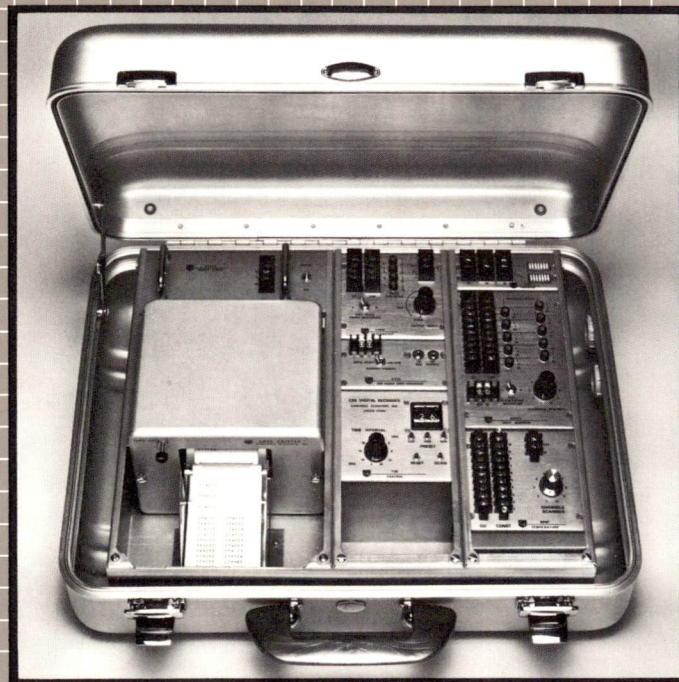


CR5 DIGITAL RECORDER AND ACCESSORIES



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CR5 DIGITAL RECORDER

Use the CR5 Digital Recorder to record:

- TEMPERATURES
- WIND
- HUMIDITY
- WATER CONDUCTIVITY
- SOIL MOISTURE & SALINITY
- AIR & WATER QUALITY
- STRAIN GAGE OUTPUTS
- SOLAR RADIATION
- FLUID FLOW RATES
- PRECIPITATION
- HEAT FLUX
- EVENT COUNTS

The CR5 Digital Recorder has wide applications capability both in research and in industry. Modular flexibility allows users to configure systems to their application. The overall data acquisition system is unique in its portability, capability, and computer compatibility.



A few CR5 features:

- **EXTREMELY LOW POWER DRAIN:** Typically 4-6 months operation on 8 alkaline "D" cells.
- **COMPLETELY PORTABLE:** 16" x 14" x 6" available in lightweight aluminum carrying case—weight typically 30 lbs.
- **PROTECTED INPUTS:** Spark gaps on all inputs to protect internal circuitry from lightning induced transients.
- **COMPUTER COMPATIBILITY:** In addition to printing the data, modules are available for formatting data on audio cassette tapes, for telecommunications, or for direct computer connection.
- **STABLE AMPLIFIERS:** Most of the amplifiers in the CR5 are fully differential and chopper stabilized, providing high signal to noise ratios.
- **AUTOMATIC TIME SCALING:** Integrators in the CR5 give a true time average of the input data without recalibration when the scan interval is changed.
- **WIDE RANGE OF INPUT MODULES:** Multiple channel scanners, integrators and pulse counters provide a wide range of input capabilities (see the following modules section for details). Most transducers are connected directly to CR5 input modules without any external signal conditioning.
- **FLEXIBILITY:** It takes only a matter of seconds to change input modules for different applications.
- **EXPANDABILITY:** The number of input channels is limited only by the space available in the mainframe. A second mainframe can be added with an extender cable.
- **OPERATING ENVIRONMENT:** -25°C to +50°C, 0 to 95% relative humidity (non-condensing).

Some Typical Applications:

The CR5 is being used to monitor wind, temper-

atures, solar radiation and other micrometeorological parameters which affect plant growth, crop yields, energy availability, etc. Battery operation, field portability and integrating capability are attractive features for users.

Other applications for the CR5 Digital Recorder include data acquisition in these areas:

- Vehicle endurance runs
- Farm machinery testing
- Insulation evaluation
- Electrical generating facility site selection
- Strip mine and mine tailings erosion studies
- Irrigation scheduling
- Forest climatology
- Air pollution monitoring
- Fresh produce transport and storage conditions
- Biological process examination
- Livestock feed preservation work
- Water quality monitoring



Mainframe

The CR5 Digital Recorder Mainframe includes:

- Aluminum Chassis
- Printer
- Power Supply
- T102 Control Module

Beyond this, the user chooses the enclosure and modules which will perform the desired data logging and control tasks.

CR53 Printer.

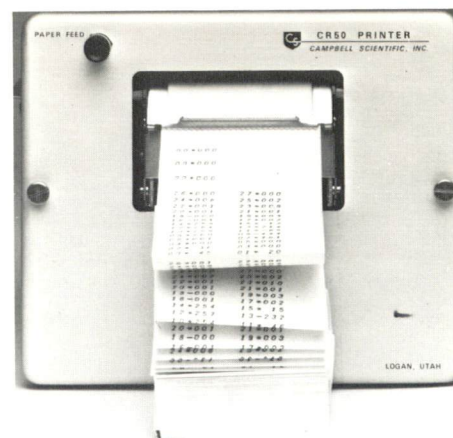
The CR53 printer by Campbell Scientific is used as the primary recording device for the CR5 Digital Recorder. It prints information from each channel as it is scanned, with the data being displayed in a double column format as shown below.

Minutes	Day	
04 * 250	05 * 249	
02 * 50	03 * 001	
00 * 23	01 * 16	Hour
12 - 037	13 - 038	
10 * 253	11 - 036	
08 * 253	09 * 251	Polarity
06 * 253	07 * 253	
04 * 253	05 * 252	
02 * 45	03 * 001	
00 * 23	01 * 16	
12 - 036	13 - 037	
Channel ID	One channel of information	

A CR5 system can operate independently from the printer if data is being recorded on another medium.

