PEPCO, Inc.

April 30, 1998

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TECHNICAL PROGESS REPORT
FOR
PEPCO: TURBO-Z BATTERY CHARGER SYSTEM

Calendar Quarter Ending: 3-31-98
Instrument Number: DE-FG01-96EE15658

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To: Department of Energy Recipients
From: Jeff Rose, President PEPCO

During the First Quarter of 1998, the engineers working on our Grant have dramatically increased the rate of work. We intend to give the Government a great deal of value for the faith that has been bestowed in our company. We are working on several areas at the same time. We are developing a Flexible Battery Charger Control Board, a Battery Charger Test Stand, and writing software that can be used with both. We are delaying development of the power section. This may be done at the end of the grant work, or we may develop a 240 kW power supply with additional funds we are seeking. The status is as follows;

- Flexible Battery Charger Control Board- a preliminary electrical design is complete. We are now investigating how the control design might incorporate provisions for an additional Electric Vehicle charging feature. This additional design is based on SAE J2293- RECOMENDED PRACTICE FOR EV COMMUNICATIONS. Investigation of J2293 is being considered for controlling a power supply using our proprietary Capacitive Charging Coupler, and controlling the power supply with this control board. This will be incorporated into the Grant development at no additional cost.
- Battery Test Stand- the preliminary hardware design is complete. The design includes some very desirable additions to the specifications, including an AC line source for the charger being tested and a battery simulator. Purchasing of the equipment and materials for the test stand is underway. Some of the required materials were not anticipated in the original Grant Proposal.

We have been working in the SAE standards setting committees for Electric Vehicles for several years. In particular, we have been working to set the Capacitive Coupler as the standard for connecting an EV to the utility grid system. Substantial test data has been distributed to the committee members on the Conductive and Inductive Charging Systems. It is our opinion that we have a superior coupling mechanism, and we are proceeding to develop this technology. We are in the process of applying for additional funds from a number of groups. The development of this system will require a substantial additional investment, but this technology may very well be set as the standard. The other systems are not able to transfer the required high power reliably and efficiently. The power required for Level 3 charging, similar to a Gas station, is 600 Volts and 400 Amps. Apparently, our competitive systems have more resistive losses and are not able to transfer this power. Please find the attached flow chart and specification update.

MASTER

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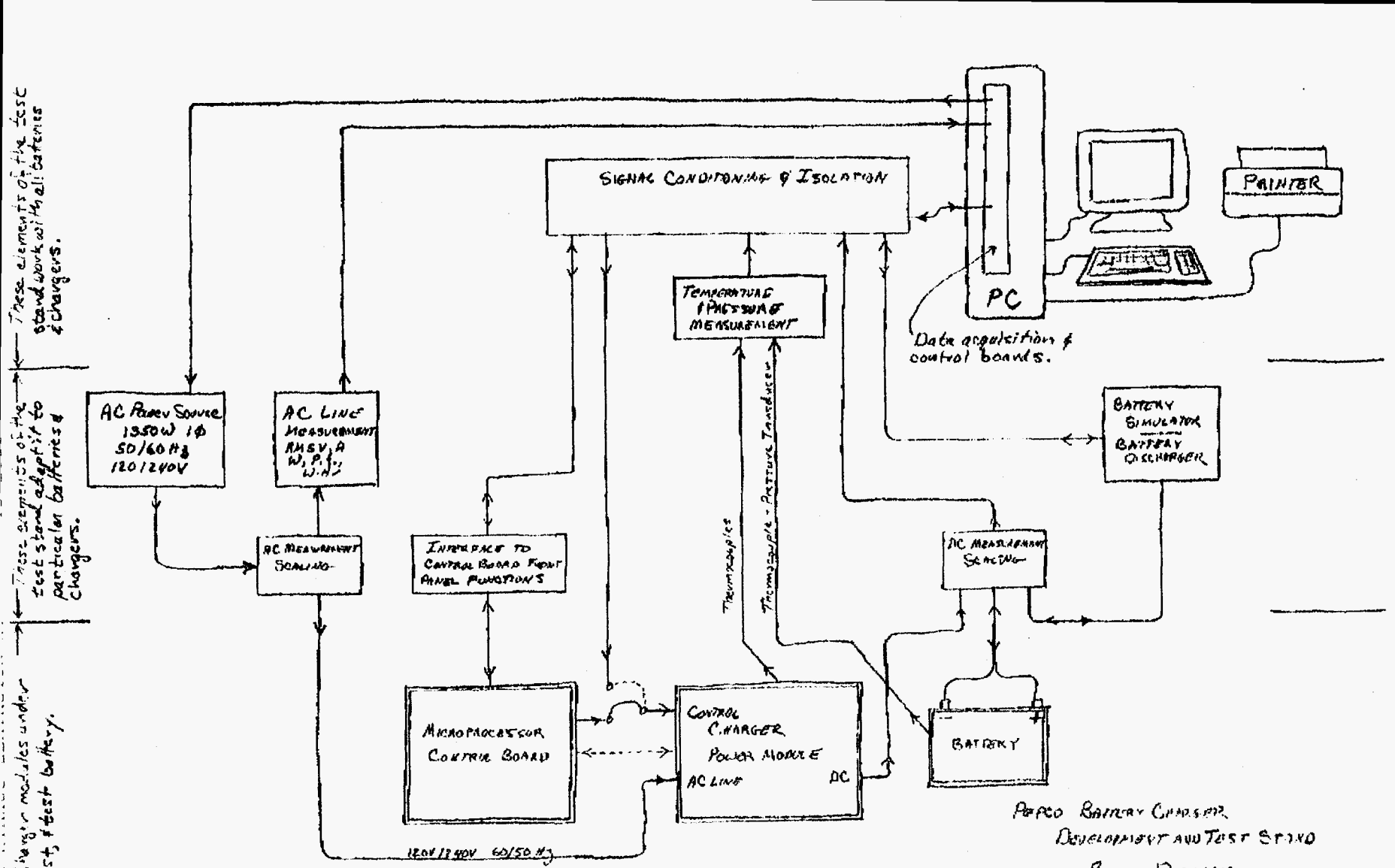

