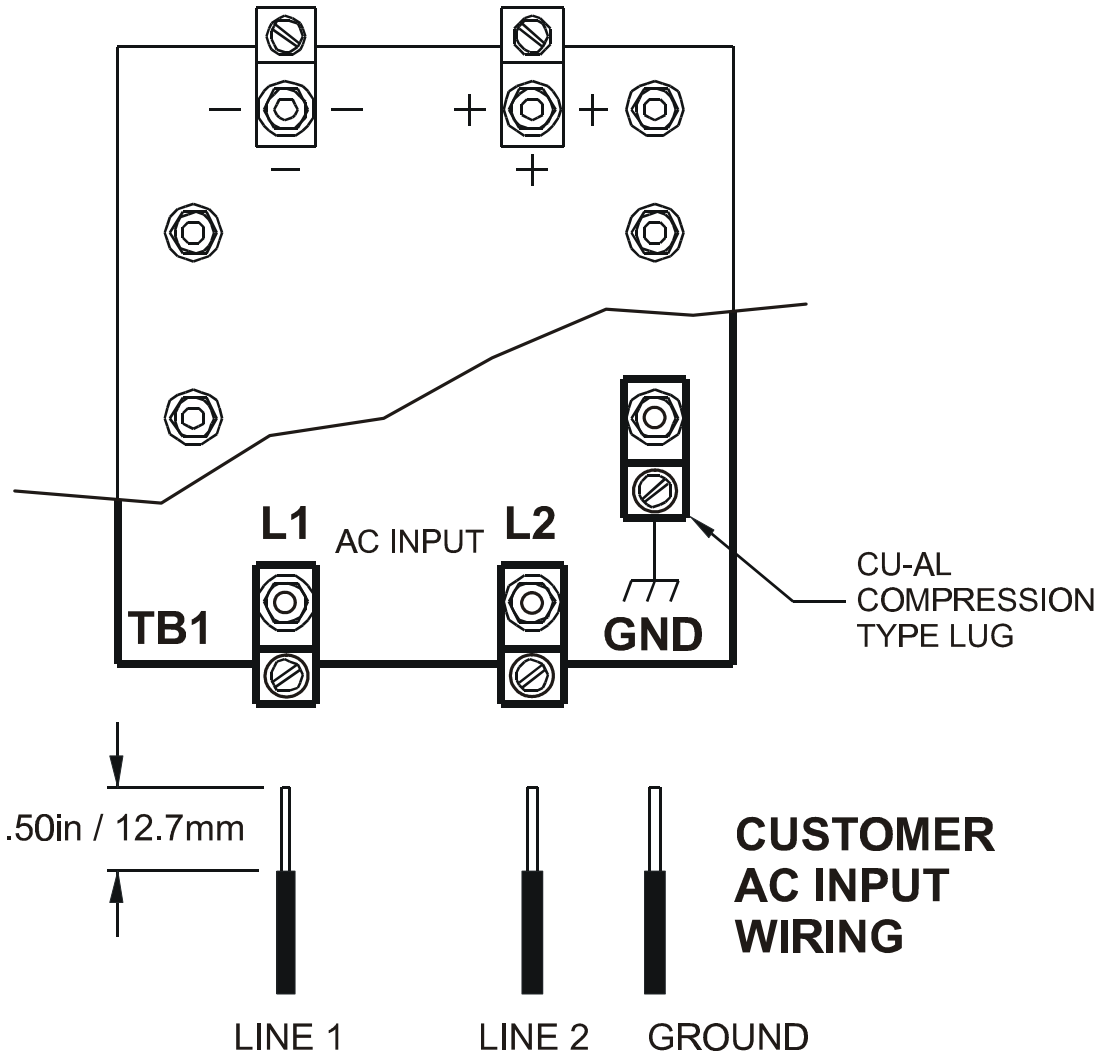
All currents shown are ±10%.

[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)				
	30	**40**	**50**	**75**	**100**
#10	3.0V	4.0V	5.0V	not recommended	not recommended
#8	1.9V	2.5V	3.1V	not recommended	not recommended
#6	1.2V	1.6V	2.0V	3.0V	not recommended
#4	0.7V	1.0V	1.2V	1.9V	2.5V
#2	0.5V	0.5V	0.8V	1.2V	1.6V
#0	0.3V	0.4V	0.5V	0.7V	1.0V

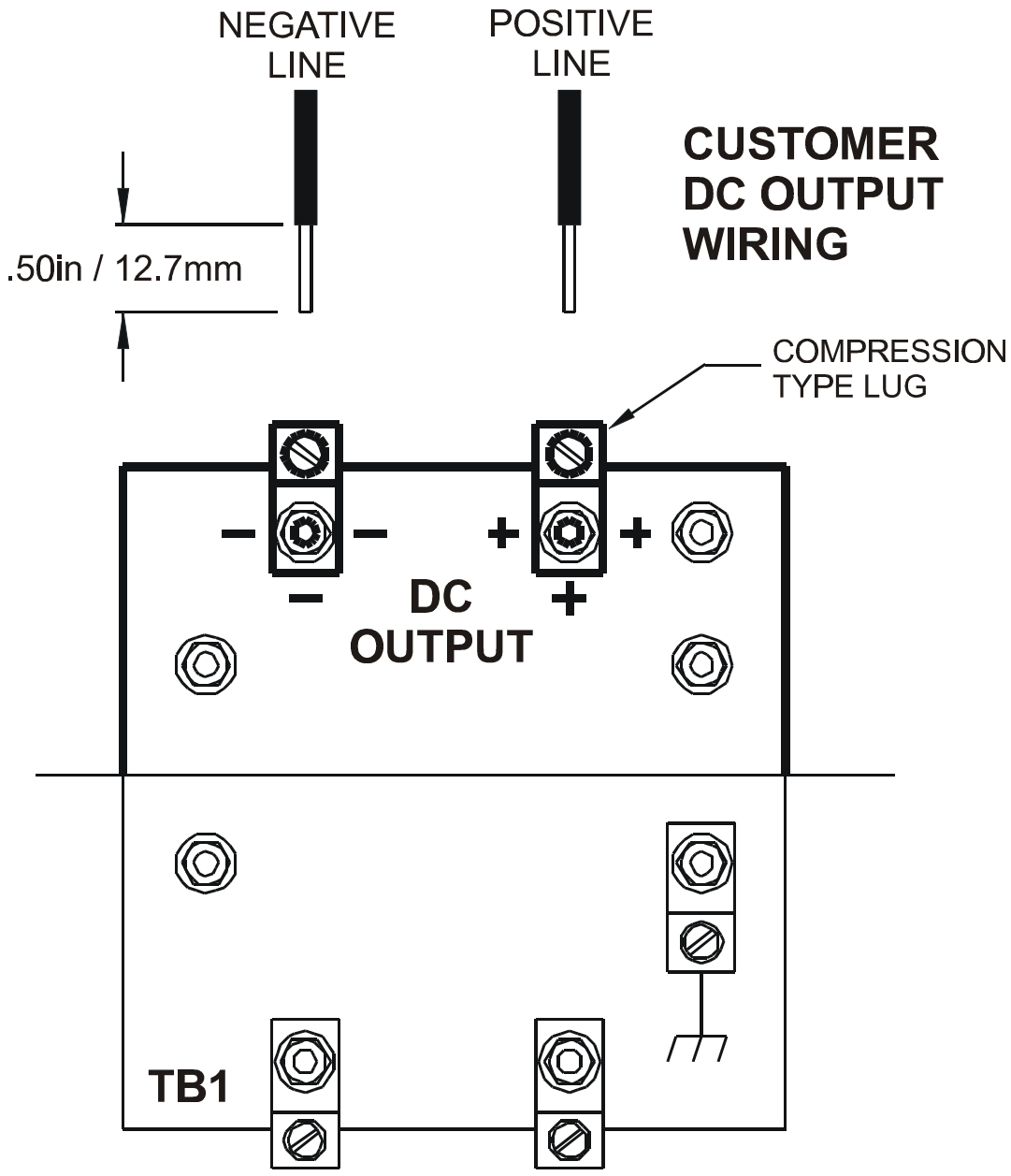
EXAMPLE: 100ft / 30.5m of #8 AWG wire at 50A has a 3.1 Volt drop.

2. The AT10.1 is factory wired to regulate the 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 #14-1/0 AWG, are supplied for your convenience. To make these connections, strip the insulation 0.5in / 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 35-50 in-lb / 4.0-5.7 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:

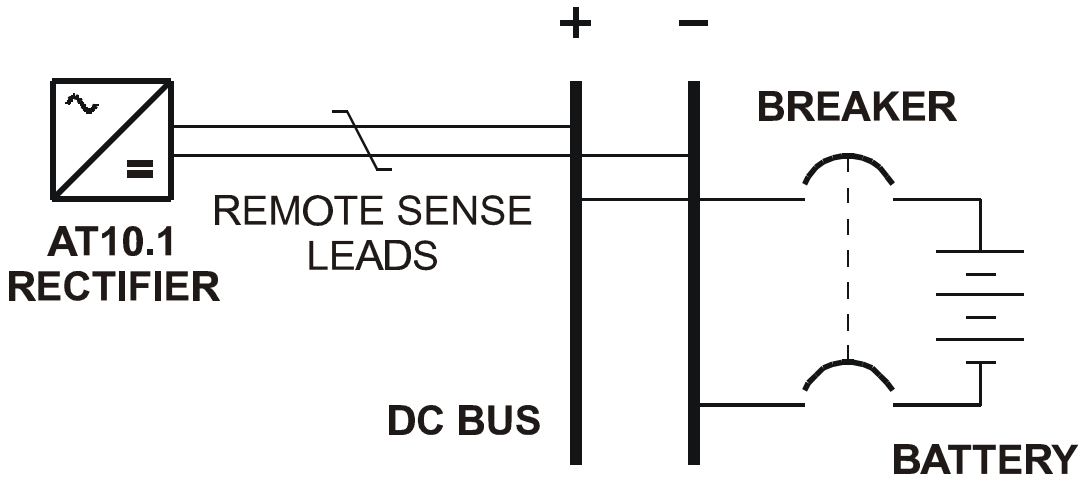
1. Compensates for voltage drop in the dc wiring between the AT10.1 and the battery.
2. Directly monitors the battery or dc bus voltage. The front panel meter displays the actual voltage on the dc bus.

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.

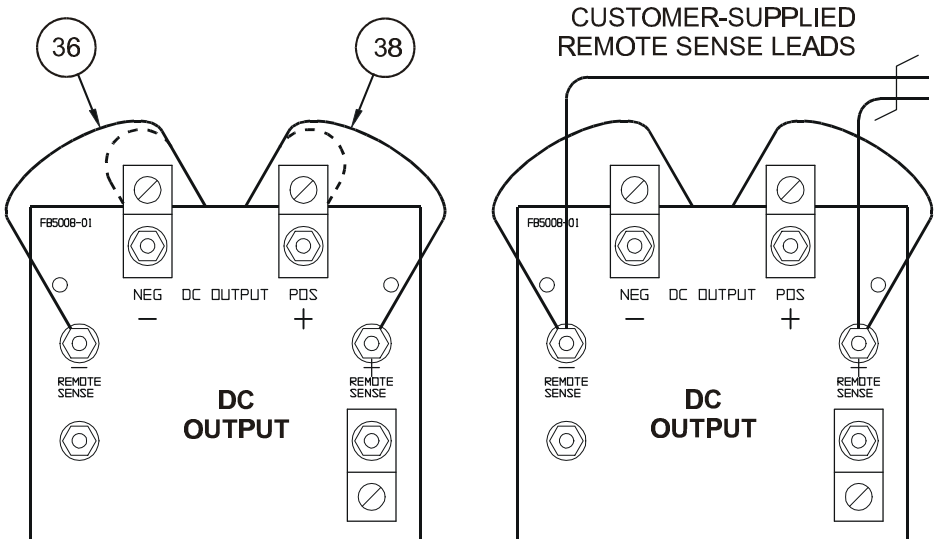
SCHEMATIC



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 wire # **36** from TB1(-) to REM SENSE(-).
5. Move wire # **38** 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 charger.
9. Restart the AT10.1 according to the instructions in Section 2.1.

NOTES

1. Use #16 AWG twisted pair.
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.

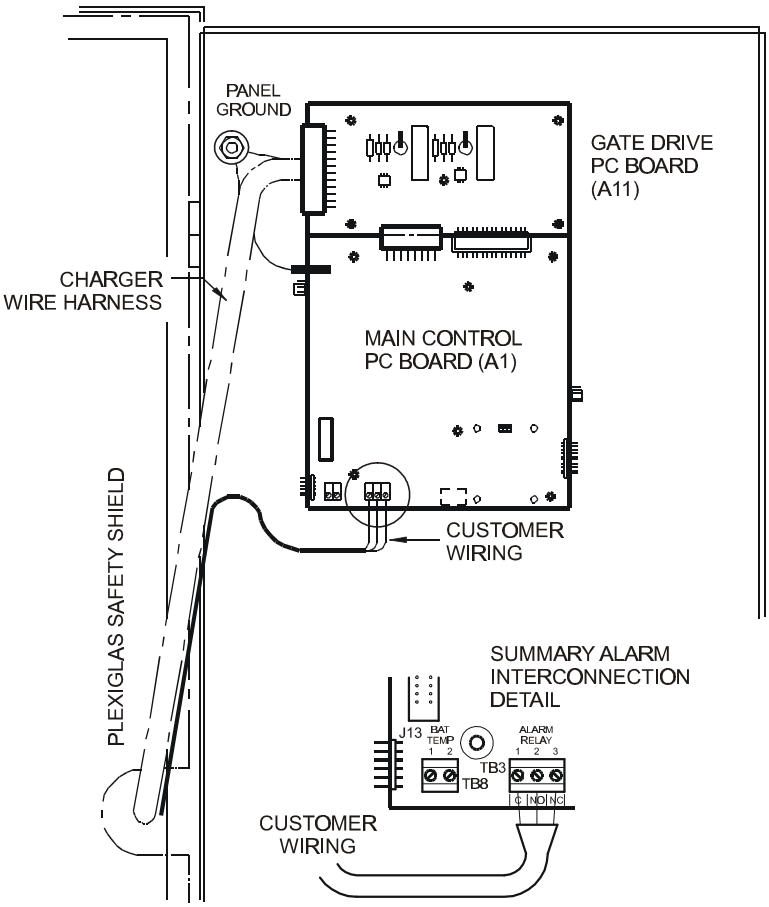
- Remove the remote sense leads from the remote sense (+) and (-) terminals on the I/O panel. Insulate each lead separately. Coil up the wires and leave them in the bottom of the charger, in case you want to wire for remote sense again in the future.
- Reconnect wire # **38** to the dc output (+) terminal.
- Reconnect wire # **36** to the dc output (-) terminal.
- Restart the AT10.1 according to the instructions in Section 2.1.

1.10. WIRING TO THE REMOTE ALARM CONTACTS

Built-in Summary (Common) Alarm Relay *(standard)*

The Main Control PC Board (A1), mounted on the back of the front door, is equipped with one form C Summary Alarm contact (TB3) that transfers for any alarm.

Follow the procedure below to wire an 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 (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/Vdc.
2. Terminal block is a compression type, accepting wire sizes #22-14 AWG.
3. Terminals are labeled in non-alarm condition.

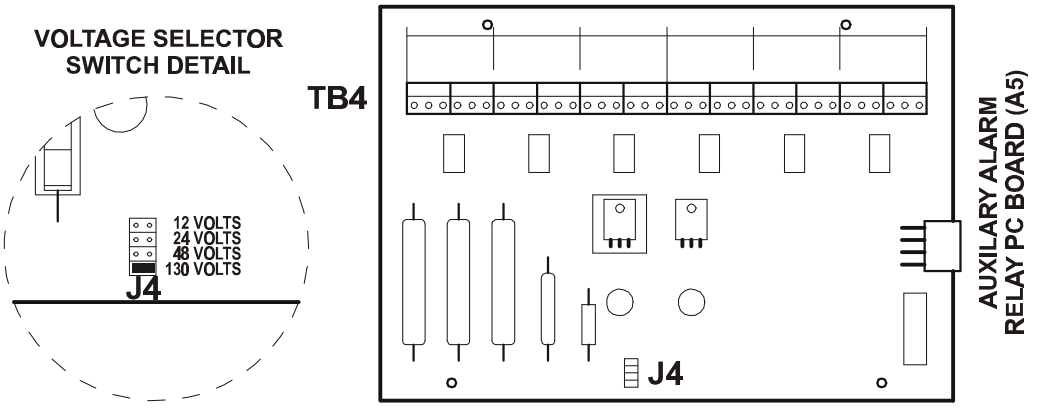
Auxiliary Relay Board *(optional)*

The optional Auxiliary Alarm Relay PC Board (A5), mounted on the right side panel of the circuit breaker bracket, 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 Input 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 OUT FAILURE	DC OUT 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



PROCEDURE

1. Deenergize and lock out all ac and dc voltages to the AT10.1.
2. Allow internal voltages to dissipate, then check with a voltmeter.
3. Remove the plexiglas safety shield.
4. Route your remote annunciator wiring into the enclosure through one of the unused conduit knockouts on the side of the enclosure.
5. Connect the wiring (use #22-14 AWG) to the appropriate terminals of TB4 on the Auxiliary Alarm Relay board (as shown in the figure above). Strip each wire 0.25in / 6.4mm and securely tighten the terminal screws.
6. Replace the safety shield and restart the AT10.1.

NOTES

1. Alarm contacts are rated at 0.5A / 125 Vac or Vdc.
2. Terminal block (TB4) is compression type, accepting #22-14 AWG wire.
3. Terminals are labeled in non-alarm condition.
4. For a detailed view of the optional Auxiliary Alarm Relay PC Board (A5), refer to drawing (**JE5030-29**) listed in Appenix C on Page 80.

1.11. INSTALLING THE TEMPCO PROBE ASSEMBLY (OPTIONAL)

The temperature compensation probe contains 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 accessory 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 AT10.1. Use extreme caution when working inside the unit. Do not attempt to work inside the AT10.1 unless you are a qualified technician or electrician.

Disconnect and lock out all power from the AT10.1 before starting to remove or replace any components. Turn the ac power off at the distribution panel upstream from the charger. Disconnect the battery from the AT10.1 output terminals TB1(+/-).