Specifications

Printhead: Seiko 18 column
 Data Format: 2 channels per line (2 digit channel ID, 1 sign, and 3 digit data)
 Print Rate: 100 channels per minute
 Paper: 2 1/4" wide x 3 1/2" fanfold
 Data Points Per Standard Paper Pak: Approximately 7000
 Current Drain:
 —Standby: .35 ma
 —Starting: 500 ma
 —Running: 50 ma
 —Printing: 100 ma
 Connector to Mainframe: card edge connector on the lower rear of the printer case
 Controls: Fast paper feed



Description T102 Control Module

The T102 Control Module provides time keeping, scan control, and time logging functions for the CR5 Digital Recorder. An internal crystal controlled clock provides the time base for the entire system. The actual figures for days, hours, and minutes are preset into the memory of the T102, and updated in real time by the clock. At each scan, days, hours, and minutes are printed in channels 00, 01, and 02.

A control knob on the panel allows selection of scan intervals from 5 minutes to 24 hours. Shorter scan intervals are available using the RT101 Rapid Scan Module. The panel reset button initiates a scan, and simultaneously starts timing the scan interval as selected. The scan button merely initiates a scan, but does not reset the scan interval timer.

Specifications

Module Length: 2.7"

Time Intervals Between Scans: Selectable; 5, 10, 15, 30 and 60 minutes and 2, 3, 6, 12, and 24 hours. Others available using the RT101 Rapid Scan Module

Scan Rate: 100 channels per minute

Controls: Preset buttons and thumbwheel switches for day, hour, and minute. Scan interval select switch, reset button, scan button.



CR503 Power Supply

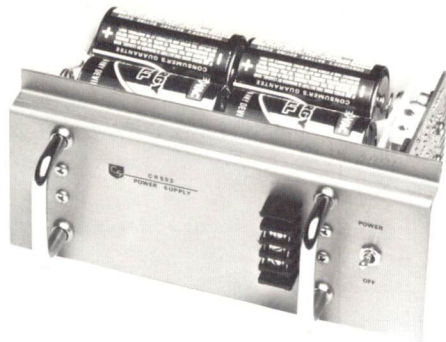
The CR503 Power Supply for the CR5 Digital Recorder consists of 8 "D" cells, typically alkaline, and a regulator which supplies +5 volts, -5 volts, and +12 volts to the data logger. Terminals are located on the panel for checking system power drain and battery voltage using a standard volt meter.

Specifications

+5 Volt Supply: Regulated to +5V ± 5mv; 25 ma maximum current drain
 -5 Volt Supply: Regulated to -5V ± 5mv; 15 ma maximum current drain
 +12 Volt Supply: Unregulated battery voltage
 Battery Life: 7 ampere-hours or about 80,000 data points
 Controls: Power switch

Auxiliary Connections:

- V—battery voltage measurements and external power connection
- I—system current drain measurement
- ⊕—system and case ground



CR503L Lead Acid Power Supply

The CR503L can be used in a CR5 in place of the CR503 in applications where AC line operation with battery backup is desired. There is approximately 2 amp hours of life in a charge, and in a typical application one could expect 15 to 20 days of operation without AC power on a single charge. CSI does not warrant the battery in the CR503L. Permanent damage to the battery can result if it is left in a deep discharge state for an extended period of time.

CR5MF Chassis Specifications

Mounting: 4- #10 machine screws through chassis base

Size: 12½" front to back, 15" wide, 5¾" high (includes printer)

Weight: typically 30 lbs. when full of modules
Maximum Sum of Module Lengths Per Row: 10.8"

CR5MFL Chassis Specifications

Mounting: 4- #10 machine screws

Size: 17" front to back, 15" wide, 5¾" high

Weight: Typically 50 lbs. when full of modules
Maximum Sum of Module Lengths Per Row: 15.6"

CR5RT Roll Paper Take-Up for CR5

The CR5RT can be purchased as a kit for installation in an existing CR5 system, or it can be purchased at the same time as a system and installed at the factory. The roll take-up is compatible only with the model CR53 Printer. The kit consists of a bracket and jack for motor plug-in, which mounts in the printer, and the motor and spool assembly, which fastens to the mainframe. While fanfold paper, standard on the CR5, facilitates field inspection of data, it is not as reliable when left unattended. It is recommended that the CR5RT be used when unattended operation with a printed record for backup is desired. One standard 2¼ inch wide by 3 inch diameter roll has a capacity of about 21,000 data points, or 3 times the capacity of one pack of fanfold paper.

Enclosures

Enclosures are available from CSI to house the CR5 mainframe. For a standard size mainframe of 10.8" of modules per row, a heavy duty steel case (ENC-S) is available for rugged field operations, or a lightweight aluminum carrying case (ENC-A) for highly mobile operations. For the large mainframe with a capacity of 15.6" of modules per row, a large fiberglass enclosure (ENC FL) is available.

A101MV 1 Channel Millivolt Integrator

Description

The A101MV one channel millivolt integrating module provides the capability to continuously average millivolt signals with full scale ranges from 800 microvolts to 100 millivolts. Controls on the panel provide for adjustment of range and zero offset. Panel test terminals allow the user to externally monitor the amplified input signal with a standard volt meter. The A101MV amplifies the input signal and passes it to an internal voltage controlled oscillator. From this, counts are accumulated. Then at scan time, the accumulation is time scaled and recorded as a true time average.

Features

- Continuous adjustment of range and offset
- Continuous signal averaging
- Differential inputs, chopper stabilized

Applications

- Net radiometers
- Solar energy measurement using thermopile or silicon cell sensors
- Heat flux plates
- Precision differential temperature measurement with a dual thermocouple

Specifications

Module Length: 1.6"

Input: millivolt signal from 800 μ v full scale to 100 mv full scale

Readout Units: Engineering units selected by the user

Accuracy: $\pm .2\%$ from 0°C to 40°C, $\pm .5\%$ from -25°C to +50°C.

Amplifier: Fully differential chopper stabilized with less than .1 microvolt drift per °C temperature changes

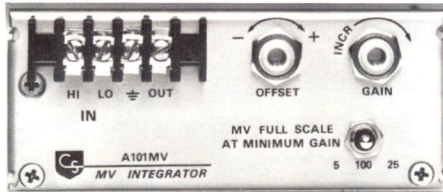
Input Current: Less than 10 nanoamps

Input Resistance: Greater than 50 megohms

Offset: Panel controls for \pm full scale

Common Mode Rejection: Greater than 130 db at 60 Hz

Common Mode Range: ± 2 volts



A104V 4 Channel Volt Range Integrator

Description

The A104V Volt Range Integrator is designed to give accurate continuous time averages of voltage signals in four different ranges. The unit provides linear amplification for four channels of input signals. A multiplexer takes a .3 second sample of the voltage from each channel every 2.4 seconds and accumulates the average to be printed out at scan time. A range select switch for each channel allows any one of three ranges to be used independently. In addition, a full scale range multiplier switch can be used to increase full scale on all channels by a factor of 10. Test terminals and an output select switch on the panel let the user check the amplified signal with a volt meter for set up and trouble shooting.

