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RD 8600 / 8700

Operations Manual

Chapter 1 - General Description
Chapter 2 - Installation and Wiring
Chapter 3 - Getting Started
Chapter 4 - Operation
Chapter 5 - Programming
Chapter 6 - Calibration
Chapter 7 - Communications Interface
Chapter 8 - Companion Software

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The information contained in this document is believed to be correct, but OMEGA Engineering, Inc. accepts no liability for any errors it contains, and reserves the right to alter specifications without notice.
WARNING: These products are not designed for use in, and should not be used for, patient-connected applications.

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Addendum

The following items have been upgraded/added since the manual was printed:

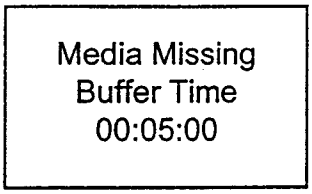
1) Screen Dimmer - The screen dimmer now has the option to turn off. When selecting the "Dim Level", the **lowest dim level is <u>off</u>** and the next position up is the lowest dim value setting. Note: The display does not turn off when programming. See section 5.4.9 for programming details.

2) 15 Channels - The recorder now has the ability to record up to fifteen (15) channels (depending on options, up to 12 live channels and the remaining channels for a total of 15 can be used as computational channels).

3) 2.5V DC Input Range - In addition to the ±100mV, ±1V and ±10V range, there is now a ±2.5V range. This range applies to the Linear, Ind Sqrt and Log Linear input types. Programming for the new range is identical to the three original ranges. See sections 5.6.6, 5.6.8 and 5.6.9 for programming details.

4) 0-20mA input Range - In addition to the 4-20mA and 10-50mA input range, there is now a 0-20mA range. This range applies to the Linear, Ind Sqrt and Log Linear input types. Programming for the new range is identical to the two original ranges. See sections 5.6.6, 5.6.8 and 5.6.9 for programming details.

5) Hot-Swap - The recorder now has the ability to "SWAP" disks without turning off the record mode so there is no data loss. WARNING - DO NOT REMOVE DISK WHILE GREEN LIGHT IS ON. When the disk is pulled out, a window will appear displaying the time left before data is lost. For the fastest record rate (4 times per second), you will have approximately 5 minutes (See chart below). Each pen has it own buffer so the approximate times listed are for any number of pens.



Buffer Time Window

The time in the window will count down in two second intervals for sample rates faster than 2 samples per second. The window will count down in intervals equivalent to the sample rate for rates faster than 2 samples per second.

If the disk is not replaced within the time frame displayed, data will be lost.

If there are different record rates, the buffer time displayed will be for the fastest record rate.

Sample Rate	Buffer Time
4 Samples / Sec.	5 Minutes
1 Sample / Sec.	20 Minutes
10 Sec / Sample	3 Hours
1 Min / Sample	20 Hours

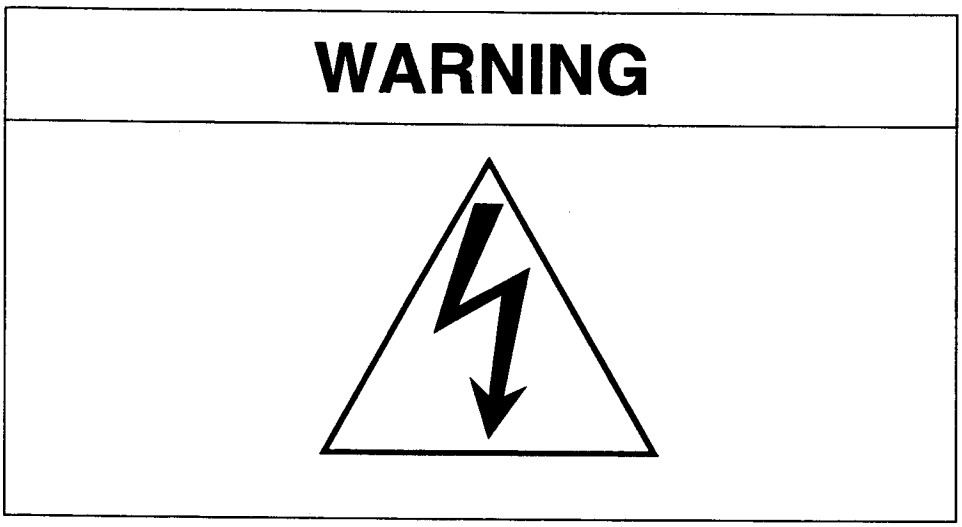
Buffer Time Guide

5000-02A-911
7/13/99
Rev 1.0

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SAFETY NOTICE

This Safety Notice has been included to emphasize the **DANGER OF HAZARDOUS VOLTAGES** on the **REAR TERMINAL PANEL** of your instrument. **USE EXTREME CAUTION WHEN INSTALLING OR SERVICING** your instrument. Please read the entire contents of the Installation and Wiring Chapter of this manual before attempting to install or service you instrument.



Use Extreme caution when servicing the rear terminal of your instrument.

