

INSTRUCTION MANUAL



CR9000 Measurement and Control System Overview

Revision: 5/05

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Overview

The CR9000 is a modular, multi-processor system that provides precision measurement capabilities in a rugged, battery-operated package. The system makes measurements at a rate of up to 100 K samples/second with 16-bit resolution. Higher sample rates and resolutions can be attained using some of our higher end modules (CR9052E filter module, or the CR9058E isolation module). The CR9000 Base System includes CPU, power supply, and A/D modules. Up to nine I/O modules are inserted to configure a system for specific applications. The on-board, BASIC-like programming language includes data processing and analysis routines. PC9000 Windows™ Software provides program generation and editing, data retrieval, and realtime monitoring.



FIGURE OV1-1. CR9000 Measurement and Control System

OV1. Physical Description

OV1.1 Basic System

CR9031 CPU Module

The CR9031 CPU Module provides system control, processing, and communication to a PC via Transputer Link (TLINK) and fiber optic. The main processor is a 32-bit Inmos T805 Transputer. The module has 2MB static RAM and 2MB Flash EEPROM.

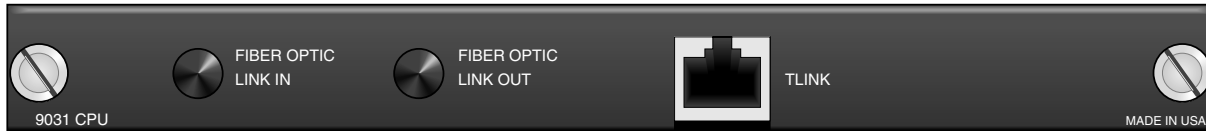


FIGURE OV1-2. CR9031

CR9041 A/D and Amplifier Module

The CR9041 A/D and Amplifier Module provides signal conditioning and 16 bit, 100 kHz A/D conversions.



FIGURE OV1-3. CR9041

CR9011 Power Supply Module and AC Adapter

The CR9011 Power Supply Module provides regulated power to the CR9000 from the internal battery modules. It also regulates battery charging from power supplied by the AC adapter, a DC input, or other external sources. The AC adapter may be used where AC power is available (100 - 240 volts) to provide power to the CR9000 and charge its batteries.

The CR9011 has a relay that allows shutting off power under program control. The Power Up inputs allow an external signal to awaken the CR9000 from a powered down state (PowerOff, Section 9). When the CR9000 is in this power off state the ON Off switch is in the on position but the internal relay is open. The power LED is not lit. If the "<0.5" input is switched to ground or if the ">2" input has a voltage greater than 2 volts applied, the CR9000 will awake, load the program in memory and run. If the "< 0.5" input continues to be held at ground while the CR9000 is powered on and goes through its 2–5 second initialization sequence, the CR9000 will not run the program in memory.

MEASUREMENTS:

Battery (voltage and current)

CONTROL:

PowerOff

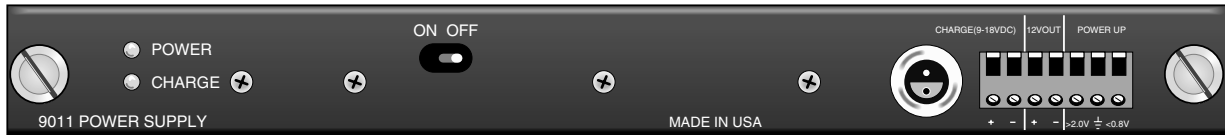


FIGURE OV1-4. CR9011

OV1.2 Measurement Modules

CR9050(E) Analog Input Module

The CR9050(E) Analog Input Module has 14 differential or 28 single-ended inputs for measuring voltages up to ± 5 V. Voltages exceeding ± 9 V may cause errors on other channels. An on-board PRT provides the reference temperature for thermocouple measurements, while 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 $1.6 \mu\text{V}$.

MEASUREMENTS:

Voltage

- Differential Voltage (VoltDiff)
- Single-Ended Voltage (VoltSE)

Thermocouple, Differential Voltage (TCDiff) Thermocouple, Single-Ended Voltage (TCSE)

Bridge measurements (also require CR9060 Excitation Module)

- Full Bridge (BrFull)
- 6 Wire Full Bridge (BrFull6W)
- Half Bridge (BrHalf)
- 3 Wire Half Bridge (BrHalf3W)
- 4 Wire Half Bridge (BrHalf4W)

Module Temperature (ModuleTemp)

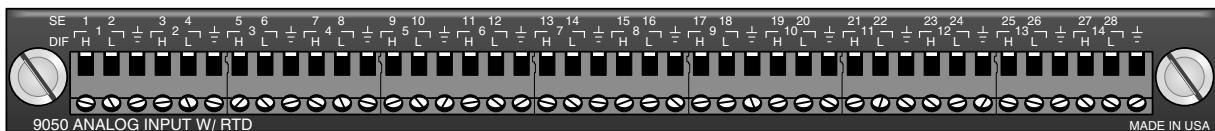


FIGURE OV1-5. CR9050

CR9051E Fault Protected 5V Analog Input Module

The number of channels and measurements are the same as for the CR9050 Analog Input Module. Each input channel is fault-protected so as to permit over-voltages between $+50$ V and -40 V without corruption of measurements on other input channels. All the CR9051E input channels become open switches when the CR9000 is powered off. The CR9051E is recommended

over the CR9050E for applications where fault voltages beyond ± 9 V could come in contact with the inputs, or when the CR9000 could be powered off while still connected to sensors that have power applied to them.