PROCEDURE

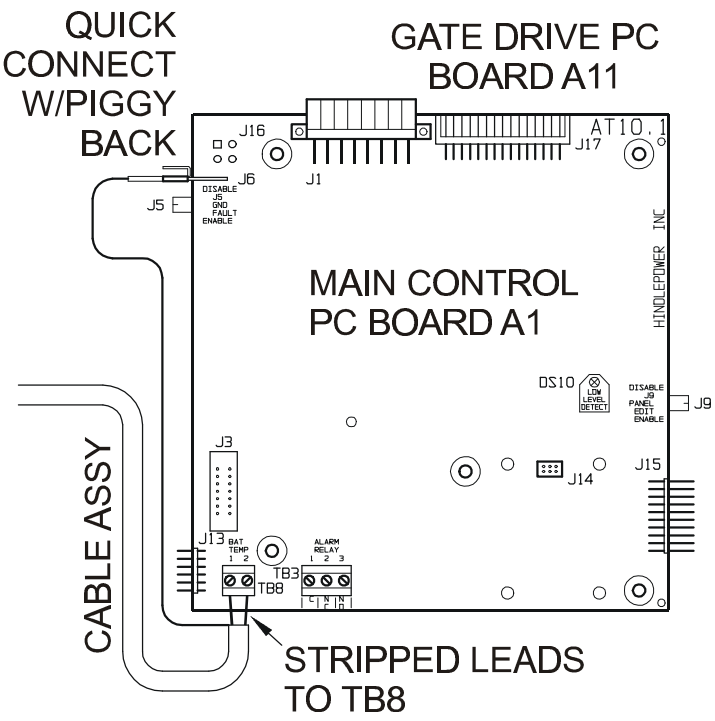
1. De-energize and lock out all ac and dc voltage sources to the AT10.1, and check with a voltmeter before proceeding.
2. Mount the probe on a clean, dry surface, as close to the battery as possible, such as the battery rack. ***DO NOT*** mount the probe:
   - on the battery itself
   - on unpainted 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 charger. The end of the cable with two stripped wires and one lead with a quick-connect terminal will be connected inside the AT10.1. 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 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.



   - Plug the connector at the end of the nylon-shielded wire of the cable assembly onto J6.
   - Using plastic wire ties, fasten the interconnection cable loosely to the existing wire harness. Make 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 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

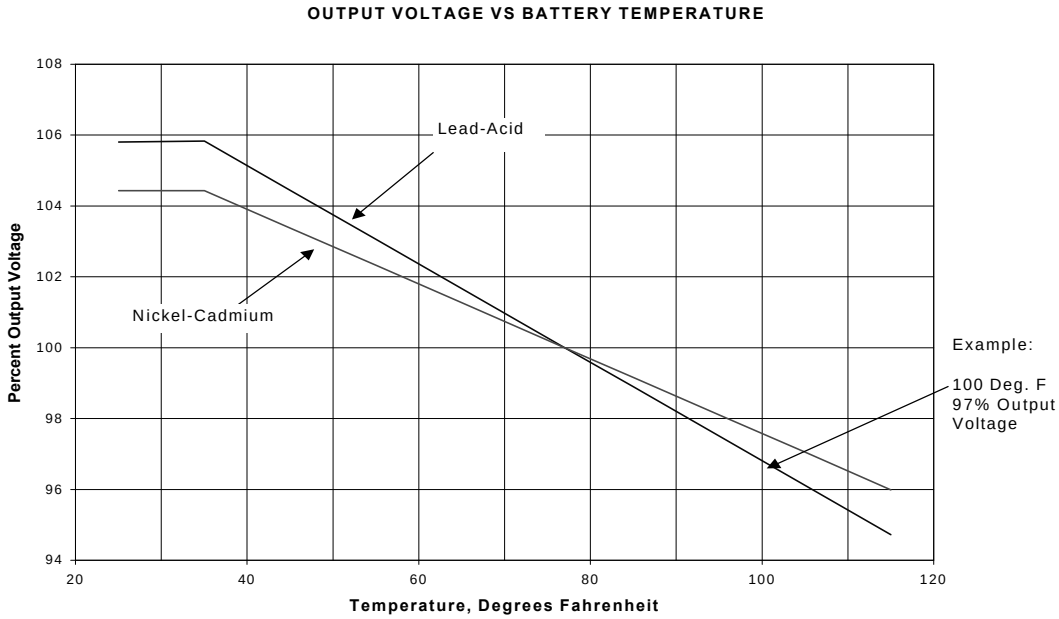
When an electric storage battery is being charged, the terminal voltage of the battery changes a small amount whenever the battery temperature changes. As the battery temperature increases, its terminal voltage decreases. When a battery is charged by a float type charger with a constant output voltage, 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.

If you are experiencing any inconsistencies in the AT10.1 when the temperature compensation probe is utilized, temporarily disconnect the probe, and refer to the *Application Note* (**JD5003-00**) for further details.

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)

Refer to separate *Operating Instructions* (**JA0102-04**).

1.13. INSTALLING FOR FORCED LOAD SHARING (OPTIONAL)

Refer to Appendix F on page 92, or *Instructions* (**JA5054-0**).

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; indicator 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 your charger is equipped with dc fuses, one or both fuses will blow when the battery is reversed.

- 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 voltage, 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 these error codes. See Section 3.2 on page 45 for a full explanation of each 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 01	manual equalize enabled for more than 24 hrs
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 again 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 the 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 will light.

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 AT10.1 summary alarm relay, press and hold the LAMP TEST key for four seconds to transfer the relay. If you are monitoring the relay with a remote annunciator, it will detect the alarm condition.

2.2.6. Testing the Auxiliary Relay Board (optional)

If you have the optional Auxiliary Relay Board (A5) installed, you can similarly test the six individual alarm relays. Press and hold the LAMP TEST key for four seconds to transfer the relays. If you are monitoring the relays with a remote annunciator, it will detect the alarm conditions.

2.2.7. Interpreting the alarm indicators

There are six red 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.
- **NEG GND**: lights whenever leakage current from the battery negative terminal to ground exceeds a specified threshold.

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.

When an alarm occurs, the indicators will light immediately. The AT10.1 also features a summary alarm relay with one form-C contacts (TB3) rated 0.5A / 125 Vac/Vdc. If an alarm condition lasts for 30 seconds or longer, the summary alarm relay transfers. Under standard settings, when the alarm condition is corrected, the corresponding relay and indicator resets automatically. Latching alarm capability for the AT10.1 battery charger is available, featured in a supplemental document (**JA5098-00**).

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 same 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 settings of the high dc voltage and low dc voltage alarms. There is a red indicator light 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 (-)

When an alarm occurs, the indicators will light immediately. The AT10.1 also features a summary alarm relay with one form-C contacts (TB3), rated 0.5A / 125 Vac/Vdc. If an alarm condition lasts for 30 seconds or longer, the summary alarm relay contacts transfer, and can be monitored remotely from TB3. When the alarm condition is corrected, the relay and all indicators reset automatically. If latching alarms/relays are enabled the relay will need to be reset manually, see Section 2.2.7 on page 29.

The summary alarm contacts (TB3) also transfer *immediately* when the AT10.1 detects certain secondary errors, indicated by codes (**E 03**, **E 04**, **E 06**, **E 07**, **E 08**, **E 09**, and **E 10**) on the 4-digit meter display, rather than a red alarm light. See Section 3.2 on Page 45 for all error codes.

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.

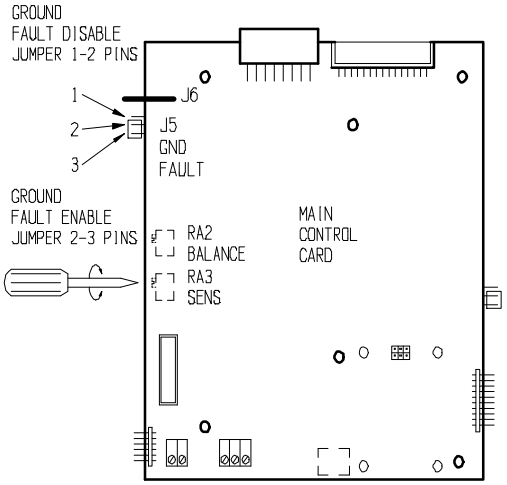
If you want to adjust the current limit setting, skip to Section 2.3.5.

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.

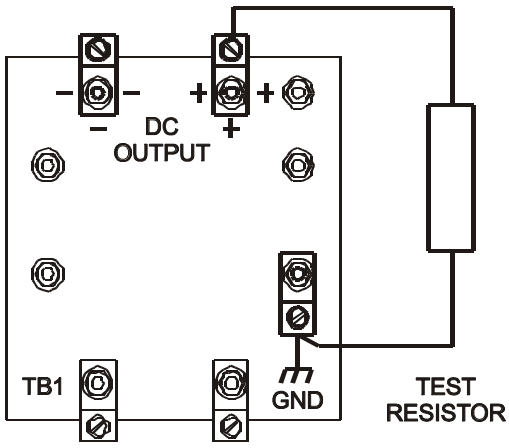


The potentiometer for adjusting ground detection circuit sensitivity is located on the main control circuit board. It is the lower of the two potentiometers labeled **RA3 SENS**, as shown in the figure at the right.

*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.

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 shows **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 ±0.25%. If you replace any component that affects meter accuracy, such as the main control PC 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.

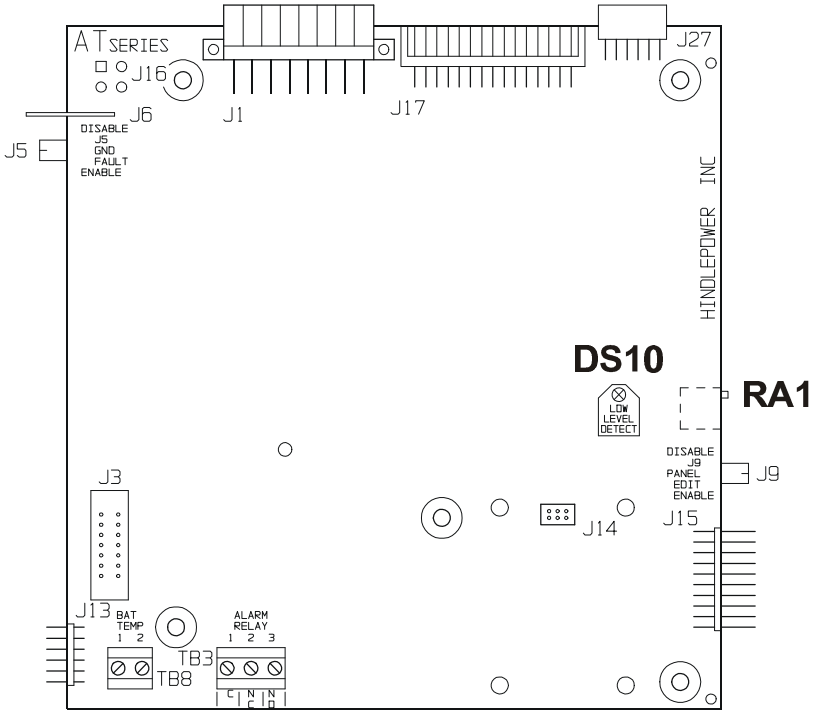
When you are finished adjusting the output voltage, the AT10.1 waits 5 seconds, then the display returns to normal operation.

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 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.

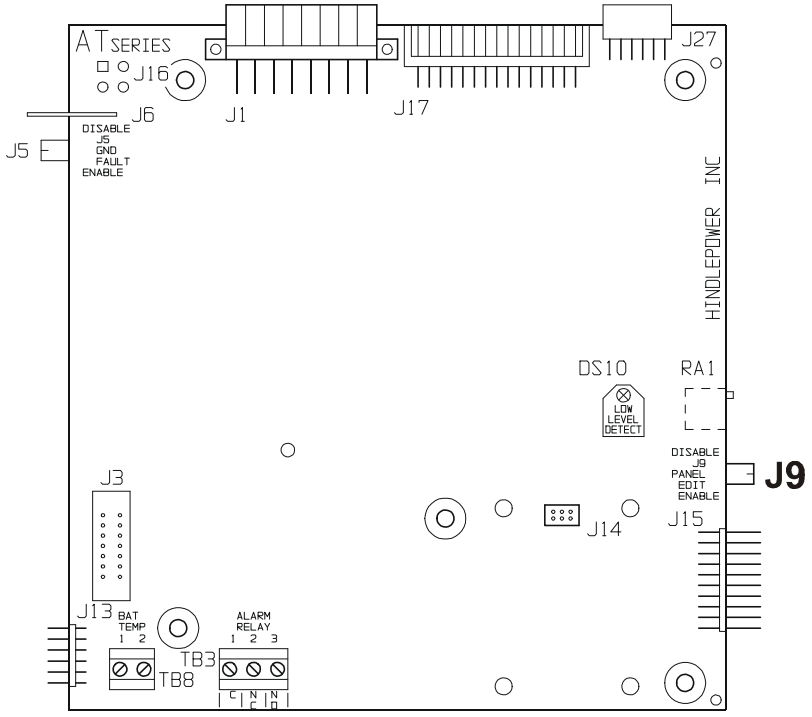
Adjust **RA1** with a small jeweler's screwdriver clockwise until the alarm just activates. A red LED indicator (**DS10**) next to **RA1** indicates when the alarm is active.

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 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 AT10.1. Use extreme caution when working inside the unit. Do not attempt to work inside the AT10.1 unless you are a qualified technician or electrician.***
>
> ***Disconnect and lock out all power from the AT10.1 before starting to remove or replace any components. Turn the ac power off at the distribution panel upstream from the charger. Disconnect the battery from the AT10.1 output terminals TB1(+/-).***

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 3,000ft / 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 54.

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 +/-0.25%, 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 hardware or wiring problems, it may display an error code on the front panel. To solve an error code problem, refer to the table below, which lists the error codes and procedures to use.

WARNING

High voltages appear at several points inside the AT10.1. Use extreme caution when working inside the unit. Do not attempt to work inside the AT10.1 unless you are a qualified technician or electrician.

Disconnect and lock out all power from the AT10.1 before starting to remove or replace any components. Turn the ac power off at the distribution panel upstream from the charger. Disconnect the battery from the AT10.1 output terminals TB1(+/-).

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 Gate Driver pc board (A11) input connector (J18). R2 is measured by the control circuit on startup, and is used to determine some of the AT10.1'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 AT10.1 according to Section 2.1.
E 02	short circuit on dc 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 AT10.1 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 AT10.1. If it is tripped, try once to reset it. If it trips again immediately, there may be an internal short circuit in the AT10.1. Check the internal wiring. If the AT10.1 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 AT10.1 for service, restart it according to Section 2.1.
E 03	High DC Voltage Shutdown activated	To restart the AT10.1, 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 AT10.1 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 failure	Locate R4 and R14 on the Gate Driver pc board (A11) on the back of the front panel. Remove the wire harness plug from J18 and remove A11 from the main control board (A1). Use an Ohmmeter to measure the values of R4 and R14 (see table 3-1 for the correct value). If either resistor is not within 1% of the specified value, the entire Gate Driver pc board (A11) 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 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 (e.g. buzzer) to the summary alarm relay contact (TB3) for remote indication of any charger problem, or monitor the AT10.1 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 Sections 1.9. The locally controlled voltage may not reflect the true requirements of the battery. When you complete the repair, restart the AT10.1 per Section 2.1.
E 07	DC breaker open, or internal 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 AT10.1 may display an **E 07** code. Restart the AT10.1 according to Section 2.1. If the battery and load are OK, see the troubleshooting chart in 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 AT10.1. 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 50 Adc charger, the current limit is set to 55 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 AT10.1 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 AT10.1 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 is a problem with the internal loop wiring, the AT10.1 will display **E 10**. Check the internal wiring in the signal harness, especially wire # **50**. Also check the harness connector on the main control circuit board.
E 14	forced load sharing not working properly	See Appendix F on page 92. Verify both AT10.1s 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 AT10.1s are connected to the same ac supply and that source phase rotation is the same for both AT10.1s.
A 01	manual equalize enabled for more than 24 hours	If AT10.1 was accidentally left in manual equalize mode, switch unit back to float, manual equalize timer, or auto-equalize timer mode.
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 AT10.1 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 AT10.1. Use extreme caution when working inside the unit. Do not attempt to work inside the AT10.1 unless you are a qualified technician or electrician.

Disconnect and lock out all power from the AT10.1 before starting to remove or replace any components. Turn the ac power off at the distribution panel upstream from the charger. Disconnect the battery from the AT10.1 output terminals TB1(+/-).

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 AT10.1'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 AT10.1 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." Charger 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 charger, 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 charger 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 (or fuses clear) immediately	1. Shorted rectifier diode or SCR	1. Test by disconnecting wire # **6** from the rectifier module on the right heat sink, or if possible at the other end from T1-X1. Measure resistance between the ac terminals (bottom terminals) on the rectifier modules. It should be at least 100,000 Ohms (check both polarities). Replace rectifier modules if resistance is low in either direction.
	2. Defective wiring to T1 or to the rectifier bridge assembly	2. Check spacing of terminals and check wiring for signs of insulation damage, burns, etc. Repair as necessary.
	3. Defective transformer T1	3. Test by disconnecting wires from X1, X5, Y1 and Y2. If ac breaker still trips, replace the transformer (T1).
AC breaker trips (or fuses clear) after a few minutes	1. Loose connection to breaker/fuse	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 # **5** or # **6** (between T1 and the rectifier modules). If it less than 50% of the dc output current, one of the SCRs or diodes is defective. Replace the rectifier module.
	4. SCR not controllable	4. Disconnect wires # **51/52** and # **53/54** from the SCR gate lead terminals (these are the small gauge twisted pairs). Be sure to note the original polarity, so that they can be replaced with the same polarity. Restart the charger. If You are able to measure output current, one of the SCRs is defective. Replace the rectifier modules.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
DC breaker trips (or fuses clear) 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 # **6** from the rectifier module on the right heat sink, or if possible at the other end from T1-X1. Measure resistance between the ac terminals (bottom terminals) on the rectifier modules. It should be at least 100,000 Ohms (check both polarities). Replace rectifier modules if resistance is low in either direction.
	3. Defective diode CR4	3. Disconnect wire # **15** from the lower bus bar (W1+) on the heat sink assembly. Measure the resistance through the diode (it's mounted on the other bus bar). Check both polarities; it should be at least 100,000 Ohms in one polarity, and less than 1,000 Ohms in the other polarity. Replace the free-wheeling diode (CR4) if it is defective.
	4. Defective polarity diode CR1 (if filter assembly is installed)	4. Disconnect wire # **17** from the dc circuit breaker (CB2), or the dc fuse (F3). Measure the resistance through the polarity diode (CR1) mounted on the current shunt (R1). Check both polarities; it should be at least 100,000 Ohms in one polarity, and less than 1,000 Ohms in the other polarity. Replace the polarity diode (CR1) if it is defective.
	5. Defective wiring	5. Check spacing of terminals and check wiring for signs of insulation damage, burns, etc. Repair as necessary.
DC breaker trips (or fuses clear) 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 # **5** or # **6**, between the transformer (T1) and the rectifier modules. If it less than 50% of the dc output current, one of the SCRs or diodes is defective. Replace the rectifier module.
	3. SCR not controllable	3. Disconnect wires # **51/52** and # **53/54** from the SCR gate lead terminals (these are the small gauge twisted pairs). Be sure to note the original polarity, so that they can be replaced with the same polarity. Restart the charger. If You are able to measure output current, one of the SCRs is defective. Replace the rectifier modules.
	4. Defective Gate Driver pc board A11	4. If the front panel meter shows more than 110% of rated dc current, the Gate Driver pc board (A11) may be defective. Unplug the A11 from the Main Control board (A1). If the output current ***does not*** go to zero, replace A11.
	5. Defective Main Control board A1	5. If the front panel meter shows more than 110% of rated dc current, the control board may be defective. Unplug the system harness connector (J18) from the Gate Driver pc board (A11). If the output current goes to zero, replace the Main Control board (A1).

