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PRODUCT SPECIFICATION
FOR
RCS

THE MODULAR, PROGRAMMABLE REAL WORLD
INTERFACE CONTROLLER SYSTEM.

COMPANY CONFIDENTIAL
NO 1005

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CONTENTS

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1.0 INTRODUCTION/ABSTRACT

2.0 GENERAL DESCRIPTION

- 2.1 Problems of Current Technology
- 2.2 Solutions of RCS
- 2.3 Exploiting the Latest Technology

3.0 SYSTEM OPERATION

- 3.1 User Communications
- 3.2 Interfacing
- 3.3 Running an Application

4.0 SPECIFICATIONS

- 4.1 Robotic Controller Unit (RCU)
- 4.2 Servo Motor Controller (SVMC)
- 4.3 Speech/Sound Synthesizer (SSS)
- 4.4 Multi Function Controller (MFC)
- 4.5 Environmental Sensor Interpreter (ESI)
- 4.6 STEpper Motor Controller (STMC)
- 4.7 Ultrasound Navigation System (UNS)

5.0 HARDWARE/SOFTWARE INTERACTION

- 5.1 Interaction Abstract
- 5.2 Overhead Hardware
- 5.3 Overhead Software
- 5.4 Interface Hardware
- 5.5 Interface Software
- 5.6 Interrupts
- 5.7 Interaction Efficiency

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1.0 INTRODUCTION/ABSTRACT

In a new and uncertain field such as robotics compatability, expandability and retrofitability are essential in a system for tailoring to new technology, technology trends and customer needs. RCS is specifically designed with these criteria in mind.

RCS is a stand alone system operable by novice users, yet also offers unprecedented support to those users with the imagination to enhance its extensive capabilities.

A sample of some of the features:

- * Single or multi tasking capability
- * 4 I/O fields each containing 32 locations
- * BASIC programming upon power up
- * Efficient machine language programming
- * Real time clock
- * 3 power priorities
- * Only 2 power sources required
- * Plug-in modules, slot independent
- * Interrupt driven
- * Memory expandible
- * EPROM compatible

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2.0 GENERAL DESCRIPTION

2.1 Problems Of Current Technology

Current robotic products fall into three classifications:

- 1.) Complete personal robots
- 2.) Simple, single function units
- 3.) Industrial or commercial units

The personal robot is a good concept and may indeed be a sign of the future, but current technology is only on the edge of being able to support the demands of a useful unit. The economics of this needed technology, at the present, clearly prohibits its use in an affordable consumer product.

There are a number of small, cute units available which are moderately reasonable in cost but have only one or two functions that are at best amusing. These units are toyish in nature and offer the serious robotic consumer very little.

The current industrial/commercial systems available are really quite impressive and could offer the serious robot consumer a great deal. Unfortunately too much. The level of sophistication of these products is so great that most consumers would become thoroughly frustrated in just trying to get the system up, let alone trying to actually use and expand it. The price for this technology and sophistication totally alienates the consumer from these products.

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2.0 GENERAL DESCRIPTION

2.2 Solutions of RCS

Building on our carefully researched ideals, ALPHA ROBOTICS, INCORPORATED, has developed a comprehensive, cost effective solution for serious robotic consumers. The basic system offers the maximum in expandability (128 I/O locations) and in flexibility. The simplicity of BASIC programming coupled with the efficiency of machine language in an interactive environment offers the user the ability to develop programs limited only by his own imagination. The system will operate speech synthesizers, motor controllers, navigation systems, peripheral device controllers, etc.

RCS consists of a Robotic Controller Unit (RCU) to which real world I/O modules are attached. As many as five modules may be plugged directly into the RCU. The RCU includes a Z8 based Micro Computer Unit (MCU), RAM, real time clock and communications interfaces.

To suit varying customer requirements, ALPHA ROBOTICS offers a full line of compatible transducers (motors, sensors, speakers, etc.) and accessories to be controlled by RCS.

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2.0 GENERAL DESCRIPTION

2.3 Exploiting The Latest Technology

To meet the criteria for this system, ALPHA ROBOTICS, INC. has incorporated the latest economically feasible technology into RCS.