Features

- Continuous averaging of four volt / millivolt level signals
- Three calibration ranges selectable for each channel

- Full scale range multiplier for expanding range of all four channels

Applications

- Solar radiation measurements
- Wind run from DC anemometer
- Averaging of strain gage bridge outputs

Specifications

Module Length: 3.6"

Input: Millivolt signals from 10 mv full scale to 10 volts full scale

Readout Units: .001 times the selected full scale range

Accuracy: $\pm .2\%$ from 0°C to 40°C, $\pm .5\%$ from -25°C to 50°C ambient temperature range

Amplifier: Fully chopper stabilized with less than .1 microvolt drift per °C temperature change

Input Current: Less than 10 nanoamps

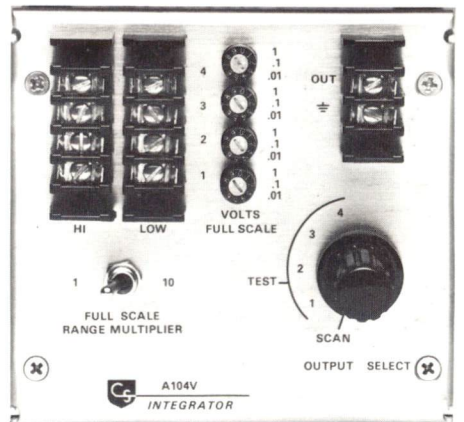
Input Resistance: 1 megohm to system ground from either input.

Ranges: 10, 100, and 1000 millivolts full scale, single polarity, selectable on each of the 4 channels. Full scale range multiplier of 10 can be switched for all 4 channels.

Offset: No offset is externally available on this module

Common Mode Rejection: Greater than 130 db at 60 Hz

Common Mode Range: ± 2 volts on low range, ± 20 volts mid range, and ± 100 volts on the high range



A104T 4 Channel Temperature Integrator

Description

The A104T Temperature Integrating Module provides for obtaining continuous time averages of temperature from copper-constantan thermocouples. All of the 4 channels are scanned every 2.4 seconds and the average temperature is accumulated and printed out at scan time.

A thermistor is located at the center of the input terminal strips to monitor the reference junction temperature. An aluminum cover is provided to help achieve temperature uniformity at these reference junctions.

An output select switch and terminals are provided to test individual thermocouple outputs. Test terminal voltages in millivolts represent temperatures directly in tenths of degrees. A toggle switch on the panel is used to select units of degrees Fahrenheit or Centigrade. Units of degrees Centigrade + 30 is also panel selectable to enable integration of negative temperatures.

Features

- Direct continuous averaging of four temperature channels
- Inexpensive thermocouple sensors
- Three selectable calibration ranges
- Linearized thermocouple amplifier

Applications

- Thermocouple integration

Specifications

Module Length: 3.6 inches.

Input: Copper-Constantan Thermocouples

Readout Units: Degrees Centigrade, Centigrade + 30, or Fahrenheit

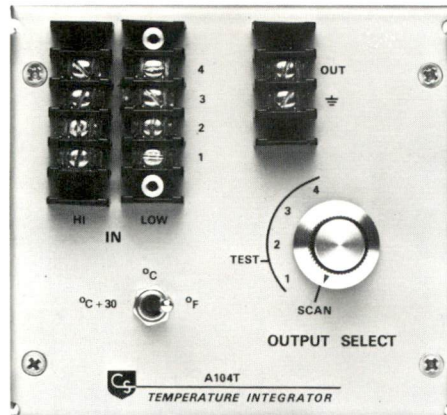
Reference Junction: Dual Thermistor, accurate to $\pm .3^{\circ}\text{C}$ from -25°C to $+50^{\circ}\text{C}$

Accuracy: Reference junction accuracy plus sensor error

Amplifier: Fully differential chopper stabilized.

Range: $0.0-99.9^{\circ}\text{F}$, $0.0-99.9^{\circ}\text{C}$, and $0.0-99.9 (^{\circ}\text{C} + 30.0)$ to integrate negative temperatures

Maximum Lead Length: Up to 1000 feet.



C101, C102, and C104 Pulse Counters

Description

These modules are available in single channel, dual-channel, and quad-channel varieties. A pulse divider switch on the panel can be set from 1 to 127 for each channel, allowing the scaling of input counts to some smaller number. This feature might be useful to calibrate a fluid flow meter output to read in gallons per minute, for example. Circuitry is included in the C-series modules to de-bounce switch closure. Standard components eliminate counts which occur faster than 500 Hz. Longer de-bounce time constants can be obtained by using a resistor-capacitor network on the inputs. Should shorter time constants be desired, two internal components on each channel can be changed for this. A hysteresis circuit is also included for help in counting noisy switch closures. Using the panel voltage source, the pulse amplitude must go above 2 volts, then below 1 volt before a count is logged.

Features

- User selectable divide factor for each channel
- Available in modules of 1, 2, or 4 channels
- Signal conditioning for noisy pulse sources or switch closures

Applications

- Switch closure type anemometers
- Tipping bucket rain gage
- Fluid flow from pulse type transducer
- Event logging

Specifications

Module Length: C101 and C102 are 1.6", C104 is 2.7"

Readout Units: Engineering units selected by the user

Accuracy: ± 1 recorded count

Frequency Range: 0 to 500 counts per second

Minimum Pulse Width: 1 millisecond

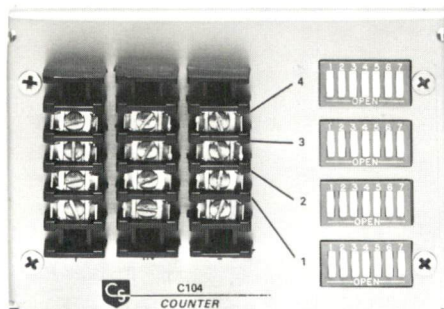
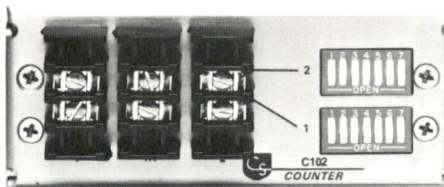
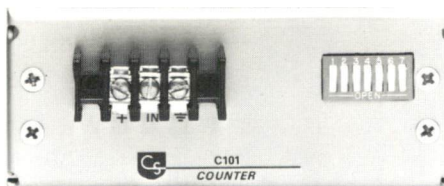
Minimum Pulse Height: From below 1 volt to above 2 volts

Maximum Pulse Height: For normal operation, the input can be between -5 and $+20$

Minimum Pulse Amplitude: 2.5 volts

Switch Closure Counting: The + connection ties the input to the +5 volt supply through a 5K resistor. When the switch closes, short-

ing the input to ground, the resistance to the + supply changes to about 1 megohm to limit the current drain.