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
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, the check feeder circuit breaker or fuse.
	2. Input fuse F1 or F2 is blown	2. Remove the ac fuses (F1/F2) from the fuse holder and check with an Ohmmeter or fuse tester. Replace ac fuses (F1/F2) 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 the transformer (T1) and the rectifier bridge assembly, main inductor (L1), dc filter assembly (if present), the dc breaker and/or fuses, and the output terminals. Check wire # **44** from T1-Y1 and wire # **45** from T1-Y2 to the Gate Driver pc board connector (J18). Repair as necessary.
	4. Defective transformer T1	4. Use an ac voltmeter to measure the ac voltage from T1-X1 to X5. 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 the transformer (T1).
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 charger 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 miswired	3. Be sure the main transformer (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 the transformer (T1) and the rectifier bridge assembly, main inductor (L1), dc filter assembly (if present), the dc breaker and/or fuses, and the output terminals. Repair as necessary.
	5. Defective rectifier bridge	5. Use an ac voltmeter to measure the voltage between the two SCR gate leads on each SCR module. If you measure about 1.0 Volt rms, but there is no output current, replace the rectifier module.
	6. Defective Gate Driver pc board A11	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 Gate Driver pc board (A11).
	7. Defective transformer T1	7. Use an ac voltmeter to measure the ac voltage from T1-X1 to X5. 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 the transformer (T1).
	8. Defective inductor L1 or L2	8. Disconnect the wiring from the main inductor (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 dc circuit breaker (CB2)	9. Disconnect the battery, and connect a light dc load to the charger. Measure the dc voltage across TB1(+) and TB1(-), with the breaker on. If no voltage is measured, replace the breaker.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
Front panel is dead; ac and dc voltages are present at TB1	1. Main Control board (A1) is not connected	1. Make sure the connector at the top edge of the Gate Driver pc board (A11) is firmly seated.
	2. Defective Main Control board A1	2. If the **AC ON** indicator is lit, but the rest of the front panel is dead, replace the Main Control board (A1).
	3. Defective wiring	3. Check the harness wiring to the Gate Driver pc board connector (J18) for signs of insulation damage, burns, etc. Be sure all wires are securely crimped in the connector.
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 J18 pin # **19**, on the Gate Driver pc board (A11), to TB1(-). It is normally 12 Vdc when the rated output voltage is at TB1(+) and TB1(-). If it isn't, then remove all power from the charger, and measure the resistance from TB1(+) to J18 pin # **19** (see the table in Section 3.6 for the proper resistance value). If the resistance is not within 10% of the table value, replace R3.
	2. Defective wiring	2. Remove the safety shield, and check the wiring to and from TB1 and the control circuit board for signs of insulation damage or burns. Repair any damaged wiring.
Charger output voltage too high, not controllable	1. Defective SCR	1. Disconnect wires # **51/52** and # **53/54** from the SCR gate lead terminals (these are the small gauge twisted pairs). Be sure to note the original polarity, so that they can be replaced with the same polarity. Restart the charger. If You are able to measure output current, one of the SCRs is defective. Replace the rectifier modules.
	2. R4 or R14 is defective, or wrong value	2. Locate R4 and R14 on the Gate Driver pc board (A11) on the back of the front panel. Remove one end of each resistor and measure its value with an Ohmmeter. See the table in Section 3.6 for resistance values. If either resistor is not within 1% of the specified value, replace R4 and/or R14 as needed.
	3. Defective temperature compensation probe (optional)	3. Remove one of the probe leads from TB8 and measure its resistance. At 77° F / 25° C the resistance should be about 10K Ohms. If it is not, replace the probe assembly (A10).
	4. Defective Main Control board A1	4. If the front panel meter shows more than 110% of rated dc current, the control board may be defective. Unplug the system harness connector (J18) from the Gate Driver pc board (A11). If the output current goes to zero, replace the Main Control board (A1).

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
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 selected voltage as if the battery were at 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. Locate R4 and R14 on the Gate Driver pc board (A11) on the back of the front panel. Remove one end of each resistor and measure its value with an Ohmmeter. See the table in Section 3.6 for resistance values. If either resistor is not within 1% of the specified value, replace R4 and/or R14 as needed.
	4. Defective Main Control board A1	4. Turn off both front panel circuit breakers (or turn off ac and dc power externally if the charger doesn't have breakers). Then turn on the dc breaker, followed by the ac breaker. If the charger still has the wrong output voltage, replace the Main Control board (A1).
Charger 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 charger 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. Be sure the transformer (T1) primary taps are wired correctly for your input voltage. See *Changing Transformer Taps*, Section 1.6. The actual ac input voltage must be at least 88% of the rated value for the charger to produce full output power.
	4. Defective rectifier bridge	4. Use a clamp-on ammeter to measure the current in wire # **5** or # **6**, between the transformer (T1) and the rectifier modules. If it less than 50% 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 (or turn off ac and dc power externally if the charger doesn't have breakers). Then turn on the dc breaker, followed by the ac breaker. If the charger output current is below the current limit value, but it still has the wrong output voltage, replace the control circuit board.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
Input current too high	1. Wrong ac input voltage, or T1 wired incorrectly	1. Be sure the T1 primary taps are wired correctly for your input voltage. See *Changing Transformer Taps*, Section 1.6. 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 wires # **51/52** and # **53/54** from the SCR gate lead terminals (these are the small gauge twisted pairs). Be sure to note the original polarity, so that they can be replaced with the same polarity. Restart the charger. If You are able to measure output current, one of the SCRs is defective. Replace the rectifier modules.
	3. Defective Transformer T1	3. Test by disconnecting wires from X1, X5, Y1 and Y2. If ac input current is still too high, replace the transformer (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 the 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. Defective filter capacitors, C1 and/or C2	4. Test with capacitance meter; replace C1 and/or C2 as needed.
Charger very noisy	1. Loose hardware or enclosure panel	1. Check and tighten all component mounting hardware and panel hardware.
	2. Defective rectifier bridge	2. Use a clamp-on ammeter to measure the current in wire # **5** or # **6**, between the transformer (T1) and the rectifier modules. If it less than 50% 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 charger. With a light dc load connected to the battery, be sure each cell reads the nominal cell voltage (2.0 V for lead-acid; 1.25 V for Ni-Cd). Restart the charger. Each cell should now read approximately the nominal Float voltage (2.2 V for lead-acid; 1.35 V for Ni-Cd).
	2. Defective scaling resistor R4 or R14	2. Locate R4 and R14 on the Gate Driver pc board (A11) on the back of the front panel. Remove one end of each resistor and measure its value with an Ohmmeter. See the table in Section 3.6 for resistance values. If either resistor is not within 1% of the specified value, replace R4 and R14 as needed.
	3. Defective Main Control pc board A1	3. If the output voltage is constant, but the front panel meter is erratic, replace the Main Control board (A1).

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
Lamp test key does not work, or some lamps do not 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 / 3.18mm through the front of the panel.
	3. Defective Main Control board A1	3. When you press the **LAMP TEST** key, if some but not all indicators light, or the digital meter does not display "***8888***", replace the Main Control board (A1).
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 board (A1) is in the **ENABLE** position.
	2. Main Control 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 Main Control board A1	3. Turn off both front panel circuit breakers (or turn off ac and dc power externally if the charger doesn't have 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 Main Control board (A1).
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 92 for troubleshooting of Forced Load Sharing feature.
HIGH DC VOLTAGE indicator is on	1. HDCV 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 wires # **51/52** and # **53/54** from the SCR gate lead terminals (these are small gauge twisted pairs). Be sure to note original polarity, so they can be replaced with the same polarity. Restart the charger. If You are able to measure output current, one of the SCRs is defective. Replace the rectifier modules.
	3. Defective Main Control board A1	3. Turn off both front panel circuit breakers (or turn off ac and dc power externally if the charger doesn't have 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 Main Control board (A1).
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* portion in Section 2.3.6.
	2. Defective Main Control board A1	2. Turn off both front panel circuit breakers (or turn off ac and dc power externally if the charger doesn't have 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.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
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 # **5** or # **6**, between the transformer (T1) and the rectifier modules. If it less than 50% of the dc output current, one of the SCRs or diodes is defective. Replace the rectifier module.
	4. Defective Main Control board A1	4. Turn off both front panel circuit breakers (or turn off ac and dc power externally if the charger doesn't have 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 Main Control board (A1).
	5. Defective dc breaker (CB2)	5. Disconnect the battery, and connect a light dc load to the charger. Measure the dc voltage across TB1(+) and TB1(-), with the breaker on. If no voltage is measured, replace the dc circuit breaker (CB2).
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 # **5** or # **6**, between the transformer (T1) and the rectifier modules. If it less than 50% of the dc output current, one of the SCRs or diodes is defective. Replace the rectifier module.
	2. Defective Main Control board A1	2. Turn off both front panel circuit breakers (CB1/CB2). If the charger does not have breakers but fuses (F1/F2 and F3/F4), turn off ac and dc power externally. Start up by turning 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 Main Control board (A1).
	3. Defective transformer T1	3. Use an ac voltmeter to measure the ac voltage from T1-X1 to T1-X5. 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 Changing Transformer Taps, Section 1.6. If it is zero, replace the transformer (T1).
	4. Defective dc breaker	4. Disconnect the battery, and connect a light dc load to the charger. Measure the dc voltage across TB1(+) and TB1(-), with the breaker on. If no voltage is measured, replace the breaker.

SYMPTOM	PROBABLE CAUSE	RECOMMENDED ACTION
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 TB1-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 Main Control board A1	4. Turn off both front panel circuit breakers (CB1/CB2). If the charger does not have breakers but fuses (F1/F2 and F3/F4), turn off ac and dc power externally. Start up by turning 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 Main Control board (A1).
POS GND or **NEG GND** indicator is on	1. Ground fault on external dc bus	1. Disconnect the charger 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 charger from the battery and dc bus. Turn the charger 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 charger, and inspect all wiring from TB1 to the dc circuit breaker (CB2), the main inductor (L1), filter assembly (if present), and the rectifier bridge. Look for evidence of insulation damage, insufficient spacing between terminals and chassis, or wires run too close to metal edges.
	5. Defective Main Control board A1	5. Turn off both front panel circuit breakers (CB1/CB2). If the charger does not have breakers but fuses (F1/F2 and F3/F4), turn off ac and dc power externally. Start up by turning on the dc breaker, followed by the ac breaker. If you are sure there is no ground fault on the external bus or within the charger, but the **POS GND** or **NEG GND** indicator is still on, replace the Main Control board (A1).
Summary alarm relay is in alarm mode, but no front panel alarm indicator is on	1. Defective Main Control board A1	1. Turn off both front panel circuit breakers (CB1/CB2). If the charger does not have breakers but fuses (F1/F2 and F3/F4), turn off ac and dc power externally. Start up by turning on the dc breaker, followed by the ac breaker. If the relay remains in alarm mode, check the Low Level Detect indicator on main control board. See Section 2.3.8. If no other alarm is on, replace the Main Control board (A1).

3.5. REPLACING DEFECTIVE COMPONENTS

WARNING

High voltages appear at several points inside the AT10.1. Use extreme caution when working inside the unit. Do not attempt to work inside the AT10.1 unless you are a qualified technician or electrician.

Disconnect and lock out all power from the AT10.1 before starting to remove or replace any components. Turn the ac power off at the distribution panel upstream from the charger. Disconnect the battery from the AT10.1 output terminals TB1(+/-).

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

Removing the safety shield

Some of the repair procedures described below requires removal of the clear plastic safety shield that covers the internal components mounted inside the enclosure. Remove the plexiglas shield by removing the fasteners from the front lip of the enclosure. Do not lay the shield on top of the AT10.1. The top vents are required for cooling.

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

Replacing the Main Control (A1) and/or Gate Driver (A11) pc boards

For details of this procedure, refer to service instruction (**JD5012-00**).

CAUTION: Printed circuit boards A1 and A11 are sensitive to damage from static discharges. Leave replacement pc boards in their anti-static bags until you are ready to install them. Ground yourself before handling these boards by touching the ground stud on the back of the door. Handle these boards only by their edges.

Turn off and remove all power to the AT10.1. Disconnect the battery from the output terminals. Note that A1 and A11 are mounted together as a pair. Remove the signal wire harness plug from J18 at the upper left edge of A11. If present, remove the summary alarm contact wires from TB3 at the bottom of A1. If present, remove the serial cable connecting J3 on the main control board to the Auxiliary Alarm Relay pc board (A5). If the optional temperature compensation probe is installed, remove the main wires from TB8 on the bottom of A1 and remove the shield wire from J6 at the top-left side of A1. Make sure all wires are detached from the two (2) pc boards.

The boards are mounted on ten (10) plastic standoffs. Compress the tab on each standoff, and pull the boards toward you until they clear all the standoffs. If you are replacing only one board, carefully separate the existing boards and reconnect the replacement board. Put the replacement board(s) in place on the front panel with the same orientation, and push them onto the standoffs. Be sure that the boards are fully seated on all ten standoffs. Re-connect the signal wire harness plug to the boards, matching the orientation when removed. If earlier removed, reconnect any wires to on A1. See Section 2.1 for the steps to restart the AT10.1.

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 ac input or dc output circuit breaker (CB1/CB2)

Turn off and remove all power to the AT10.1. Disconnect the battery from the output terminals. This includes remote sense wires if they were installed. Check with a voltmeter before proceeding. Open the front panel and remove the plexiglas safety shield. Remove the mounting screws for the circuit breaker on the circuit breaker bracket, and carefully remove the circuit breaker from the AT10.1. 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 fasteners are tight.*** Install the replacement breaker into the bracket, reversing the procedure above, using the original mounting screws.

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

Turn off and remove all power to the AT10.1. Open the door and remove the safety shield. Disconnect the battery from the output terminals.

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 and remove all power to the AT10.1. Open the door and remove the safety shield. Disconnect the battery from the output terminals.

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 EMI filter networks (VR6/C4, VR7/C5)

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

Turn off and remove all power to the AT10.1. Open the door and remove the safety shield. Disconnect the battery from the output terminals.

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 network VR7/C5, use the above procedure, but start with the lead on TB1(+). Tighten all hardware. Replace cut wire ties if possible.

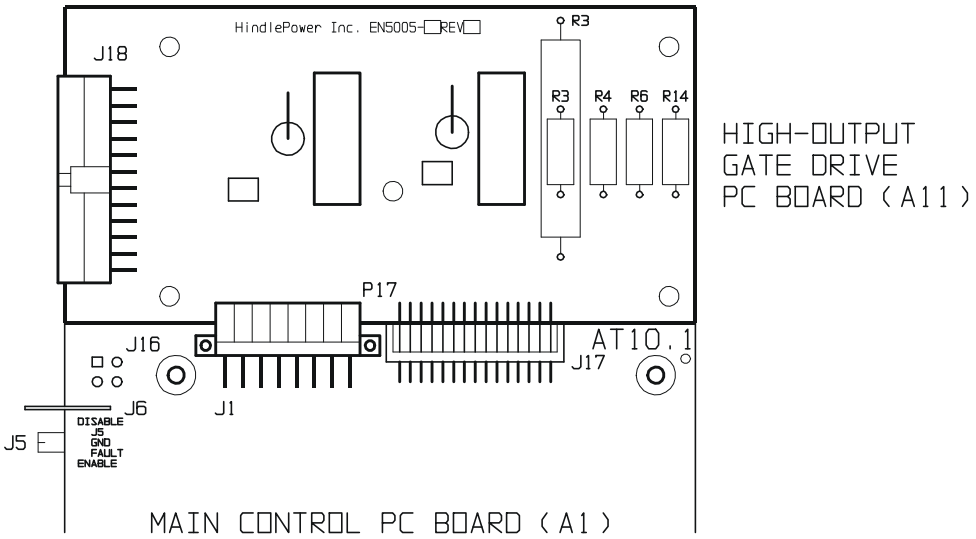
NOTE: The surge suppressor networks are not polarized.

Replacing the power (ballast) resistor (R3) - 48 and 130 Vdc units only

For 48 Vdc and 130 Vdc AT10.1s rated 30-100 Adc, resistor R3 is mounted with metal brackets onto the back panel of the enclosure. Cut wires # **49** and # **55**, connected to R3, as close to the resistor leads as possible. Strip off 0.25in / 6.4mm of insulation from the cut ends of the wires. Unscrew the top mounting-bracket and remove the existing resistor. Mount the new R3 resistor and replace the top mounting-bracket. Carefully re-solder the cut wires to R3. Polarity is not important.

Replacing resistors (R3, R4, R6, R14) on the Gate Driver pc board (A11)

In all AT10.1s rated 30-100 Adc, resistors R4, R6 and R14 are soldered directly onto the Gate Driver pc board (A11). In 12 Vdc and 24 Vdc AT10.1s rated 30-100 Adc, R3 is also soldered directly onto A11. See detail of the Gate Driver pc board (A11) below for proper location.



If any of these resistors need to be replaced we suggest you order a new Gate Driver pc board (A11). See *Replacing the Main Control pc board (A1) and/or Gate Driver pc board (A11)* on page 59.

If any of these resistors *must* be replaced without replacing A11, select the proper part number listed in the table starting on page 62 and order it from the factory or your sales representative.

Remove A11 as described on page 59. Using wire cutters, clip the soldered leads of the old resistor and remove it from A11. Carefully solder on the new resistor, making sure not to damage any other components on A11. Polarity is not important for these resistors. Once the solder cools, replace A11 as described on page 59.

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:

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

Refer to the table below for the most common items.