* A Powerful Micro Computer Unit (MCU) offers:

- 1.5 us instruction time
- Dynamic memory allocation
- Comprehensive instruction set
- Interrupt prioritizing

* MOS technology is used exclusively, where feasible, for very low power consumption and wide noise margins.

* A fully modular approach is used. Individual modules plug in with card edge connectors. All IC's are fully socketed.

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3.0 SYSTEM OPERATIONS

3.1 User Communications

The primary communication channel is via RS-232 link. An RS-232 port is mounted directly on the RCU for interfacing to a terminal or personal computer. Upon setting of the baud rate and a push of the hardware reset button, program development may begin.

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3.0 SYSTEM OPERATIONS

3.2 Interfacing

Various real-world I/O modules are available for use with RCS. Each module is designed generically enough to allow for virtually any control application to the real world. All modules are independent and can be combined in any combination to suit the users application.

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3.0 SYSTEM OPERATIONS

3.3 Running An Application

Once a particular module has been selected and installed application programming may begin. The system is designed to run an application "monitor" program without a user communication channel, once initiated. The application will continue to run for as long as the user desires and is only limited by the users imagination.

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4.0 SPECIFICATIONS

4.1 ROBOTIC CONTROLLER UNIT (RCU)

HARDWARE I/O FIELDS	4
TOTAL HARDWARE I/O LOCATIONS	128
STANDARD INTERFACE SLOTS	5
POWER PRIORITIES	3
REQUIRED POWER	+5 VDC, +12 VDC
OPERATOR CONTROL	RS-232 INTERFACE
BAUD RATES	110, 150, 300, 600, 1200, 2400, 4800, 9600, 19,200
SYSTEM CLOCK	PROGRAMMABLE: YEAR, MONTH, DATE, DAY, HOUR, MINUTE, SECOND, 1/10 SECOND

COMPUTER

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MCU	Z8671
INSTRUCTION LENGTH	8-BIT
HARDWARE G-P REGISTERS	124
I/O PORT REGISTERS	16
ADDRESSING MODES	4 REGISTER, INDIRECT REGISTER, IMMEDIATE, DIRECT ADDRESS, INDEXED, PROGRAM COUNTER
INSTRUCTION TIME	1.5 MICROSECOND
STANDARD MEMORY SIZE	4K, 8-BIT WORDS
FUTURE EXPANDED MEMORY SIZE	48K, 8-BIT WORDS
INTERRUPTS	6 VECTORED, MASKABLE, PRIORITIZABLE
COUNTERS/TIMERS	2
PROGRAMMING	MACHINE/BASIC

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4.0 SPECIFICATIONS

4.2 SERVO MOTOR CONTROLLER (SVMC)

CHANNELS	2
SPEEDS	128 INCLUDING STOP
DIRECTIONS	2
SPEED CONTROL	PULSE WIDTH MODULATION
PWM RATE	ON-BOARD ADJUSTMENT
FEEDBACK	CLOSED LOOP, OPTO-INTERRUPTER
ACCELERATION RAMP	ON-BOARD ADJUSTMENT
OUTPUT VOLTAGE	12 VDC
MAXIMUM OUTPUT CURRENT	3 AMP
PROTECTION	MOTOR STALL, HARDWARE INTERRUPT

RELAY CONTROL

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OUTPUT VOLTAGE	6 VDC
MAXIMUM OUTPUT CURRENT	500 MA

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4.0 SPECIFICATIONS

4.3 SPEECH/SOUND SYNTHESIZER (SSS)

SPEECH SECTION

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STANDARD VOCABULARY	128 WORDS
EXPANDED VOCABULARY	256 WORDS
STANDARD MEMORY	128K 8-BIT WORDS IN ROM
EXPANDED MEMORY	256K 8-BIT WORDS IN ROM
AUDIO OUTPUT POWER	500 MW
NOMINAL LOAD IMPEDANCE	8 OHM
VOLUME CONTROL	ON-BOARD ADJUSTMENT
TONE CONTROL	ON-BOARD ADJUSTMENT

SOUND SECTION

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4.0 SPECIFICATIONS

4.4 MULTI FUNCTION CONTROLLER (MFC)

OUTPUT SECTION

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GENERAL OUTPUTS	8
OUTPUT VOLTAGE	12 VDC
MAXIMUM CURRENT PER OUTPUT	500 MA
PROTECTION	SHORT CIRCUIT, OPTO-ISOLATED

