EST Charger

Industrial Battery Charger

Installation and Operation Manual

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1. Installation

1.1. Receiving

Immediately upon receipt of the charger, check it against the shipping invoice to ensure the shipment is complete and undamaged. Examine the outside of the packing far signs of rough handling before accepting the charger from the carrier. If there is evidence of damage, the receipt should be signed, and both copies (carrier's and receiving copies) marked "Shipment Received Damaged". The carrier's representative should be called immediately and asked to make a "Carrier's Damage Report". If concealed damage is later detected, the carrier should be called and requested to make a "Carrier's Inspection far Concealed Damage Report". After inspection by the carrier, arrangements should be made with the charger representative to have the charger repaired before placing it in service.

When contacting your charger representatIve for assistance on a damage clalm or shIpment error, provide the Model, and Serial Number of the charger, and a full descriptIon of the damage or error. It Is good practice to move the charger to the InstallatIon sIte before uncratIng. When usIng bars, hammers, etc. for uncrating, use care to avoId damage to the charger.

1.2. Location

Far the best operating conditions and longest life, take care in selecting an installation site. Avoid locations exposed to high humidity, temperature extremes or dust. Moisture condensing on machine parts and electrical components can cause corrosion, which seriously affects operation, efficiency and life. Dust and dirt will also decrease heat radiation from heat-generating components, such as transformers and diodes. This will result in higher operating temperatures and shorter life. Adequate air circulation is needed at all times in order to ensure proper operation. Provide a minimum of 6 inches of free air space at the sides and rear of the charger. The front of the charger must remain unobstructed far serviceability.

1.3. Line Voltage

ST chargers are set voltage chargers with appropriately sized AC cordage and plugs. Proper grounding of the charger is provided via the cordage and plug connector. The AC service should be verified as correct (voltage, amperage and grounding) for the charger prior to connecting the charger.

Warning! ChangIng the charger's AC connection cord and/or connector may create a hazardous condItIon. Refer to natIonal and local electrIcal codes prior to makIng any changes.

1.4. AC Service Requirements

Follow local code requirements if they are different than the instructions in this manual. Refer to Table 1-1, to determine the correct ratings for the AC cable, AC fuses, and AC service disconnect switch for the line amperes as listed on the nameplate of the charger for the available AC voltage.

TABLE 1-1

Line Amperes	Fuse Size Amps	Power Cable Size
0.1 - 4.0	05	#14
4.1 - 8.0	10	#14
8.1 -12.0	15	#14
12.1-16.0	20	#12
16.1 - 20.0	25	#10
20.1 -24.0	30	#10
24.1 -28.0	35	#10
28.1 -32.0	40	#8
32.1 -40.0	50	#8
40.1 -48.0	60	#6
48.1 -64.0	80	#4

1.5. Battery Connector Charging Cable

Verify that the connector on both the battery and the charger are attached so that the positive output terminal of the charger is connected to the positive battery terminal.

CAUTION! IF THE POLARITY IS REVERSED, THE DC FUSE WILL BLOW. IF IN DOUBT, CHECK THE POLARITY WITH A DC VOLTMETER.

2. Operation

The charger utilizes a ferro-resonant transformer to provide isolation from the AC service line and to regulate the charging current. The transformer output is connected to a full-wave bridge of silicon diodes, which provides DC charging current to the battery. The starting charge amps and length of time required for a charge vary depending on the charger model. See the data plate on the charger for information.

2.1 046-0301 Control

The charger utilizes a standard ferro-resonant transformer, which provides isolation from the AC service line and regulates the charging current. The transformer output is connected to a full-wave bridge of silicon diodes, which provides DC charging current to the battery.

The starting charge amps and length of time required for a charge vary depending on the charger model. See the data plate on the charger for information.