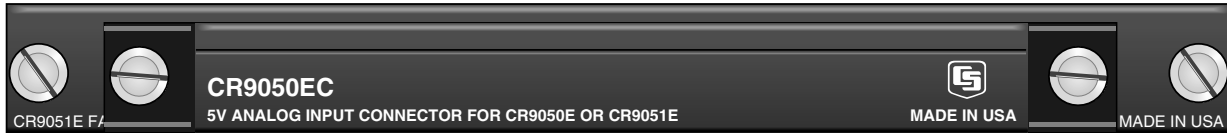


FIGURE OV1-6. CR9051E

CR9052DC Anti-Alias Filter Module with DC Excitation

The CR9052DC is a high-performance anti-alias filter module that extends the capability of the CR9000 Measurement and Control System. The module includes six anti-aliased analog measurement channels with differential input ranges from ± 20 mV to ± 5 V. Each input channel has current and voltage excitation options. Measurement rates up to 50 kHz per channel are possible.

MEASUREMENTS:

- VoltFilt
- FFTFilt

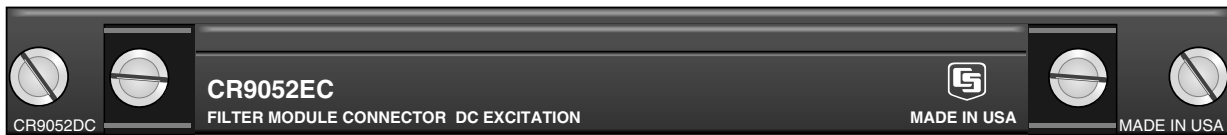


FIGURE OV1-7. CR9052DC

CR9052IEPE Anti-Alias Filter Module with DC Excitation

The The CR9052IEPE module allows direct connection of Internal Electronics Piezo-Electric (IEPE) accelerometers and microphones to CR9000- or CR9000X-series dataloggers. Each CR9052IEPE includes six channels. Each channel has a BNC connector, an open circuit indicator LED, and a short circuit indicator LED which can indicate if the channel is over- or under-driven. Each channel has a built-in constant current source which is software programmable to 0, 2, 4, or 6 mA.

MEASUREMENTS:

- VoltFilt
- FFTFilt



FIGURE OV1-8. CR9052IEPE

CR9058E Isolation Module

The CR9058E is a 10 channel, differential input isolation module. Each channel has a 24 bit A/D converter which supplies input isolation for up to ± 60 V continuous common mode voltage conditions. The full scale ranges available are ± 60 V, ± 20 V, and ± 2 V with a resolution to 2 μ Volts. Due to its superb signal to noise ratio, and good resolution, an accurate thermocouple measurement can be made on the 2 Volt range code. An on-board programmable DSP provides digital filtering.

MEASUREMENTS:

VoltDiff
TCDiff

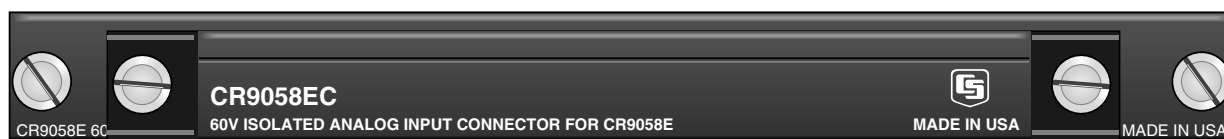


FIGURE OV1-9. CR9058

CR9055 50-Volt Analog Input Module

The CR9055 50-Volt Analog Input Module has 14 differential or 28 single-ended inputs for measuring voltages up to ± 50 V. Resolution on the most sensitive range is 16 μ V. The CR9055 has a common mode range of ± 50 V.

MEASUREMENTS:

Voltage
Differential Voltage (VoltDiff)
Single-Ended Voltage (VoltSE)

Normally thermocouple measurements would be made on the CR9050 Analog Input Module (± 5 Volt) because of its greater resolution, however they can be made on the CR9055 if the ± 50 V common mode range is necessary.

Thermocouple, Differential Voltage (TCDiff)
Thermocouple, Single-Ended Voltage (TCDiff)

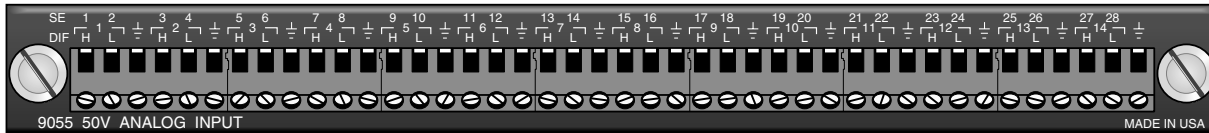


FIGURE OV1-10. CR9055

CR9060 Excitation Module

The CR9060 Excitation Module has six continuous analog outputs with individual digital-to-analog converters for PID Algorithm, waveform generation, and excitation for bridge measurements. Ten switched excitation channels provide precision voltages for bridge measurements. Each analog output will provide up to 50 mA between ± 5 V. Also includes eight digital control outputs (0 V low, 5 V high).

