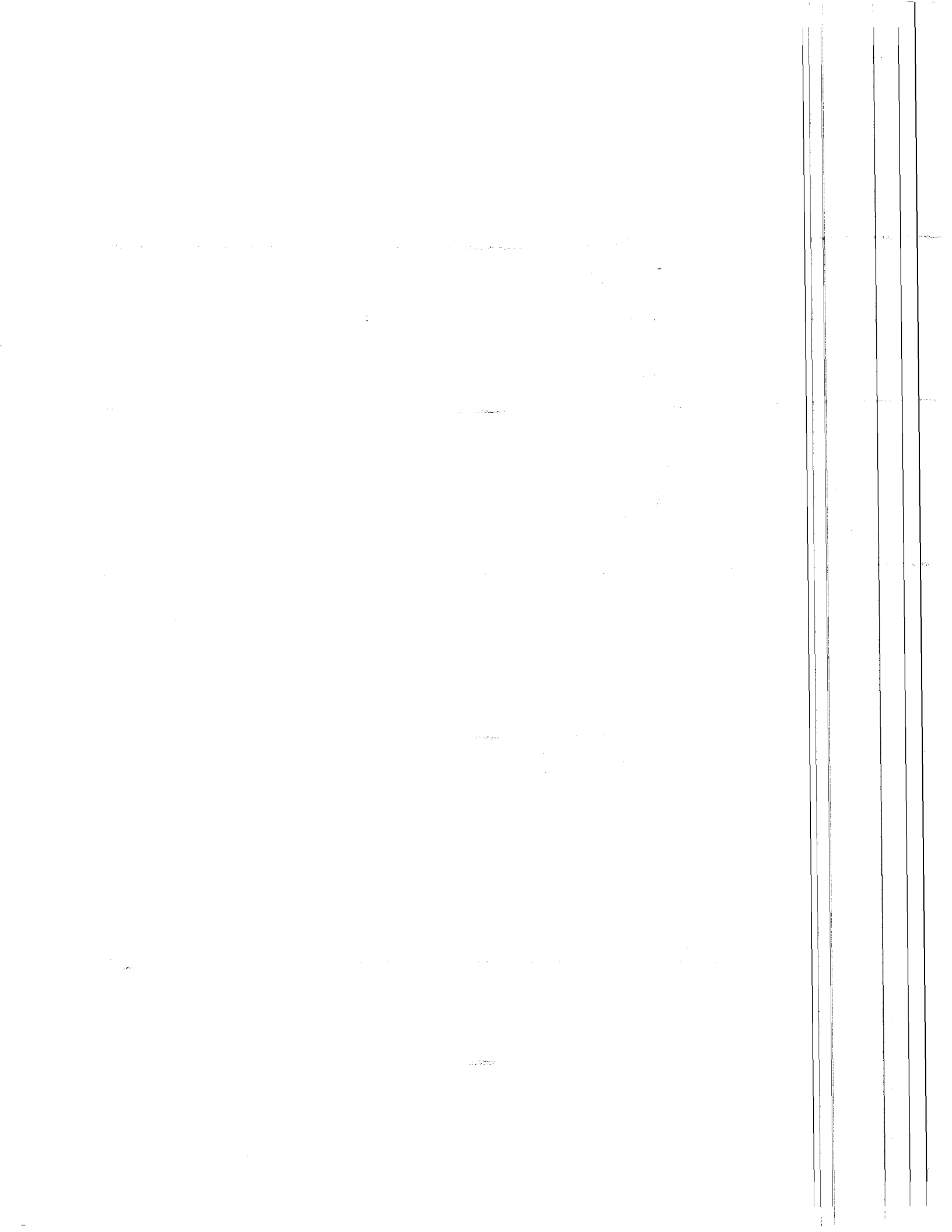


**CR10 MEASUREMENT AND CONTROL MODULE  
OPERATOR'S MANUAL**

**REVISION: 5/95**

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