Feature Summary

- Charges flooded lead-acid batteries.
- Automatic start when battery is connected or manual start (if selected).
- Automatic stop when charge is finished.
- Fully charges partially discharged batteries without overcharging.
- Dead battery 'jump start' for overly-discharged batteries.
- Equalize charge by user request or automatic equalize every 7 charges (if selected).
- Automatic refresh charging every 12 hours (if selected).
- Automatic shut-down if battery starts to overheat.
- Automatically resumes charge after a power failure (if auto-start selected).
- Displays charging amps during the charge cycle.
- End voltage, end current, amp-hours retumed, and run time can be displayed at the end of charge or after disconnecting the battery.
- Delayed start adjustable from O to 12 hours (if auto-start selected).
- Displays fault codes if a fault occurs during charging.
- Cool down timer that shows elapsed time after the charge is complete (if selected).

Operation

The control is used in ferro-resonant taper chargers to provide fully automatic battery charging. The control has a charging profile that handles standard flooded lead-acid batteries. The charging profile, or algorithm, uniquely monitors the output current and voltage to optimally charge the battery, based on battery manufacturer's recommendations.

The standard charging profile for flooded lead-acid batteries has 2 phases. During phase 1 the battery is charged at high current until the battery is 80% charged. Then phase 1 terminates and phase 2 begins. As the battery voltage rises during phase 2, charging current tapers down toward the finish rate current and the battery voltage starts to flatten out. Phase 2 ends and the charge is terminated when the battery voltage no longer changes. This termination method is called 'dv/dt-di/dt'.

The control offers several safeguards to protect the battery. If a wrong voltage battery is connected, the charger does not start and a Low-Battery-Voltage (F3) or High-Battery-Voltage (F4) fault message is displayed. While charging, if the battery voltage exceeds a profile-specific cut-off value, the charge terminates with an End-On-Voltage waming message (EnU followed by the end voltage in v/c).

Normai Dally Charge

When no battery is connected, the keypad will be flashing GREEN and the display will show 'CONNECT BATTERY'. With the auto-start feature enabled, connecting a battery to the charger will cause it to begin a charge cycle. The charger will first perform a self-diagnostic test to verify the control is working properly.

During this time a lamp test is performed causing all display segments and indicators to light. This allows the operator to observe any defective segments or indicators. When the self-diagnostic is complete, the charge starts if no delay is set, and the keypad will be flashing AMBER. The display shows the charging amps to indicate the charger is in phase 1 of the charge cycle. If auto start is disabled, the display shows 'OFF'. Press the 1/0 button to manually start the charge.

When the battery is 80% charged, the charger starts phase 2 of the charge cycle.

When a charge is finished, the charger automatically turns off. The keypad will be solid GREEN.

Disconnecting the Battery

Warning: RIsk of explosion. Do not disconnect the battery while the charger Is runnIng. Hydrogen gas produced by the battery during chargIng can be IgnIted by arcIng that occurs when the battery cable Is disconnected.

If the battery must be disconnected before the end of the charge cycle, the charger should be turned off first. Press the center 1/0 button and verify the Charging icon goes out. The 3-digit display will show **'OFF'.** The battery may then be safely disconnected. If the Battery Ready icon is lit, the battery may be disconnected at any time.

Equalize Charge

Over time batteries can develop inequalities in cell charge. This can lower the effective capacity of the battery and shorten life. An equalizing charge re-balances the charge in the battery cells. Perform an equalize charge if any of the following conditions exist:

1. On flooded batteries, the specific gravity of any cell at the end of charge is 20 points less than the average of all the cells.
2. The on-charge voltage of any cell at the end of charge is 20 millivolts less than the average of all the cells.
3. The battery has been stored for 30 days.

The control can perform an equalize automatically every 7 charge cycles if auto equalize is enabled. Normai equalize consists of an additional 3-hour charge time at the end of a normal charge cycle. The control can also perform an equalize charge when requested manually. First connect the battery and allow the charge to start normally. Then press the left button "=" to select an Equalize charge, the equalize icon will light. The charge time will be extended by 3 hours to allow the cells to equalize their charge.