MEASUREMENTS:

Excite
PortSet

Full Bridge (BrFull)
6 Wire Full Bridge (BrFull6w)
Half Bridge (BrHalf)
3 Wire Half Bridge (BrHalf3W)
4 Wire Half Bridge (BrHalf4W)

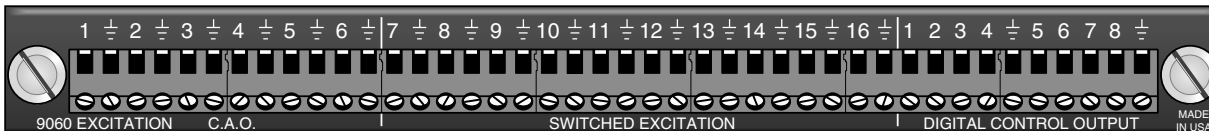


FIGURE OV1-11. CR9060

CR9070 Counter - Timer / Digital I/O Module — Obsolete

Features 12 channels capable of high-level (5 V square wave) pulse counting at frequencies up to 5 MHz. Four channels can also count switch closures; the other eight can count low-level A/C signals. In addition, there are 16 independent digital I/O channels for digital control, communications, and triggering.

MEASUREMENTS:

Count Pulses or frequency (PulseCount)
Read state of I/O Channels (ReadI/O)
Write to I/O Channels (WriteI/O)

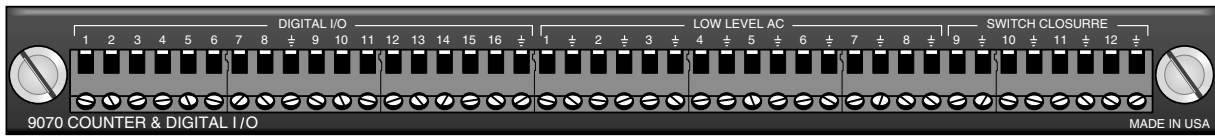


FIGURE OV1-12. CR9070

CR9071E Counter and Digital I/O Module

Features 12 channels capable of high-level (5 V square wave) pulse counting at frequencies up to 1 MHz. The pulse channels can also do interval timing measurements with 40 ns resolution. Four channels can also count switch closures; the other eight can count low-level A/C signals. In addition, there are 16 independent digital I/O channels for digital control, communications, and triggering.

MEASUREMENTS:

- Count Pulses or frequency (PulseCount)
- Read state of I/O Channels (ReadI/O)
- Write to I/O Channels (WriteI/O)
- Interval and Timing Measurements (TimerI/O)



FIGURE OV1-13. CR9071E

Data Storage Peripheral and Memory Module

Contains slots for two type I/II PCMCIA cards or one type III PCMCIA card. A 9-pin serial I/O port supports CSI peripherals. The LEDs indicate the status of the cards in slots A and B. **Not lit:** no card detected, **green:** present and correctly formatted, **red:** present but corrupt or unrecognized, **orange:** accessing the card. Press the button next to the status LED to power down a card before removing it. The LED will blink green several times then go out for ten seconds. Remove the card while the LED is not lit. 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 power (CR9011 Module) while the cards are present and active.

MEASUREMENTS:

- Output data to PAM (PAMOut)
- DSP4 Display (DSP4)
- CSAT3 Sonic Anemometer (CSAT)

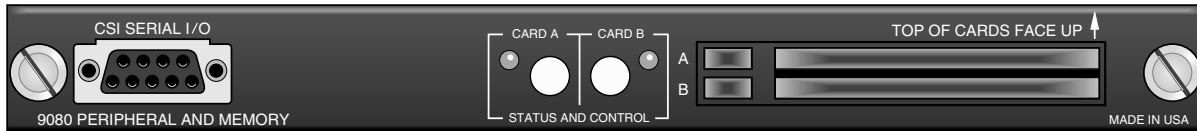


FIGURE OV1-14. CR9080

OV1.3 Communication Interfaces

TL925 RS232-TLINK Interface

The TL925 CR9000 to Computer Interface converts RS232 signals from the computer into a transputer link for the CR9000. The TLINK cable can be up to 30 meters long.

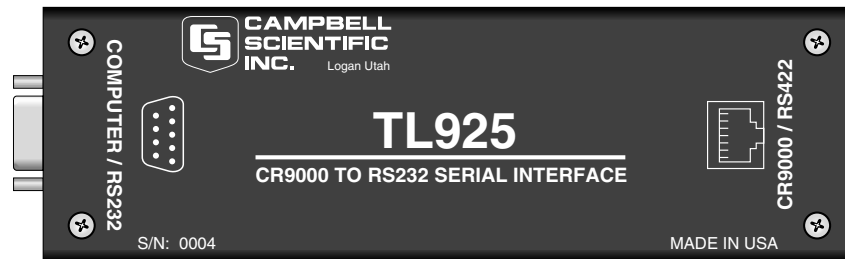


FIGURE OV1-15. TL925

BLC100 Bus Link Card and Fiber Optic Link Interface — Obsolete

The BLC100 is an interface board that plugs into a half-length card slot (AT bus) in the user's computer. It can be used for either TLINK (8 wire, up to 30 meters) or for fiber optic (separate transmit and receive) communications. Communication rates up to 10 MBPS can be attained.