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Chapter 1

General Description

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Chapter 1 General Description

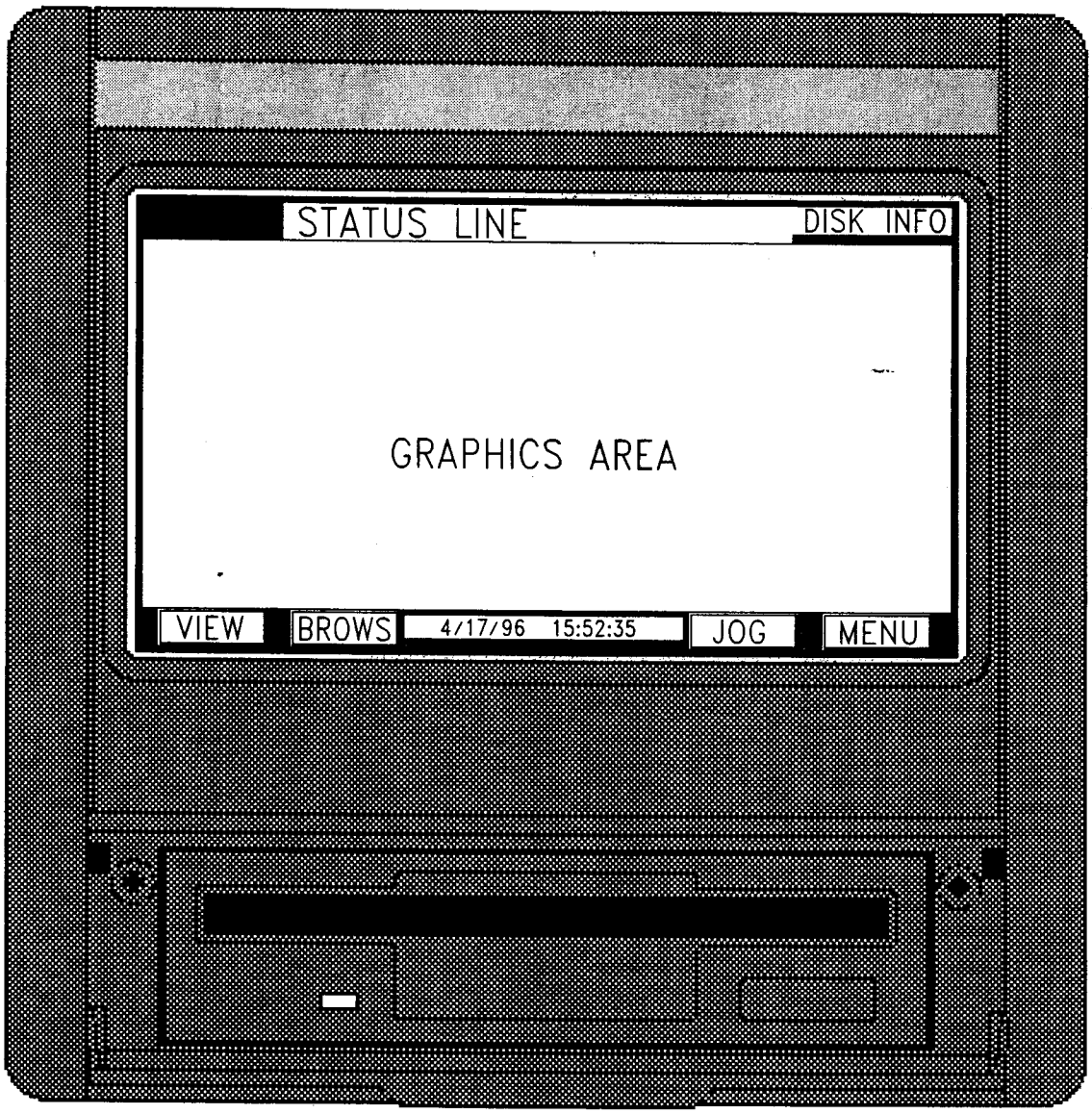


Figure 1-1 Solid State Data Recorder

This manual is a user reference guide for the Solid State Paperless Data Recorder (Figure 1-1). The manual provides detailed instruction for installation, operation, programming, calibration and maintenance of the instrument.

The recorder is a sophisticated piece of equipment that requires some level of programming before use. The user is advised to browse through this manual in its entirety before proceeding with the installation and programming. For those who will be using the minimum configuration, the **Getting Started** chapter (Chapter 3) should get you up and running in the least amount of time.

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1.1 Recorder Description

The Solid State Data Recorder is a Paperless Recording instrument that stores it's data in internal memory and on either 3½ inch (89mm) floppy disk drive or an industry-standard removable PCMCIA memory card. All data is stored in MSDOS format and may be archived or analyzed on any IBM compatible PC running Microsoft's Windows 3.1 or Windows 95 using the available *Companion* software. The instrument retains all the features of a traditional Paper Chart Recorder by virtue of its monochrome large Liquid Crystal Display (LCD) or TFT color which presents the data in the traditional chart mode as well as in bar graph or digital numeric form.

The unit has many features and functions which are unique and cannot be performed on traditional paper recorders such as data compression and historic data browsing. The recorder is programmed via touch screen keypad on the display.

The recorder will measure and process up to twelve direct inputs, calculated, conditional, or external points for logging, trending, or data manipulation. If direct inputs are not desired, the Data Recorder will accept up to twelve points from a combination of calculated, conditional, or external point types.

1.1.1 Inputs

Direct input sources may come from voltage, current, dry contacts, thermocouple, or RTD sources. The voltage and current ranges accepted by the instrument include: 0 to ±100mV, 0 to ±1 Volt, and 0 to ±10 Volts; 4 to 20 and 10 to 50mA current. Thermocouple inputs include B, C, E, J, K, R, S, T, Nickel/Nickel Moly, and Nicrosil-Nisil. RTD inputs accepted include 10 ohm Cu, 100 ohm Platinum, 200 ohm Platinum and 120 ohm Nickel.