The auto-equalize or manual equalize cycle can be cleared by pressing the left button, "=", while in the normal charge cycle. The 'Equalize' icon will turn off. Note that once an auto-equalize has been queued in the control, the control will attempt to perform the auto-equalize every time a battery is connected until an equalize charge has been completed.

If auto equalize is not desired, contact your battery/charger service provider for control setup change.

Delayed Start

The delayed-start feature allows the operator to delay starting the charge cycle. This might be desired to reduce peak energy surcharges if the charger were ready to start during a peak energy period. The delay time could be set to keep the charger from starting until after the peak period ends.

The control has a delay icon that will light when the delay is triggered. See the control parameters and settings chart to program the delay start.

If the auto-start feature is disabled, the delayed start is automatically set to O and is disabled. The delayed start time cannot be set.

Auto-Refresh Charge

The control can provide an auto-refresh charge periodically as long as the battery remains connected to the charger. If AC power is lost during the wait period, the control will resume from where it left off after power is restored. During the auto-refresh charge, the amp-hours and charge time will be added to the original charge.

Emergency Stop

To manually terminate the charge cycle, press the center '1/0' button. The charge will immediately stop. The Charge State display will then show 'OFF'. Pressing '1/0' while the DATA display shows **'OFF** 'causes the charge to resume.

Battery Cool Down TIme

A time can be set to allow a battery to cool down after being charged. While the charger is in the cool down period, the Data area will display the timer in Military time, the Units will display as Time. The Cool down timer can be set to count down or count up the set time. See programming instructions.

Charge Indications

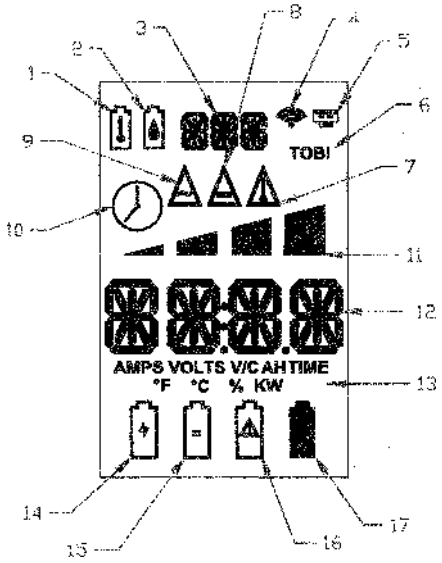
The following indications are not necessarily a result of a charger problem. They are typically caused by extemal problems such as AC line, poor battery conditions, connections, etc. If abnormal charge conditions are detected, the charge is terminated, the keypad will be solid RED and the display shows the code:

DISPLAY	FAULT DESCRIPTION
F0 **#:t#f.**	Possible shorted cell or low charging amps. Battery voltage did not reach 2.0V/C (1.2V/C for Ni-Cad) within 30 minutes. #:'11#- is the charae time
F1 #:t#f.	Possible shorted cell or low charging amps. Battery did not reach gassing voltaae during cha ge ehase 1. #:'11#- is the charae time.
F2 *##f.* **Of**	Hot battery. Battery exceeded the No Charge Temp. *'11#-#* is battery temperature.
F3 **#.t#f.V/C**	Low battery voltage, less than 1.6V/C at start up. *#.'11#-* is the volts per cell when battery was connected.
F4 ***#.'11#-*** **V/C**	High battery voltage, more than 2.4V/C at start up. *#.'11#-* is the volts per cell when batterv was connected.
FS **#t#f.AMPS**	No charging current to the battery.
F6 **#t#f.AMPS**	Charger current/voltage not what was set by control. N/A for ferro-resonant charger.
F7 #:t#f.	Long charge, the charger ran longer than the allotted time. #:'11#- is the charge time.
F8 **#t#f.AMPS**	Charger stayed on when control requested it shut off. *'11#-#* is the charger current.
F9	Bad keypad. One or more buttons are stuck.
F10 **#t#f.AMPS**	Charger current exceeded 110% of the shunt rating. *'11#-#* was the charger current.
F11 **255°F**	Faulty thermistor. Bad thermistor on the Tobi, no Tobi installed, or no communication between the charaer and Tobi.