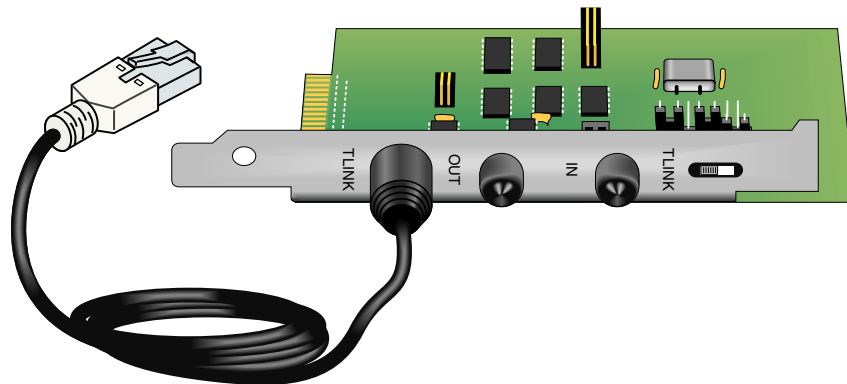


FIGURE OV1-16. BLC100 Bus Link Card

PLA100-L Parallel Link Interface

The PLA100-L converts a parallel port on a computer to a TLINK for communication with the CR9000.

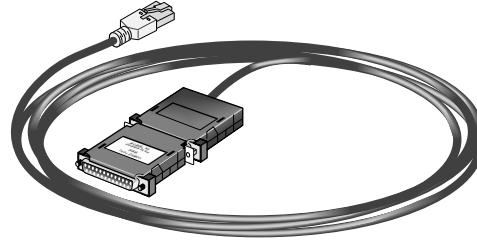


FIGURE OV1-17. PLA100-L Parallel Link Interface

OV2. Memory and Programming Concepts

OV2.1 Memory

The CR9031 CPU Module in the CR9000 base system has 2MB static RAM and 2MB Flash EEPROM. The static RAM allows fast read write cycles (150 ns). The Flash EEPROM is much slower to write to (15 μ s *minimum*) but it retains its information when power is shut off. The operating system and user program listing(s) are stored in the flash EEPROM. When the CR9000 is powered up, the operating system and the compiled program are loaded into RAM. 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 with the 9080 PAM Module.

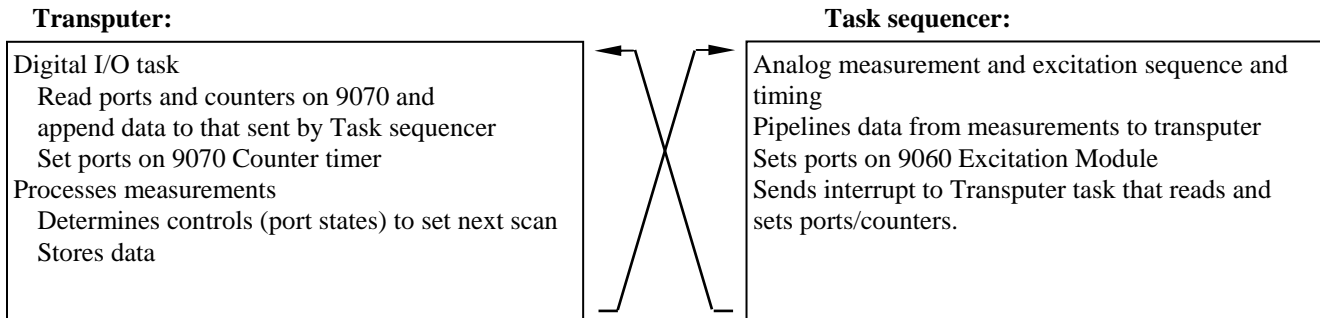
OV2.2 Measurements, Processing, Data Storage

The CR9000 divides datalogging and control between two entities. The **task sequencer** manipulates the measurement and control hardware on a rigidly timed sequence. The main processor, an Inmos T805 **Transputer**, processes and stores the resulting measurements and makes the decisions to actuate controls.

The **Transputer** is a 32-bit processor that has parallel processing capabilities. Four communication links allow rapid transfer of data with little processor time. One link is used to transfer data to and from intelligent modules in the CR9000 (e.g., the PAM module). One link is used for TLINK communications and another for the fiber optic link. The forth link gives the task sequencer direct memory access (DMA) to store raw Analog to Digital Converter (ADC) data directly into transputer memory. As soon as the data from a scan is in memory, the transputer starts processing it. There are two buffers allocated for this raw ADC data, thus the transputer can be busy full time processing one scan of data while the task sequencer is filling the other.

The transputer directly controls the 9070/CR9071E Counter and Digital I/O Module.

The **task sequencer** is a combination of components that include memory, a Xilinx Programmable Gate Array (i.e., a CSI customized chip), and the digital bus. When a program is compiled by the transputer, it loads the task sequencer memory with a series of instructions that define the sequence and timing of the measurements. This control includes channel and gain switching and ADC control that is done in our other dataloggers by the CPU. When the program runs, the task sequencer steps through the instructions at a precise rate, ensuring that the measurement timing is exact and invariant.