INPUT SECTION

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GENERAL INPUTS	8
MAXIMUM INPUT VOLTAGE	12 VDC
MAXIMUM INPUT CURRENT-LIMITED	1 MA
SWITCH OVER VOLTAGE	4 VDC
PROTECTION	SHORT CIRCUIT, OPTO-ISOLATED

DIGITAL-TO-ANALOG SECTION

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RESOLUTION	1 PART IN 256
OUTPUT VOLTAGE RANGE	0-6 VDC
MAXIMUM OUTPUT CURRENT	100 MA

ANALOG-TO-DIGITAL SECTION

=====

RESOLUTION	2 PARTS IN 256
INPUT VOLTAGE RANGE	0-6 VDC
MAXIMUM INPUT CURRENT-LIMITED	1 MA
CONVERSION RATE	<< TBA >>

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4.0 SPECIFICATIONS

4.5 ENVIRONMENTAL SENSOR INTERPRETER (ESI)

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4.0 SPECIFICATIONS

4.6 STEPPER MOTOR CONTROLLER (STMC)

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4.0 SPECIFICATIONS

4.7 ULTRASOUND NAVIGATION SYSTEM (UNS)

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5.0 HARDWARE/SOFTWARE INTERACTION

5.1 Interaction Abstract

Most overhead operations of RCS are done in hardware to virtually reserve the software capabilities of the system for user applications. The software overhead is minimal.

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5.0 HARDWARE/SOFTWARE INTERACTION

5.2 Overhead Hardware

The system is based on Z8 Micro Computer Unit (MCU) technology. Most hardware functions can be left transparent to the user on simple systems. All memory configuration and sizing is automatic upon power up. The only system configuration required for basic operation is the selection of a data transfer baud rate for the RS-232 communication link and the setting of the system clock.

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5.0 HARDWARE/SOFTWARE INTERACTION

5.3 Overhead Software

There are only three minimum software requirements for system operation:

- 1.) Vectored interrupt handler
- 2.) Port configuration
- 3.) User application program

A basic handler needs to be written dependent upon the modules implemented. This handler identifies the source of the interrupt and redirects the user program to satisfy the immediate need of a particular module. The user also has the ability to prioritize the various interfaces both in hardware and software. The handler is written in machine language and may call BASIC sub-routines. For simple applications only three bytes may be needed.

The data address ports need to be configured. This configuration remains fixed until the unit is powered down.

The user application is the actual program written to execute the desired functions.

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5.0 HARDWARE/SOFTWARE INTERACTION

5.4 Interface Hardware

All modules plug directly into RCU and are slot independent. Each module may reside in one of four memory mapped I/O fields, which is selectable by a switch on each module. All cabling for the applicable transducers is available on a connector residing on the front of each board. A number of boards have manual adjustments on them for optimizing the module to the particular transducer. Power for a transducer is generally taken directly from the module.

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5.0 HARDWARE/SOFTWARE INTERACTION

5.5 Interface Software

The basic philosophy of module communication is to read or write an entire byte to an I/O location, much like a memory read or write. To initiate action by an output transducer the user simply writes a byte to the location of the target transducer and execution is initiated immediately. To initiate the action of an input transducer, or to read the status of an output transducer the user simply reads a byte in from the applicable location. Some modules use multiple address locations when several transducers are being used or when the complexity of a transducer dictates their use. Each byte is strategically broken down into specific control bits for the various attributes of the target transducer.

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5.0 HARDWARE/SOFTWARE INTERACTION

5.6 Interrupts

Upon completion of a task most modules generate a hardware interrupt back to the MCU to signal a request for additional data, if desired. The module can generate an interrupt on one of three priority lines, which is selectable by switch. It is the responsibility of the vectored interrupt handler to prioritize all incoming interrupts and branch program execution to identify and act upon them. The interrupt scheme frees the system of laborious polling routines and offers faster response time to requesting modules.

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5.0 HARDWARE/SOFTWARE INTERACTION

5.7 Efficient Interaction

This module byte reading and writing completely relieves the CPU during transducer execution and only requires minimal response during the interrupt event. By not having the CPU process continual, dedicated control signals for one transducer at a time, the CPU may control many transducers concurrently.

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