F3 **(Low Battery) Overrlde**

If battery voltage is below 1.6 volts per cell the charger will not start automatically. If this is due to an overly discharged battery of the correct voltage, the F3 fault can be manually overridden by pressing the center 1/0 button while the F3 message (Low Battery) displays.

46-301/305 Control Reference Gulde



1. BATTERY HIGH TEMPERATURE INDICATOR
2. BATTERY LOW WATER INDICATOR
3. CHARGE STATE / CHARGE CYCLE MESSAGE
4. WI-Z COMMUNICATION INDICATOR
5. USB COMMUNICATTION INDICATOR
6. TOBI COMMUNICATION INDICATOR
7. HF MODULE HIGH TEMPERATURE INDICATOR
8. HF MODULE DC FAULT INDICATOR
9. HF MODULE AC FAULT INDICATOR
10. CHARGER WAITING INDICATOR
11. CHARGE STATUS BAR GRAPH
12. DATA AREA
13. UNITS AREA
14. BATTERY CHARGING INDICATOR
15. EQUALIZE CHARGE SELECTED INDICATOR
16. ABNORMAL CHARGE INDICATOR
17. CHARGE COMPLETE INDICATOR

Display Icons

1. The battery high temperature indicator will be displayed when a battery connected to the charger having a Tobi PI installed is above the OK to charge temperature stored in the Tobi (304 control only).
2. The battery low water indicator will be displayed when a battery connected to the charger having a Tobi PI installed detects low water and the charge cycle is complete (304 control only).
3. The charge state/charge cycle message area is used to indicate the charger state during normal operation. It will display the charge cycle number when reviewing charge history (301/304).
4. The Wi-2 communication indicator will be displayed when the charger is connected to a Wi-2 network and communicating with the coordinator (304 control only).
5. Not Used.
6. The TOBi communication indicator will be displayed when a battery connected to the charger having a Tobi PI installed is communicating with the charger (304 control only).
7. The HF module high temperature indicator will be displayed when an HF module in the charger has exceeded the safe operating temperature (304 control only).
8. The HF module DC fault indicator will be displayed when an HF module in the charger has detected a fault on the DC output (304 control only).
9. The HF module AC fault indicator will be displayed when an HF module in the charger has detected a fault on the AC input (304 control only).
10. The charger waiting indicator will be displayed when the charger is in a wait state (301/304).
11. The charge status bar graph displays the status of the charge cycle (301/304).
12. The data area will display charging amps during a charge cycle. It will display additional charge data when reviewing charge parameters and will display data for previous charge cycles when reviewing history (301/304).
13. The units area will display the units for the value shown in the data area (301/304).
14. The battery charging indicator will be displayed when the charger is on and charging (301/304).
15. The equalize charge selected indicator will be displayed when an equalize cycle has been selected for the current charge cycle (301/304).
16. The abnormal charge indicator will be displayed when the charger detects an abnormal charge condition (301/304).
17. The charge complete indicator will be displayed when the charge cycle is complete (301/304).

Keypad

The keypad has 4 directional buttons, UP(+), D0WN(-), LEFT(=), RIGHT(info), and a center 0n/0ff (1/0) button.