OV2.3 Data Tables

The CR9000 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

TOA4 TIMESTAMP TS	StnName RECORD RN	Temp RefTemp_Avg DegC Avg	TC_Avg(1) DegC Avg	TC_Avg(2) DegC Avg	TC_Avg(3) degC Avg	TC_Avg(4) degC Avg	TC_Avg(5) degC Avg	TC_Avg(6) degC Avg
1995-02-16 15:15:04.61	278822	31.08	24.23	25.12	26.8	24.14	24.47	23.76
1995-02-16 15:15:04.62	278823	31.07	24.23	25.13	26.82	24.15	24.45	23.8
1995-02-16 15:15:04.63	278824	31.07	24.2	25.09	26.8	24.11	24.45	23.75
1995-02-16 15:15:04.64	278825	31.07	24.21	25.1	26.77	24.13	24.39	23.76

OV3. PC9000 Application Software

PC9000 is a Windows™ application for use with the CR9000. The software supports CR9000 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 recommended:

- IBM PC, Portable or Desktop
- 64 Meg of Ram
- VGA Monitor
- Windows 2000, Windows XP, Windows NT, or Windows 4.0
- 60 Meg of Hard Drive Space for software
- 400 Meg of Hard Drive Space for data
- Parallel port and a PLA100-L, RS232 Serial Port and TL925, or BLC100 Bus Link Card

The following computer resources are recommended:

- 128 Meg of Ram
- 233 MHz 486 or faster
- Mouse

OV3.2 PC9000 Installation

To install the PC9000 Software:

- Start Microsoft Windows 2000, NT, or XP
- Insert diskette 1 (marked 1 of 2) in a disk drive.
- From the Program Manager, select **F**ile menu and choose **R**un
- Type (disk drive):\setup and press Enter e.g. a:\setup<Enter>
- The setup routine will prompt for disk 2.

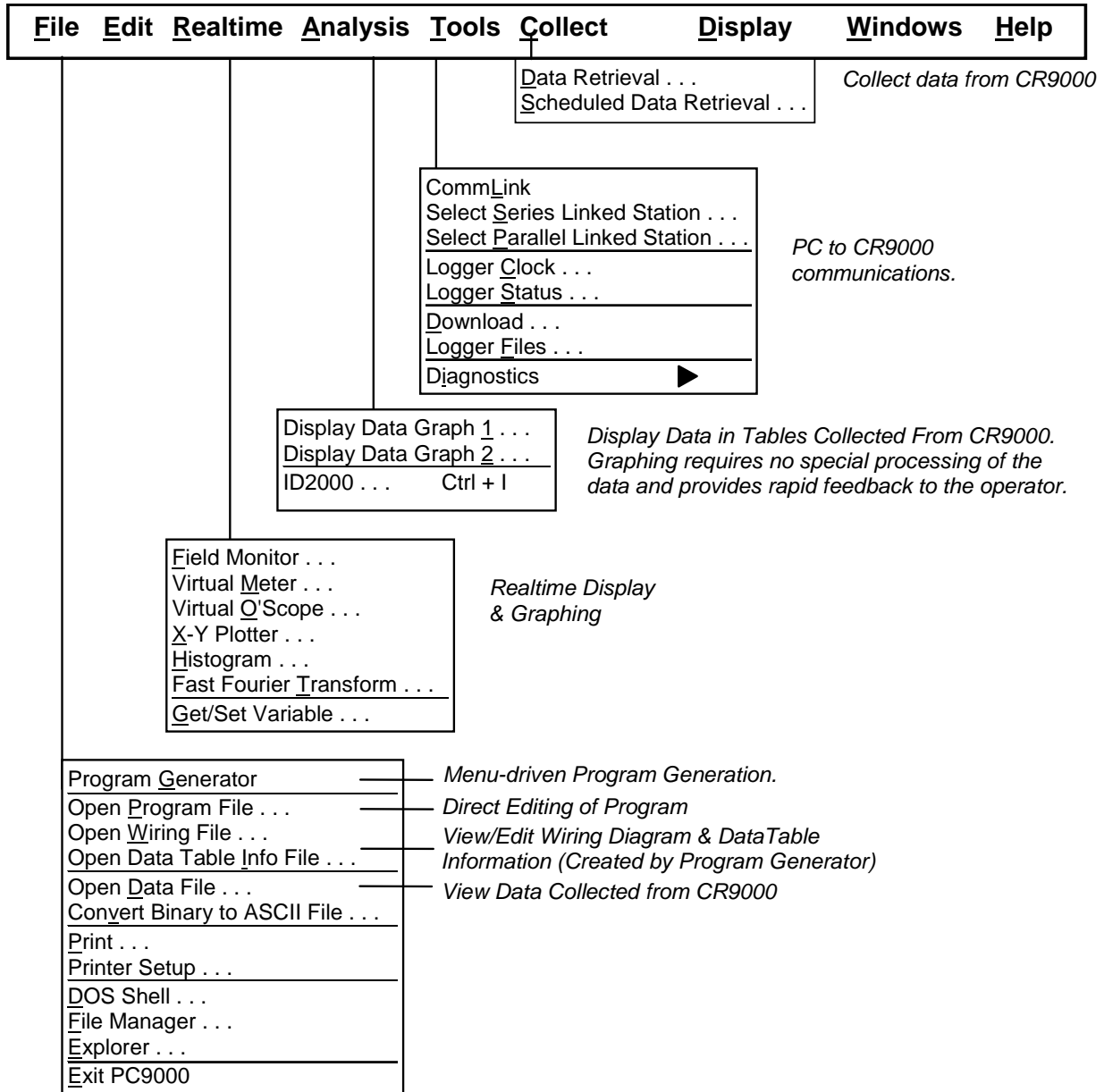
You may use the default directory of PC9000 or install the software in a different directory. The directory will be created for you.

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

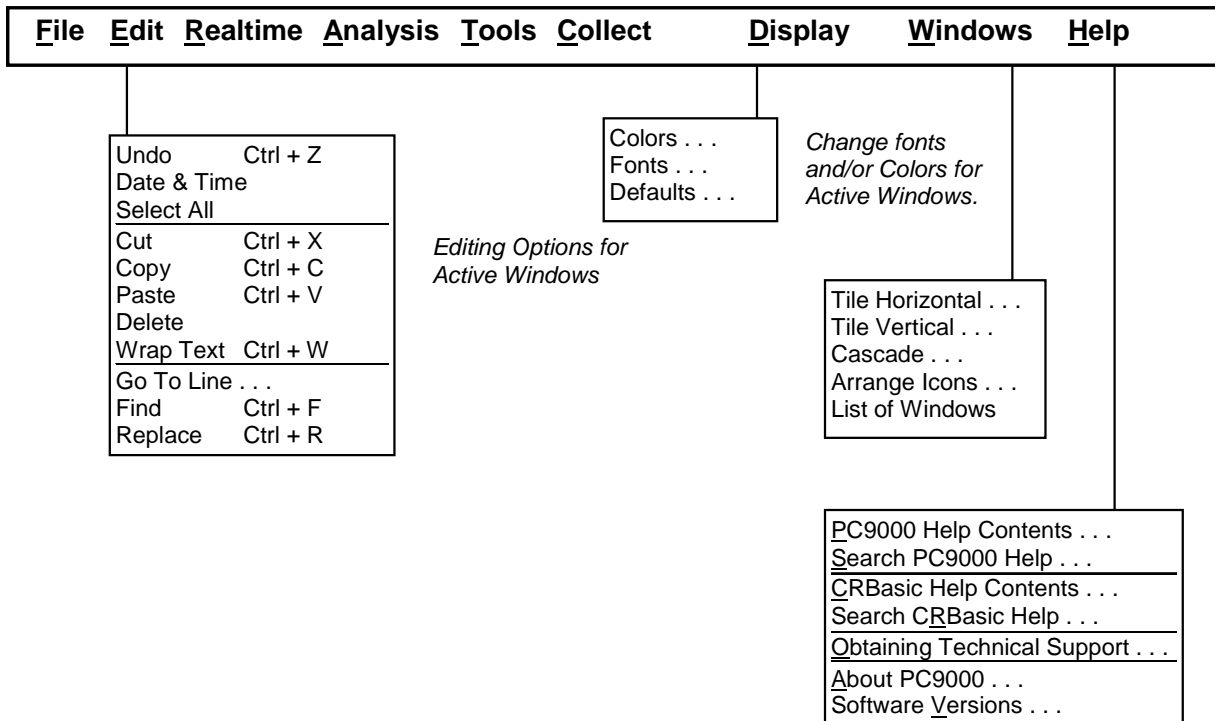
OV3.3 PC9000 Software Overview

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. Install PC9000 to get the details. A CR9000 is not necessary to try out the programming and real time display options; the demo uses canned data for viewing. Without a CR9000, 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).



OV3-1. PC9000 Primary Functions



OV3-2. PC9000 Editing, Help, and User Preferences

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 CR9000 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 CR9000. Provides context-sensitive help for the CR9000's BASIC-like language.

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.

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.

TOOLS

Control and Communications

Supports PC to CR9000 communications: clock read/set, status read, program download, and program retrieval.

COLLECT

Collect data from CR9000 data tables

DISPLAY

Configure the font and color scheme in an active window.

WINDOWS

Size and arrange windows.

HELP

On-line help for PC9000 software.

OV4. Specifications

General CR9000 & CR9000C Specifications

Electrical specifications are valid over a -25° to +50°C range unless otherwise specified; testing over -40° to +70°C available as an option, excluding batteries. Non-condensing environment is required. To maintain specifications, Campbell Scientific recommends recalibrating dataloggers every two years.

<p>9031 CPU MODULE</p> <p>PROCESSORS: Main CPU is 32-bit with on-chip floating point unit. Measurements, timing, and setup done by hardware task sequencer with DMA type transfer to CPU memory.</p> <p>MEMORY: 2 MB Flash EEPROM, 2 MB Static RAM</p> <p>9011 POWER SUPPLY MODULE</p> <p>VOLTAGE: 9.6 to 18 Vdc</p> <p>TYPICAL CURRENT DRAIN: Base system with no modules is 500 mA active 300 mA standby. Current drain of individual I/O modules varies. Refer to specifications for each I/O module for specific values. Power supply module can place the system in standby mode by shutting off power to the rest of the modules.</p> <p>DC CHARGING: 9.6 to 18 Vdc input charges internal batteries at up to 2 A rate. Charging circuit includes temperature compensation.</p> <p>INTERNAL BATTERIES: Sealed rechargeable with 14 Ah (7 Ah for the CR9000C) capacity per charge.</p> <p>EXTERNAL BATTERIES: External 12 V batteries can be connected.</p> <p>9041 A/D and AMPLIFIER MODULE</p> <p>A/D Conversions: 16-bit, 100 kHz</p>	<p>PC9000(C) INTERFACES</p> <p>PLA100</p> <p>TYPICAL CURRENT DRAIN: 50 mA, supplied by the CR9000(C)</p> <p>SIZE (excluding cables): 2.25" x 0.5" x 4.0" (5.7 x 1.3 x 10.2 cm)</p> <p>CABLE LENGTH: Specified, in feet, by the user, 50 ft maximum length</p> <p>WEIGHT: 2.5 lb (0.11 kg)</p> <p>TL925</p> <p>TYPICAL CURRENT DRAIN: 50 mA, supplied by the CR9000(C)</p> <p>BAUD RATE: 300 lps to 115.2 kbps with auto baud detection.</p> <p>SIZE: 2.1" x 1.0" x 6.8" (5.3 x 2.5 x 17.3 cm)</p> <p>WEIGHT: 2.5 lb (0.11 kg)</p> <p>TRANSIENT PROTECTION</p> <p>All analog and digital inputs and outputs use gas discharge tubes and transient filters to protect against high-voltage transients. Digital I/Os also have over-voltage protection clamping.</p>	<p>PHYSICAL SPECIFICATIONS</p> <p>Size</p> <p>Lab Enclosure: 15.75"L x 9.75"W x 8"D (40 x 24.8 x 20.3 cm)</p> <p>Fiberglass Enclosure: 18"L x 13.5"W x 9"D (45.7 x 34.3 x 22.9 cm)</p> <p>CR9000C: 10"L x 11"W x 9"D (25.4 x 27.9 x 22.9 cm)</p> <p>Weight</p> <p>Lab Enclosure: 30 lbs including modules (13.6 kg)</p> <p>Fiberglass Enclosure: 42 lbs including modules (19.1 kg)</p> <p>CR9000C: 27 lbs including modules (12.3 kg)</p> <p>Replacement Batteries: 6.4 lbs (2.9 kg)</p> <p>Additional Modules: 1 lb each (0.5 kg)</p> <p>WARRANTY</p> <p>Three years against defects in materials and workmanship.</p> <div style="border: 1px solid black; padding: 5px; margin-top: 10px;"> <p>We recommend that you confirm system configuration and critical specifications with Campbell Scientific before purchase.</p> </div>
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CR9000 & CR9000C I/O Module Specifications

CR9050(E) and CR9051E ANALOG INPUT MODULE with RTD

INPUT CHANNELS PER MODULE: 14 differential or 28 single-ended.

RANGE AND RESOLUTION:

Input Range (mV)	Resolution (1 A/D count) (µV)	Input Noise (µV RMS)	Max Sample Rates (k/s)
±5000	158.0	105	100
±1000	32.0	35	100
±200	6.3	7	50
±50	1.6	4	50

Input Range (mV)	Input Noise CR9050 (E) (µV RMS)	CR9051E (µV RMS)
±5000	105	130
±1000	35	35
±200	7	7
±50	4	4

Note: Measurement averaging provides lower noise and better resolution.

ACCURACY OF VOLTAGE MEASUREMENTS:

Single-Ended & Differential:

±(0.07% of reading + 4 A/D counts) -25° to +50°C
±(0.14% of reading + 4 A/D counts) -40° to +70°C

Dual Differential:

(two measurements with input polarity reversed)
±(0.07% of reading + 1 A/D count) -25° to +50°C
±(0.14% of reading + 1 A/D count) -40° to +70°C

COMMON MODE REJECTION: ±5 V

DC COMMON MODE REJECTION: >120 dB

INPUT RESISTANCE: 2.5 gigohms typical

MAXIMUM INPUT VOLTAGE WITHOUT DAMAGE: ±20 V CR9050(E), -40 to +50 V CR9051E

TYPICAL CURRENT DRAIN: 25 mA active

Resistance & Conductivity Measurements (Also requires 9060 Excitation Module)

ACCURACY: ±(0.04% of reading + 2 A/D counts) limited by accuracy of external bridge resistors.

MEASUREMENT TYPES: 6-wire and 4-wire full bridge, 4-wire, 3-wire, and 2-wire half bridge. Uses excitation reversal to remove thermal EMF errors.

CR9052 ANTI-ALIAS FILTER MODULE

INPUT CHANNELS PER MODULE: six differential

CONTINUOUS EXCITATION CHANNELS PER MODULE: 12 (6 current, 6 voltage)

TYPICAL CURRENT DRAIN: $400 \text{ mA} + 1.5 \cdot [I_{ex}]$ where I_{ex} is the sum of excitation currents provided by all channels.

Refer to the CR9052 product literature for a complete listing of specifications.

CR9055(E) 50 V-ANALOG INPUT MODULE

INPUT MODULE

INPUT CHANNELS PER MODULE: 14 differential or 28 single-ended.