Table 3-1: REPLACEMENT PARTS

Symbol	Description	Factory Part Number				Rec. Spares
		12 Vdc	24 Vdc	48 Vdc	130 Vdc	
A1	Main Control PC Board assembly	EJ1243-10				Y
A5	Auxiliary Relay PC Board assembly (optional)	EJ1243-03				Y
A7	DC Filter assembly	See Table 3-2				
A8	Battery Eliminator Filter assembly (requires filtered charger)	See Table 3-3				
A10	Temperature Compensation Probe assembly	See Appendix B				
A11	Gate Driver PC Board assembly	EJ5047-01	EJ5047-02	EJ5047-03	EJ5047-04	Y
C1	Filter Capacitor (standard)	RP5001-20	RP5001-20	RP5001-20	RP5001-40	Y
C2	Filter Capacitor (battery eliminator)	RP5001-20	RP5001-20	RP5001-20	RP5001-40	Y
C4	EMI Filter Capacitor	See VR6/C4				
C5	EMI Filter Capacitor	See VR7/C5				
CB1	AC Circuit Breaker (standard) 120 Vac	See Table 3-4				
CB1	AC Circuit Breaker (medium AIC) 120 Vac	See Table 3-7				
CB1	AC Circuit Breaker (high AIC) 120 Vac	See Table 3-10				
CB1	AC Circuit Breaker (standard) 208/240 Vac	See Table 3-5				
CB1	AC Circuit Breaker (medium AIC) 208/240 Vac	See Table 3-8				
CB1	AC Circuit Breaker (high AIC) 208/240 Vac	See Table 3-11				
CB1	AC Circuit Breaker (standard) 480 Vac	See Table 3-6				
CB1	AC Circuit Breaker (medium AIC) 480 Vac	See Table 3-9				
CB1	AC Circuit Breaker (high AIC) 480 Vac	See Table 3-12				
CB2	DC Circuit Breaker (standard)	See Table 3-16				
CB2	DC Circuit Breaker (medium AIC)	See Table 3-17				
CB2	DC Circuit Breaker (high AIC)	See Table 3-18				

Symbol	Description	Factory Part Number				Rec. Spares
		12 Vdc	24 Vdc	48 Vdc	130 Vdc	
CR1	Polarity Diode (30, 40 & 50 Adc ratings)	EJ5106-00				Y
CR1	Polarity Diode (75 Adc rating)	EJ5106-01				Y
CR1	Polarity Diode (100 Adc rating)	RK0017-14				Y
CR4	Free-Wheeling Diode (30/40/50 Adc ratings)	EJ5108-00				Y
CR4	Free-Wheeling Diode (75 Adc rating)	EJ5108-01				Y
CR4	Free-Wheeling Diode (100 Adc rating)	RK0017-14				Y
F1x	AC Input Fuses (optional)	See Tables 3-13, 3-14, 3-15				Y
F3/F4	DC Output Fuses (optional)	See Table 3-19				Y
L1	Main Inductor	See Table 3-20				
L2	Filter Inductor	See Table 3-21				
P5	Jumper for disabling Ground Detection circuit on Main Control PC Board (A1)	RC0100-00				
P7	Jumper for voltage selection on Auxiliary Relay PC Board (A5)	RC0100-00				
P9	Jumper for front panel lockout feature on Main Control PC Board (A1)	RC0100-00				
Q1/Q2	Rectifier Module (30 Adc & 40 Adc ratings)	RM0001-00				Y
Q1/Q2	Rectifier Module (50 Adc ratings)	RM0001-01				Y
Q1/Q2	Rectifier Module (75 Adc & 100 Adc ratings)	RM0004-00				Y
R1	Main DC Shunt	RB0008-03				
R2	Current Rating Resistor	See Table 3-22				
R3	Power Supply (Ballast) Resistor	RJ0007-26 12Ω 2W	RJ0035-25 68Ω 11W	EJ1127-02 150Ω 50W	EJ1127-03 (note 1)	
R4	Positive External Scaling Resistor	RJ0056-48 3160Ω	RJ0056-81 6980Ω	RJ0075-14 14.0KΩ	RJ0075-56 38.3KΩ	
R6	Voltage (Crowbar) Resistor	RJ0063-76	RJ0064-11	RJ0064-41	RJ0064-80	
R9	Filter Capacitor (C1) Bleed Resistor	RJ0028-25	RJ0028-25	RJ0028-27	RJ0036-40	
R14	Negative External Scaling Resistor	RJ0074-48 3160Ω	RJ0074-81 6980Ω	RJ0075-14 14.0KΩ	RJ0075-56 38.3KΩ	
T1	Main Transformer (120/208/240 Vac)	See Table 3-23				
T1	Main Transformer (480 Vac)	See Table 3-24				
TB1-x	Style-5017/5018 input/output/ground terminal CU-AL compression lug for #14 - 1/0 AWG	RC0056-18				
VR1	Output Surge Suppressor	EJ1132-10				Y
VR2	Input Surge Suppressor (120/208/240 Vac)	EJ1132-11				Y
VR2	Input Surge Suppressor (480 Vac)	EJ1132-12				Y
VR3	AC Input Lightning Arrestor	EJ1074-01				
VR4/5	Input Surge Suppressor (120 Vac)	EJ1132-10				Y
VR4/5	Input Surge Suppressor (208/240 Vac)	EJ1132-11				Y
VR4/5	Input Surge Suppressor (480 Vac)	EJ1132-12				Y
VR6+C4	EMI Filter Network	EJ5021-03				Y
VR7+C5	EMI Filter Network	EJ5021-03				Y

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

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

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	EJ5031-00	EJ5031-05	EJ5031-10	EJ5031-15
40 Adc	EJ5031-01	EJ5031-06	EJ5031-11	EJ5031-16
50 Adc	EJ5031-02	EJ5031-07	EJ5031-12	EJ5031-17
75 Adc	EJ5031-03	EJ5031-08	EJ5031-13	EJ5031-18
100 Adc	EJ5031-04	EJ5031-09	EJ5031-14	n/a

Table 3-3: DC FILTER ASSEMBLIES - ELIMINATOR (C2) - REQUIRES STANDARD FILTER

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	EJ5031-20	EJ5031-25	EJ5031-30	EJ5031-35
40 Adc	EJ5031-21	EJ5031-26	EJ5031-31	EJ5031-36
50 Adc	EJ5031-22	EJ5031-27	EJ5031-32	EJ5031-37
75 Adc	EJ5031-23	EJ5031-28	EJ5031-33	EJ5031-38
100 Adc	EJ5031-24	EJ5031-29	EJ5031-34	n/a

Table 3-4: STANDARD AC CIRCUIT BREAKERS (CB1) - 120 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	RE0015-04	RE0015-06	RE0015-09	RE0015-15
40 Adc	RE0015-05	RE0015-07	RE0015-10	RE0015-19
50 Adc	RE0015-05	RE0015-09	RE0015-12	RE0217-02
75 Adc	RE0015-07	RE0015-10	RE0015-15	RE0217-04
100 Adc	RE0015-09	RE0015-15	RE0015-19	n/a

Table 3-5: STANDARD AC CIRCUIT BREAKERS (CB1) - 208/240 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	RE0015-04	RE0015-04	RE0015-06	RE0015-10
40 Adc	RE0015-04	RE0015-05	RE0015-07	RE0015-15
50 Adc	RE0015-04	RE0015-06	RE0015-09	RE0015-15
75 Adc	RE0015-05	RE0015-07	RE0015-12	RE0015-19
100 Adc	RE0015-06	RE0015-09	RE0015-15	n/a

Table 3-6: STANDARD AC CIRCUIT BREAKERS (CB1) - 480 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	RE0015-03	RE0015-03	RE0015-04	RE0015-06
40 Adc	RE0015-03	RE0015-04	RE0015-04	RE0015-07
50 Adc	RE0015-03	RE0015-04	RE0015-05	RE0015-09
75 Adc	RE0015-04	RE0015-04	RE0015-06	RE0015-12
100 Adc	RE0015-04	RE0015-05	RE0015-07	n/a

Table 3-7: MEDIUM AMPERE INTERRUPTING CAPACITY AC CIRCUIT BREAKERS (CB1) - 120 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	RE0171-00	RE0171-01	RE0171-04	RE0171-09
40 Adc	RE0171-00	RE0171-02	RE0171-05	RE0171-12
50 Adc	RE0171-00	RE0171-04	RE0171-07	RE0217-02
75 Adc	RE0171-02	RE0171-05	RE0171-09	RE0217-04
100 Adc	RE0171-04	RE0171-09	RE0171-12	n/a

Table 3-8: MEDIUM AMPERE INTERRUPTING CAPACITY AC BREAKERS (CB1) - 208/240 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	RE0171-00	RE0171-00	RE0171-01	RE0171-05
40 Adc	RE0171-00	RE0171-00	RE0171-02	RE0171-09
50 Adc	RE0171-00	RE0171-01	RE0171-04	RE0171-09
75 Adc	RE0171-00	RE0171-02	RE0171-07	RE0171-12
100 Adc	RE0171-01	RE0171-04	RE0171-09	n/a

Table 3-9: MEDIUM AMPERE INTERRUPTING CAPACITY AC CIRCUIT BREAKERS (CB1) - 480 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	RE0043-00	RE0043-00	RE0043-00	RE0043-01
40 Adc	RE0043-00	RE0043-00	RE0043-00	RE0043-02
50 Adc	RE0043-00	RE0043-00	RE0043-00	RE0043-04
75 Adc	RE0043-00	RE0043-00	RE0043-01	RE0043-07
100 Adc	RE0043-00	RE0043-00	RE0043-02	n/a

Table 3-10: HIGH AMPERE INTERRUPTING CAPACITY AC CIRCUIT BREAKERS (CB1) - 120 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	RE0043-00	RE0043-01	RE0043-04	RE0043-09
40 Adc	RE0043-00	RE0043-02	RE0043-05	RE0043-12
50 Adc	RE0043-00	RE0043-04	RE0043-07	RE0219-02
75 Adc	RE0043-02	RE0043-05	RE0043-09	RE0219-04
100 Adc	RE0043-04	RE0043-09	RE0043-12	n/a

Table 3-11: HIGH AMPERE INTERRUPTING CAPACITY AC CIRCUIT BREAKERS (CB1) - 208/240 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	RE0043-00	RE0043-00	RE0043-01	RE0043-05
40 Adc	RE0043-00	RE0043-00	RE0043-02	RE0043-09
50 Adc	RE0043-00	RE0043-01	RE0043-04	RE0219-09
75 Adc	RE0043-00	RE0043-02	RE0043-07	RE0219-12
100 Adc	RE0043-01	RE0043-04	RE0043-09	n/a

Table 3-12: HIGH AMPERE INTERRUPTING CAPACITY AC CIRCUIT BREAKERS (CB1) - 480 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	RE0152-09	RE0152-09	RE0152-09	RE0152-00
40 Adc	RE0152-09	RE0152-09	RE0152-09	RE0152-10
50 Adc	RE0152-09	RE0152-09	RE0152-09	RE0152-11
75 Adc	RE0152-09	RE0152-09	RE0152-00	RE0152-03
100 Adc	RE0152-09	RE0152-09	RE0152-10	n/a

Table 3-13: AC INPUT FUSES (F1/F2) - 120 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	RE0061-09	RE0061-12	RE0061-14	RE0061-21
40 Adc	RE0061-11	RE0061-13	RE0061-16	RE0061-23
50 Adc	RE0061-11	RE0061-14	RE0061-18	RE0061-26
75 Adc	RE0061-13	RE0061-16	RE0061-21	RE0061-28
100 Adc	RE0061-14	RE0061-21	RE0061-23	n/a

Table 3-14: AC INPUT FUSES (F1/F2) - 208/240 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	RE0061-08	RE0061-09	RE0061-12	RE0061-16
40 Adc	RE0061-08	RE0061-11	RE0061-13	RE0061-21
50 Adc	RE0061-09	RE0061-12	RE0061-14	RE0061-21
75 Adc	RE0061-11	RE0061-13	RE0061-18	RE0061-23
100 Adc	RE0061-12	RE0061-15	RE0061-21	n/a

Table 3-15: AC INPUT FUSES (F1/F2) - 480 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	RE0008-06	RE0008-06	RE0008-08	RE0008-12
40 Adc	RE0008-06	RE0008-08	RE0008-09	RE0008-13
50 Adc	RE0008-06	RE0008-08	RE0008-11	RE0008-14
75 Adc	RE0008-08	RE0008-09	RE0008-12	RE0008-18
100 Adc	RE0008-08	RE0008-11	RE0008-13	n/a

Table 3-16: STANDARD DC CIRCUIT BREAKERS (CB2)

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	RE0015-30	RE0015-30	RE0015-30	RE0015-30
40 Adc	RE0015-31	RE0015-31	RE0015-31	RE0015-31
50 Adc	RE0015-34	RE0015-34	RE0015-34	RE0015-34
75 Adc	RE0015-36	RE0015-36	RE0015-36	RE0015-36
100 Adc	RE0217-03	RE0217-03	RE0217-03	n/a

Table 3-17: MEDIUM AMPERE INTERRUPTING CAPACITY DC CIRCUIT BREAKERS (CB2)

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	RE0170-07	RE0170-07	RE0170-07	RE0170-07
40 Adc	RE0170-08	RE0170-08	RE0170-08	RE0170-08
50 Adc	RE0170-10	RE0170-10	RE0170-10	RE0170-10
75 Adc	RE0170-12	RE0170-12	RE0170-12	RE0170-12
100 Adc	RE0217-03	RE0217-03	RE0217-03	n/a

Table 3-18: HIGH AMPERE INTERRUPTING CAPACITY DC CIRCUIT BREAKERS (CB2)

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	RE0043-07	RE0043-07	RE0043-07	RE0043-07
40 Adc	RE0043-08	RE0043-08	RE0043-08	RE0043-08
50 Adc	RE0043-10	RE0043-10	RE0043-10	RE0043-10
75 Adc	RE0043-12	RE0043-12	RE0043-12	RE0043-12
100 Adc	RE0188-06	RE0188-06	RE0188-06	n/a

Table 3-19: DC OUTPUT FUSES (F3/F4)

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	RE0061-18	RE0061-18	RE0061-18	RE0061-18
40 Adc	RE0061-19	RE0061-19	RE0061-19	RE0061-19
50 Adc	RE0061-21	RE0061-21	RE0061-21	RE0061-21
75 Adc	RE0061-23	RE0061-23	RE0061-23	RE0061-23
100 Adc	RE0061-26	RE0061-26	RE0061-26	n/a

Table 3-20: MAIN INDUCTOR (L1)

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	AP0604-10	AP0604-10	AP0604-10	AP0604-10
40 Adc	AP0604-10	AP0604-10	AP0604-10	AP0482-10
50 Adc	AP0481-10	AP0481-10	AP0481-10	AP0482-10
75 Adc	AP0314-10	AP0808-10	AP0833-10	AP5001-00
100 Adc	AP0339-10	AP0339-10	AP0827-10	n/a

Table 3-21: FILTER INDUCTOR (L2)

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	AP0604-10	AP0604-10	AP0604-10	AP0604-10
40 Adc	AP0604-10	AP0604-10	AP0604-10	AP0604-10
50 Adc	AP0481-10	AP0481-10	AP0481-10	AP0482-10
75 Adc	AP0314-10	AP0314-10	AP0833-10	AP0377-10
100 Adc	AP0339-10	AP0339-10	AP0339-10	n/a

Table 3-22: RATING RESISTOR (R2)

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	EJ1133-00 34.8 KΩ	EJ1133-05 13.0 KΩ	EJ1133-10 5.11 KΩ	EJ1133-15 1.50 KΩ
40 Adc	EJ1133-01 40.2 KΩ	EJ1133-06 15.4 KΩ	EJ1133-11 6.19 KΩ	EJ1133-16 2.21 KΩ
50 Adc	EJ1133-02 53.6 KΩ	EJ1133-07 19.6 KΩ	EJ1133-12 7.50 KΩ	EJ1133-17 2.74 KΩ
75 Adc	EJ1133-03 78.7 KΩ	EJ1133-08 23.7 KΩ	EJ1133-13 9.09 KΩ	EJ1133-18 3.57 KΩ
100 Adc	EJ1133-04 118 KΩ	EJ1133-09 29.4 KΩ	EJ1133-14 11.0 KΩ	n/a
Connector terminal extraction tool	Molex P/N **11-03-0044**			

Table 3-23: MAIN TRANSFORMER (T1) - 120/208/240 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	AB1545-10	AB1569-10	AB1613-10	AB1589-10
40 Adc	AB1561-10	AB1541-10	AB1597-10	AB1601-10
50 Adc	AB1561-10	AB1541-10	AB1597-10	AB1601-10
75 Adc	AB1520-10	AB1720-10	AB1553-10	AB1641-10
100 Adc	AB1565-10	AB1633-10	AB1549-10	n/a

Table 3-24: MAIN TRANSFORMER (T1) - 480 Vac

Current Rating	12 Vdc	24 Vdc	48 Vdc	130 Vdc
30 Adc	AB1546-10	AB1570-10	AB1614-10	AB1590-10
40 Adc	AB1562-00	AB1542-10	AB1598-10	AB1602-10
50 Adc	AB1562-10	AB1542-10	AB1598-10	AB1602-10
75 Adc	AB1249-10	AB1257-10	AB1554-10	AB1642-10
100 Adc	AB1566-10	AB1516-10	AB1550-10	n/a

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	30 Adc rating, full load, %	61	74	83	90
	75 Adc rating, full load, %	62	75	84	91

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	11.0-14.5	22.0-29.5	44.0-58.0	110-141
	Equalize	11.7-15.5	23.4-31.0	46.8-59.0	117-143
	High DC Voltage alarm	12-19	24-38	48-76	120-175
	Low DC Voltage alarm	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 - 150			

Surge withstand capability	Test per **ANSI C37.90.1-1989**	No erroneous outputs
Reverse current from battery	AC input power failure, no options installed	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 options and accessories 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:

- Model number and serial number of your battery charger
- Factory part number and description, from the table below
- 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 3-3
Auxiliary Alarm Relay PC Board (A5)	EI0213-02
Ground Bus with one (1) box lug for #14-1/0 AWG	EI0195-01
AC Input Lightning Arrestor (VR3)	EJ1074-01
Floor-Mounting Kit for Style-5017 Enclosure	EI0192-00
Relay Rack-Mounting Kit for Style-5017 Enclosure (19in/483mm)	EI0193-01
Relay Rack-Mtg. Kit for Style-5017 Enclosure (23-24in/584-610mm)	EI0193-02
Cabinet Heater Strips for Style-5017 Enclosure	EJ5041-00
Wall-Mounting Kit for Style-5018 Enclosure	EI5008-00
Relay Rack-Mtg. Kit for Style-5018 Enclosure (23-24in/584-610mm)	EI0193-03
Cabinet Heater Strips for Style-5018 Enclosure	EJ5042-00
NEMA-2 Type Drip Shield for Style-5017/5018 Enclosure	EI0191-01/02
Padlock for Style-5017/5018 Enclosure Front Panel Door	EI0215-01
Remote Temperature Compensation Probe Assembly (A10)	see table below
DNP3 Level 2 / Modbus Communications Module	see Appendix E
Forced Load Sharing Accessory	EJ5126-XX