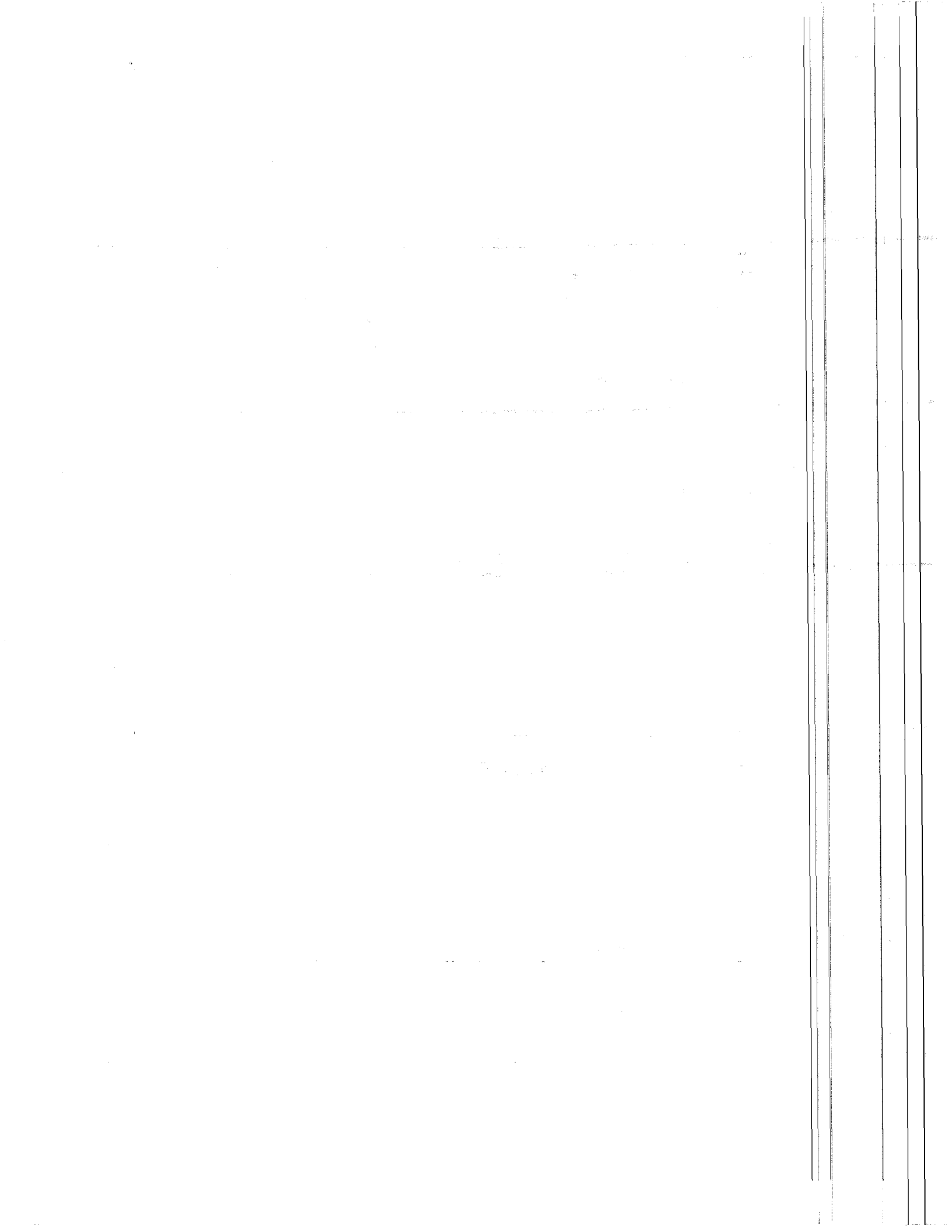


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# CR10 MEASUREMENT AND CONTROL MODULE