RANGE AND RESOLUTION:

Input Range (V)	Resolution (1 A/D count) (µV)	Input Noise (µV RMS)	Max Sample Rates (k/s)
±50	1580	1050	100
±10	320	350	100
±2	63	85	50
±0.5	16	60	50

Note: Measurement averaging provides lower noise and better resolution.

ACCURACY OF VOLTAGE MEASUREMENTS:

Single-Ended & Differential:

±(0.1% of reading + 4 A/D counts) -25° to +50°C
±(0.2% of reading + 4 A/D counts) -40° to +70°C

Dual Differential:

(two measurements with input polarity reversed)
±(0.1% of reading + 1 A/D count) -25° to +50°C
±(0.2% of reading + 1 A/D counts) -40° to +70°C

COMMON MODE RANGE: ±50 V

DC COMMON MODE REJECTION: >62 dB

INPUT RESISTANCE: 100 Kohms typical

MAXIMUM INPUT VOLTAGE WITHOUT DAMAGE: ±150 V

TYPICAL CURRENT DRAIN: 15 mA active

CR9058E ISOLATION MODULE

INPUT CHANNELS PER MODULE: 10 isolated, differential; each channel has its own isolation ground for shielded cable connection.

RANGE, RESOLUTION, AND INPUT RESISTANCE:

Input Range (Vdc)	Resolution w/o Averaging (µV)	Resolution w/ Averaging (µV)	Input Resistance (Kohms)
±2	±10	±2	10,000
±20	±100	±20	88.9
±60	±300	±60	269

ACCURACY: ±0.02% of Full Scale Range over -40° to +70°C

MINIMUM SCAN TIME PER MODULE:

Voldiff: 1285 µs (778 samples per second) + integration time for no input reversal (RevDiff=0); or 2990 µs (334 samples per second) + integration time with input reversal (RevDiff=1)

TDiff (range parameter set to V2C): 2570 µs (389 samples per second) + integration time for no input reversal (RevDiff=0); or 4275 µs (233 samples per second) + integration time with input reversal (RevDiff=1).

MAXIMUM CONTINUOUS VOLTAGE W/O DAMAGE:

Input Range (Vdc)	H or L to ISO Ground (Vdc)	H or L to System Ground (Vdc)	ISO Ground to System Ground (Vdc)
±2	±208	±109	±360
±20	±223	±121	±360
±60	±448	±233	±360

MAXIMUM ESD VOLTAGE ON INPUTS: ±5000V

CR9060 EXCITATION MODULE

TYPICAL CURRENT DRAIN:

108 mA quiescent, 125 mA active

Analog Outputs

ANALOG OUTPUTS PER MODULE:

10 switched, 6 continuous

SWITCHED: Provides excitation for resistance measurements. Only one output can be active at a time.

CONTINUOUS: All outputs can be active simultaneously.

RANGE: ±5 V

ACCURACY: ±(0.2% of output ±4 mV)

RESOLUTION: 12-bit A/D (2.4 mV)

OUTPUT CURRENT: ±50 mA

Digital Control Outputs

CONTROL CHANNELS PER MODULE: 8

OUTPUT VOLTAGES (no load):

High: 5.0 V ±0.2 V

Low: < 0.2 V

OUTPUT RESISTANCE: 100 ohms

CR9071E COUNTER & DIGITAL I/O MODULE

Counter Channels

COUNTER CHANNELS PER MODULE: 12

MAXIMUM COUNTS PER INTERVAL: 2^{32} Maximum counts per interval should never be reached because with a maximum input frequency of 1 MHz, the 32-bit counter will go 71.58 minutes before it rolls over. The maximum CR9000 scan rate is 1 minute.

SWITCH CLOSURE MODE (4 channels)

Minimum switch closed time: 5 ms

Minimum switch open time: 6 ms

Maximum bounce time: 1 ms open without being counted

HIGH FREQUENCY MODE (all channels)

Minimum pulse width: 500 ns

Maximum input frequency: 1 MHz

Thresholds: Pulse counted on transition from

below 1.5 V to above 3.5 V

Maximum input voltage: ±20 V

LOW LEVEL AC MODE (8 channels)

Input hysteresis: 10 mV

Minimum ac voltage: 25 mV RMS

Maximum input voltage: ±20 V

Frequency range:

(mV RMS)	RANGE (Hz)
25 mV	1 to 10,000
≥50 mV	0.5 to 20,000

Digital Inputs/Outputs

I/O CHANNELS PER MODULE: 16

OUTPUT VOLTAGES (no load)

High: 5.0 V ±0.2 V

Low: < 0.2 V

OUTPUT RESISTANCE: 320 ohms

Input State

High: 3.5 to 5 V

Low: -0.5 to 1.2 V

Input Resistance: 100 Kohms

Interval Measurement

IO CHANNELS:

Resolution is the scan rate

PULSE CHANNELS

Maximum interval: 1 minute

Resolution: ±40 ns

CR9080 PCMCIA and MEMORY MODULE

PCMCIA CARD INTERFACE: Accepts two Type I/II, or one Type III SRAM or ATA Flash Memory Cards.

SERIAL I/O: Allows serial communications with CSI peripherals at up to 115,200 bps.

TYPICAL CURRENT DRAIN: 300 mA active

We recommend that you confirm system configuration and critical specifications with Campbell Scientific before purchase.



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