To terminate a charge cycle, press the 1/0 button
To select/unselect an equalize cycle for the current charge, press the LEFT(=) button
To view additional charge data during a charge cycle, press the RIGHT(info) button. The data area of the display will show the data and the units area will display the units for the parameter being displayed. Press RIGHT(info) again for additional data. After 10 seconds, the display will retum to the normal display of amps.
To view charge history, press the UP(+) or D0WN(-) buttons to display a previous charge cycle. The charge cycle number will be displayed in the charge cycle message area and the data will be displayed in the data area along with the units in the units area. Cycle 1 is the most recent and 100 is the oldest. To view additional data for the charge cycle, press the RIGHT(info) button. The data area of the display will show the data and the units area will display the units for the parameter being displayed. Press RIGHT(info) again for additional data. After 10 seconds, the display will retum to the normal display of amps.

LED Indlcatlon

The kevoad center 1/0 button has a mu¦t¶-co¦or LED b ackllah t to in d¶1cate eharaer status.

LEDCOLOR	STATUS
Flashina GREEN	Charaer readv for batterv
Solid GREEN	Charge complete
Flashina **AMBER**	Charaina
SolidAMBER	Battery connected. Charger 0FF
Solid RED	Abnormal charae detected

3. Troubleshooting

Caution-There are lethal voltages exposed when the charger Is energized wlth the enclosure open. Always dlsconnect the AC servlce voltage to the charger and disconnect the battery before opening the enclosure. The following chart llsts the most probable cause of a **malfunction.**

3.1. No charging current, the control has no display, contactor doesnot operate.

POSSIBLE CAUSE

A. No AC service voltage.
B. Incorrect AC voltage.
C. Defective control transformer.
D. Defective control board.

3.2. No charging current, control has a display.

POSSIBLE CAUSE

A. Blown DC fuse.
B. Defective ammeter.
C. 0pen battery cell.
D. Defective diode.
E. Defective capacitor.

F. Shorted power transforrner secondary.

3.3. AC fuse blows/Circuit breaker trips.

POSSIBLE CAUSE

A. Incorrect fuse rating.
B. Incorrect AC voltage.
C. Shorted transformer winding.

3.4. DC fuse blows.

POSSIBLE CAUSE

A. Reversed battery connector.
B. Incorrect fuse rating.
C. Shorted diode in rectifier assembly.

3.5. Excessive water loss in battery.

POSSIBLE CAUSE

A. Charger amp-hour rating exceeds the battery amp-hour rating.
B. Battery has defective cells.

3.6. Low specific gravity at the end of the charge cycle.

POSSIBLE CAUSE

A. Battery was over-discharged.
B. Charger amp-hour rating is less than the battery AH rating.
C. Defective open diode.
D. Battery has defective cells.
E. Battery has been over-watered.