## TABLE OF CONTENTS

	PAGE
<b>OV1. PHYSICAL DESCRIPTION</b>	
OV1.1 Wiring Panel.....	OV-1
OV1.2 Connecting Power to the CR10.....	OV-5
<b>OV2. MEMORY AND PROGRAMMING CONCEPTS</b>	
OV2.1 Internal Memory .....	OV-5
OV2.2 CR10 Instruction Types.....	OV-7
OV2.3 Program Tables, Execution Interval and Output Intervals.....	OV-7
<b>OV3. COMMUNICATING WITH CR10</b>	
OV3.1 CR10 Keyboard/Display .....	OV-9
OV3.2 Using the PC208 Terminal Emulator (GraphTerm).....	OV-9
OV3.3 ASCII Terminal or Computer with Terminal Emulator.....	OV-9
<b>OV4. PROGRAMMING THE CR10</b>	
OV4.1 Functional Modes .....	OV-10
OV4.2 Key Definition .....	OV-10
OV4.3 Programming Sequence .....	OV-11
OV4.4 Instruction Format .....	OV-11
OV4.5 Entering a Program .....	OV-12
<b>OV5. PROGRAMMING EXAMPLES</b>	
OV5.1 Sample Program 1 .....	OV-13
OV5.2 Sample Program 2 .....	OV-14
OV5.3 Editing an Existing Program.....	OV-15
<b>OV6. DATA RETRIEVAL OPTIONS .....</b>	<b>OV-17</b>
<b>OV7. SPECIFICATIONS.....</b>	<b>OV-20</b>

## PROGRAMMING

### 1. FUNCTIONAL MODES

1.1	Program Tables - *1, *2, and *3 Modes .....	1-1
1.2	Setting and Displaying the Clock - *5 Mode .....	1-2
1.3	Displaying/Altering Input Memory, Flags, and Ports - *6 Mode .....	1-3
1.4	Compiling and Logging Data - *0 Mode .....	1-4
1.5	Memory Allocation - *A.....	1-4
1.6	Memory Testing and System Status - *B .....	1-6
1.7	*C Mode -- Security .....	1-7
1.8	*D Mode -- Save or Load Program.....	1-7

# CR10 TABLE OF CONTENTS

## 2. INTERNAL DATA STORAGE

2.1	Final Storage Areas, Output Arrays, and Memory Pointers .....	2-1
2.2	Data Output Format and Range Limits .....	2-3
2.3	Displaying Stored Data on Keyboard/Display - *7 Mode .....	2-3

## 3. INSTRUCTION SET BASICS

3.1	Parameter Data Types .....	3-1
3.2	Repetitions.....	3-1
3.3	Entering Negative Numbers .....	3-1
3.4	Indexing Input Locations and Ports .....	3-1
3.5	Voltage Range and Overrange Detection .....	3-2
3.6	Output Processing.....	3-2
3.7	Use of Flags: Output and Program Control.....	3-3
3.8	Program Control Logical Constructions.....	3-4
3.9	Instruction Memory and Execution Time.....	3-5
3.10	Error Codes .....	3-8

## DATA RETRIEVAL/COMMUNICATION

## 4. EXTERNAL STORAGE PERIPHERALS

4.1	On-Line Data Transfer - Instruction 96.....	4-1
4.2	Manually Initiated Data Output - *8 Mode.....	4-3
4.3	Cassette Tape Option .....	4-3
4.4	Printer Output Formats.....	4-5
4.5	Storage Module (SM192/716) .....	4-6
4.6	*9 Mode -- Storage Module Commands.....	4-7

## 5. TELECOMMUNICATIONS

5.1	Telecommunications Commands.....	5-1
5.2	Remote Programming of the CR10.....	5-4

## 6. 9-PIN SERIAL INPUT/OUTPUT

6.1	Pin Description .....	6-1
6.2	Enabling and Addressing Peripherals .....	6-2
6.3	Ring Interrupts .....	6-3
6.4	Interrupts During Data Transfer .....	6-3
6.5	Modem/Terminal Peripherals .....	6-4
6.6	Synchronous Device Communication .....	6-4
6.7	Modem/Terminal and Computer Requirements.....	6-5