Remote Temperature Compensation Probe

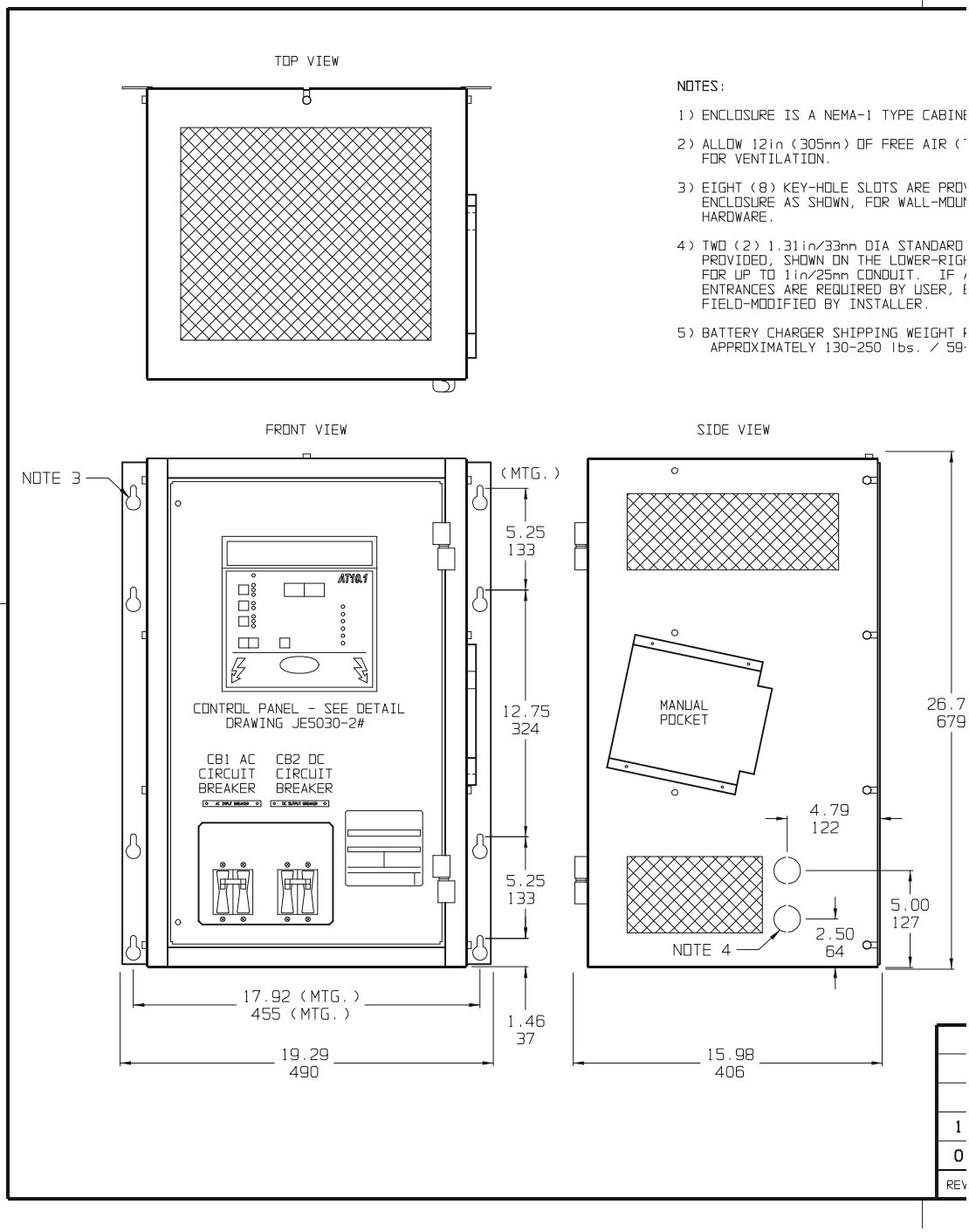
The temperature compensation assembly consists of two (2) components:

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. Do attempt to splice cables together to increase the length. If a longer cable is needed, order it from the table below, which also features ordering part numbers for a complete tempco 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

Outline: AT10.1 Group II Battery Charger
NEMA-1 Style-5017 Enclosure (**JE5025-00**)



Outline: AT10.1 Group II Battery Charger
NEMA-1 Style-5017 Enclosure (**JE5025-00**)

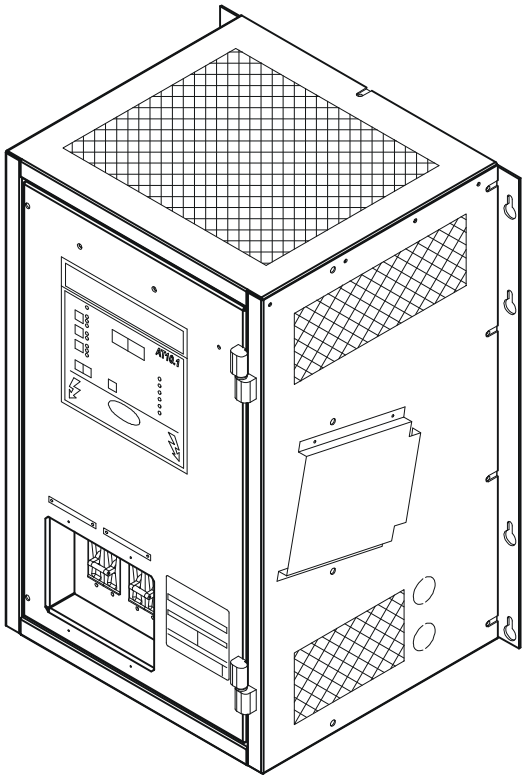
TYPE CABINET WITHOUT GASKETS.

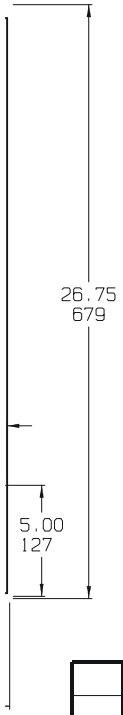
FREE AIR (TOP AND FRONT OF CABINET)

)TS ARE PROVIDED ON THE BACK OF
)R WALL-MOUNTING WITH .25in (6.25mm)

:A STANDARD PRE-FAB KNOCKOUTS ARE
: LOWER-RIGHT SIDE OF ENCLOSURE
)DUIT. IF ADDITIONAL CONDUIT
) BY USER, ENCLOSURE SHOULD BE
'ALLER.

:NG WEIGHT RANGE:
) lbs. / 59-113 kg.





DUAL DIMENSIONS in mm

				THIRD ANGLE PROJECTION	
				DRAWN BY MCR	022603
				APPROVED	022603
1	E1541	090905		UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES. TOLERANCES ARE:	
0	E1151	022603			
REV	ECN No	DATE	APP		

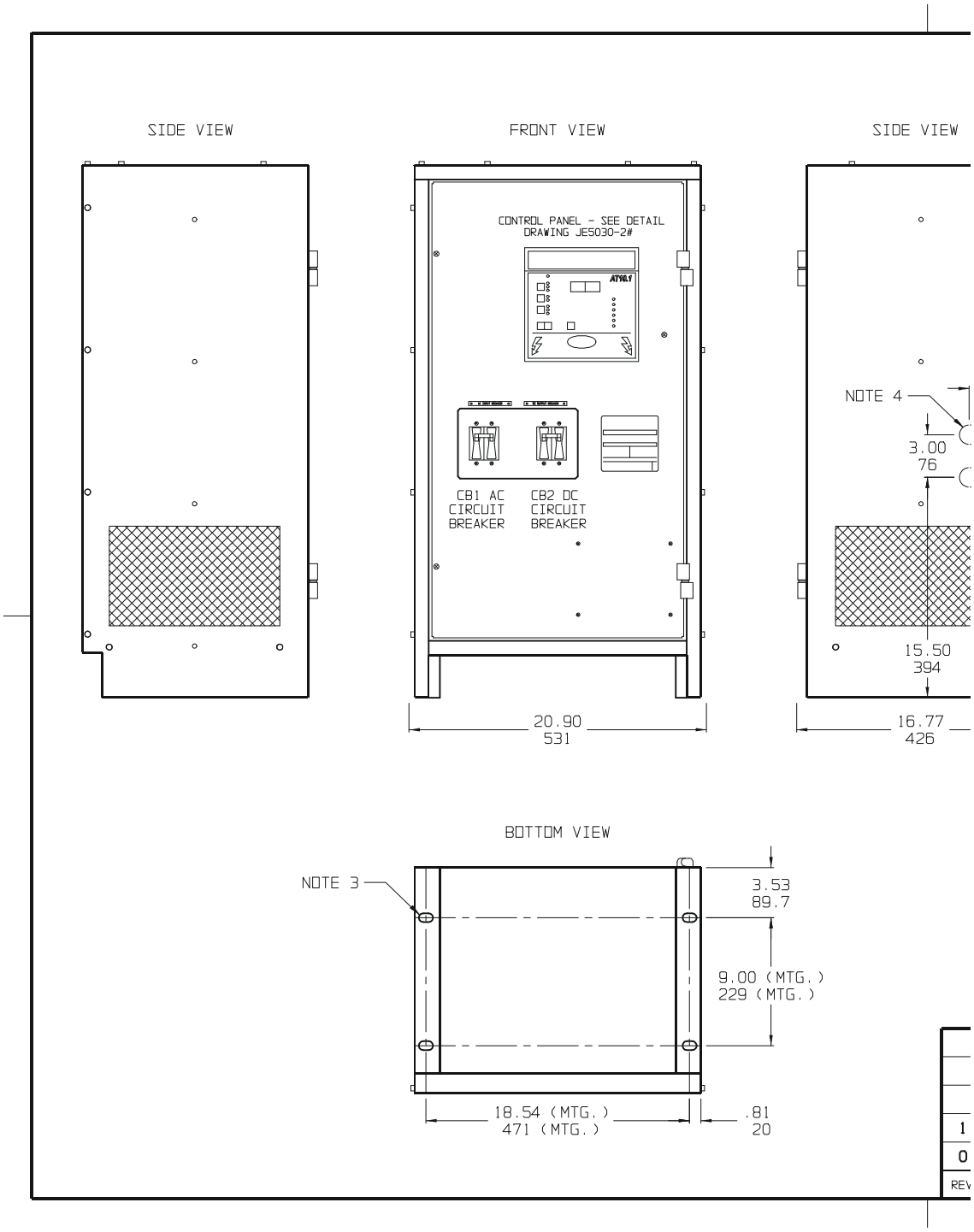
TITLE AT10.1 SERIES BATTERY CHARGER OUTLINE: NEMA-1 STYLE-5017 ENCLOSURE

DRAWING No JE5025-00 REV 1 B

SCALE NTS PART No JE5025-00 SHEET 1 OF 1

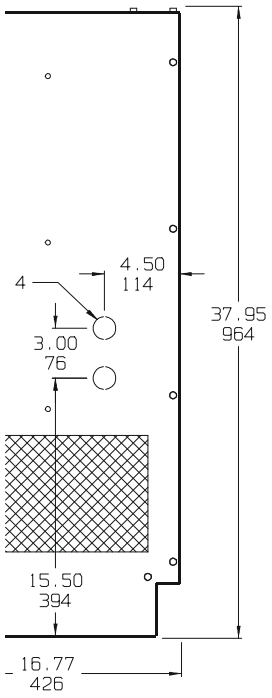
http://www.ATSeries.net/PDFs/JE5025-00.pdf

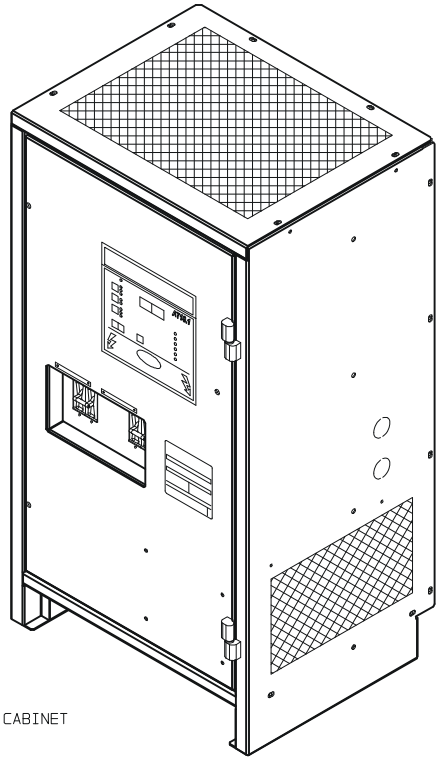
Outline: AT10.1 Group II Battery Charger
NEMA-1 Style-5018 Enclosure (**JE5026-00**)



Outline: AT10.1 Group II Battery Charger
NEMA-1 Style-5018 Enclosure (**JE5026-00**)

IDE VIEW





NOTES:

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

2) ALLOW 12in (305mm) OF FREE AIR (TOP AND FRONT OF CABINET) FOR VENTILATION.

3) FOUR (4) 1in x .625in (25mm x 16mm) FLOOR-MOUNTING SLOTS ARE PROVIDED ON BOTTOM OF ENCLOSURE AS SHOWN.

4) TWO (2) 1.31in/33mm DIA STANDARD PRE-FAB KNOCKOUTS ARE PROVIDED, SHOWN ON THE LOWER-RIGHT SIDE OF ENCLOSURE FOR UP TO 1in/25mm CONDUIT. IF ADDITIONAL CONDUIT ENTRANCES ARE REQUIRED BY USER, ENCLOSURE SHOULD BE FIELD-MODIFIED BY INSTALLER.

5) BATTERY CHARGER SHIPPING WEIGHT RANGE: APPROXIMATELY 205-660 lbs. / 93-300 kg.

DUAL DIMENSIONS in mm

REV	ECN No	DATE	APP
1	E1541	012304	
0	E1151	022603	

THIRD ANGLE PROJECTION

DRAWN BY MCR 022603

APPROVED 022603

UNLESS OTHERWISE NOTED DIMENSIONS ARE IN INCHES. TOLERANCES ARE:

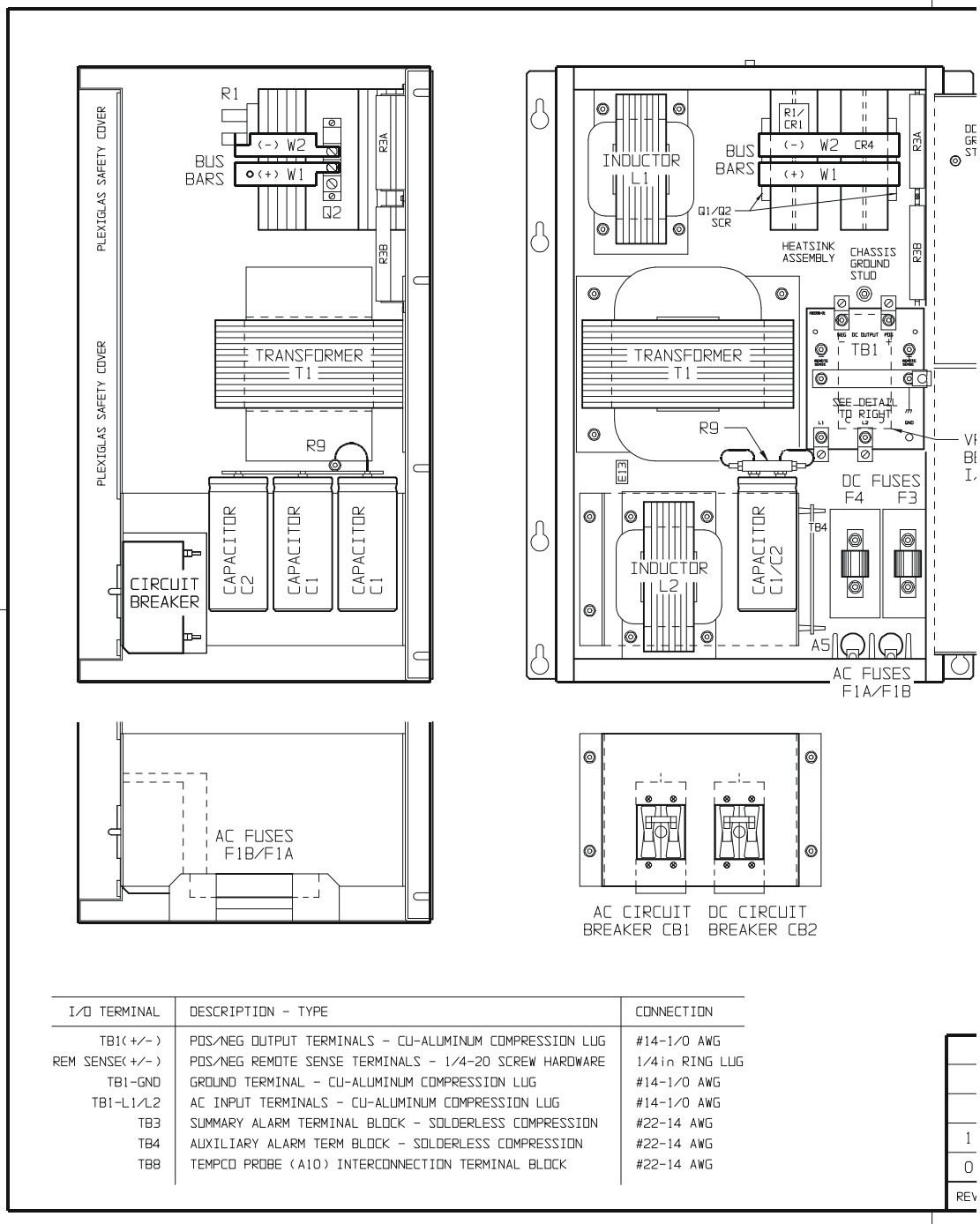
TITLE AT10.1 SERIES BATTERY CHARGER OUTLINE: NEMA-1 STYLE-5018 ENCLOSURE

DRAWING No JE5026-00 REV 1 B

SCALE NTS PART No JE5026-00 SHEET 1 OF 1

http://www.ATSeries.net/PDFs/JE5026-00.pdf

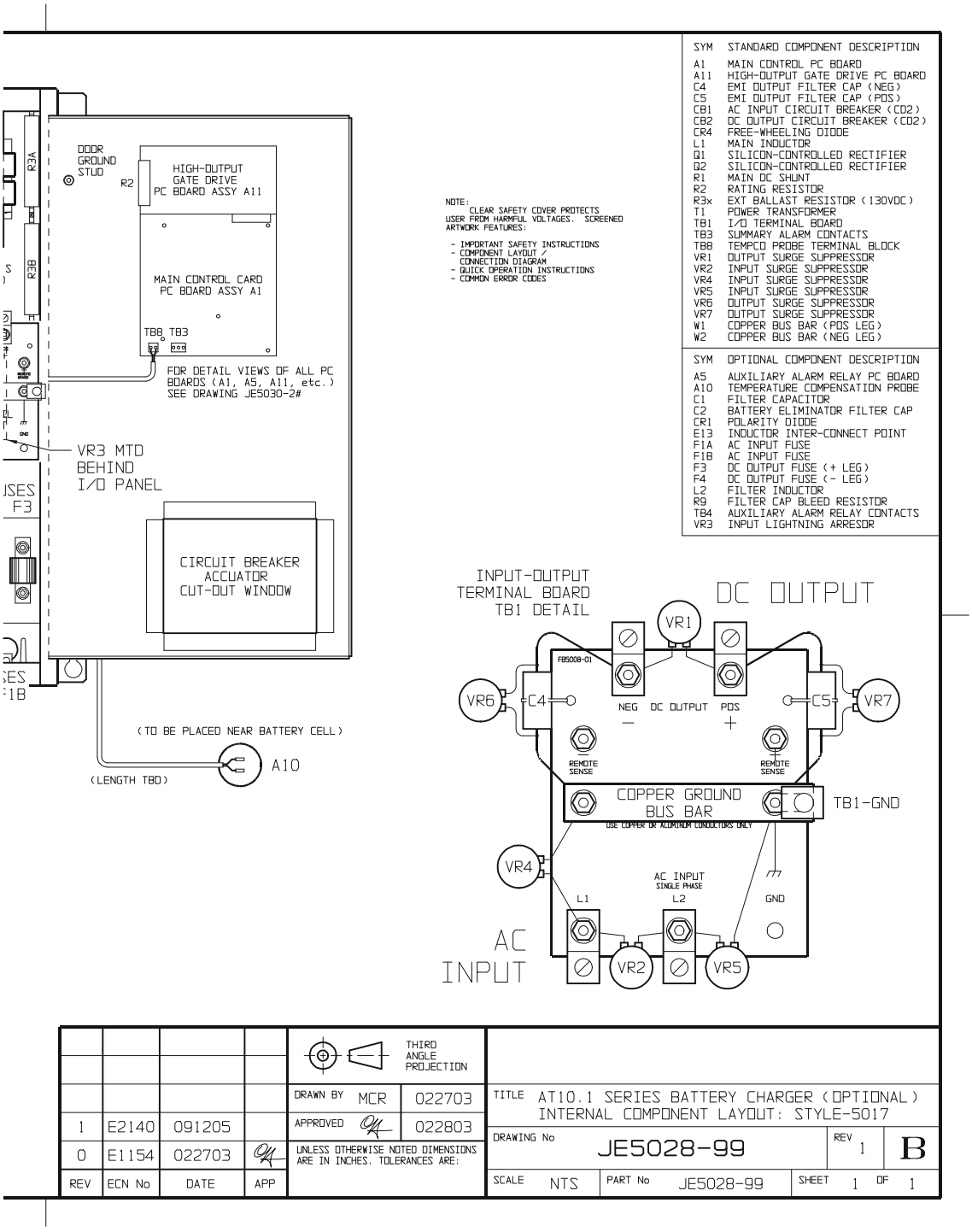
Internal Component Layout: AT10.1 Group II Battery Charger
Style-5017 Enclosure w/Common Options (**JE5028-99**)