PEPCO BATTERY CHARGER DEVELOPMENT AND TEST STAND

BLOCK DIAGRAM

ERA Co. 4-23-98

----------> Revision to SECOND DRAFT "PCOTSD02" 23 November 1997 Pg.3 <------

PEPCO BATTERY CHARGER TEST STAND

SPECIFICATION OUTLINE

Proposed Revisions.

COMPUTER DRIVEN MEASUREMENT AND CONTROL

ELECTRICAL INPUTS For control feedback and data collection.

Battery Voltage (16 bit resolution.)

Battery Current (Possible to derive peak, average, and RMS values, as well as A-Hr.)

AC Line Voltage

AC Line Current (Possible to derive RMS current, power factor, watts and Kw-Hr.)

5 each Temperature Probes. Electrically isolated type K thermocouple.
Possible use: Ambient, Heatsink, Transformer, Battery interior, Spare.

Pressure Transducer for battery cell pressure. 0 to 1 ? 5 ? PSI.

2 each Photo Sensor for charger LED indicator.

ELECTRICAL OUTPUTS

Charger On. Charger Off. (Isolated relay contacts, two sets.)

Charger spare. On / Off. (Isolated relay contacts.)

Charging current. (0 to + 5 volts, or 0 to + 10 volts for zero to maximum current.)

Discharge pulse.
- On / Off. (Timing controlled by timer on DAC board.)
- Current. (0 to + 10 volt signal for zero to maximum current.)

Discharge load. For discharging battery after charging.
- On / Off.
- Current. (0 to + 10 volt signal for zero to maximum current.)

Battery Simulator.
- Voltage. (0 to +10 volt signal for zero to maximum voltage.)

AC Line. (120 / 240 V 1 Ph power to charger under test.)
- On / Off.
- Voltage. (Analog control voltage ? RS-232 / IEEE-488 control ?)
- Frequency. (Includes both 50 and 60 Hz.)

----------> Addition to SECOND DRAFT "PCOTSD02" 23 November 1997 <------

PEPCO BATTERY CHARGER TEST STAND

SPECIFICATION OUTLINE

Proposed Revisions.

Add to the description:

BATTERY-SPECIFIC TEST STAND HARDWARE

Parts of the test stand hardware may have to be modified or replaced in order to test different battery chargers.

The items provided initially are at least adequate for testing chargers for the 12 Volt, 10 Ampere Hour battery.

1.) AC Power Source. 1350 Volt-Amp, single phase. 0 to 135 or 0 to 270 Vrms at 45 to 500 Hz.

This is about the largest unit which can draw power from an ordinary 120V AC outlet. Smaller units are not much less money, larger ones get expensive. This one is much larger than is necessary to power the nominal 12 V 10 A Hr charger, but is too small to run a Turbo-Z charger.

2.) AC Line Measurement Instrument.

The instrument used will serve for almost any single phase 60 Hz measurements, but may not handle multi-phase or 50 Hz power.

3.) AC Measurement Scaling.

Different current transformers, shunts and voltage dividers may be required to handle different chargers' AC line requirements.

4.) Interface to Control Board Front Panel Functions.

This allows the test stand computer to read the status of any indicator LEDs on the Control Board and to actuate any switch or button inputs on the Control Board. It must be adapted to the individual control board.

5.) DC Measurement Scaling.

Different shunts and voltage dividers may be required to handle different chargers' and batteries' DC characteristics.

6.) Battery Simulator - Battery Discharger.

The control portion of this device is more or less universal, but the power portion is sized for the 12 V 10 A Hr battery.