## PROGRAM EXAMPLES

### 7. MEASUREMENT PROGRAMMING EXAMPLES

7.1	Single-Ended Voltage - LI200S Silicon Pyranometer .....	7-1
7.2	Differential Voltage Measurement .....	7-2
7.3	Thermocouple Temperatures Using the Optional CR10TCR to Measure the Reference Temperature .....	7-3
7.4	Thermocouple Temperatures Using an External Reference Junction .....	7-3
7.5	107 Temperature Probe .....	7-4
7.6	207 Temperature and RH Probe .....	7-4
7.7	Anemometer with Photochopper Output .....	7-5
7.8	Tipping Bucket Rain Gage with Long Leads .....	7-6
7.9	100 ohm PRT in 4 Wire Half Bridge .....	7-6
7.10	100 ohm PRT in 3 Wire Half Bridge .....	7-8
7.11	100 ohm PRT in 4 Wire Full Bridge .....	7-9
7.12	Pressure Transducer - 4 Wire Full Bridge .....	7-10
7.13	Lysimeter - 6 Wire Full Bridge .....	7-11
7.14	227 Gypsum Soil Moisture Block .....	7-13
7.15	Nonlinear Thermistor in Half Bridge (Model 101 Probe) .....	7-14
7.16	Water Level - Geokon's Vibrating Wire Pressure Sensor .....	7-15
7.17	Paroscientific "T" Series Pressure Transducer .....	7-19
7.18	SDM Peripherals .....	7-24
7.19	Paroscientific Pressure Transducer Processing .....	7-24

### 8. PROCESSING AND PROGRAM CONTROL EXAMPLES

8.1	Computation of Running Average .....	8-1
8.2	Rainfall Intensity .....	8-2
8.3	Using Control Ports and Loop to Run AM416 Multiplexer .....	8-3
8.4	Sub 1 Minute Output Interval Synched to Real Time .....	8-5
8.5	Interrupt Subroutine Used to Count Switch Closures (Rain Gage) .....	8-5
8.6	SDM-A04 Analog Output Multiplexer to Strip Chart .....	8-7
8.7	Converting 0-360 Wind Direction Output to 0-540 for Strip Chart .....	8-8
8.8	Use of 2 Final Storage Areas - Saving Data Prior to Event .....	8-9
8.9	Logarithmic Sampling Using Loops .....	8-10

## INSTRUCTIONS

9.	INPUT/OUTPUT INSTRUCTIONS .....	9-1
10.	PROCESSING INSTRUCTIONS .....	10-1
11.	OUTPUT PROCESSING INSTRUCTIONS .....	11-1
12.	PROGRAM CONTROL INSTRUCTIONS .....	12-1

## CR10 TABLE OF CONTENTS

### MEASUREMENTS

#### 13. CR10 MEASUREMENTS

13.1	Fast and Slow Measurement Sequence .....	13-1
13.2	Single-Ended and Differential Voltage Measurements.....	13-2
13.3	The Effect of Sensor Lead Length on the Signal Settling Time .....	13-3
13.4	Thermocouple Measurements .....	13-12
13.5	Bridge Resistance Measurements .....	13-17
13.6	Resistance Measurements Requiring AC Excitation.....	13-21
13.7	Calibration Process .....	13-22

### INSTALLATION

#### 14. INSTALLATION AND MAINTENANCE

14.1	Protection from the Environment.....	14-1
14.2	Power Requirements.....	14-1
14.3	Campbell Scientific Power Supplies.....	14-2
14.4	Solar Panels .....	14-5
14.5	Direct Battery Connection to the CR10WP Wiring Panel.....	14-5
14.6	Vehicle Power Supply Connections.....	14-5
14.7	Grounding.....	14-6
14.8	Wiring Panel.....	14-7
14.9	Switched 12 Volt.....	14-7
14.10	Use of Digital I/O Ports for Switching Relays .....	14-7
14.11	Maintenance.....	14-9