1.1.2 Instrument Size

The instrument is sized to fit in a DIN standard panel cutout of 138mm x 138mm (5.43 inches x 5.43 inches) and requires only 22.2 cm (8 ¾ inches) behind panel depth. Actual dimensions of the instrument are shown in Figure 2-1 Recorder Dimensions in Chapter 2 of this manual.

1.1.3 Menus

The instrument's features are accessed through a series of menus. These menus are accessed via a command button bar which is initiated by pressing the **MENU** button displayed in the bottom right hand corner of the LCD screen. There is also a STATUS bar or line along the top of the screen which can be used to display various recorder parameters. (Refer to Section 3.1). The Command button bar contains three user programming option buttons - **DISP**lay, **PROG**ram, and **FUNC**tion. Refer to Figure 1-2 below. Each menu level features easy-to-follow prompts that simplify operation

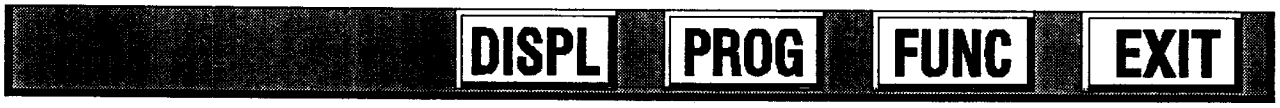


Figure 1-2 The Command Button Bar

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1.1.3.1 Display Menu

Pressing the Display Key (**DISP**) on the Command button bar will allow the user to access the Display Menu. The Display Menu can be used to display any programmed point or series of points, or any current alarm or series of alarms on the STATUS line along the top of the display. The version of operating software can also be shown in a pop up window.

1.1.3.2 Program Menu

This Menu item may be passcode protected. Pressing the Program Key (**PROG**) on the Command button bar brings up the Program Menu. The Program Menu allows you to define the system operating parameters. Menu driven prompts, answered by yes, no or by entering the desired value, enable you to customize the Instrument to meet your application requirements. Refer to Chapter 5.

1.1.3.3 Function Menu

This Menu item may be passcode protected. The Function Key (**FUNC**) on the Command button bar will invoke the Function Menu. The Function Menu allows the user to Activate, Bypass, and/or Reset a point. This menu also allows changing between high and low display chart speed or record speed, turning Alarm Check on or off, and choosing Scale Set 1 or 2.

1.1.3.4 Hidden Menu

This menu item may be passcode protected and can only be accessed by pressing a certain combination of buttons. The hidden menu allows the user to Initialize the recorder, set Passcodes, perform Calibrations and perform Diagnostics on the recorder. Refer to Chapter 5.

1.1.4 Memory

All the Random Access Memory in the Recorder is battery backed. This enables the unit to recover in the event of a mains failure with minor data loss. Any programming will be protected in the event of power removal and past browse data is maintained in the off state. The battery is the rechargeable type (Nicad. Non-rechargeable lithium available as a special option) and will keep memory intact for at least 12 months.

1.1.5 Clock

A real time clock keeps time and date in the event of a power loss. It operates off the same battery as the memory.

1.1.6 Recorder Construction

The Data Recorder features modular construction. Power Supply and Analog conditioning modules are conveniently accessible for fast and simple troubleshooting and/or removal. The floppy disk or PCMCIA drive is conveniently situated behind a protective panel at the front of the unit. Figure 1-1 shows the recorder with the access panel open, exposing the floppy disk drive.

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1.2 Recording Options

The user can order the Recorder with one of two storage mediums, a standard PC compatible floppy disk drive or an industry-standard PCMCIA memory card drive. The merits of the two are discussed briefly below. The *Companion* software provided with the unit supports both media types.

1.2.1 Floppy Disk Drive

The Floppy disk drive uses PC compatible 3½ inch (89mm) floppy disks which, in fact are quite rigid. These disks can store 1.44 Megabytes of data which translates to approximately 700,000 data samples (each sample is 16 bits). The disks are magnetic media and the drives are mechanical. This limits their use in harsh environments where vibration or temperature is a problem, but they are convenient as they are very inexpensive and can simply be plugged into any IBM compatible PC.

1.2.2 PCMCIA Memory Card

The PCMCIA card (Personal Computer Memory Card Interface Association) is a small solid state card about the size of a credit card and about 0.125 inch (3mm) thick containing either battery backed up Static RAM or the newer Flash memory. The Flash memory cards are significantly less expensive than the battery backed RAM cards and are available in larger capacities. The memory cards are more expensive than floppy disks, but are not prone to the same vibration or temperature constraints. The *Recorder* supports both memory card types up to 20 Megabytes in size which is approximately 10,000,000 data samples. The cards do require a special drive in the PC which is readily available, inexpensive and already standard on many laptops and desktop machines. Contact your dealer for details.

NOTE: The following is a list of fully tested and recommended ATA Flash cards:

Brand	Size
Sandisk	4 Meg - 20 Meg

1.3 Recorder Options

Additional functions and capabilities can be added to the Data Recorder as options. These options are briefly described in the following paragraphs.

1.3.1 Digital Input and Output

This option provides six form C (Normally Open, Common, Normally Closed contacts) Relay outputs capable of switching 250 VAC and three isolated digital control inputs. The relay outputs can be programmed to respond to alarm events while the digital inputs can be used to trigger events such as changing recording speeds or stopping and starting recording. Three form C Relay outputs without the digital inputs are also offered as an option.

1.3.2 Communications Interface

There are two communications options available, an ESD protected RS232 interface (standard) or an isolated RS485 interface (optional). The recorder acts as a slave device in a Modbus RTU or Modbus ASCII environment.