I/O TERMINAL	DESCRIPTION - TYPE	CONNECTION
TB1(+/-)	POS/NEG OUTPUT TERMINALS - CU-ALUMINUM COMPRESSION LUG	#14-1/0 AWG
REM SENSE(+/-)	POS/NEG REMOTE SENSE TERMINALS - 1/4-20 SCREW HARDWARE	1/4in RING LUG
TB1-GND	GROUND TERMINAL - CU-ALUMINUM COMPRESSION LUG	#14-1/0 AWG
TB1-L1/L2	AC INPUT TERMINALS - CU-ALUMINUM COMPRESSION LUG	#14-1/0 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

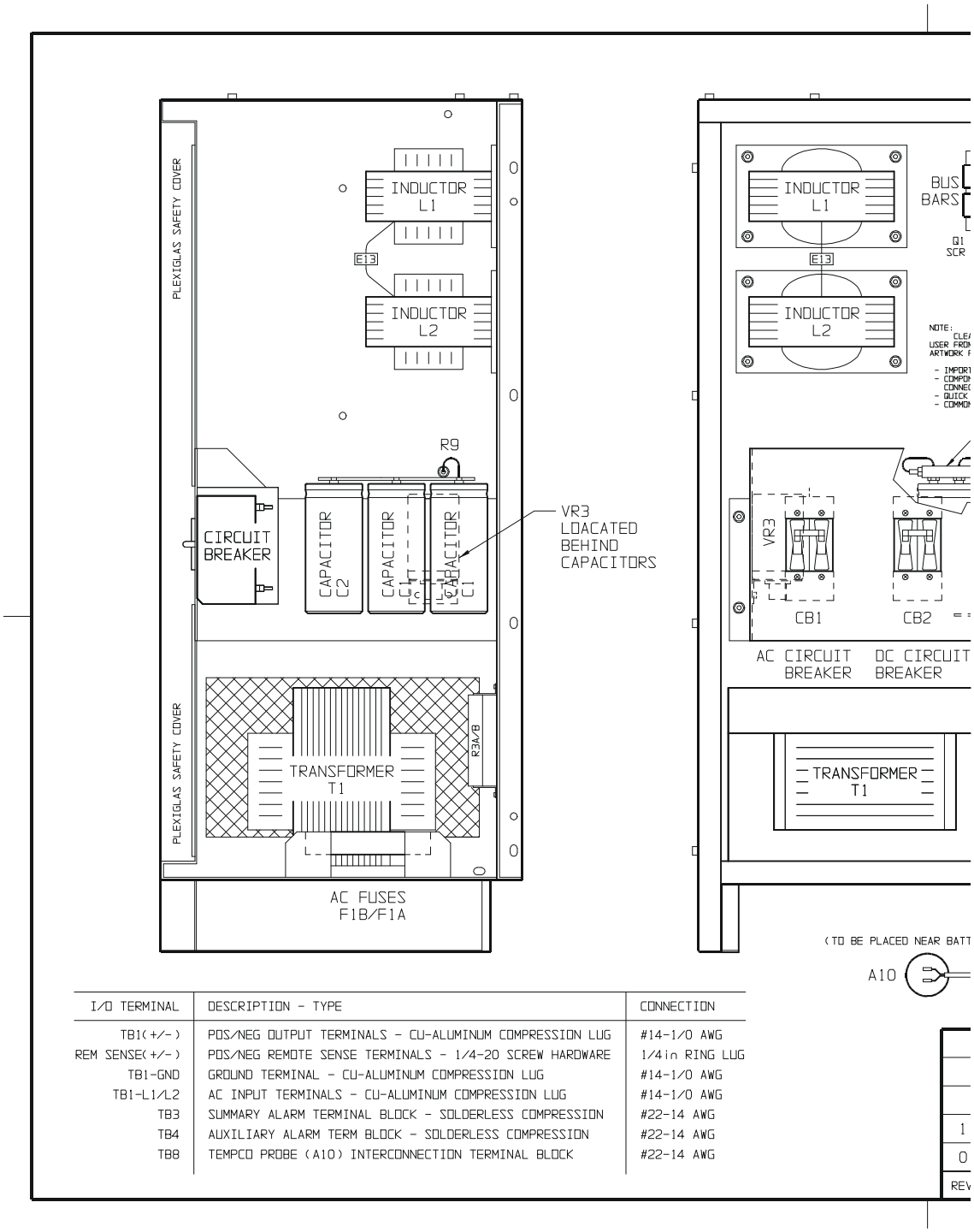
Note: This internal component layout drawing (**JE5028-99**) depicts an AT10.1 Series battery charger housed in a Style-5017 enclosure, with ALL available options. Standard components (A1 through VR7) are supplied in all such units. Optional components (A5 through VR3) are supplied only in those AT10.1 chargers configured with such options.

Internal Component Layout: AT10.1 Group II Battery Charger
Style-5017 Enclosure w/Common Options (**JE5028-99**)



http://www.ATSeries.net/PDFs/JE5028-99.pdf

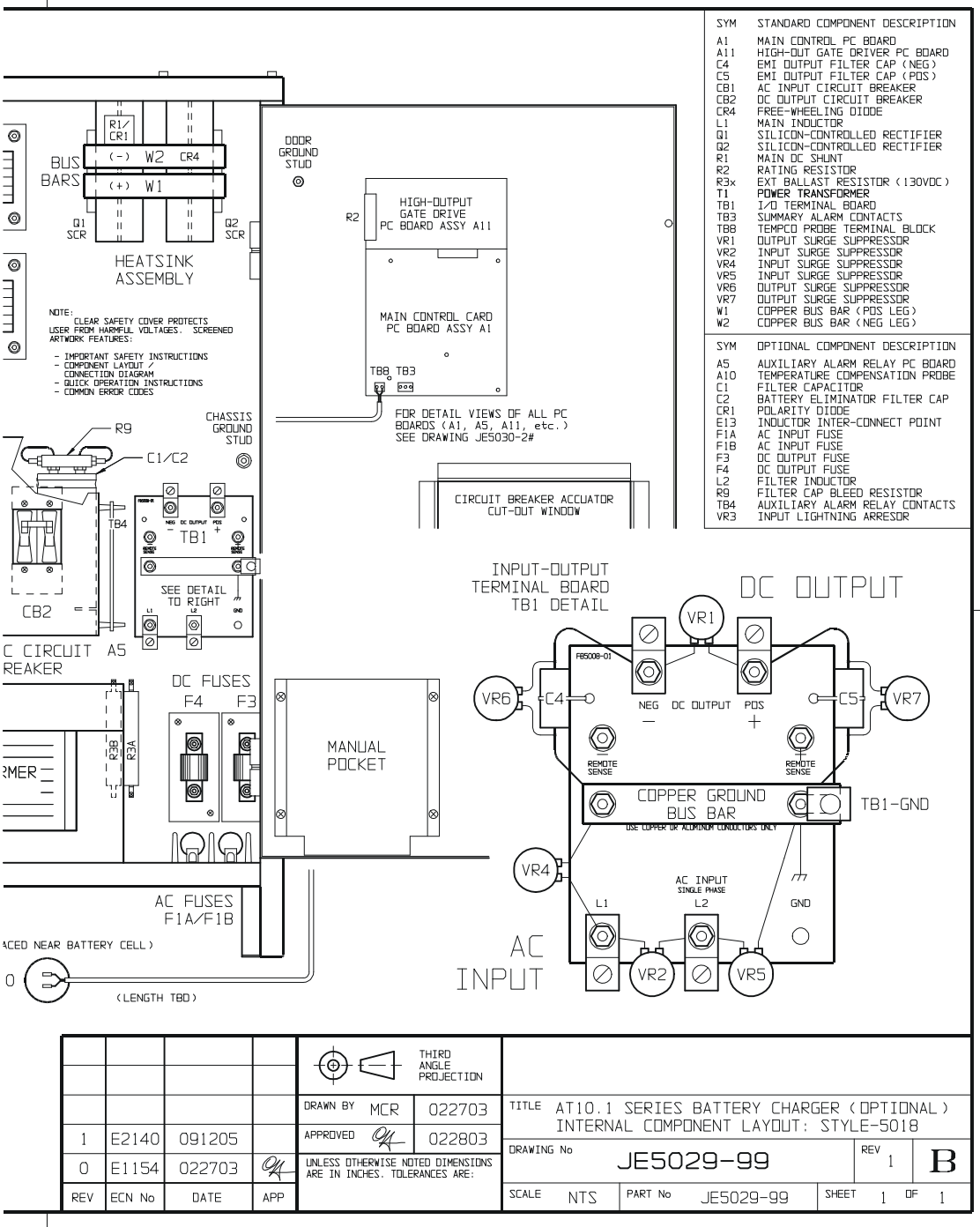
Internal Component Layout: AT10.1 Group II Battery Charger
Style-5018 Enclosure w/Common Options (**JE5029-99**)



I/O TERMINAL	DESCRIPTION - TYPE	CONNECTION
TB1(+/-)	POS/NEG OUTPUT TERMINALS - CU-ALUMINUM COMPRESSION LUG	#14-1/0 AWG
REM SENSE(+/-)	POS/NEG REMOTE SENSE TERMINALS - 1/4-20 SCREW HARDWARE	1/4in RING LUG
TB1-GND	GROUND TERMINAL - CU-ALUMINUM COMPRESSION LUG	#14-1/0 AWG
TB1-L1/L2	AC INPUT TERMINALS - CU-ALUMINUM COMPRESSION LUG	#14-1/0 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

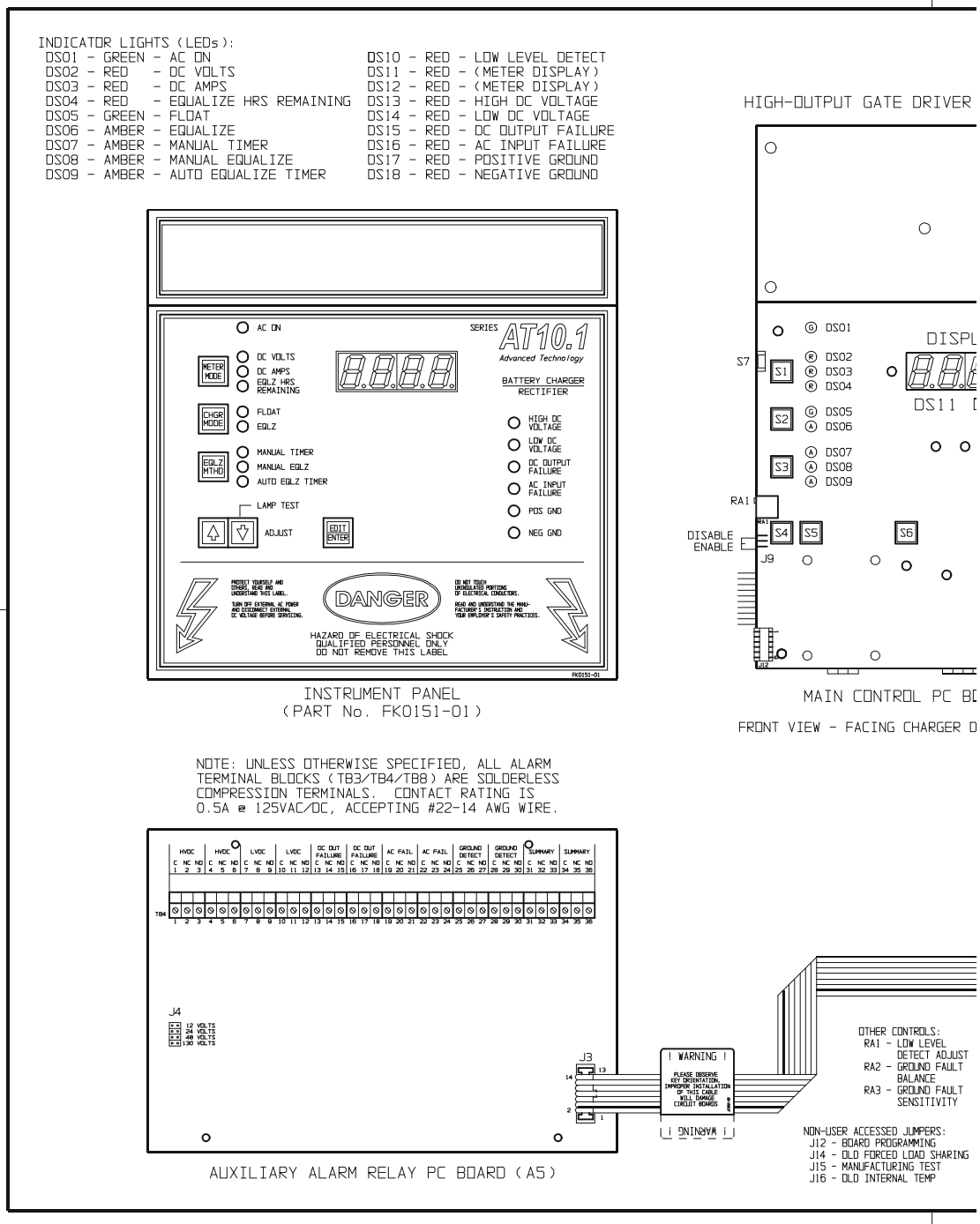
Note: This internal component layout drawing (**JE5029-99**) depicts an AT10.1 Series battery charger housed in a Style-5018 enclosure, with ALL available options. Standard components (A1 through VR7) are supplied in all such units. Optional components (A5 through VR3) are supplied only in those AT10.1 chargers configured with such options.

Internal Component Layout: AT10.1 Group II Battery Charger
Style-5018 Enclosure w/Common Options (**JE5029-99**)



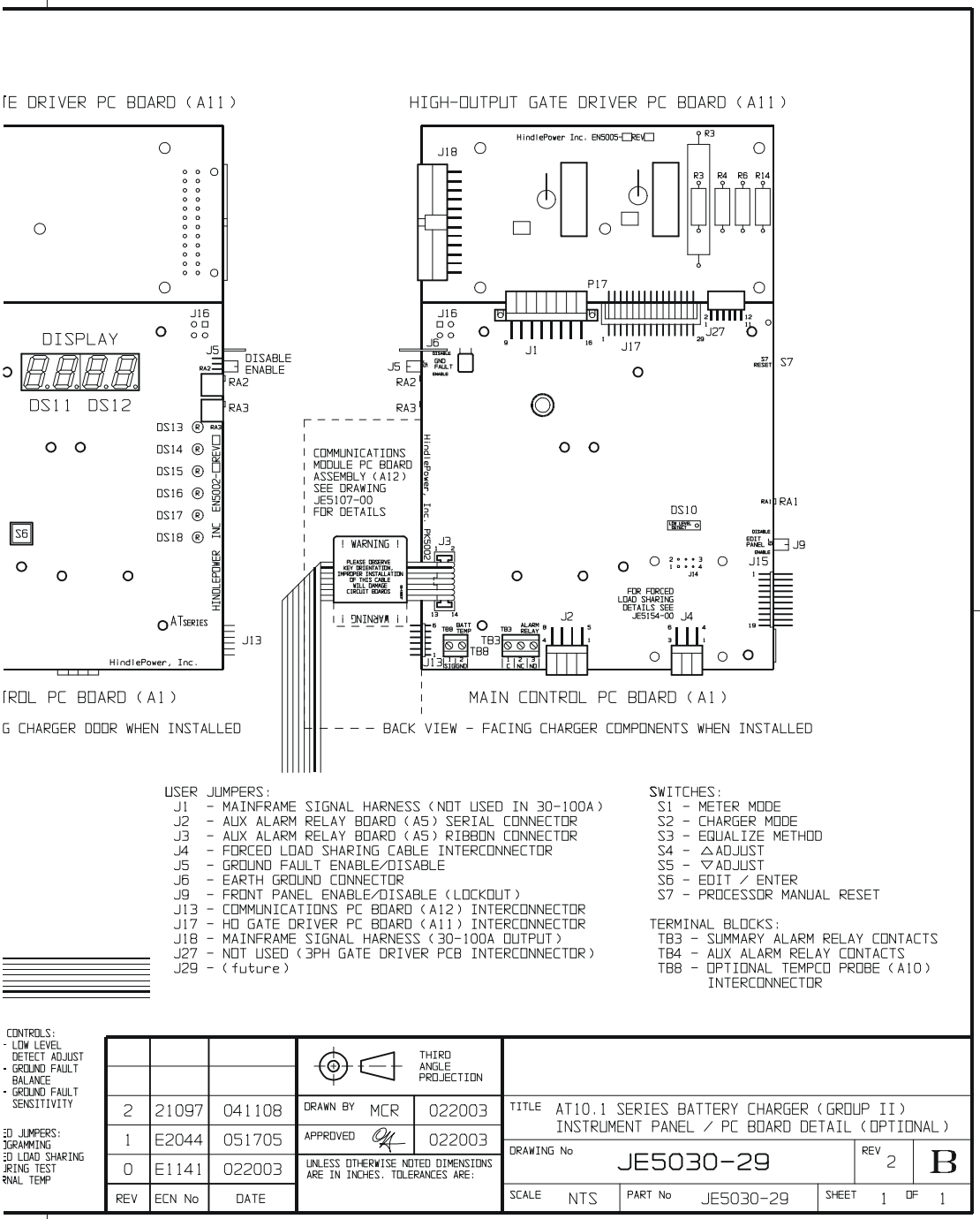
http://www.ATSeries.net/PDFs/JE5029-99.pdf