CT101, CT102, and CT104 Pulse Counters

These modules are identical to the C101, C102, and C104 respectively except that they time scale the data. For example, 500 pulses into a C101 and a CT101 on a 5 minute scan interval will yield an output on the printer of 500 from both modules. On a 10 minute scan interval with the same input, the C101 will yield 500 counts out and the CT101 will yield 250 counts out. For a given application of counting pulses, the CT series module should be specified if it is anticipated that the total number of pulses to be counted in a time interval as selected on the T102 Control Module exceeds 127,000.

K18 Processor

Description

The K18 is a microprocessor based module programmed to manipulate incoming data from transducers before recording. A variety of standard and special signal conditioners and input/output modules are available for use with the K18.

This processor module and its associated input/output and modules fit into the CR5 Digital Recorder Mainframe in the same fashion as other standard modules. The K18 scans its inputs at 1.67 cycles per second. As the data is brought in, processing takes place. When the CR5 scans, this processed data is output to the CR5 data bus for recording.

Read only memories are programmed at the factory to handle the various data calculations which are user defined. Using a companion I/O module with the K18, the user can select from multiple data pre-processing routines stored in memory for various data logging applications.

Features

- Capable of scanning up to 5 dual channel signal conditioner modules
- Programmed data analysis before recording
- Multiple programmable outputs

Applications

- Strain gage signal analysis
- Direct evapotranspiration calculations
- One line heat flux calculations
- Wind data processing for integrated wind vectors, wind cubing, wind roses, etc.
- Maximum & minimum recording
- Limit checking, alarms, and controlling

Specifications

Module Length: 1.6"

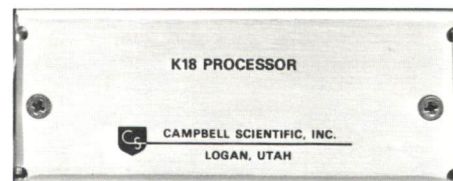
Inputs: From K18 I/O modules

Outputs: To CR5 data bus or digital through K18 I/O modules

Read Only Memory: Up to 1.5K Bytes depending on specific application

Random Access Memory: Up to 512 Bytes

Programs: Factory programmed to user specifications. Consult factory on programming fee.



K Series I/O Modules: (all 1.6")

KR102W Wind Sensor Translator

The KR102W is used with a high frequency tachometer type wind speed transmitter and a potentiometric or voltage output wind direction sensor. Excitation for the sensors is derived from another source, usually a P102 module. The wind speed signal is buffered through to a binary counter which is inputted and reset every .6 seconds by the K18 Processor. One wind direction sample is taken each .6 seconds along with the input of the wind speed. The standard software configuration is designed for a Climatronics Mark III wind set and will output a wind vector direction and magnitude and average wind speed in meters per second.

KR102V Voltage Signal Conditioner

This K series module has 2 inputs for analog voltages which it converts to frequency oscillations for processing by the K18. Each channel feeds into a separate differential amplifier and VCO. The output of the VCO's goes to a binary counter which is interrogated and reset at the K18 scan rate. Full scale voltage ranges are specified by the customer and are typically .1, 1, 5, or 10 volts. Applications include thermistor bridges, flow transducers, SO2 and NOX analyzers, and other voltage signals requiring special processing such as averaging, maximum values, minimum values, standard deviation, etc.

KRD16 Binary Input Module

The digital input modules KRD16 and KRD32 are designed to input binary information such as switch closures, BCD information, and other data represented by high and low states on multiple lines. The KRD16 has two banks of rocker DIP switches on its panel for inputting 16 different high or low states. In addition, up to 9 input terminals and a common can be installed on the panel to parallel the left 9 switches. The closed switch corresponds to the grounded state of an input terminal. When a panel switch is open, or the parallel input connector is left open, the input is pulled to plus 5 volts through a 1 megohm resistor. Common applications include K18 program control, state inputs of switches, and data entry (e.g. scaling factors) to the K18.

KRD32 Binary Input Module

The KRD32 is similar to the KRD16 in function. It handles 32 lines of binary information pre-

sented to the module through a 37 conductor socket type "D" connector on the panel. In order to input a high state into a line of the KRD32, that line must be pulled high by the input. If left open, it will be held low through a 1 megohm resistor. Instantaneous samples of the binary input configuration are taken by the K18 at its regular sampling rate. The state of lines between samples is insignificant. Applications include determining percentages of time that switches were closed.

KOD32 Binary Output Module

Parallel outputs from the K series modules can be done using the KOD32 module. At the K18 cycle rate of 100 per minute, the 32 lines of this module can be latched high or low according to the program in the K18 Processor. Common uses of this module include driving panel displays and controlling external devices.

P102 Bridge Power Supply

Description

The P102 Bridge Power Supply is a precision voltage source housed in a module to operate from the CR5 Digital Recorder Mainframe. It is designed specifically to provide signal conditioning for Wheatstone bridge applications such as those relating to strain gages, load cells, and thermistor networks. Two 10 turn potentiometers on the panel allow for adjustment of full scale range and zero offset. Through variations of the transducer connecting scheme, the P102 is capable of handling full or half bridge networks. A panel switch is provided to power down the P102 between scans for conserving power when in the battery operation mode. Readout of the P102 is accomplished by connecting the output to an adjacent volt range sampling or integrating module.

Features

- Precision power source and offset reference for Wheatstone bridge requirements
- Sources adjustable with precision 10 turn potentiometers
- Can be programmed to power up only at scan time

Applications

- Thermistor signal conditioners
- Strain gage bridges

Specifications

Module Length: 1.6"

Input: Strain gage or resistance

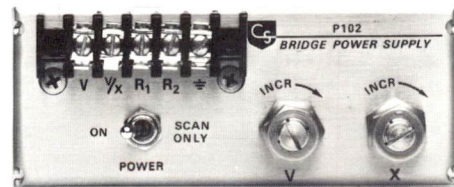
Output: Precision supply voltage and zero offset voltage

Units of Readout: Analog voltage dependent on sensor and panel control settings

Supply Voltage Range: 0-5 volts

Maximum Supply Current: 200 ma

Offset Voltage Range: 0 to 4 volts



S202R 2 Channel Bridge/Voltage Sampler

Description

The S202R is a 2 channel sampling module with the capability of supplying a regulated voltage to the sensors. Typically it is used to read out resistance and volt level transducers. Panel controls give the capability of setting the zero and range values as desired by the user.

The S202R also has the capability to power up sensors for scan only, thus prolonging battery life in remote operations.

Features

- Provides complete signal conditioning for resistance or voltage transducers
- Can be programmed to provide power to sensor only at scan time
- Dual polarity recording

Applications

- Relative humidity sensors
- Thermistor readout
- Barometric pressure sensors

Specifications

Module Length: 1.6"

Input: Resistance or voltage

Output: Precision voltage level to transducer if desired; 100 ma maximum current

Readout Units: Engineering units selected by the user

Accuracy: $\pm 2\%$ from 0°C to 40°C , $\pm 5\%$ from -25°C to 50°C

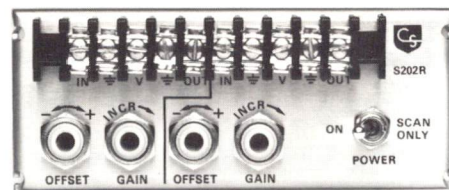
Amplifier: Differential

Input Current: Less than 50 nanoamps

Input Resistance: Over 1 megohm

Range: .1 to 5 volts full scale

Offset: \pm full scale



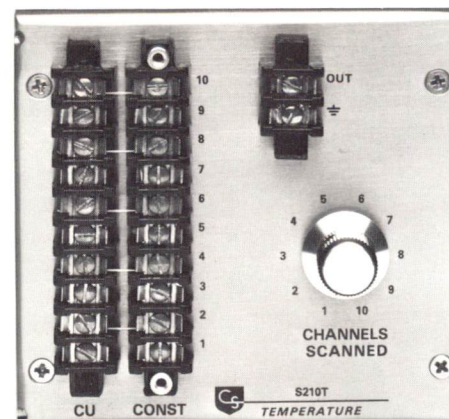
S210T 10 Channel Temperature Sampler

Description

The S210T is a 10 channel copper-constantan thermocouple scanning module. A select switch on the panel allows any number of thermocouples from 1 to 10 to be scanned by the system. This same rotary switch connects the selected channel to the amplifier test terminals on the panel during the time the CR5 is not scanning. A double thermistor reference junction located between the terminal strips provides the correct temperature compensation for the thermocouples. An aluminum cover is provided to achieve temperature uniformity across the terminal strip.

Features

- Scans up to 10 thermocouples
- Dual purpose switch limits number of channels scanned if less than 10 sensors are used and selects channel for continuous monitoring via the test terminals
- Uses inexpensive thermocouple sensors
- Dual polarity recording
- Linearized thermocouple recording



Applications

- Thermocouple sampling

Specifications

Module Length: 3.6"

Input: Copper-constantan thermocouple

Readout Units: Degrees centigrade

Reference Junction: Dual thermistor, accurate to $\pm .3^{\circ}\text{C}$ from -25°C to $+50^{\circ}\text{C}$

Accuracy: Reference junction accuracy plus sensor error

Amplifier: Fully differential and chopper stabilized with less than .1 microvolt drift per $^{\circ}\text{C}$ temperature change

Range: $\pm 99.9^{\circ}\text{C}$

Maximum Lead Length: Approximately 1000 feet



S210V 10 Channel Volt Range Sampler

Description

The S210V is a 10 channel volt range scanner for sampling up to 10 transducers. Panel switches allow full scale range selection from three ranges for each individual channel. A full scale range multiplier for all channels allows up to 10 volts on the inputs. The panel rotary switch has the dual function of specifying the total number of channels to be scanned on the module and selecting the channel to be amplified and connected to the output test terminals between scans.

In operation, the module controller connects each of the inputs in succession to the amplifier. A .3 second average of the amplified signal is transmitted to the CR5 data bus as the control passes to the next channel.

Features

- Scans selectably up to 10 inputs
- Triple range select on each channel and a full scale range multiplier applicable to all channels
- Dual polarity recording

Applications

- Strain gages
- Meteorological instrumentation
- Fluid level transducers

Specifications

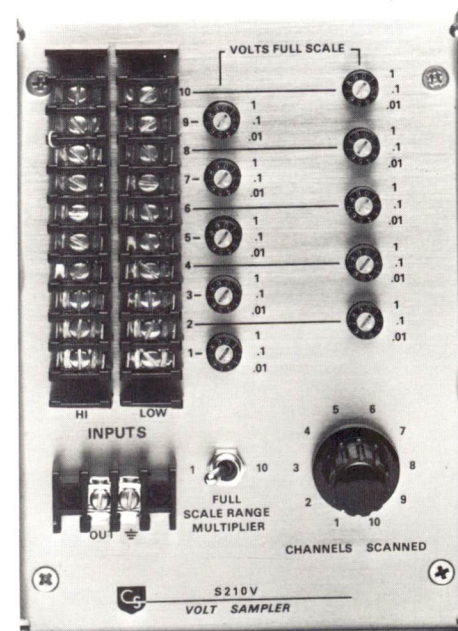
Module Length: 5.4"

Input: Millivolt and volt level signals from ± 10 mv full scale to ± 10 volts full scale

Readout Units: .001 times selected range

Accuracy: $\pm 2\%$ from 0°C to 40°C and $\pm .5\%$ from -25°C to $+50^{\circ}\text{C}$ ambient temp. range

Amplifier: Fully differential chopper stabilized



with less than .1 microvolt drift per °C temperature change
 Input Current: Less than 10 nanoamps
 Input Resistance: One megohm from each input to system ground
 Range: Plus or minus 10 mv, 100 mv, 1 V and 10 V full scale
 Zero Offset: None
 Common Mode Rejection: Greater than 130 db at 60 Hz
 Common Mode Range: ± 2 volts on low range, ± 20 volts on mid range, and ± 100 volts on high range



S250 50 Channel Scanner

Description

The S250 Scanner uses relays for switching inputs providing the user with an inexpensive means of sampling a large number of the same type of sensor. Using the S250 Scanner, signals from up to 50 separate sources can be recorded on each scan of the CR5 Digital Recorder. Two S250 Scanners can fit into the standard CR5 Mainframe, and three can fit into the CR5MFL large Mainframe.

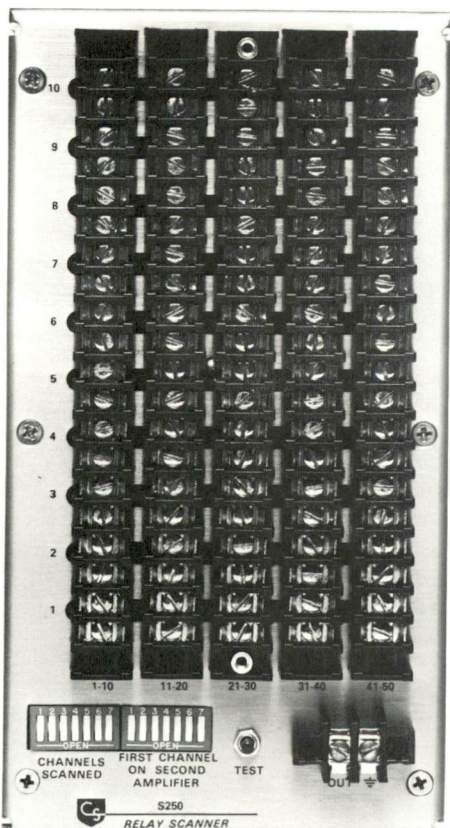
The panel of the S250 contains terminals for two leads from each of 50 separate transducers. A binary switch is provided on the panel so the user can select the exact number of channels to be sampled at each scan. The second binary switch is used to specify the switch-over point to an optional second signal conditioner in the S250.

Features

- Lowest cost per channel for sampling large numbers of the same type of sensor
- Wide variety of signal conditioners available
- Can use two signal conditioners simultaneously with the capability of selecting the switch-over point
- Selectable number of channels to be scanned
- External channel selection for testing
- Relay multiplexing

Applications

- Process monitoring



- Fresh produce storage and transport condition recording
- Livestock feed bin and stack temperature monitoring
- Water quality research
- Temperature profiles

Specifications

Module Length: 7.2 inches
 Channels Scanned: Selectable up to 50
 Switching: Relays

Available Signal Conditioners:

1. copper-constantan thermocouple amplifier with reference junction compensator
2. thermistor bridge circuit
3. volt level amplifier
4. millivolt level amplifier
5. AC conductivity signal conditioner

Copper-constantan thermocouple signal conditioner

Amplifier: Fully differential chopper stabilized
 Range: -99.9°C to $+99.9^{\circ}\text{C}$

Reference Junction: Double thermistor type, accurate to $\pm .3^{\circ}\text{C}$ from -25°C to $+50^{\circ}\text{C}$.

Accuracy: Amplifier gain is $250 \pm .2\%$. Thermocouple readout is not linearized on this signal conditioner.

Thermistor signal conditioner

Accuracy: .2% of full scale
 Range: -99.9°C to $+99.9^{\circ}\text{C}$

Note: The standard configuration is for the YSI Thermoliner Thermistor Probe. When using any other thermistor, consult factory on specifications and special setup fee.

Volt level signal conditioner

Amplifier Drift with Temperature: Less than .01 millivolt per °C.

Amplifier Type: Fully differential

Common Mode Range: ± 4 volts

Common Mode Rejection: Greater than 130 db at 60 Hz.

Input Resistance: 50 megohms

Range: $-.999$ volts to $+.999$ volts (others available on request).

Millivolt level signal conditioner

Amplifier Drift With Temperature: Less than .1 microvolt per °C.

Amplifier Type: Fully differential chopper stabilized.

Common Mode Range: ± 4 volts

Common Mode Rejection: Greater than 130 db at 60 Hz

Input Resistance: 50 megohms

Range: -9.99 millivolts to 9.99 millivolts

AC Conductivity Signal Conditioner

Range: 0 to 10 millimho standard. 0 to 1 millimho available on request.

Maximum sensor cable length: 250 feet at 10 millimhos full scale

Accuracy: $\pm 1\%$ after correction for capacitive coupling error

Oscillation frequency: 3 kHz

Applications: RH sensing using sulfonated polystyrene sensor; soil moisture blocks; water quality



RT101 Rapid Scan Module

Description

The RT101 Rapid Scan Module is an auxiliary control unit designed to be placed in front of input modules which are to be scanned "ON CALL" or at more frequent intervals than the T102 Main Control Module scans. Panel controls provide for activation of the unit and for setting the scan interval. Terminals on the panel allow the unit to be activated at the closure of an externally connected switch.

Features

- Scan "on call" capability by external switch activation connected to panel terminals

- Panel rapid scan enable
- Quick scan time intervals selectable from 6 seconds to 127 minutes
- Scans only those modules following in order of installation

Applications

- Precipitation rate recording
- Recording time of event occurrence
- Initiating scan of pertinent parameters during critical time periods
- Variable scan rates

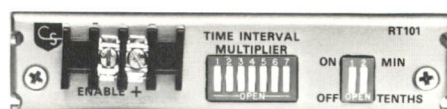
Specifications

Module Length: .9 inches

Scan Interval: Selectable $-.1$ minute to 12.7 minutes in increments of .1 minute, and 1 minute to 127 minutes in increments of one minute.

Time and Channel Recording: Depending on position of "units" switch, records tenths of minutes or minutes in channel 00, then numbers following channel sequentially beginning with 1.

Activation: A flipflop is set when the inputs are shorted or the switch is on. At the next even RT101 scan interval, the module initiates a scan of the modules following it in the module string.



X200 Modules and Cable Assembly for Mainframe Expansion

One of the virtues of the CR5 Digital Recorder is its expandability. The X200 consists of two .9 inch modules and a 3 foot connecting cable. One of the modules plugs into the "mother" CR5 and the other into the "daughter" mainframe. This will allow for control of all modules in both mainframes from a single T102 Control Module. It is not necessary to have a printer or power supply in the second mainframe. Circuitry in the X200 modules buffers all lines connecting the mainframes.



P200D Power Supply Controller with Delay

Description

The P200D is basically a power supply relay designed to operate in the CR5 Digital Recorder. It activates at the beginning of a scan and resets at the end of the scan. If a period of time is required after the relay is activated and before following channels are scanned, the scan can be interrupted at the location of the P200D Module for a user selected time period up to 12.7 minutes. This delay feature allows for pre-readout equilibration of certain types of sensors after powering them up. Panel terminals provide relay connections with one pole normally open, one normally closed, and one common. Also a ground and $+12$ Volts from the CR5 may be tapped from the panel. The 7 pole DIP switch on the panel provides for setting any desired time delay.

Features

- Closes a relay for sensor power during scan only
- Panel selectable time delay provides scan pause for sensor equilibration
- Normally open and normally closed relay connection

Applications

- Powering up aspirated psychrometer
- Neutron probe power for soil water measurement

Specifications

Module Length: .9 inches

Time Delay: .1 to 12.7 minutes in increments of .1 minute.

Maximum Switching Power (Resistive): 33VA AC and 20W DC
Maximum Switching Voltage: 110V AC, 30V DC
Maximum Currents: .3A AC, 1A DC.



R235 Cassette Interface Module

Description

Interface module: The R235 Cassette Interface Module provides the user with the means to record data on a computer compatible storage medium. With each scan of the CR5 Digital Recorder the R235 picks up the same information which is passed to the printer and stores it in a memory. After accumulating more than 33 channels of data the R235 activates an audio cassette tape recorder and writes a block of data on the tape. Panel connectors on the R235 are provided for connections to the tape recorder. A memory unload switch is also provided to dump a partially filled buffer to the tape.

After recording data on cassettes the information can be transferred to a computer through the A235 Cassette/Terminal Interface. (see information on the A235).

Recorder: Several brands of audio cassette recorders have been tested and used with the CR5. In supplying such units with the R235 under the RC235 model number, the amplifier circuit of the recorder is slightly modified to switch off with the recorder motor for remote operation.

Features

- Basis for producing a computer readable record of data from the CR5
- Uses standard audio cassette as the recording media
- Allows the capability of audio verification of data being recorded on the tape
- High reliability at a minimized cost

Application

- Format data on audio cassette

Specifications

Module Length: 1.6"

Logic: RCA 1802 Microprocessor and 512 bytes of ROM

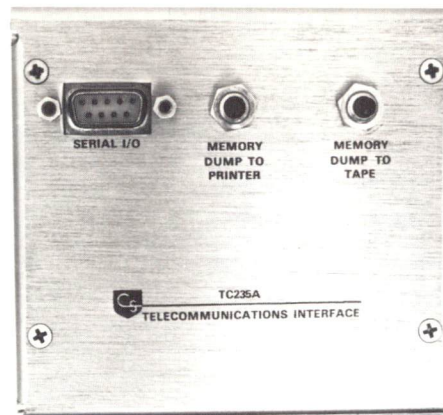
Data Format: There are 10 channels of data per line. Each channel has six digits followed by one space, making each line 70 characters long. Each line is followed by a carriage return, line feed.

Tape Code: ASCII, generated on the tape by a sequence of voltage pulses

TC235A Telecommunications Interface Module

The TC235A is a 3.6 inch module which stores data from the CR5 in memory and transmits that data on request over a telephone or radio link. It can also transmit data to the CR56 Printer or RC235 Cassette Recorder. Using a divider cable, it can transmit data to different recording/transmission devices simultaneously. A 9 conductor "D" type connector on the panel allows for communication with peripheral equipment. Two push button switches on the panel of the TC235A control the data transfer to cassette or printer. Other peripherals available for use with the TC235A are the SC232 RS232 Logic Level Converter and the SSP1 Parallel to Serial Control and Sensing Unit for line control and sensing of 7 each parallel ports using telecommunications. The TC235A stores 2048 data points. Data is

transmitted serially, and logic levels are 0 volts and 5 volts.



A235 Cassette/Terminal Interface

Description

The A235 Cassette/Terminal Interface provides the means to transfer tape recorded data from the CR5 to a computer system. The unit is equipped with two EIA RS232-C connectors allowing coupling of the A235 in the transmission line between the terminal and modem or computer. With the A235 connected, communication is handled between the terminal and computer in a normal fashion. When data is to be transferred,

the user "plays" the tape into the A235, filling the memory with blocks of data. At this point, the computer can call for the data one line at a time, or all at once as desired by sending control characters to the A235.

Panel switches on the A235 allow selection of baud rate, tape polarity, and record/playback. There are panel indicator lights for tape on and power. This system is in use on IBM, DEC, Data General, Burroughs, and other computers. The A235 interfaces to programmable calculators as well. Popular units currently in use with the A235 include the Wang 2200 and HP 9825. All of these applications use the EIA RS232-C interface.

Features

- "Smart" cassette playback device
- Buffers data in from cassette—transmits as requested by host computer
- Parity check on data from tape to detect errors
- RS232-C Interface

Applications

- Transfer of CR5 data to computer
- Record header information on data tape from keyboard terminal

Specifications

Size: 9" x 7" x 4 1/2"

Weight: 5 lbs.

Power: 110 volts AC

Terminal Interface: EIA RS232-C

Tape Recorder: Standard audio cassette recorder

Baud Rate: Selectable—110, 300, or 1200

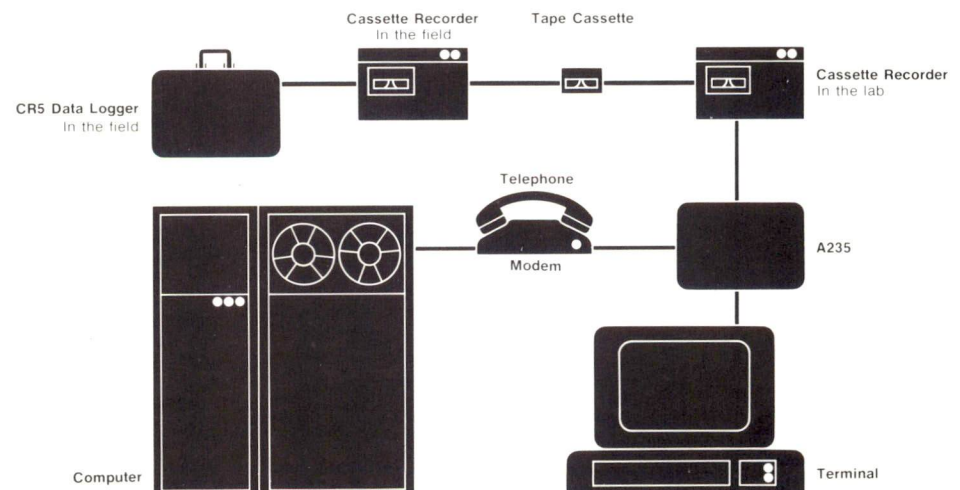
Tape Polarity: Selectable

Logic: RCA 1802 Microprocessor

Memory: 512 bytes ROM, 1056 bytes RAM



Data flow diagram using R235 and A235 with the CR5 Digital Recorder System.



C2000

Network Data Acquisition Microcomputer

Description

The C2000 is a Z80 based microcomputer with 48K of RAM, 600K of mass storage on two floppy disk drives, three serial RS232 ports, and a cassette interface for reading and writing CSI formatted cassette tapes. This system can be expanded to 56K of RAM and up to 8 additional STD bus cards for additional functions and peripheral interfacing.

Applications

- Reading and processing data from cassette tapes generated by CR5 or CR21 Dataloggers
- Automatic data transfer directly to and from dataloggers
- Generating reports based on collected data
- Activating alarms and displaying alarm messages based on collected data
- General purpose programming and text editing
- Transfer of processed data to and from other computers

The C2000 uses the well established STD microcomputer bus structure allowing a wide variety of expansion options.

Specifications

Mainframe: Card cage for up to 15 STD bus cards, power supplies, 2 floppy disk drive slots, desktop case

Power Supplies: +5v at 20a, $\pm 12v$ at 1.5a, and supply for 2 floppy disk drives

CPU: Z80 microprocessor with clock frequency at 2.5 mHz

Memory: 48 kilobytes of RAM, 2 kilobytes of ROM
Disk Drives: 2 single density 8 inch floppy disk drives (IBM format) with a formatted capacity of 300 kilobytes each

Serial I/O: 3 channels, RS232

Cassette I/O: CSI datalogger audio format, relay to turn tape drive on and off under computer control

Size: 9 in. high, 17 in. wide, 20 in. front to back
Weight: 51 lbs.

Software: CP/M (Digital Research Inc.) Disk Operating System, Wordmaster (Micro Pro) text editor, extended basic interpreter (Micro Soft), cassette read/write utilities, ROM based memory test utilities

Options and Peripherals for the C2000

Model

Description

2023 19 inch rack mounting hardware

2100 Clock and CMOS RAM card to provide a battery backed up real time clock with programmable system power up and auto restart after power fail

2105 Telecommunications option—Includes a 300 baud modem for direct-connect to the telephone switching network, an automatic dialer, and telecommunications software for

automatically polling CR5 and CR21 Dataloggers at pre-programmed time intervals
2110 DMA Controller with Dual Density—Expands floppy disk storage to 1.2 megabytes on 2 disk drives

2200 CRT terminal—Teletype model TVI-912C

2250 Dot matrix line printer—Texas instruments Model 810

2300 9 track tape interface and drive—Kennedy Model 9832 drive for IBM formatted 9 track tape

2505 Word Processing Software — MicroPro Wordstar

2510 Basic Compiler from MicroSoft—Includes macro assembler.

2515 Fortran Compiler from MicroSoft—Includes macro assembler.

CS22 Calibration Source

Description

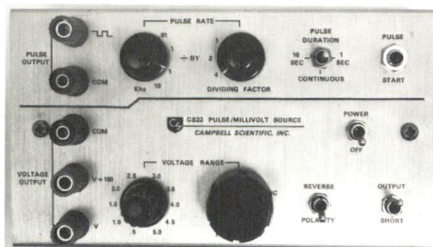
The CS22 Calibration Test Source is a convenient calibration source for the signal conditioner modules of the CR5 Digital Recorder System. A range switch and fine adjust allow the user to set a constant millivolt signal on the outputs using a digital voltmeter. Switches are provided for polarity reversal and grounding the output leads. Part of the CS22 Calibration Test Source is dedicated to several pulse generating functions. The main rotary switch selects four pulse rates, and the second knob enables one of three divider factors. The three position toggle switch on this half of the panel selects the pulse string duration, and a push button initiates the pulse string.

Features

- Battery operated—completely portable
- Combined millivolt and pulse source
- Discrete fixed length pulse string output
- Precision divide by 100 millivolt source

Applications

- Set up calibration on CR5 Modules
- Test CR5 printed output against known input on voltage and pulses
- Test source for other instruments



Specifications

Power Source: 9 volt alkaline battery
Voltage Range: 0 to ± 5.0 volts

Maximum Voltage Source Current: 100 μ a.
Millivolt Source Controls: Range select, fine adjust, polarity switch, and grounding switch
Maximum Pulse Current: .5 ma
Pulse Amplitude: 5 volts
Pulse Rates: .01, .1, 1, and 10kHz with panel selectable divide factors of 1, 2, and 4.
Pulse String Durations: 1, 10, and ∞ seconds.
Pulse Source Controls: Pulse start button, duration select, pulse rate select, and divide factor select.

TA5 CR5 Test Accessory Set

Description

A service manual, extender cables and extender circuit cards are configured for testing and trouble shooting various parts of the CR5 System. Using these items, a technician can isolate and test individual modules and circuit cards in those modules. These accessories used with a standard oscilloscope, digital volt meter, and pulse counter are sufficient to handle most of the maintenance and trouble shooting on the CR5 System.

The following items are included in the set:

1. Service manual
2. Two 18 pin x 24" extender cables
3. One 10 pin x 24" extender cable
4. One 6 pin x 24" extender cable
5. One extra set of 10 pin card edge connectors to be used alternately with the 6 pin cable
6. One 22 pin extender board
7. Two 18 pin extender boards
8. One 15 pin extender board
9. One 10 pin extender board
10. One 6 pin extender board

The SP5 Spare Parts Kit contains miscellaneous integrated circuitry used in the CR5.



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