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1.4 Specifications

OPERATING

Input Signals

DC Voltage: Linear and square root .
Full scale ranges: ±100mV, ±1V, and ±10V ±0.05% of programming range

DC Current:
4 to 20mA, 10 to 50mA. ±0.1% using external shunt Part No. MAS-50R0

Dry Contact or External Input (Serial)

Thermocouple: Resolution 0.1°C
Thermocouple burnout detection - user programmable duration.

J	-210 to 1200 °C	±1.5°C	-340 to 2190 °F	±3°F
K	-270 to 1372 °C	±1.5°C	-450 to 2500 °F	±3°F
T	-270 to 400 °C	±1.5°C	-450 to 750 °F	±3°F
E	-270 to 1000 °C	±1.5°C	-450 to 1832 °F	±3°F
R	-50 to 1768 °C	±3°C	-58 to 3200 °F	±6°F
S	-50 to 1768 °C	±3°C	-58 to 3200 °F	±6°F
B	0 to 1820 °C	±4°C	32 to 3300 °F	±7°F
C	0 to 2400 °C	±3°C	32 to 4350 °F	±6°F
N	-270 to 1300 °C	±1.5°C	-450 to 2372 °F	±3°F

RTD : Base accuracy 0.2% or 0.5°C (1°F). Resolution 0.1°C
2 or 3 wire connection. Cable compensation to ±50 Ohm
Open and short circuit detection.

10 ohm Cu	-70 to 170 °C	-94 to 338 °F
100 ohm Pt 385	-220 to 850 °C	-364 to 1560 °F
100 ohm Pt 392	-180 to 820 °C	-292 to 1500 °F
200 ohm Pt 385,	-220 to 400 °C	-364 to 750 °F
200 ohm Pt 392	-180 to 400 °C	-292 to 750 °F
120 ohm Ni	-70 to 300 °C	-94 to 570 °F

Input Resolution 0.006% of full scale
Input Impedance >10 megohms on 100mV, 1V Ranges, ~50k on 10 Volt Range
Input Capacity 12 total - direct and/or computational
Isolation 250 Vdc or peak AC channel to channel, 300 Vdc or peak AC to Chassis
Scan Rate 42ms/channel, all 12 channels in 0.25 second (4 per channel per second)
Common Mode Voltage 250 Vdc or peak Vac (Isolation between channels)
Common Mode Noise Rejection >100 dB, 50/60 Hz
Normal Mode Noise Rejection >50 dB at 50/60 Hz
EMC Compliance Meets or exceeds the requirements of CE for EMC 89/336/EEC

RECORDING

Recording Rates User programmable from 4 samples per second to 1 sample every 600 seconds. Channels independently programmed.
Format MSDOS compatible file system. Proprietary file structure. User File naming.
Storage Capacity 3½ inch (89mm) floppy disk - approximately 700,000 samples for a 1.44 Megabyte Disk
PCMCIA Static RAM cards - approximately 1,000,000 samples for a 2 Megabyte Card
PCMCIA Flash cards - approximately 10,000,000 samples for a 20 Megabyte Card
File types Up to 12 point (data) files, Alarm and Event file, Configuration files, Language Files. Multiple files of different names on a single disk. Disk format capability.

DISPLAY

Display Type Mono CCFL backlit STN Liquid Crystal Display.
Resolution Mono 240 (H) X 128 (V) pixels. Display area 2.3 x 4.3 inches (5.8 x 10.9 cm)
Display Type Color CCFL backlit Active Matrix TFT Liquid Crystal Display.
Resolution Color 320 (H) X 240 (V) pixels. Display area 3.0 x 4.0 inches (6.8 x 10.9 cm)
Display Modes Graphics (Trending Vertical or Horizontal), Bar Graphs, Large Digital Display, Alphanumeric Alarm and Event data, or combinations on a split screen.
Display Update Rate 1 second. Data update rate programmable from 1 second to 60 seconds.
Virtual Chart Speed Programmable: 0.5in/hr to 600in/hr
Virtual Chart Scales 2 sets of 8 scales
Display Windows Time/Date, Graphics (Bars, Large Digital, Trends), Disk Status, System Status or Ident, Button bar.

FEATURES

Touch Screen Touch sensitive screen with Button Bar for simple programming and easy operation.
Math Package Algebraic equations (basic math, powers, roots, natural and base 10 logarithms, exponentiation), peak monitoring, differentials, true rolling averages, time averages, gated timing, conditionals (Boolean logic), totalization, logarithmic scaling. 12 Programmable constants.

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Buffer	Internal 128k buffer (RAM) enables real time browsing of historic chart data independent of recorded data. Equivalent browse capability is approximately 560 pen inches. This represents about 5½ days for 4 pens at 1 inch/hour.
File Browse	Any data file on disk can be browsed. File directory allows selection of different file names.
Disk Full Alarm	User can set disk full threshold. Disk errors and alarms can be routed to contact closure.
Trend direction	User selectable Horizontal or Vertical chart trending. "Pen" pointers for easy trace identification.