Instrument Panel / PC Board Detail: AT10.1 Group II Battery Charger w/Optional Auxiliary Alarm Relay Board (**JE5030-29**)



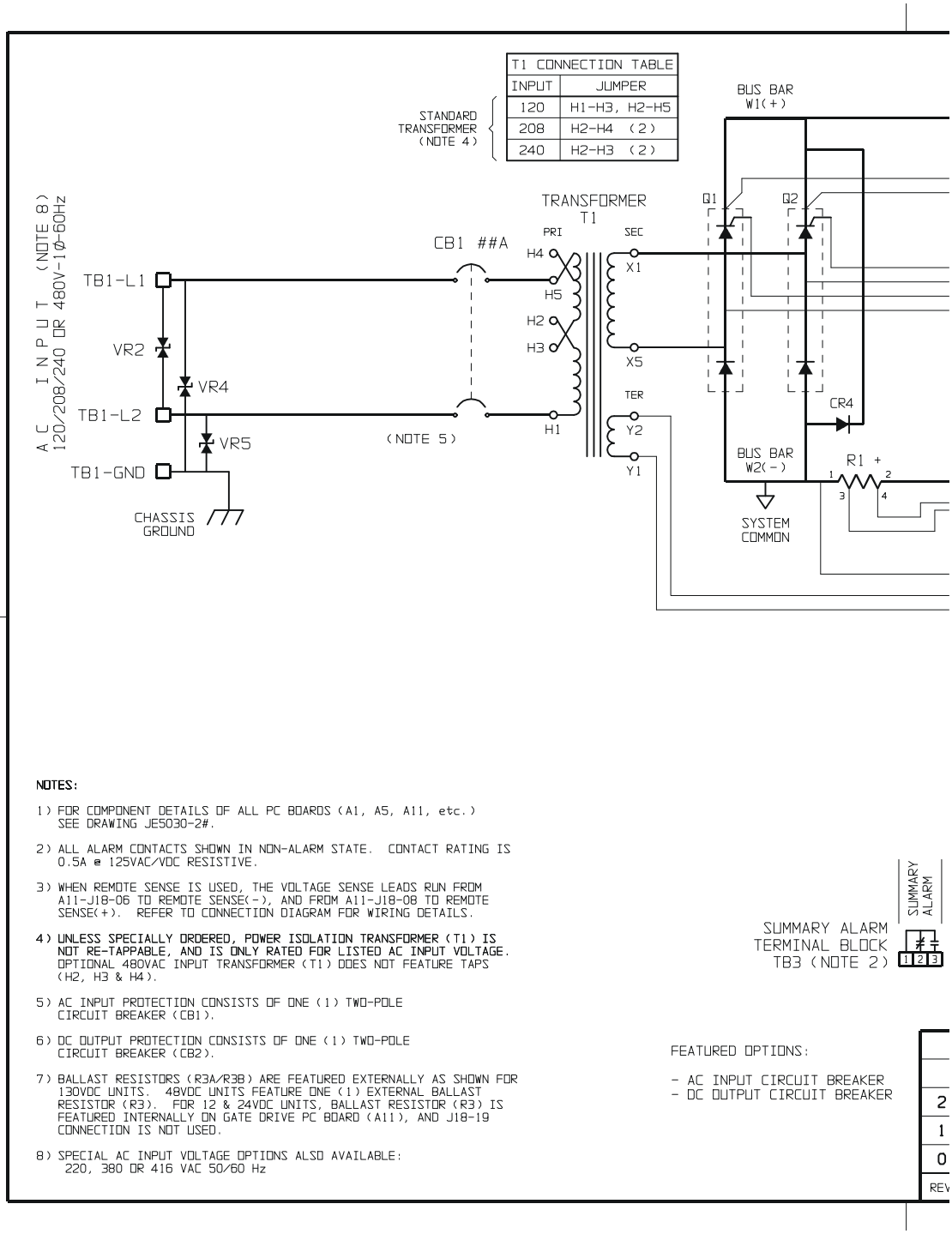
Note: This instrument panel drawing (**JE5030-29**) depicts the optional Auxiliary Alarm Relay PC Board (A5), which provides two (2) sets of individual form-c contacts (TB4) for all alarm conditions. Standard AT10.1 battery chargers feature one (1) set of form-c summary (common) alarm contacts (TB3).

Instrument Panel / PC Board Detail: AT10.1 Group II Battery Charger w/Optional Auxiliary Alarm Relay Board (**JE5030-29**)

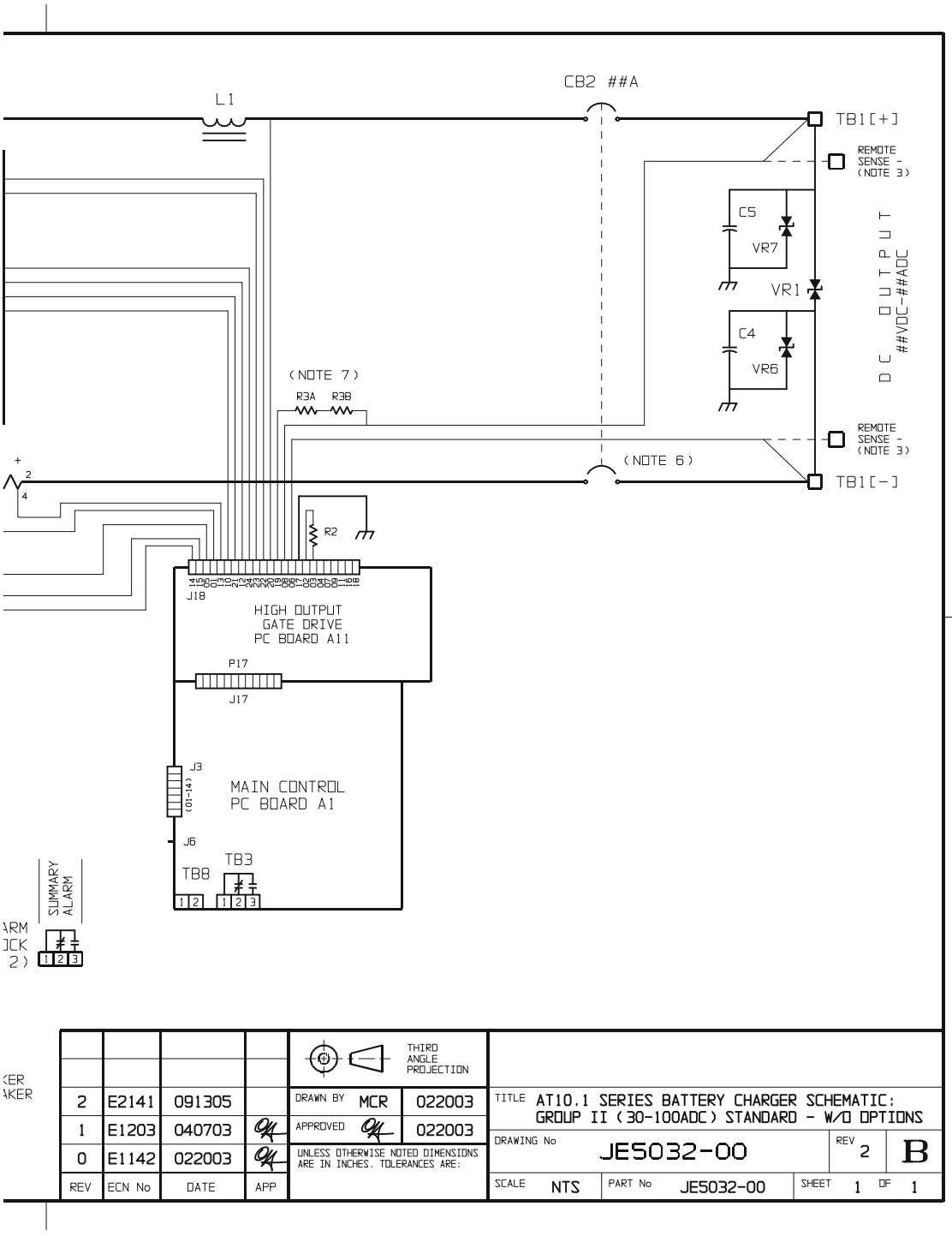


http://www.ATSeries.net/PDFs/JE5030-29.pdf

Schematic: AT10.1 Group II Battery Charger
Standard w/o Options (**JE5032-00**)

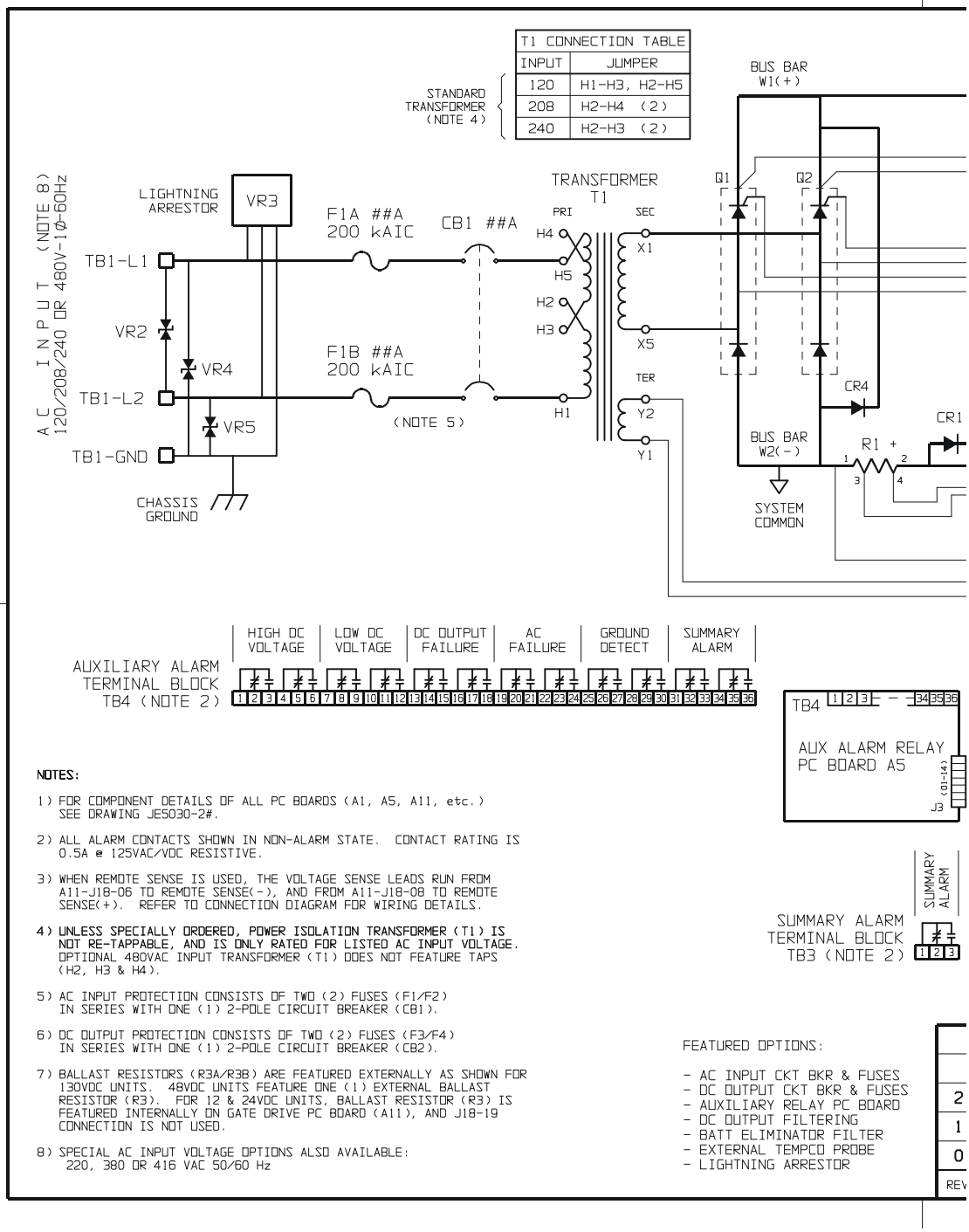


Schematic: AT10.1 Group I Battery Charger
Standard w/o Options (**JE5032-00**)

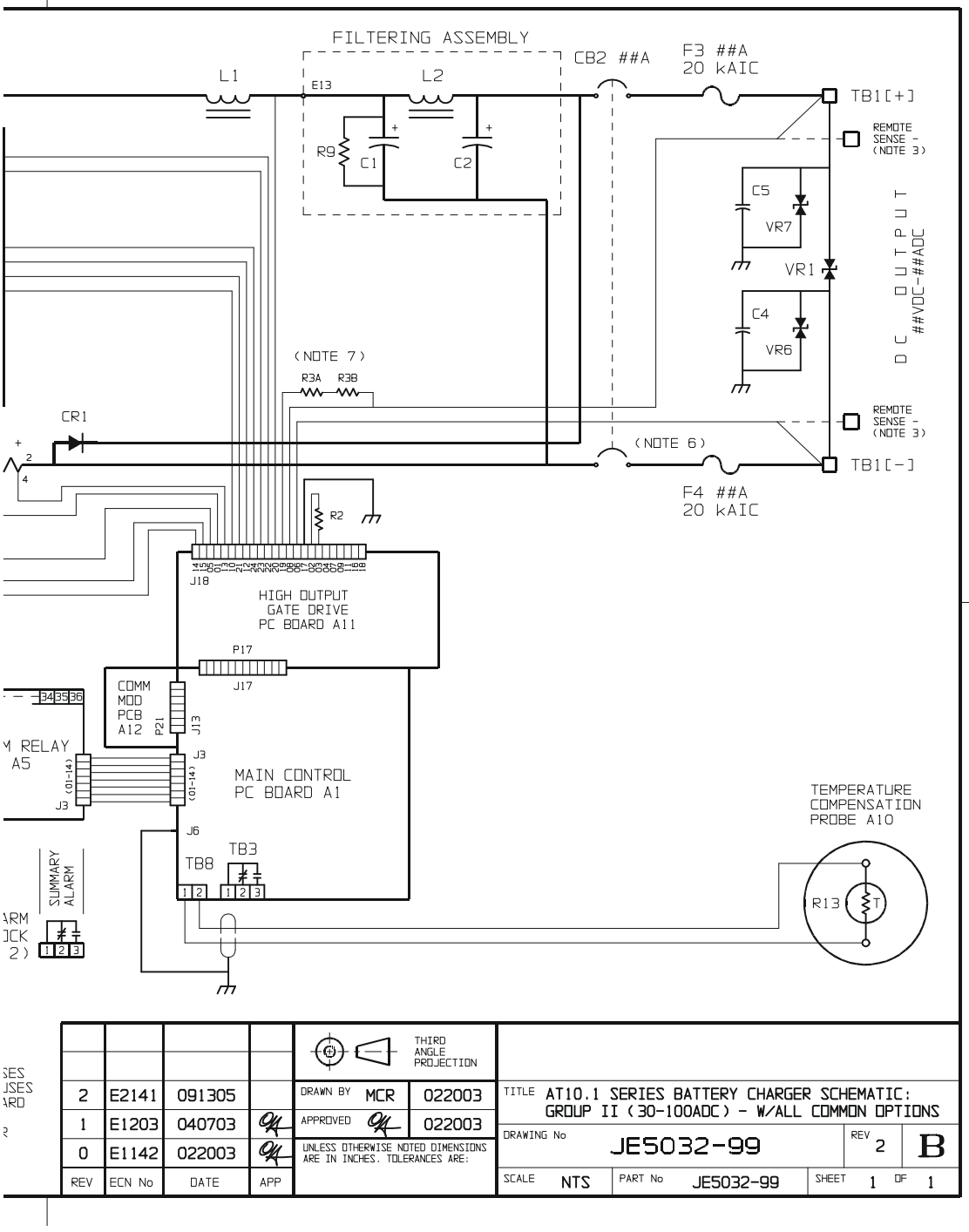


http://www.ATSeries.net/PDFs/JE5032-00.pdf

Schematic: AT10.1 Group II Battery Charger w/Common Options (**JE5032-99**)

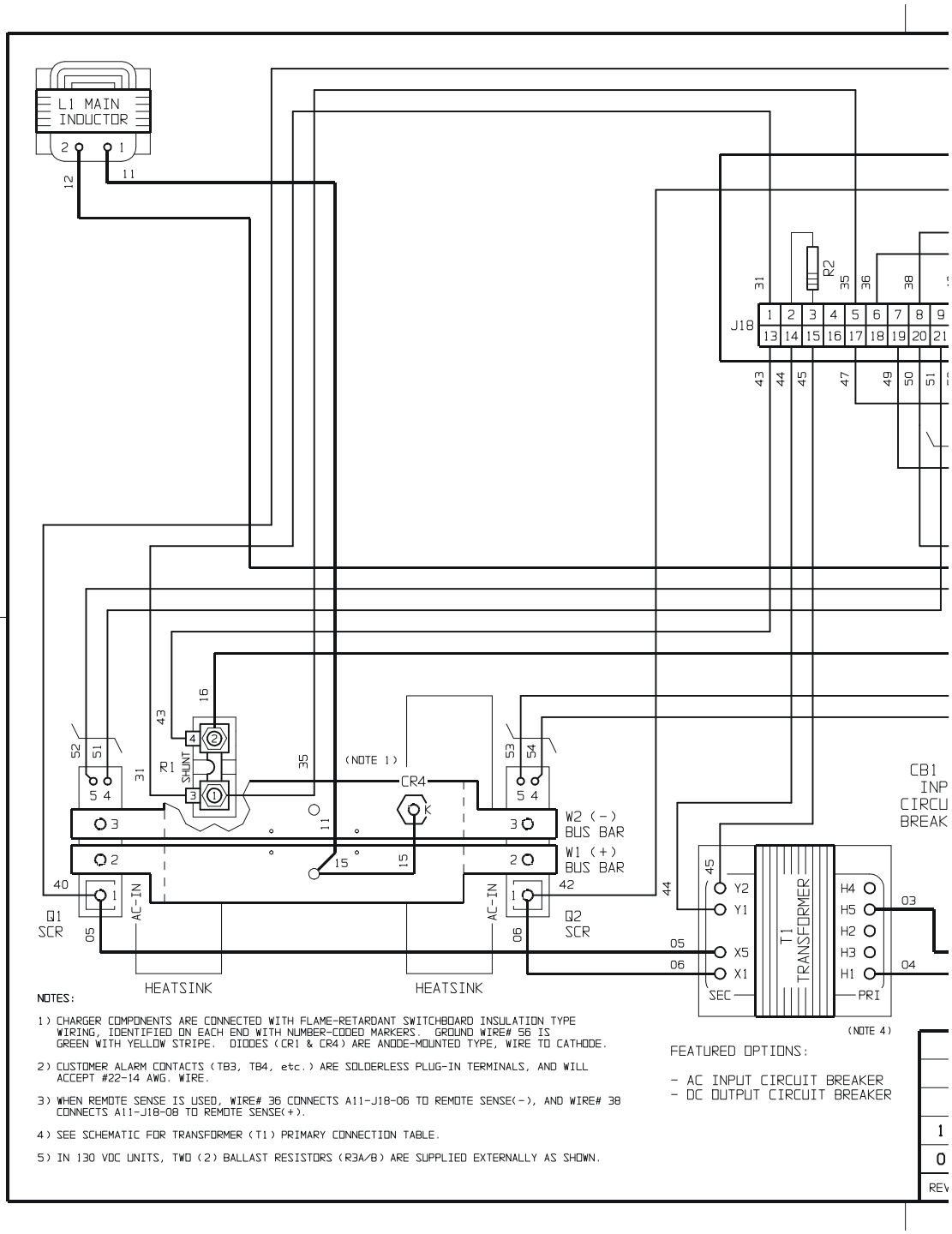


Schematic: AT10.1 Group II Battery Charger w/Common Options (**JE5032-99**)

