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SYSTEM DEBUG ITEM 0006 OF MICROPROCESSOR-BASED POWER CONDITIONE--ETC(U)
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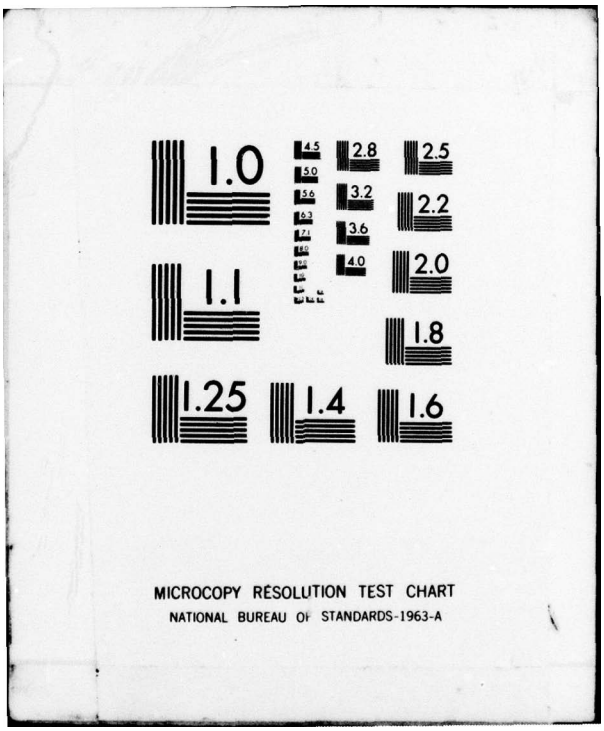
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MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

SYSTEM DEBUG

ITEM 0006

OF

MICROPROCESSOR-BASED POWER CONDITIONER CONTROLLER .

CONTRACT NO. DAAK70-78-C-0117

PREPARED FOR

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1.0.0 SUMMARY

This report describes the efforts performed under Task 6 of the U. S. Army contract no. DAAK70-78-C-0117 to develop a microprocessor-based controller for the Delco 15 KW power conditioner.

With the controller hardware successfully interfaced to the software, the work under this task, the first phase of the contract has been completed.

The controller hardware and software, developed and tested separately, in previous tasks using the facilities provided by Motorola Exorcisor development system and the MC6809 simulator, have now been operated at a system successfully using the MC6809 part. As the debug progressed, the controller eventually became free of the development system.

During debug, it was necessary to simulate sense signals to the controller. The controller performed satisfactorily as intended using these simulated signals. Further into the program, when the controller is actually interfaced to the Delco converter, other refinement could be necessary. It is anticipated these would be minor and should not pose a large task.

2.0.0 PREFACE

Work described in this report was performed by Yucca International, Inc. under the direction of the U. S. Army Mobility Equipment Research & Development Command. This completes the sixth task of the first phase of the U. S. Army contract no. DAAK70-78-C-0117. The Contracting officer's Representative is Dr. David Lee of the U. S. Army MERADCOM Headquarters at Fort Belvoir, Virginia.

3.0.0 COPYRIGHT PERMISSION

No copyright permission is required.

4.0.0 INTRODUCTION

This is a report of Task 6, the last task of the first phase of an effort to develop a microprocessor-based power conditioner controller.

The objective of the first phase is to produce a controller that will regulate the output voltage in the Delco 15 KW power conditioner.

This task, System Debug, will combine and debug the controller hardware and software which were developed and tested independent of each other in the previous tasks.

5.0.0 INVESTIGATION

5.1.0 SYSTEM DEBUG USING EXORCISER DEVELOPMENT SYSTEM

The controller software was tested in Task 5 using the Motorola Exorciser development system and the MC6809 simulator. This permitted the controller software to be tested using the Exorciser memory and 6800 microprocessor. Debug of the hardware and software combined (system debug) began by interfacing the empty microprocessor socket on the MPU board of the controller to the Exorciser address, data, and control lines.

The controller program was loaded into Exorciser RAM memory positioned at C000H to CFFFH.

The controller program, residing in the Exorciser RAM memory (instead of in PROM memory on the controller MPU board) could be modified easily during debug.

Execution of the controller software in the Exorciser was slowed considerably because the 6809 simulator was using 6800 instructions to emulate the 6809 instructions.

The controller hardware, constantly "listening" to the addresses on the Exorciser bus, responded to addresses assigned to the controller hardware during simulation of the program.

Correct execution of the controller program and correct operation of the controller hardware was checked simultaneously using the facilities provided by the MC6809 simulator. These included single step, trace breakpoint, and other capabilities.

To effect a closed loop between the controller output signals and input sense signals, some simulation circuitry was utilized.

This circuitry consisted of adjustable voltage sources that were connected to the converter output voltage and inverter input current sense signals.

The converter SCR simulation circuitry (described in the report on Task 4) was used to simulate the converter SCR commutation sense signals.

When correct operation of the hardware and software had been verified using the facilities of the development system, further debug was suspended until availability of an MC6809 microprocessor sample.

5.1.2 SYSTEM DEBUG FREE OF DEVELOPMENT SYSTEM

The MC6809 microprocessor and two 2716 PROMS, containing the controller program, were inserted into the controller MPU board to test the stand alone capability of the controller. Some minor modifications to the hardware were necessary due to timing problems.

Correct execution of the controller program (free of a development system) was verified using the Creative Technology, Inc. CT-150 microprocessor analyzer with a 6809 probe.

6.0.0 DISCUSSION

The hardware and software necessary to perform voltage regulation of the AC to DC section of the Delco 15 KW power conditioner has been developed and debugged to the extent practical at this time.

The controller lacks the sense signal conditioning circuitry which will attenuate and filter the sense signals to levels suitable for measurement by the controller.

The controller has been designed to accept signals from the outputs of optical couplers which will monitor the commutation of the converter SCR's.

The optical coupler sensing method and the sense signal conditioning circuitry remains to be developed before voltage regulation of the converter can be performed.

Although the voltage regulation routines were tested using simulation techniques, other adjustments may be required. When the Delco 15 KW power conditioner becomes available for testing, at that time the voltage regulation algorithms can be refined

and the sense signal conditioning circuitry and the converter SCR commutation sensing circuitry can be developed.

7.0.0 CONCLUSIONS

The controller hardware and software have been combined to form a system and are operating correctly together.

The capability of the controller to regulate the AC to DC section of the power conditioner has been developed and tested to the maximum extent practical at this time.

Further refinement of the voltage regulation algorithm and development of sense signal conditioning circuitry and SCR commutation sense circuitry will be performed when the power conditioner is available for testing.

8.0.0 RECOMMENDATION

1) The program continued to a workable converter inverter system;

2) The next step with the controller is to upgrade and retest and correct any existing problems with the hardware and software discovered during this task. Once these corrections are made, the system should be interfaced with the inverter system.