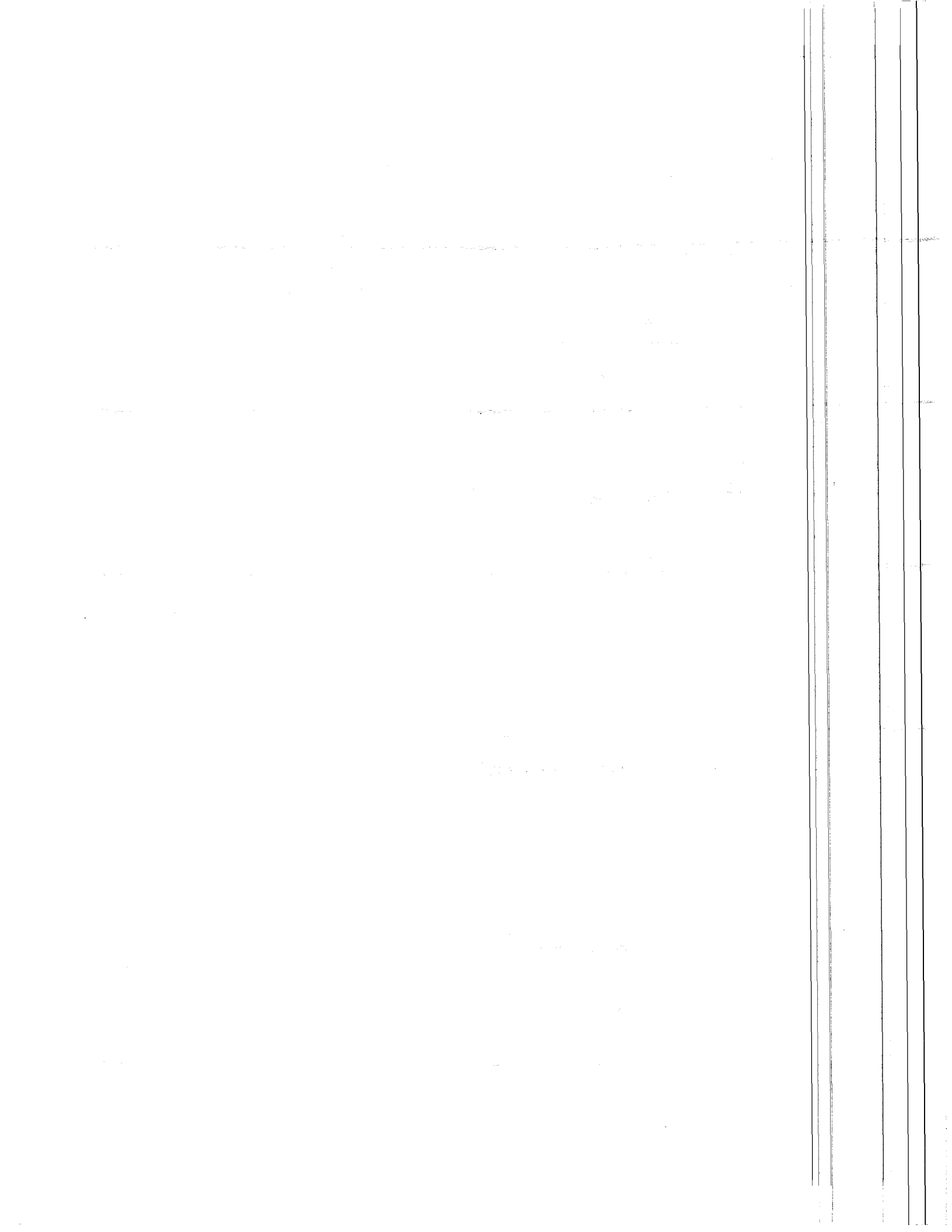
### APPENDICES

<b>A. GLOSSARY.....</b>	<b>A-1</b>
<b>B. CR10 PROM SIGNATURE AND OPTIONAL SOFTWARE</b>	
B.1 PROM Signature and Version .....	B-1
B.2 Available PROMs/Library Options .....	B-1
B.3 Description of Library Options Not in Standard Manual .....	B-2
<b>C. BINARY TELECOMMUNICATIONS</b>	
C.1 Telecommunications Command with Binary Responses .....	C-1
C.2 Final Storage Format.....	C-2
C.3 Generation of Signature .....	C-4
<b>D. CR10 37 PIN PORT DESCRIPTION .....</b>	<b>D-1</b>
<b>E. ASCII TABLE.....</b>	<b>E-1</b>
<b>G. CHANGING RAM OR PROM CHIPS</b>	
G.1 Disassembling the CR10.....	G-1
G.2 Installing New RAM Chips in CR10s with 16K RAM .....	G-1
G.3 Installing New PROM .....	G-1
G.4 Installing 4K Program Memory PROM .....	G-1

**LIST OF TABLES..... LT-1**

**LIST OF FIGURES..... LF-1**

**INDEX ..... I-1**



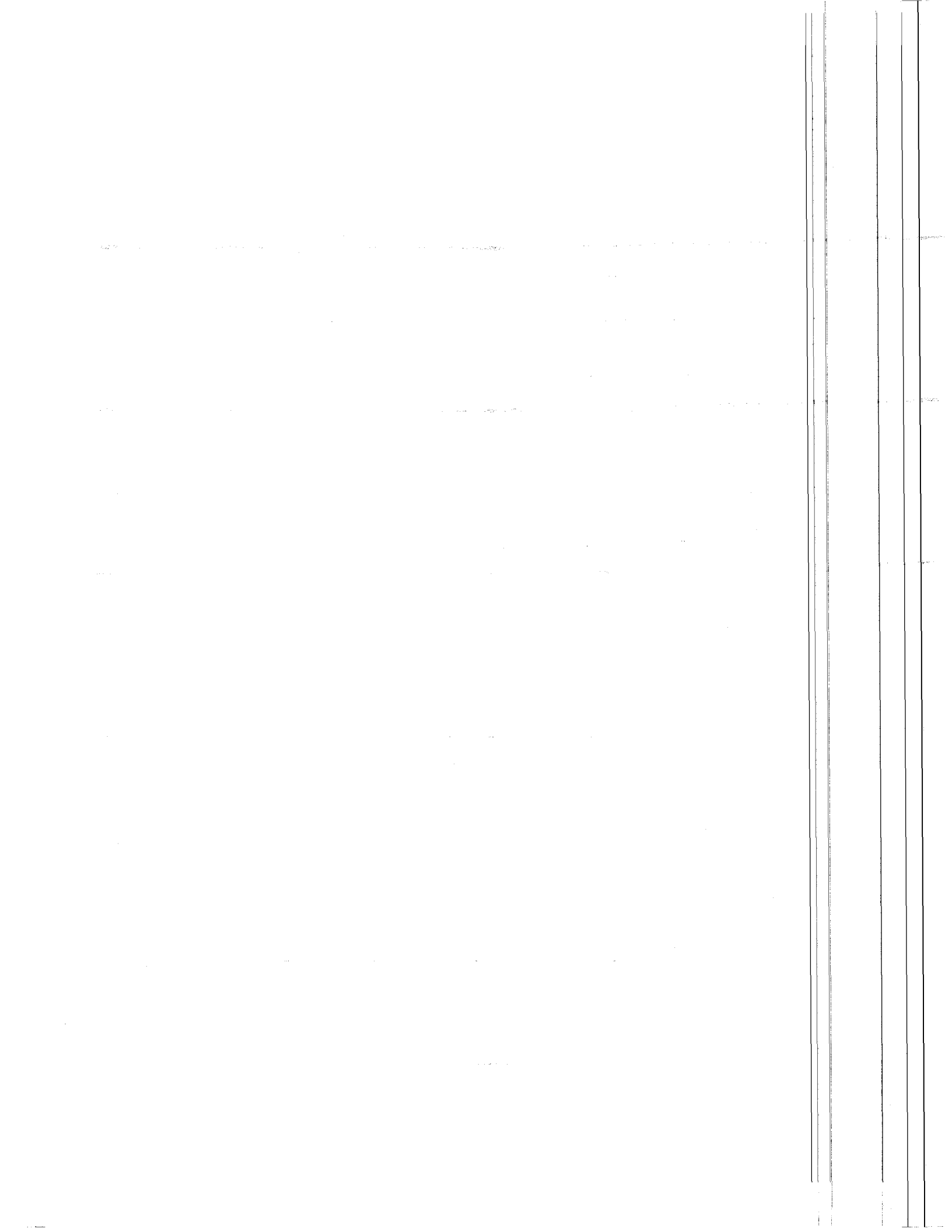
## SELECTED OPERATING DETAILS

1. **Storing Data** - Data are stored in Final Storage only by Output Processing Instructions and only when the Output Flag is set. (Sections OV4.1.1 and OV4.2.1)
2. **Storing Date and Time** - Date and time are stored with the data in Final Storage ONLY if the Real Time Instruction 77 is used. (Section 11)
3. **Data Transfer** - On-line data transfer from Final Storage to peripherals (printer, Storage Module, etc.) occurs only if enabled with Instruction 96 in the datalogger program. (Sections 4 and 12)
4. **Final Storage Resolution** - All Input Storage values are displayed (\*6 mode) as high resolution with a maximum value of 99999. However, the default resolution for data stored in Final Storage is low resolution, maximum value of 6999. Results exceeding 6999 are stored as 6999 unless Instruction 78 is used to store the values in Final Storage as high resolution values. (Sections 2.2.1 and 11)
5. **Floating Point Format** - The computations performed in the CR10 use floating point arithmetic. CSI's 4 byte floating point numbers contain a 23 bit binary mantissa and a 6 bit binary exponent. The largest and smallest numbers that can be stored and processed are  $9 \times 10^{18}$  and  $1 \times 10^{-19}$ , respectively. (Section 2.2.2)
6. **Erasing Final Storage** - Data in Final Storage can be erased without altering the program by using the \*A Mode to repartition memory. (Section 1.5.2)
7. **ALL memory can be erased** and the CR10 completely reset by entering 1986 for the number of bytes left in Program Memory. (Section 1.5.2)
8. **The set of instructions** available in the CR10 is determined by the PROM (Programmable Read Only Memory) that it is equipped with. Standard and optional software are identified in Appendix B. If you have ordered optional software that is not covered in the standard manual, the documentation is in Appendix H.
9. **Radiotelemetry Users** - As of February, 1990, CR10 PROMs no longer contain radio frequency interface software. That function is now contained in the RF95 Modem. To make measurements at a phone-to-RF base station using the RF100/RF200 Radio and RF95 Modem, current CR10 software is required. A CR10 with old software can be used with the new RF95 in the "RF95-ME" state, but the datalogger loses the "callback" capability as well as the SDC function.
10. **Changes with the release of OS10-0.1:**
  - Wind Vector Instruction 69** has replaced Instruction 76. The options to do sub-interval averaging of the standard deviation of wind direction,  $\sigma(\theta)$ , and to calculate  $\sigma(\theta)$  using the Yamartino algorithm have been added to the previous options (Section 9).
  - Intermediate Processing Disable Flag 9** is now set low if a conditional test for setting it high fails (same as Output Flag 0, Section 3.7.2).
  - \*D options for saving and loading programs with a cassette tape** are no longer in a standard PROM and must be ordered as a library option PROM (Appendix B).

## CAUTIONARY NOTES

1. Damage will occur to the analog input circuitry if voltages in excess of  $\pm 16$  V are applied for a sustained period. Voltages in excess of  $\pm 5$  V will cause errors and possible overranging on other analog input channels.
2. When using the CR10 with the PS12LA, remember that the sealed lead acid batteries are permanently damaged if discharged below 10.5 V. The cells are rated at a 7 Ahr capacity but experience a slow discharge even in storage. It is advisable to maintain a continuous charge on the PS12LA battery pack, whether in operation or storage (Section 14).
3. When connecting power to the CR10, first connect the positive lead from the power source to the 12 V terminal. Then connect the negative lead to G. Connecting these leads in the reverse order creates the possibility of a short (Section 14).
4. There are frequent references in this manual to Storage Modules. The Storage Modules referred to are the SM192 and SM716. The old SM16 and SM64 Storage Modules will NOT work with the CR10 without a specially modified cable. In addition, the SM16 and SM64 cannot perform many of the functions that the SM192 and SM716 are capable of performing.
5. Voltages in excess of 5.5 volts applied to a control port can cause the CR10 to malfunction.
6. Voltage pulses can be counted by CR10 Pulse Counters configured for High Frequency Pulses. However, when the pulse is actually a low frequency signal (below about 10 Hz) AND the positive voltage excursion exceeds 5.6 VDC, the 5 VDC supply will start to rise, upsetting all analog measurements.  
  
Pulses whose positive voltage portion exceed 5.6 VDC with a duration longer than 100 milliseconds need external conditioning. See the description of the Pulse count instruction in Section 9 for details on the external conditioning.
7. The CR10 module is sealed and contains desiccant to protect against excess humidity. The Wiring Panel and the connections between the Wiring Panel and the CR10 are still susceptible to humidity. To prevent corrosion at these points, additional desiccant must be placed inside the enclosure. To reduce vapor transfer into the enclosure, plug the cable entry conduit with Duct Seal, a putty-type sealant available at most electrical supply houses. DO NOT totally seal enclosures equipped with lead acid batteries. Hydrogen concentration may build up to explosive levels.





# CR10 MEASUREMENT AND CONTROL MODULE OVERVIEW

Campbell Scientific Inc. provides four aids to understanding and operating the CR10:

1. PCTOUR
2. This Overview
3. The CR10 Operator's Manual
4. The CR10 Prompt Sheet

PCTOUR is a computer-guided tour of CR10 operation and the use of the PC208 Datalogger Support Software. Much of the material in this Overview is covered in PCTOUR. A copy of PCTOUR is included with every datalogger or PC208 order.

This Overview introduces the concepts required to take advantage of the CR10's capabilities. Hands-on programming examples start in Section OV5. Working with a CR10 will help the learning process, so don't just read the examples, do them. If you want to start this minute, go ahead and try the examples, then come back and read the rest of the Overview.

The sections of the Operator's Manual which should be read to complete a basic understanding of the CR10 operation are the Programming Sections 1-3, the portions of the data retrieval Sections 4 and 5 appropriate to the method(s) you are using (see OV6), and Section 14 which covers installation and maintenance.

Section 6 covers details of serial communications. Sections 7 and 8 contain programming examples. Sections 9-12 have detailed descriptions of each programming instruction, and Section 13 goes into detail on the CR10 measurement procedures.

The Prompt Sheet is an abbreviated description of the programming instructions. Once familiar with the CR10, it is possible to program it using only the Prompt Sheet as a reference, consulting the manual if further detail is needed.

Read the Selected Operating Details and Cautionary Notes at the front of the Manual before using the CR10.

## OV1. PHYSICAL DESCRIPTION

The CR10 is a fully programmable datalogger/controller in a small, rugged, sealed module. Programming is very similar to Campbell Scientific's 21X and CR7 dataloggers. Some fundamental physical differences are listed below.

- The CR10 does not have an integral keyboard/display. The user accesses the CR10 with the portable CR10KD Keyboard Display or with a computer or terminal (Section OV2).
- The CR10 does not have an integral terminal strip. A removable wiring panel (Figure OV1.1-1) performs this function and attaches to the two D-type connectors located at the end of the module.

- The power supply is external to the CR10. This gives the user a wide range of options (Section 14) for powering the CR10.

### OV1.1 WIRING PANEL

The CR10 Wiring Panel and CR10 datalogger make electrical contact through the two D-type connectors at the (left) end of the CR10.

The Wiring Panel contains a 9-pin Serial I/O port used when communicating with the datalogger and provides terminals for connecting sensor, control, and power leads to the CR10. It also provides transient protection and reverse polarity protection. Figure OV1.1-2 shows the panel and the instructions used to access the various terminals.