POWER

Power Requirements	100 to 240 Vac ±10%, 50/60 Hz, 35VA Max.
Power fail protection	Programmed parameters stored in non-volatile memory. Clock battery backed. Retention time without power > 12 months. Chart and alarm browse buffers preserved.
Safety	UL (3111-1) cUL (IEC1010-1) CE Low Voltage Directive 73/23/EEC

ENVIRONMENTAL

Operating Temperature	5° to 40°C per UL3111-1/IEC1010-1
Operating Humidity	10% to 80% RH to 31°C decreasing linearly to 50% RH at 40°C per UL3111-1/IEC1010-1

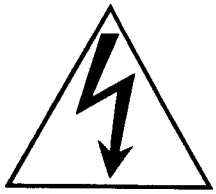
OPTIONS

Alarm Contacts	6 isolated Form C, 3 amp @ 250 Vac or 26 Vdc
Remote Inputs	3 isolated inputs user selectable as dry contact or 5 to 12 VDC activated. Inputs share a common. Configurable for chart control, alarm, acknowledge/reset, event markers, totalizer reset or logic input.
Communications	ESD protected RS232 with full hand shaking. Supports Modem - or, Isolated RS485 network port . Serial Protocol - MODBUS RTU or MODBUS ASCII. Unit may be remotely configured.

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SAFETY NOTICE

This Safety Notice has been included to emphasize the danger of hazardous voltages on the **REAR TERMINAL PANEL** of your instrument. **USE EXTREME CAUTION WHEN INSTALLING OR SERVICING** your instrument. Please read the entire contents of the Installation and Wiring Chapter before attempting to install or service your instrument.

WARNING 	ELECTRIC SHOCK HAZARD MAY CAUSE INJURY OR DEATH. USE EXTREME CAUTION WHEN INSTALLING OR SERVICING REAR TERMINAL PANEL. FOLLOW INSTRUCTIONS BELOW.

POWER INPUTS WARNING

When connecting power to the Rear Terminal Panel of your instrument, it is important to ensure that the AC mains cable has an effective ground or provide a low impedance earth ground connection (Safety Ground) to the screw terminal labeled "⏚ " or "GND" to prevent the possibility of electrical shock. Power may be exposed on the Rear Terminal Panel and is exposed inside the instrument case. When wiring, use the supplied AC mains cable or recommended plug, make sure the HOT wire, or Line 1 is connected to L/H. Make sure the NEUTRAL wire, or Line 2, is connected to N, and make sure a low impedance SAFETY GROUND wire is connected to "⏚ " or "GND".

SIGNAL INPUTS WARNING

Use extreme caution when wiring signal input connections. Hazardous potentials may exist on signal input terminals, which are floating, with respect to instrument ground. These hazardous potentials may be exposed inside the instrument case and on the Rear Terminal Panel of your instrument. Any voltage potential at the signal source will exist on the instrument's respective signal input terminal: e.g. power generator stator winding temperature-monitoring thermocouples.

CONTACT OUTPUT TERMINALS WARNING

Use extreme caution when wiring contact output connections. Hazardous potentials may exist on contact output terminals, which are floating, with respect to instrument ground. These hazardous potentials may be exposed inside the instrument case and on the Rear Terminal Panel of your instrument. Any voltage potentials at the contact circuit will exist on the instrument's respective contact output terminals: e.g. line-powered circuits.

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Chapter 2

Installation and Wiring

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Chapter 2 Installation and Wiring

This chapter provides information and procedures on installing and wiring the Recorder. Included are handling procedures, installation and wiring specifications, and instructions for both standard and optional equipment.

2.1 Equipment Handling

2.1.1 Initial Inspection

Exercise care when unpacking the instrument from the shipping carton. The instrument is packed in a shock-proof foam retainer to prevent damage during normal transit. If damage to the shipping carton is evident, ask the carrier's representative to be present when the instrument is unpacked and refer to Limited Warranty Statement, Appendix A.

2.1.2 Unpacking Procedure

Perform the following steps to unpack your Recorder.

2.1.2.1 Remove the foam retainer and instrument from the shipping carton.

2.1.2.2 Carefully remove the instrument from the foam retainer.

2.1.3 Detected Damage

If damage is detected after unpacking the instrument, re-pack the instrument and return it to the factory as described in the following paragraph.

2.1.4 Equipment Return

Before returning a damaged or malfunctioning instrument to the factory for repairs, a Return Merchandise Authorization number must be obtained from the factory.

2.1.4.1 Return Authorization

Refer to Appendix B, "Return Authorization", for complete instructions on returning instrumentation.

2.1.4.2 Required Information

If the instrument is to be returned for repairs, the instructions detailed in Appendix B entitled "Required Information for Factory Repairs" must be completed and returned with the instrument.

2.1.5 Storage

For prolonged storage before installation, re-pack the Recorder in the shipping container. Cushion the Recorder with foam molding or an equivalent and store in a cool, dry area. We do not recommend storage of the Recorder for more than one year. If longer storage time is required, contact the factory for additional storage information.

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2.2 Installation

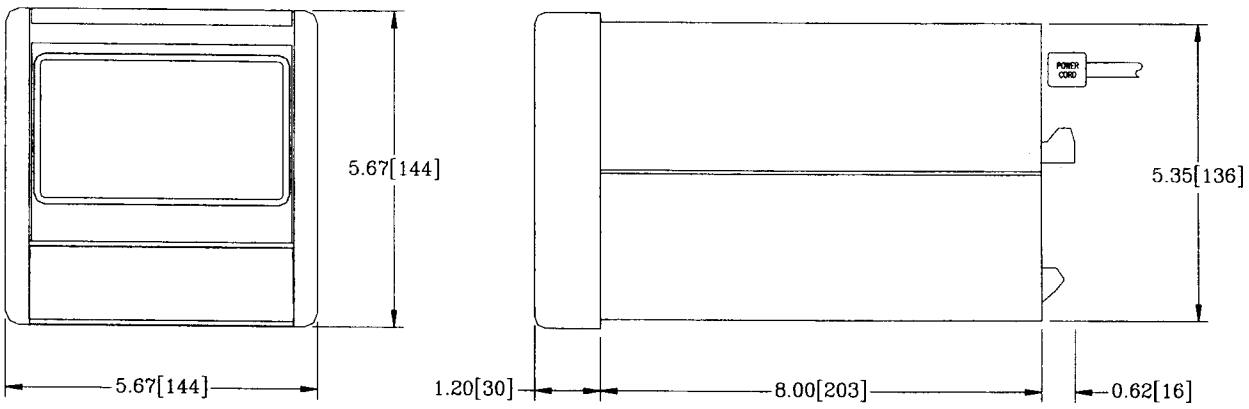
The instrument is intended to operate in the following environment:

Installation Category II	per IEC 664
Pollution Degree Level II	per UL3111-1/IEC1010-1
Indoor Use Only.	

Temperature	5°C to +40°C (41°F to 104°F) per UL3111-1/IEC1010-1
Humidity	5 to 80% RH non-condensing up to 31°C (87°F), decreasing linearly to 50% RH at 40°C (104°F) per UL3111-1/IEC10101-1
AC Mains supply	100 - 240 VAC~ 50/60 Hz 35VA

NOTE: The recorder is designed to be panel mounted and as such should be considered as permanently connected. Disconnection from the supply must be possible via a customer supplied switch or circuit breaker. This disconnection device must be included in the panel installation and should be clearly marked, in close proximity to the Recorder and easily accessible to the operator.

The Recorder can be used on a counter top by affixing the optional rubber feet. The instrument is sized to fit in a DIN standard panel cutout of 138mm x 138mm (5.43 inches x 5.43 inches) and requires only 22.2 cm (8¾ inches) behind panel depth. Actual dimensions of the instrument are shown in Figure 2-1.



Note: Depth Dimension - Allow space for insertion of mains plug (IEC Type)
Dimensions are INCHES [MILLIMETERS]

Figure 2-1 Recorder Dimensions

USE OF THIS EQUIPMENT IN A MANNER THAT IS INCONSISTENT WITH IT'S INTENDED PURPOSE, OR IN AN ENVIRONMENT THAT EXCEEDS THE RATED SPECIFICATIONS BY THE MANUFACTURER, MAY IMPAIR THE PROTECTION PROVIDED BY THE EQUIPMENT.

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2.2.1 Panel Mounting

The Recorder should be mounted in a vertical panel to ensure proper operation. Ensure you have the proper clearances and proceed as follows:

2.2.1.1 Cut a panel opening 138mm x 138mm (5.43 x 5.43 inches).

2.2.1.2 Remove any packaging material from the recorder. Always handle the unit carefully to avoid damaging the LCD display or scratching the display surface.

2.2.1.3 If equipped, remove the four rubber feet from the bottom of the Recoder. These are adhesive types and can be peeled off fairly easily.

2.2.1.4 Remove the two screws on the rear panel holding the jacking bars in place, and remove the jacking bars by pulling to the rear. Refer to Figure 2-2 opposite.

2.2.1.5 Insert the Recorder, rear end first, into the panel opening from the front of the panel.

2.2.1.6 With the Recorder held firmly in place against the panel, install one of the Jacking Bars, by locating the circular end of the retaining rib in the center of the Jacking Bar, into the slot on the side of the Recorder Panel. **Note: The end of the Jacking Bar rib which is notched back must be inserted into the slot.** Refer to Figure 2-3 opposite for detail.

2.2.1.7 Insert the Jacking Bar Retaining Screw into the slot and, using a screwdriver, tighten the screw until the Locking Bar is just pressing against the panel.

2.2.1.8 Install the other Jacking Bar into the slot on the opposite side of the Recorder then insert the Jacking Bar Retaining Screw and tighten as before.

2.2.1.9 Using the screwdriver, tighten both screws so that the Recorder is held firmly in place. **Do not over tighten.** Note: If the Jacking Bar is in back to front, you will be unable to tighten it against the panel.

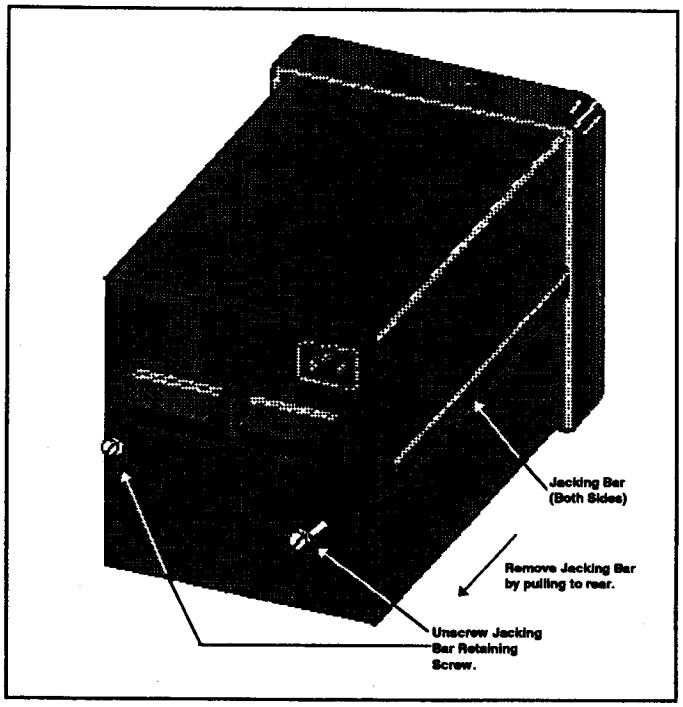


Figure 2-2 Removal of Jacking Bars

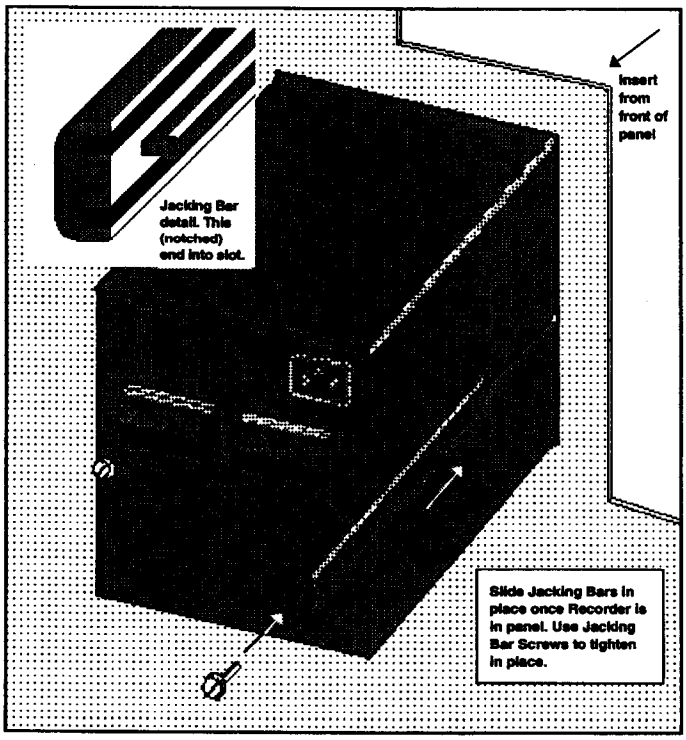


Figure 2-3 Mounting in Panel

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2.3 Wiring Specifications and Procedures

2.3.1 Power Requirements

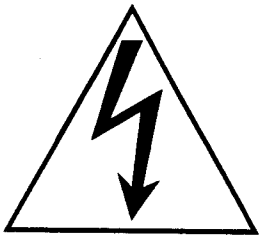
The Recorder operates on any voltage from **100 to 240 VAC ±10%, 50/60 Hz** enabling it to be used in most countries. The maximum apparent power required by the unit is 35 VA.

2.3.2 Power Connections

NOTE: **The Recorder is designed to be panel mounted and as such should be considered as permanently connected. Disconnection from the supply must be possible via a cus tomer supplied switch or circuit breaker. This disconnection device must be included in the panel installation and should be clearly marked, in close proximity to the recorder and easily accessible to the operator.**

All connections to the Recorder are made to the Rear Terminal Panel (Figure 2-4 or Figure 2-5). Any wiring carrying hazardous voltages must conform to all applicable local and national safety codes. AC Mains connection is via an internationally accepted IEC 320 AC mains socket or screw terminal.

WARNING



ENSURE ALL MAINS POWER IS TURNED OFF BEFORE PROCEEDING WITH INSTALLATION. THIS UNIT IS PROVIDED WITH A MATING CONNECTOR FOR THE AC POWER SOCKET OR WITH A COMPATIBLE THREE WIRE GROUNDED CABLE WHICH MAY BE TERMINATED WITH A PLUG. ALWAYS EN-SURE THE GROUND WIRE (GREEN OR GREEN AND YELLOW) OR GROUND PIN OF THE PLUG, IS CONNECTED TO A LOW IMPEDANCE SAFETY GROUND (EARTH) WITHIN THE AC POWER DISTRIBUTION SYSTEM YOU ARE USING. ALWAYS USE THE RECOMMENDED MATING CONNECTOR AND AN APPROVED THREE WIRE CABLE TO CONNECT THIS UNIT TO THE AC MAINS.

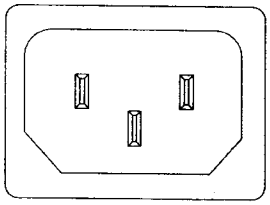


Figure 2-4 AC Connector

Figure 2-4 shows the IEC 320 AC mains socket on the rear of the Recorder. The center pin is the ground termination. If a mating plug is provided, it will be marked with the Ground, LINE (L) or hot, and NEUTRAL (N) or return. In the United States, an approved cable with integral plug (NEMA 5-15 P) is provided. In some instances, a cable with no plug may be provided. In this instance, the user must connect an ap-proved plug to the cable prior to connecting to the AC source.

Figure 2-5 shows the screw terminal power connections on the rear of the Recorder. The right terminal is ground, the center terminal is LINE (L) or hot and the left terminal is NEUTRAL (N) or return. The wire color codes are as follows:

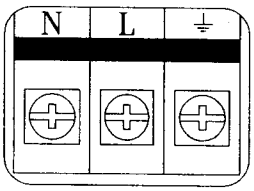


Figure 2-5 Screw Terminal

COUNTRY	NEUTRAL (RET)	LINE (HOT)	GROUND
USA	White	Black	Green
EEC	Blue	Brown	Green/Yellow

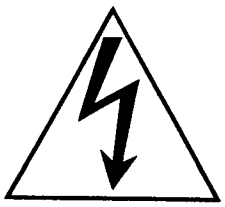
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This unit is equipped with an AC mains Fuse internally. If this fuse should blow, it generally indicates a serious problem with the Recorder. **THE FUSE SHOULD NOT BE REPLACED BY AN OPERATOR.** The fuse is a **Quick acting 5 x 20mm type rated at 2.5 Amps 250 VAC (~).**

An optional AC mains plug retention clip is available - contact the factory.

2.3.3 Signal Input Wiring

WARNING!!!