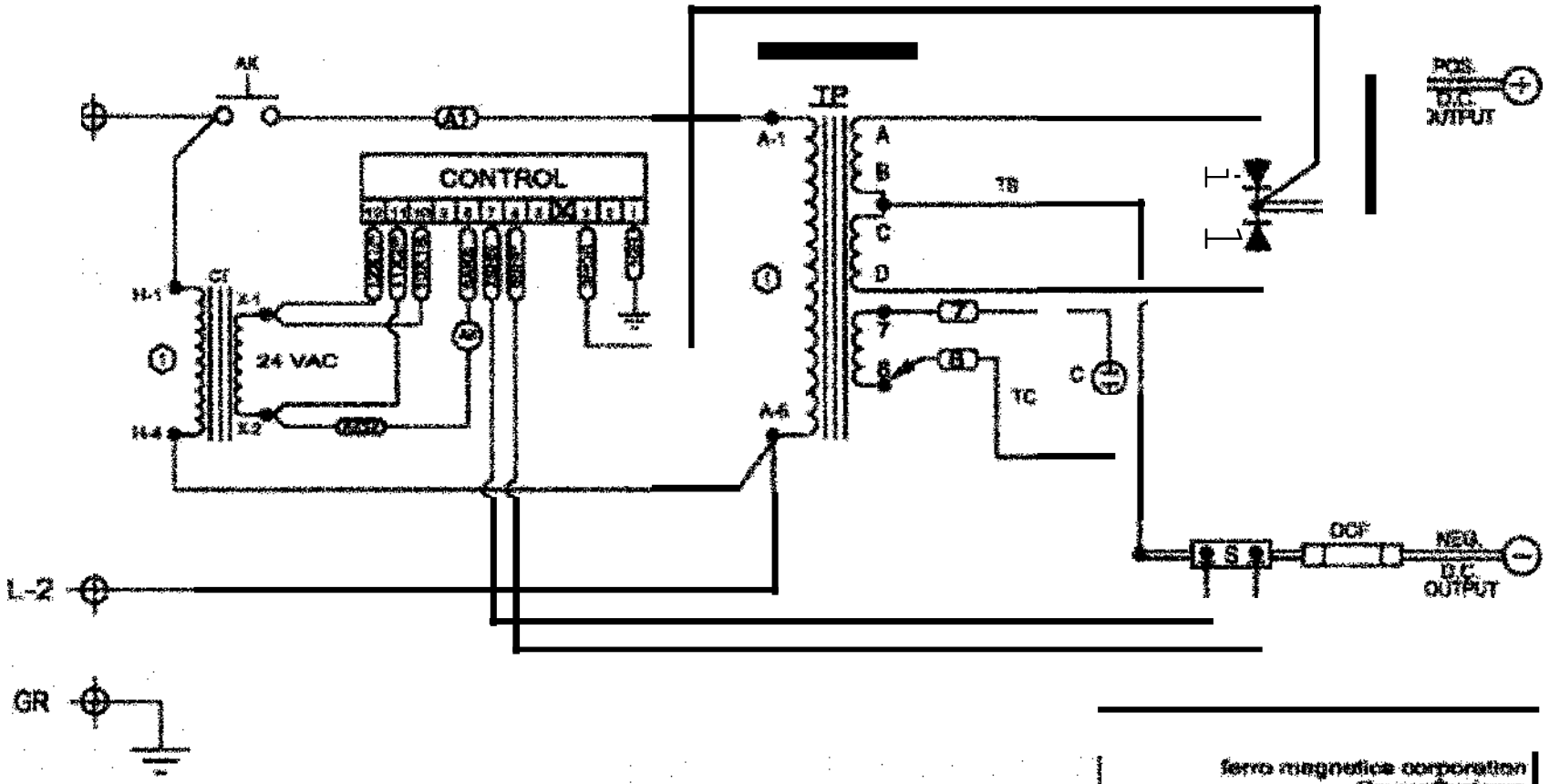
3.7. Charger does not turn off when the control terminates the charge cycle.

POSSIBLE CAUSE

A. Defective control.
B. AC contactor has welded contacts.

3.8. General Maintenance

The charger requires a minimum of maintenance. Connections and terminals should be kept clean and tight. The charger should be periodically cleaned with an air hose to prevent any excessive dirt build up on components. Care should be taken not to bump or move any adjustments during cleaning. Make sure that both the AC lines and the battery are disconnected before cleaning. The frequency of this type of maintenance depends on the environment in which this unit is installed. If any cabinet sheet metal panels are removed for cleaning, be certain they are properly reinstalled upon completion.



NOTES:

1. SHOWN IN SET VOLTAGE

NO.	REVISION	DATE
	REMOVED RESISTOR	12/30/98
	ADDED THERMAL OVERLOAD	12/30/98
	REMOVED 3 WIRE	08/28/97
	REMOVED THERMAL OVERLOAD	01/30/98

ferro magnetics corporation
Power Systems

WIRING DIAGRAM : 1 PHASE, 1 TRANS
STANDARD CONFIGURATION, CORD CONNECTED

DRW. BY: CMP

APP. BY:

WIRING DIAGRAM #: 82434

SCALE: NONE | DATE: 04/29/98 | SHEET: