## CR5000 MEASUREMENT AND CONTROL SYSTEM OVERVIEW

**TABLE OF CONTENTS**

PDF viewers note: These page numbers refer to the printed version of this document. Use the Adobe Acrobat® bookmarks tab for links to specific sections.

<table>
<thead>
<tr>
<th>PAGE</th>
</tr>
</thead>
<tbody>
<tr>
<td>OV1. PHYSICAL DESCRIPTION</td>
</tr>
<tr>
<td>OV1.1 Measurement Inputs</td>
</tr>
<tr>
<td>OV1.2 Communication and Data Storage</td>
</tr>
<tr>
<td>OV1.3 Power Supply and AC Adapter</td>
</tr>
<tr>
<td>OV2. MEMORY AND PROGRAMMING CONCEPTS</td>
</tr>
<tr>
<td>OV2.1 Memory</td>
</tr>
<tr>
<td>OV2.2 Measurements, Processing, Data Storage</td>
</tr>
<tr>
<td>OV2.3 Data Tables</td>
</tr>
<tr>
<td>OV3. PC9000 APPLICATION SOFTWARE</td>
</tr>
<tr>
<td>OV3.1 Hardware and Software Requirements</td>
</tr>
<tr>
<td>OV3.2 PC9000 Installation</td>
</tr>
<tr>
<td>OV3.3 PC9000 Software Overview</td>
</tr>
<tr>
<td>OV4. KEYBOARD DISPLAY</td>
</tr>
<tr>
<td>OV4.1 Data Display</td>
</tr>
<tr>
<td>OV4.2 Run/Stop Program</td>
</tr>
<tr>
<td>OV4.3 File Display</td>
</tr>
<tr>
<td>OV4.4 Configure Display</td>
</tr>
<tr>
<td>OV5. SPECIFICATIONS</td>
</tr>
</tbody>
</table>
The CR5000 provides precision measurement capabilities in a rugged, battery-operated package. The system makes measurements at a rate of up to 5,000 samples/second with 16-bit resolution. The CR5000 includes CPU, keyboard display, power supply, and analog and digital inputs and outputs. The on-board, BASIC-like programming language includes data processing and analysis routines. PC9000 Software provides program generation and editing, data retrieval, and realtime monitoring.

**OV1. Physical Description**

Figure OV1-2 shows the CR5000 panel and the associated program instructions. Unless otherwise noted, they are measurement instructions (Section 7).

**OV1.1 Measurement Inputs**

**OV1.1.1 Analog Inputs**

There are 20 differential or 40 single-ended inputs for measuring voltages up to ±5 V. A thermistor installed in the wiring panel can be used to measure the reference temperature for thermocouple measurements, and a heavy copper grounding bar and connectors combine with the case design to reduce temperature gradients for accurate thermocouple measurements. Resolution on the most sensitive range is 0.67 µV.
CR5000 Overview

SWITCHED VOLTAGE EXCITATION (VX)
- Excite
- BrFull
- BrFull6w
- BrHalf
- BrHalf3W
- BrHalf4W

CONTINUOUS ANALOG OUTPUTS (CAO)
- ExciteCAO

PULSE INPUTS
- PulseCount
- PulseCountReset

SWITCHED CURRENT EXCITATION (IX)
- ExciteI
- Resistance

CONTROL I/O
- PortGet
- PortSet
- ReadIO
- TimerIO
- WriteIO

ANALOG INPUTS
- Voltage
- VoltDiff
- VoltSE
- Thermocouple
- TCdiff
- TCSE
- Bridge measurements (use VX)
  - BrFull
  - BrFull6w
  - BrHalf
  - BrHalf3W
  - BrHalf4W
- Others
  - Resistance
  - PanelTemp
  - PeriodAvg
  - AM25T

SIGNAL GROUND (__) FOR
- Analog
- Pulse
- Excitation

CS I/O
- DSP4 (Data Tables and Output)

RS-232

CHARGER INPUT

GROUND LUG (__)

POWER IN

POWER GROUND (G), FOR
- 5V
- SW-12
- 12V
- SDM

PCMCIA PC CARD
- CardOut (Data Tables and Output)

POWER UP
- PowerOff (program control)

SDI-12

12 V

SDM CONNECTIONS
- CS7500
- CSAT3
- SDMINT8
- SDMSpeed
- SDMTrigger

SWITCHED 12 VOLTS SW-12
- PortSet
- SW12

FIGURE OV1-2. CR5000 Panel and Associated Instructions.
OV1.2 Signal Grounds (\(\oplus\))

The Signal Grounds (\(\oplus\)) should be used as the reference for Single-ended Analog inputs, Excitation returns, and sensor shield wires.

Signal returns from the CAO and Pulse channels should use the \(\oplus\) terminals located on the CAO and Pulse terminal strip to minimize current flow through the \(\oplus\) grounds on the analog terminal strips.

OV1.3 Power Grounds (G)

The Power Grounds (G) should be used as the returns for the 5V, SW12, 12V, and C1-C8 outputs. Use of the G grounds for these outputs with potentially large currents will minimize current flow through the analog section, which can cause Single-ended voltage measurement errors.

OV1.4 Ground Lug \(\oplus\)

The large ground lug is used to connect a heavy gage wire to earth ground. A good earth connection is necessary fix the ground potential of the datalogger and to send to earth transients that come in on either the G or \(\oplus\) terminals or are shunted to ground via the spark gaps protecting other inputs.

OV1.5 Power In

The G and 12V terminals on the unplugable Power In connector are for connecting power from an external battery to the CR5000. These are the only terminals that can be used to input battery power; the other 12V and SW-12V terminals are out only. Power from this input will not charge internal CR5000 batteries. Power to charge the internal batteries (17-28 VDC or 18 VRMS AC) must be connected to the charger input on the side of the LA battery back.

OV1.6 Switched 12 Volts SW-12

The SW-12 terminals provide an unregulated 12 volts that can be switched on and off under program control.

OV1.7 Switched Voltage Excitation (VX)

Four switched excitation channels provide precision programmable voltages within the \(\pm\)5 Volt range for bridge measurements. Each analog output will provide up to 50 mA between \(\pm\)5 V.

OV1.8 Switched Current Excitation (IX)

Four Switched Current Excitation channels provide precision current excitations programmable within \(\pm\)2.5 mA for resistance or bridge measurements.

OV1.9 Continuous Analog Outputs (CAO)

Two Continuous Analog Outputs (CAO) with individual outputs under program control for proportional control (e.g., PID algorithm) and waveform generation. Each analog output will provide up to 15 mA between \(\pm\)5 V.
OV1.1.10 Control I/O

There are 8 digital Input/Output channels (0 V low, 5 V high) for frequency measurement, digital control, and triggering.

OV1.1.11 Pulse Inputs

Two Pulse input channels can count pulses from high-level (5 V square wave), switch closure, or low-level A/C signals.

OV1.1.12 Power Up

The CR5000 allows shutting off power under program control. The Power Up inputs allow an external signal to awaken the CR5000 from a powered down state (PowerOff, Section 9). When the CR5000 is in this power off state the ON Off switch is in the on position but the CR5000 is off. If the "<0.5 " input is switched to ground or if the ">2" input has a voltage greater than 2 volts applied, the CR5000 will awake, load and run the “run on power-up” program. If the "< 0.5" input continues to be held at ground while the CR5000 is powered on and goes through its 2-5 second initialization sequence, the CR5000 will not run “run on power-up” program.

OV1.1.13 SDM Connections

The Synchronous Device for Measurement (SDM) connections C1,C2, and C3 along with the adjacent 12 volts and ground terminals are used to connect SDM sensors and peripherals.

OV1.2 Communication and Data Storage

OV1.2.1 PCMCIA PC Card

One slot for a Type I/II/III PCMCIA card. The keyboard display is used to check card status. The card must be powered down before removing it. The card will be reactivated if not removed.

CAUTION
Removing a card while it is active can cause garbled data and can actually damage the card. Do not switch off the CR5000 power while the card is present and active.

OV1.2.2 CS I/O

A 9-pin serial I/O port supports CSI peripherals.

OV1.2.3 Computer RS-232

RS-232 Port
OV1.3 Power Supply and AC Adapter

The CR5000 has two base options: the low profile without any power supply and the lead acid battery power supply base. The low profile base requires an external DC power source connected to the Power In terminal on the panel.

The battery base has a 7 amp hour battery with built in charging regulator and includes an AC adapter for use where 120 VAC is available (18 VAC RMS output). Charging power can also come from a 17-28 VDC input such as a solar panel. The DCDC18R is available for stepping the voltage up from a nominal 12 volt source (e.g., vehicle power supply) to the DC voltage required for charging the internal battery.

OV2. Memory and Programming Concepts

OV2.1 Memory

The CR5000 has 2MB SRAM and 1MB Flash EEPROM. The operating system and user programs are stored in the flash EEPROM. The memory that is not used by the operating system and program is available for data storage. The size of available memory may be seen in the status file. Additional data storage is available by using a PCMCIA card in the built in card slot.

OV2.2 Measurements, Processing, Data Storage

The CR5000 divides a program into two tasks. The measurement task manipulates the measurement and control hardware on a rigidly timed sequence. The processing task processes and stores the resulting measurements and makes the decisions to actuate controls.

The measurement task stores raw Analog to Digital Converter (ADC) data directly into memory. As soon as the data from a scan is in memory, the processing task starts. There are at least two buffers allocated for this raw ADC data (more under program control), thus the buffer from one scan can be processed while the measurement task is filling another.

When a program is compiled, the measurement tasks are separated from the processing tasks. When the program runs, the measurement tasks are performed at a precise rate, ensuring that the measurement timing is exact and invariant.

Processing Task:
- Digital I/O task
  - Read and writes to digital I/O ports (ReadI/O, WriteI/O)
  - Processes measurements
    - Determines controls (port states) to set next scan
    - Stores data

Measurement Task:
- Analog measurement and excitation sequence and timing
- Reads Pulse Counters
- Reads Control Ports (GetPort)
- Sets control ports (SetPort)
OV2.3 Data Tables

The CR5000 can store individual measurements or it may use its extensive processing capabilities to calculate averages, maxima, minima, histograms, FFTs, etc., on periodic or conditional intervals. Data are stored in tables such as listed in Table OV2-1. The values to output are selected when running the program generator or when writing a datalogger program directly.

Table OV2-1. Typical Data Table

<table>
<thead>
<tr>
<th>TOA4</th>
<th>TIMESTAMP</th>
<th>StnName</th>
<th>Temp</th>
<th>RefTemp_Avg</th>
<th>TC_Avg(1)</th>
<th>TC_Avg(2)</th>
<th>TC_Avg(3)</th>
<th>TC_Avg(4)</th>
<th>TC_Avg(5)</th>
<th>TC_Avg(6)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>degC</td>
<td>degC</td>
<td>degC</td>
<td>degC</td>
<td>degC</td>
<td>degC</td>
<td>degC</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Avg</td>
<td>Avg</td>
<td>Avg</td>
<td>Avg</td>
<td>Avg</td>
<td>Avg</td>
<td>Avg</td>
</tr>
<tr>
<td>1995-02-16 15:15:04.63</td>
<td>278824</td>
<td>31.07</td>
<td>24.2</td>
<td>25.09</td>
<td>26.8</td>
<td>24.11</td>
<td>24.45</td>
<td>23.75</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

OV3. PC9000 Application Software

PC9000 is a Windows™ application for use with the CR5000. The software supports CR5000 program generation, real-time display of datalogger measurements, graphing, and retrieval of data files.

OV3.1 Hardware and Software Requirements

The following computer resources are necessary:

- IBM PC, Portable or Desktop
- 8 Meg of Ram
- VGA Monitor
- Windows 95 or newer
- 30 Meg of Hard Drive Space for software
- 40 Meg of Hard Drive Space for data
- RS232 Serial Port

The following computer resources are recommended:

- 16 Meg of Ram
- 33 MHz 486 or faster
- Mouse

OV3.2 PC9000 Installation

To install the PC9000 Software:

- Start Microsoft Windows
- Insert diskette 1 (marked 1 of 2) in a disk drive.
- From the Program Manager, select File menu and choose Run
- Type (disk drive):\setup and press Enter  e.g. a:\setup<Enter>
  - The setup routine will prompt for disk 2.
You may use the default directory of PC9000 or install the software in a different directory. The directory will be created for you.

To abort the installation, type Ctrl-C or Break at any time.

**OV3.3 PC9000 Software Overview**

This overview points out the main PC9000 functions and where to find them. PC9000 has extensive on-line help to guide the user in its operation, run PC9000 to get the details. A CR5000 is not necessary to try out the programming and real time display options; a demo uses canned data for viewing. Without a CR5000, there are no communications with the datalogger; operations such as downloading programs and retrieving data will not function.

Figures OV3-1 and OV3-2 show the main PC9000 menus. The primary functions of PC9000 are accessed from the File, Comm, Realtime, and Analysis selections on the main menu (Figure OV3-1).
### CR5000 Overview

<table>
<thead>
<tr>
<th>File</th>
<th>Edit</th>
<th>Realtime</th>
<th>Analysis</th>
<th>Tools</th>
<th>Collect</th>
<th>Display</th>
<th>Windows</th>
<th>Help</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Data Retrieval...</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Scheduled Data Retrieval...</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>CommLink</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Select Series Linked Station...</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Select Parallel Linked Station...</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Logger Clock...</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Logger Status...</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Download...</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Save and Download</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Logger Files...</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Diagnostics</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Display Data Graph 1...</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Display Data Graph 2...</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>ID2000... Ctrl + I</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Collect data from CR5000</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>PC to CR5000 communications.</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Display Data in Tables Collected From CR5000.</td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Graphing requires no special processing of the data</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>and provides rapid feedback to the operator.</td>
<td></td>
</tr>
</tbody>
</table>

### OV3-1. PC9000 Primary Functions

- CR9000 Program Generator
- CR5000 Program Generator
- CR9000 Program Editor...
- CR5000 Program Editor...
- Open Wiring Diagram...
- Open Data Table Info File...
- Open Data File...
- Convert Binary to ASCII File...
- Print...
- Printer Setup...
- DOS Shell...
- File Manager...
- Explorer...
- Exit PC9000

---

Menu-driven Program Generation.

Direct Editing of Program

View/Edit Wiring Diagram & DataTable Information (Created by Program Generator)

View Data Collected from CR5000
OV3.2 File

Program Generator
Guides the user through a series of menus to configure the measurement types: thermocouple, voltage, bridge, pulse counting, frequency, and others. Creates a CR5000 program, wiring diagram, output table, description, and configuration file.

Program Editor
Create programs directly or edit those created by the program generator or retrieved from the CR5000. Provides context-sensitive help for the CR5000's BASIC-like language.

OV3.2 Edit

REALTIME

Virtual Meter
Updates up to five displays simultaneously. Choices include analog meter, horizontal and vertical bars, independent scaling/offset, multiple alarms, and rapid on-site calibration of sensors
**Virtual Oscilloscope**
Displays up to six channels. Time base variable from milliseconds to hours.

**X-Y Plotter**
Allows comparison of any two measurements in real time.

### OV3.3.3 Analysis

**Data Graphing**
Displays up to 16 fields simultaneously as strip charts or two multi-charts with up to 8 traces each. Includes 2D/3D bars, line, log/linear, area, and scatter. Line statistics available for max/min, best fit, mean, and standard deviation. Handles files of unlimited size. Historical graphing requires no special processing of the data and provides rapid feedback to the operator.

### OV3.3.4 Tools

**Control and Communications**
Supports PC to CR5000 communications: clock read/set, status read, program download, and program retrieval.

### OV3.3.5 Collect

Collect data from CR5000 data tables

### OV3.3.6 Display

Configure the font and color scheme in an active window.

### OV3.3.7 Windows

Size and arrange windows.

### OV3.3.8 Help

On-line help for PC9000 software.
OV4. Keyboard Display

Power Up Screen

Press any key for Main Menu (except < >)

CAMPBELL
SCIENTIFIC

CR5000 Datalogger
06/18/2000, 18:24:35
CPU: TRIG.CR5
Running.

Real Time Tables
Real Time Custom
Final Storage Data
Reset Data Tables
Graph Setup

New
Edit
Copy
Delete
Run Options
Directory
Format

ROM Version : xxxx
OS Version : xxxx
OS Date : xxxx
OS Signature
Serial Number
Rev Board
Station Name : xxxx
Program Name : xxxxx
Start Time : xxxx
Run Signature
DLD Signature
Battery : xxxx

Set Time/Date
Settings
Display
OV4.1 Data Display

List of Data Tables created by active program

List of Data Tables created by active program

List of Data Tables created by active program

All Tables

List of Data Tables created by active program

Graph Type: Scope
Scaler: Manual
Upper: 0.000000
Lower: 0.000000
Display Val Off
Display Max Off
Display Min Off
OV4.1.1 Real Time Tables

List of Data Tables created by active program. For Example,

Table:
- **Tref**: 23.0234
- **TCTemp(1)**: 19.6243
- **TCTemp(2)**: 19.3429
- **TCTemp(3)**: 21.2003
- **Flag(1)**: -1.0000
- **Flag(2)**: 0.00000
- **Flag(3)**: 0.00000
- **Flag(4)**: 0.00000

Cursor to desired Table and press Enter

Public Table values can be changed. Cursor to value and press Enter to edit value.

Press Graph/Char for Graph of selected field

New values are displayed as they are stored.
OV4.1.2 Setting up Real Time Custom Display

List of Data Tables created by active program. For Example,

Table1
  Temps
  Public

Cursor to desired Table and Press Enter

Tref
  TCTemp(1)
  TCTemp(2)
  **TCTemp(3)**
  Flag(1)
  Flag(2)
  Flag(3)
  Flag(4)

Cursor to desired Field and Press Enter

TCTemp(3) : 24.9496

Cursor to position for next value and Press Enter

New values are displayed as they are stored.
OV4.1.3 Final Storage Tables

List of Data Tables created by active program. For Example:

<table>
<thead>
<tr>
<th>TimeStamp</th>
<th>Record</th>
<th>Tref</th>
<th>TC(1)</th>
<th>TC(2)</th>
<th>TC(3)</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;2000-01-03 00:12:38&quot;</td>
<td>0</td>
<td>5</td>
<td>21.934</td>
<td>22.8419</td>
<td>22.8142</td>
</tr>
<tr>
<td>&quot;2000-01-03 00:12:39&quot;</td>
<td>1</td>
<td>5</td>
<td>21.9173</td>
<td>22.8364</td>
<td>22.8308</td>
</tr>
<tr>
<td>&quot;2000-01-03 00:12:40&quot;</td>
<td>2</td>
<td>5</td>
<td>21.9229</td>
<td>22.8364</td>
<td>22.8364</td>
</tr>
<tr>
<td>&quot;2000-01-03 00:12:41&quot;</td>
<td>3</td>
<td>5</td>
<td>21.9173</td>
<td>22.8419</td>
<td>22.8419</td>
</tr>
<tr>
<td>&quot;2000-01-03 00:12:42&quot;</td>
<td>4</td>
<td>5</td>
<td>21.9173</td>
<td>22.8253</td>
<td>22.8253</td>
</tr>
<tr>
<td>&quot;2000-01-03 00:12:43&quot;</td>
<td>5</td>
<td>5</td>
<td>21.9118</td>
<td>22.8364</td>
<td>22.8364</td>
</tr>
<tr>
<td>&quot;2000-01-03 00:12:44&quot;</td>
<td>6</td>
<td>5</td>
<td>21.9173</td>
<td>22.8087</td>
<td>22.8142</td>
</tr>
<tr>
<td>&quot;2000-01-03 00:12:45&quot;</td>
<td>7</td>
<td>5</td>
<td>21.9173</td>
<td>22.8364</td>
<td>22.8364</td>
</tr>
<tr>
<td>&quot;2000-01-03 00:12:46&quot;</td>
<td>8</td>
<td>5</td>
<td>21.9173</td>
<td>22.8253</td>
<td>22.8253</td>
</tr>
<tr>
<td>&quot;2000-01-03 00:12:47&quot;</td>
<td>9</td>
<td>5</td>
<td>21.9118</td>
<td>22.8364</td>
<td>22.8364</td>
</tr>
<tr>
<td>&quot;2000-01-03 00:12:48&quot;</td>
<td>10</td>
<td>5</td>
<td>21.945</td>
<td>22.8364</td>
<td>22.8364</td>
</tr>
<tr>
<td>&quot;2000-01-03 00:12:49&quot;</td>
<td>11</td>
<td>5</td>
<td>21.9506</td>
<td>22.8364</td>
<td>22.8364</td>
</tr>
</tbody>
</table>

Cursor to desired Table and Press Enter

Use Hm (oldest), End (newest), PgUp (older), PgDn (newer), ←, →, ↑, and ↓ to move around in data table.

Press Ins for Jump To screen.

Press Graph/Char for Graph of selected field.
Use ←, →, PgUp, PgDn to move cursor and window of data graphed.

Press Ins for Graph Setup

Go to Record:
5
press Ins to edit

Table Size: 1000
Current Record: 759
OV4.2 Run/Stop Program

PCCard Display

Remove Card
Format Card
Table Status
Card Status

Data
Run/Stop Program
File
Status
Configure, Settings

CPU:
List of Programs
No Program
CRD:
List of Programs

You may now remove the Card.
CR5000 closes tables first.

All Card Data Will be Lost!
Proceed?

Yes
No

List of Data Tables on card created by active program

PC Card Status:
Battery OK
5Volt Card
WP Disabled
OV4.3 File Display

Data
Run/Stop Program
File
Status
Configure, Settings

New File Name:
CPU: .CR5
CRD: .CR5

CPU:
CRD:

Copy
From
To
Execute

List of files on
CPU or Card.

CPU: Program
No Program
CRD: Program

CPU:
All programs and other files
will be lost!
Proceed?
Yes List of Programs
No

Cursor to
File and
Press Enter

New
Edit
Copy
Delete
Run Options
Directory
Format
OV4.3.1 File: Edit

The Program Editor in PC9000 is recommended for writing and editing datalogger programs. Changes in the field can be made with the keyboard display.

List of Program files on CPU: or CRD: For Example:

CPU:
- TCTEMP.CR5
- RACE.CR5

CR5000
- TCTemp.CR5
Public TREF,TC(3),FLAG(8)
DataTable (Temps,1,1000)
Sample (1,TREF,IEEE4)
Sample (3,TC(),IEEE4)

Edit Instruction parameters with parameter names and some pick lists:
- DataTable
  - TableName
  - > Temps
  - TrigVar
    - 1
  - Size
    - 1000

Insert blank line

Cursor down to highlight desired block and press Enter

To insert a block created by this operation, cursor to desired place in program and press Ins.
OV4.4 Configure Display

Data
- Run/Stop Program
- File
- Status
- Configure, Settings

05/24/2000, 15:10:40
- Year: 2000
- Month: 5
- Day: 24
- Hour: 15
- Minute: 10
- Set
- Cancel

Cursor to Configure, Settings and Press Enter

Set Time/Date
- Settings
- Display

Security Enable
- RS-232 Time Out: No
- CR5000 Off

Enter Passwords:
- Level 1:
- Level 2:
- Level 3:

Enter Password

Light
- Dark

Turn off display
- Back Light
- Contrast Adjust
- Display Time Out: No, Yes (if yes)

Time out (min) 1
### OV5. Specifications

**Electrical specifications are valid over a -25° to +50°C range unless otherwise specified; tested over +40° to +85°C available as an option, excludes batteries. Non-condensing environment required. Yearly calibrations are recommended to maintain electrical specifications.**

**PROGRAM EXECUTION RATE**
The CR5000 can measure one channel and store the result in 500 µs; all 40 SE+ channels can be measured in 8 ms (5 kHz aggregate rate).

**ANALOG INPUTS**
- **DESCRIPTION:** 20 DF+ or 40 SE, individually configured. Channel expansion provided through AM16/32, AM4/16, and AM2/ST Multiplexers.
- **RANGES, RESOLUTION, AND TYPICAL INPUT NOISE:** Basic Resolution is the A/D resolution of a single conversion. Resolution of DFM† with input reversal is half the Basic Res. Noise values are for DFM with input reversal; noise is greater with SEM.

<table>
<thead>
<tr>
<th>Rng (mV)</th>
<th>Res (µV)</th>
<th>(µV RMS)</th>
<th>(µV RMS)</th>
<th>(µV RMS)</th>
</tr>
</thead>
<tbody>
<tr>
<td>±5000</td>
<td>167</td>
<td>70</td>
<td>60</td>
<td>±10 µV</td>
</tr>
<tr>
<td>±1000</td>
<td>33.3</td>
<td>30</td>
<td>12</td>
<td>±6 µV</td>
</tr>
<tr>
<td>±200</td>
<td>6.67</td>
<td>8</td>
<td>2.4</td>
<td>±1.2 µV</td>
</tr>
<tr>
<td>±50</td>
<td>1.67</td>
<td>3.0</td>
<td>0.8</td>
<td>±0.3 µV</td>
</tr>
<tr>
<td>±10</td>
<td>0.47</td>
<td>1.8</td>
<td>0.5</td>
<td>±0.2 µV</td>
</tr>
</tbody>
</table>

**ACCURACY:** ±0.05% of Reading + Offset

**ACCURACY†:**
- ±0.05% Reading + Basic Res
- ±0.075% Reading + Basic Res
- ±0.10% Reading + Basic Res

**RANGE:** Voltage (current) outputs programmable

**PERIOD AVERAGING MEASUREMENTS**
- **DESCRIPTION:** The average period for a single cycle is determined by measuring the duration of a specified number of cycles. Any of the 40 SE analog inputs can be used; signal attenuation and ac coupling may be required.

**INPUT FREQUENCY RANGE:**

<table>
<thead>
<tr>
<th>Rng (mV)</th>
<th>Signal (peak to peak) Min.</th>
<th>Min.</th>
<th>Max.</th>
<th>Max.</th>
<th>Pulse W.</th>
<th>Freq</th>
</tr>
</thead>
<tbody>
<tr>
<td>±5000</td>
<td>600 mV</td>
<td>10 V</td>
<td>2.5 µs</td>
<td>200 kHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>±1000</td>
<td>100 mV</td>
<td>2.0 V</td>
<td>5.0 µs</td>
<td>100 kHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>±200</td>
<td>4 mV</td>
<td>2.0 V</td>
<td>25 µs</td>
<td>20 kHz</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**RESISTANCE MEASUREMENTS**
- **DESCRIPTION:** Provides voltage ratio measurements of 4- and 6-wire full bridges, and 2-, 3-, 4-wire half bridges. Direct resistance measurements available with current excitation.

**VOLTAGE RATIO ACCURACY†:**
- ±(0.10% Reading + Basic Res) + 0° to 45°C
- ±(0.05% Reading + Basic Res) -25° to 50°C
- ±(0.06% Reading + Basic Res) -40° to 85°C

**ACCURACY WITH CURRENT EXCITATION:**
- ±0.7°C, -40° to 85°C
- ±0.5°C, -25° to 50°C
- ±0.25°C, 0° to 40°C

**PERIOD AVERAGING MEASUREMENTS**
- **DESCRIPTION:** The average period for a single cycle is determined by measuring the duration of a specified number of cycles. Any of the 40 SE analog inputs can be used; signal attenuation and ac coupling may be required.

**INPUT FREQUENCY RANGE:**

<table>
<thead>
<tr>
<th>Rng (mV)</th>
<th>Signal (peak to peak) Min.</th>
<th>Min.</th>
<th>Max.</th>
<th>Max.</th>
<th>Pulse W.</th>
<th>Freq</th>
</tr>
</thead>
<tbody>
<tr>
<td>±5000</td>
<td>600 mV</td>
<td>10 V</td>
<td>2.5 µs</td>
<td>200 kHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>±1000</td>
<td>100 mV</td>
<td>2.0 V</td>
<td>5.0 µs</td>
<td>100 kHz</td>
<td></td>
<td></td>
</tr>
<tr>
<td>±200</td>
<td>4 mV</td>
<td>2.0 V</td>
<td>25 µs</td>
<td>20 kHz</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**EMI and ESD PROTECTION**
The CR5000 is encased in metal and incorporates EMI filtering on all inputs and outputs. Gas discharge tubes provide robust ESD protection on all terminal block inputs and outputs. The following European standards apply:

**CPU AND INTERFACE**
- **PROCESSOR:** Hitachi SH7034
- **MEMORY:** Battery-backed SRAM provides 2 Mbytes for data and operating system use with 128 kbytes reserved for program storage. Expanded data storage with PCMCIA type I, type II, or type III card.
- **BAUD RATES:** Selectable from 1,200 to 115,200 bps. ASCII protocol is eight data bits, one start bit, one stop bit, no parity.
- **LOCK CLOCK ACCURACY:** ±1 minute per month

**SYSTEM POWER REQUIREMENTS**
- **VOLTAGE:** 11 to 16 Vdc
- **TYPICAL CURRENT DRAIN:** 400 µA software power off; 1.5 mA sleep mode; 4.5 mA at 1 Hz (200 mA at 5 kHz) sample rate.

**PHYSICAL SPECIFICATIONS**
- **SIZE:** 9.8" x 8.3" x 4.5" (24.7 cm x 21.0 cm x 11.4 cm)
- **WEIGHT:** 12.2 lbs (5.5 kg) with rechargeable base

**WARRANTY**
- Three years against defects in materials and workmanship.

---

*SE(M): Single-Ended (Measurement)  
DF(M): Differential (Measurement)  
† Sensor and measurement noise not included.*
Campbell Scientific Companies

**Campbell Scientific, Inc. (CSI)**
815 West 1800 North
Logan, Utah 84321
UNITED STATES
www.campbellsci.com
info@campbellsci.com

**Campbell Scientific Africa Pty. Ltd. (CSAf)**
PO Box 2450
Somerset West 7129
SOUTH AFRICA
www.csafrica.co.za
cleroux@csafrica.co.za

**Campbell Scientific Australia Pty. Ltd. (CSA)**
PO Box 444
Thuringowa Central
QLD 4812 AUSTRALIA
www.campbellsci.com.au
info@campbellsci.com.au

**Campbell Scientific do Brazil Ltda. (CSB)**
Rua Luisa Crapsi Orsi, 15 Butantã
CEP: 005543-000 São Paulo SP BRAZIL
www.campbellsci.com.br
suporte@campbellsci.com.br

**Campbell Scientific Canada Corp. (CSC)**
11564 - 149th Street NW
Edmonton, Alberta T5M 1W7
CANADA
www.campbellsci.ca
dataloggers@campbellsci.ca

**Campbell Scientific Ltd. (CSL)**
Campbell Park
80 Hathern Road
Shepshed, Loughborough LE12 9GX
UNITED KINGDOM
www.campbellsci.co.uk
sales@campbellsci.co.uk

**Campbell Scientific Ltd. (France)**
Miniparc du Verger - Bat. H
1, rue de Terre Neuve - Les Ulis
91967 COURTABOEUF CEDEX
FRANCE
www.campbellsci.fr
campbell.scientific@wanadoo.fr

**Campbell Scientific Spain, S. L.**
Psg. Font 14, local 8
08013 Barcelona
SPAIN
www.campbellsci.es
info@campbellsci.es

*Please visit www.campbellsci.com to obtain contact information for your local US or International representative.*