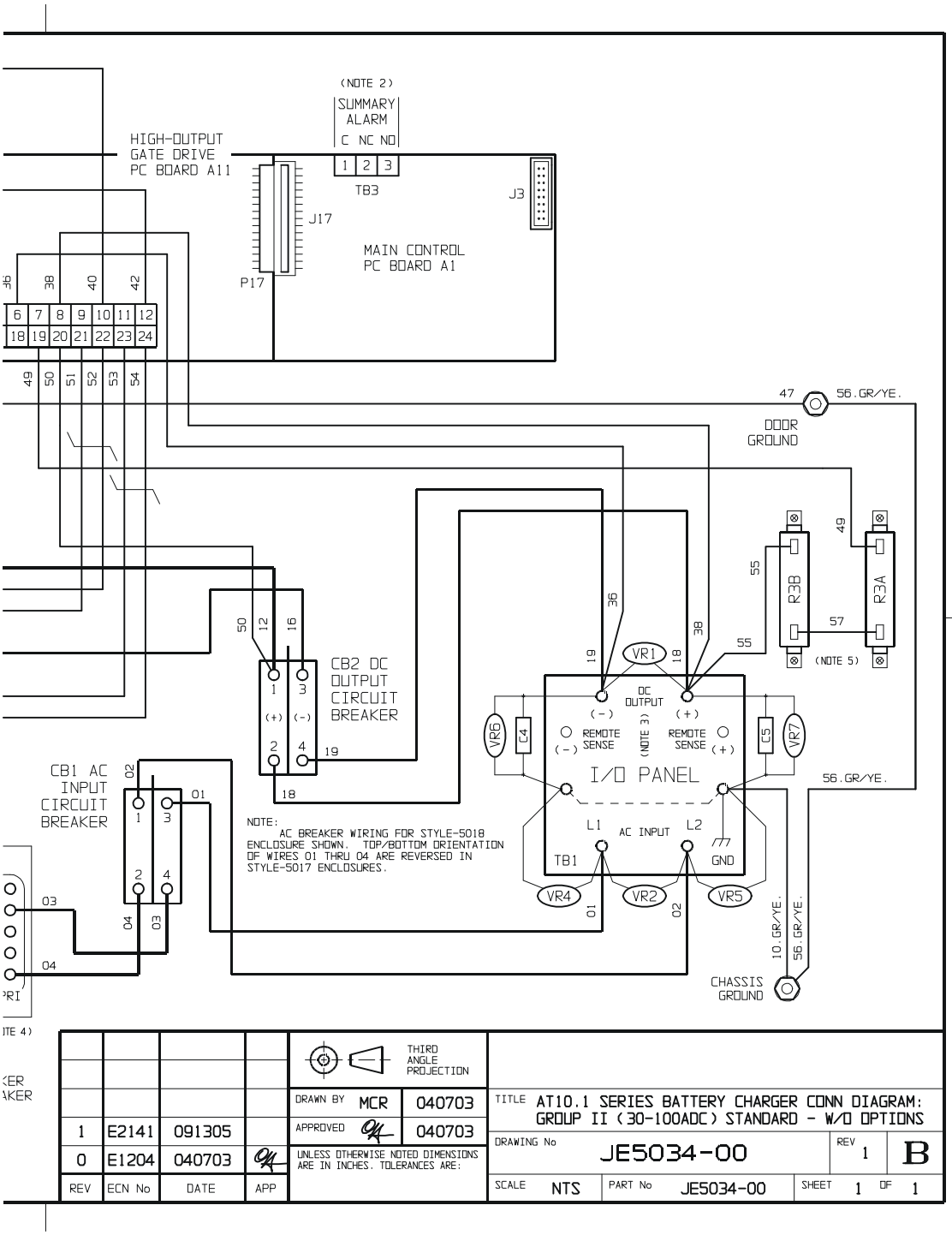


http://www.ATSeries.net/PDFs/JE5032-99.pdf

Connection Diagram: AT10.1 Group II Battery Charger
Standard w/o Options (**JE5034-00**)

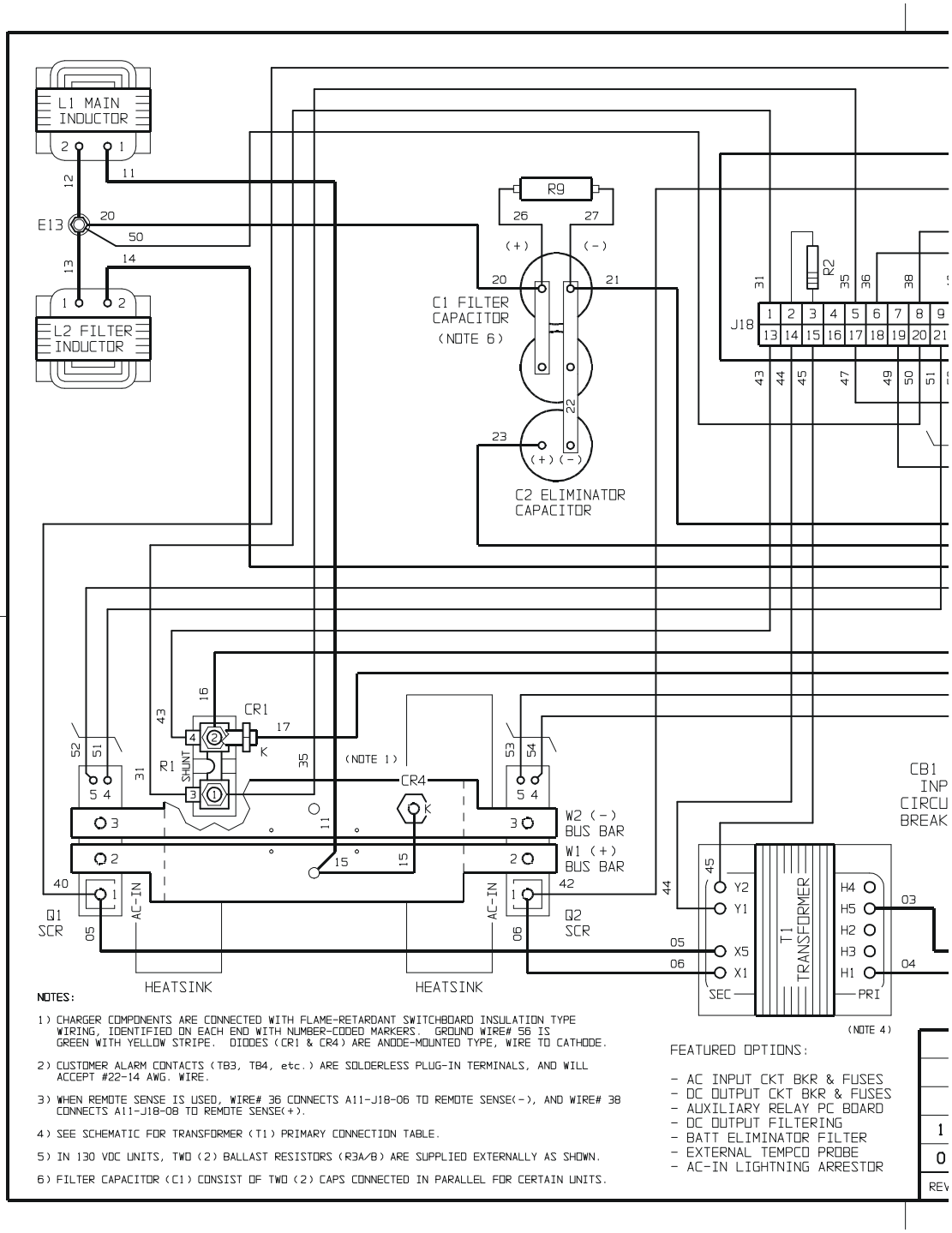


Connection Diagram: AT10.1 Group II Battery Charger
Standard w/o Options (**JE5034-00**)

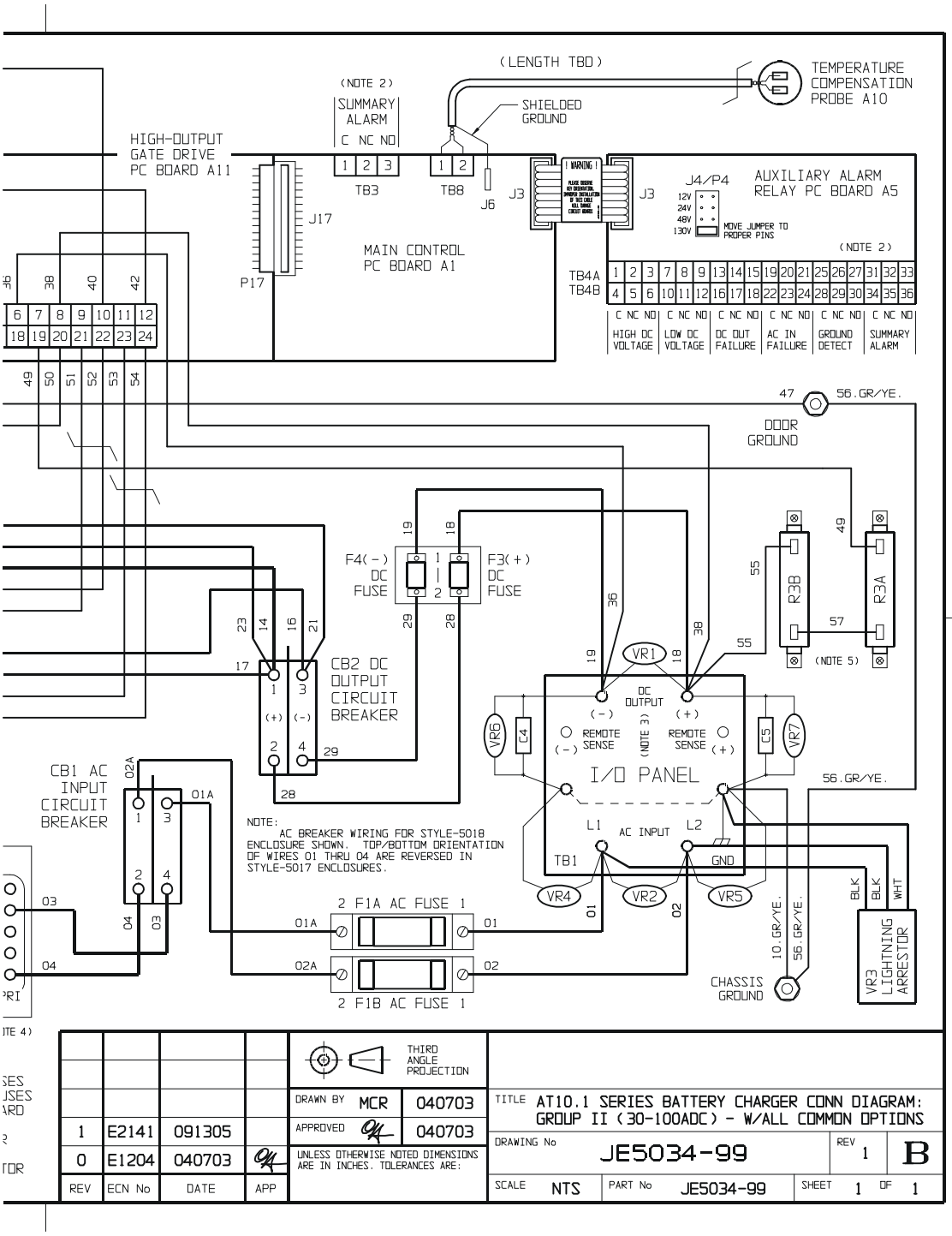


http://www.ATSeries.net/PDFs/JE5034-00.pdf

Connection Diagram: AT10.1 Group II Battery Charger w/Common Options (**JE5034-99**)



Connection Diagram: AT10.1 Group II Battery Charger w/Common Options (**JE5034-99**)



http://www.ATSeries.net/PDFs/JE5034-99.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. 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 option (**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

ONLINE SUPPLEMENT

http://www.ATSeries.net/PDFs/JA5054-00.pdf

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 (2) 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 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 (2) AT10.1 Series battery chargers. You cannot force load sharing with three (3) 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 pc 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 AT10.1 may be selected as Primary or Secondary, but you may wish to choose the unit that is more accessible to be the Primary. The Primary charger controls the dc output voltage of both AT10.1s.

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 AT10.1s, and anchor it in place at both ends before connecting. Connect each end to the Main Control pc 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.

APPENDIX F

OPERATING CHARGERS WITH LOAD SHARING

Restore external power connections to both AT10.1s, and restart according to the normal procedure in the AT Series Battery Charger Operating and Service Instructions. After the AT10.1s 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 AT10.1s. 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 will not 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 the two (2) AT10.1s 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 (2) AT10.1s 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 temperature compensation accessory. It is recommended that each AT10.1 have a tempco probe, and that the probes be located as close as possible to each other. When the AT10.1s are load sharing, the primary charger will determine the temperature compensated voltage and adjust the output voltage accordingly. The primary charger and secondary charger will display the set point voltage, not the temperature compensated output voltage. The voltage displayed by the master and secondary may be different, if either temperature probe is not installed or defective. A slight difference in the displayed voltages may also occur if the two probes are not located in close proximity of each other.

TROUBLE SHOOTING

If the AT Series Forced Load Sharing option is installed, but the output currents of the AT10.1s 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 AT10.1s 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.

MANUAL SPECIFICATIONS

DOCUMENT NUMBER

The text and graphics contained within this manual are controlled by the battery charger manufacturer's internal part number (**JA5018-00**). 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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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 62. The data in that particular 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 your AT10.1 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.

ONLINE AVAILABILITY

An unlabeled version of this operating and service instruction manual is available online at http://www.ATSeries.net/PDFs/JA0102-02.pdf. Other related product operating manuals, feature and accessory special instructions, standard drawings (including the ones listed in this manual), field service instructions, and product application notes for the **AT Series** microprocessor-controlled battery chargers and battery charger products are available online at http://www.ATSeries.net/. Saved in Adobe Acrobat Portable Document Format (PDF), they are readily available for downloading and printing.

If revision levels differ between the drawings embedded in this manual and the full online PDF drawings, refer to document with the higher revision level. For document availability of private-labeled manuals and/or standard drawings, please contact your sales representative or visit the web site listed on the back cover of this manual.

RELATED DOCUMENTS

Doc. No.	Online Hyperlink	Description
JA0102-01	http://www.ATSeries.net/PDFs/JA0102-01.pdf	AT10.1 G1 Manual (unlabeled)
JA0102-02	http://www.ATSeries.net/PDFs/JA0102-02.pdf	AT10.1 G2 Manual (unlabeled)
JA0102-03	http://www.ATSeries.net/PDFs/JA0102-03.pdf	AT30 Manual (unlabeled)
JA0102-04	http://www.ATSeries.net/PDFs/JA0102-04.pdf	AT Comm. Module Manual (unlabeled)
JA0102-05	http://www.ATSeries.net/PDFs/JA0102-05.pdf	AT-DC Dist Panel Manual (unlabeled)
JA0083-00	http://www.ATSeries.net/PDFs/JA0083-00.pdf	AT10.1 Floor-Mtg. Instructions
JA0091-00	http://www.ATSeries.net/PDFs/JA0091-00.pdf	AT10.1 St-586/594 Rack-Mtg. Instructions
JA0091-02	http://www.ATSeries.net/PDFs/JA0091-02.pdf	AT10.1 Style-5017 Rack-Mtg. Instructions
JA0091-03	http://www.ATSeries.net/PDFs/JA0091-03.pdf	AT Style-5018 Rack-Mtg. Instructions
JA5015-00	http://www.ATSeries.net/PDFs/JA5015-00.pdf	AT TempCo Probe Acsy. Instructions
JA5054-00	http://www.ATSeries.net/PDFs/JA5054-00.pdf	AT Forced Load Sharing Instructions
JA5098-00	http://www.ATSeries.net/PDFs/JA5098-00.pdf	AT Latching Alarm Relays Instructions
JD0064-00	http://www.ATSeries.net/PDFs/JD0064-00.pdf	Preventative Maintenance Procedure
JD5003-00	http://www.ATSeries.net/PDFs/JD5003-00.pdf	TempCo Probe Application Note
JD5008-00	http://www.ATSeries.net/PDFs/JD5008-00.pdf	AT Comm. Module Field Installation
JD5009-00	http://www.ATSeries.net/PDFs/JD5009-00.pdf	AT10.1 G1 Rectifier Field Installation
JD5010-00	http://www.ATSeries.net/PDFs/JD5010-00.pdf	AT Power Res. (R3) Field Installation
JD5012-00	http://www.ATSeries.net/PDFs/JD5012-00.pdf	Main Ctrl PC Board (A1) Field Installation
JD0052-00	http://www.ATSeries.net/PDFs/JD0052-00.pdf	Battery Discharge Dual Operation Note
JD5002-00	http://www.ATSeries.net/PDFs/JD5002-00.pdf	DC Motor Starting Application Note
JD5006-00	http://www.ATSeries.net/PDFs/JD5006-00.pdf	Alt. & Temp. De-Rating Application Note
JD5011-00	http://www.ATSeries.net/PDFs/JD5011-00.pdf	Ext. Free-Wheeling Diode Application Note
JD5013-00	http://www.ATSeries.net/PDFs/JD5013-00.pdf	AC Ripple Specification Application Note

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GNB Industrial Power takes pride in its commitment to a better environment. Its Total Battery Management program, an integrated approach to manufacturing, distributing and recycling of lead acid batteries, has been developed to ensure a safe and responsible life cycle for all of its products.

GNB Industrial Power
USA – Tel: 888.898.4462
Canada – Tel: 800.268.2698

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