TO PREVENT THE POSSIBILITY OF ELECTRICAL SHOCK, USE EXTREME CAUTION WHEN WIRING SIGNAL INPUT CONNECTIONS. HAZARDOUS POTENTIALS MAY EXIST ON SIGNAL INPUT TERMINALS WHICH ARE FLOATING WITH RESPECT TO CASE GROUND. THESE HAZARDOUS POTENTIALS MAY BE ON THE REAR TERMINAL PANEL OF YOUR INSTRUMENT. ANY VOLTAGE POTENTIAL AT THE SIGNAL SOURCE WILL EXIST ON THE INSTRUMENT'S RESPECTIVE SIGNAL INPUT TERMINAL. E.G. POWER GENERATOR STATOR WINDING

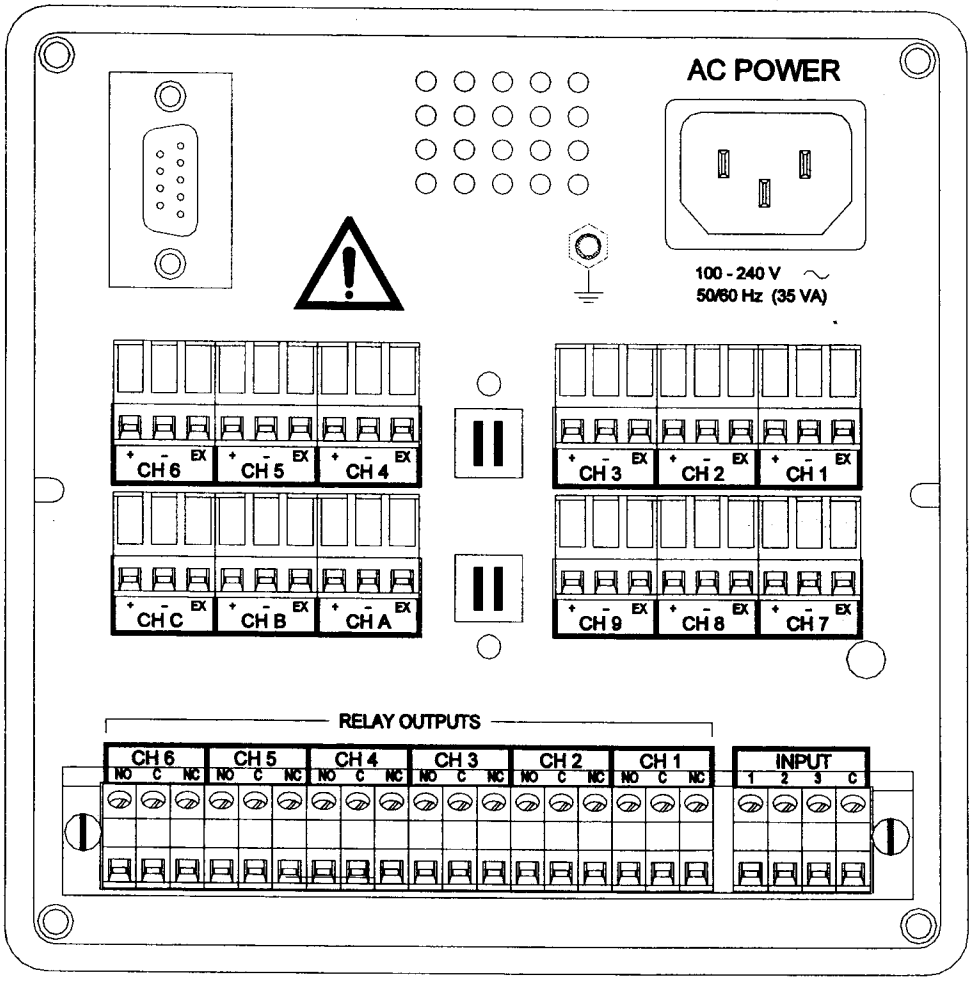


Figure 2-6 Rear Panel Connections

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The standard Recorder accepts up to six direct inputs. Input connection is via plug in screw terminal connectors on the rear panel. Inputs can be mixed in any combination of thermocouple, RTD , milliamps, millivolts, volts or contact inputs. As inputs are connected, it is recommended that you record the data on the Point Programming Chart.

There is a common ground lug, marked with a ⏚ for connection of signal cable shields or screens. Read the following procedures before connecting inputs to the terminals.

ENSURE THE POWER IS OFF BEFORE CONNECTING SIGNAL INPUTS TO THE UNIT.

The plug in screw terminal connectors are of the clamping screw variety, putting even pressure on the signal wire. It is therefore not necessary to terminate the wires with lugs, however you may do so if you wish. The maximum gauge wire that can be accommodated is 14 AWG or 2.5mm².

You will need a small screwdriver and a pair of wire cutters and strippers. The use of shielded twisted lead wire is recommended to minimize electromagnetically induced noise.

CAUTION - NEVER RUN SIGNAL AND POWER OR CONTROL WIRING TOGETHER IN THE SAME CONDUIT. THIS IS TO PREVENT POSSIBLE RECORDING ERRORS DUE TO INDUCED SIGNALS BETWEEN LINES. ROUTE SIGNAL WIRES AWAY FROM POWER WIRES AT THE REAR PANEL.

GROUND CABLE SHIELDS AT ONE END ONLY TO ELIMINATE THE POSSIBILITY OF INTERFERENCE DUE TO GROUND LOOP CURRENTS. WHEN GROUNDED TRANSDUCERS ARE USED, THE SHIELD SHOULD BE GROUNDED AT THE SENSOR END ONLY.

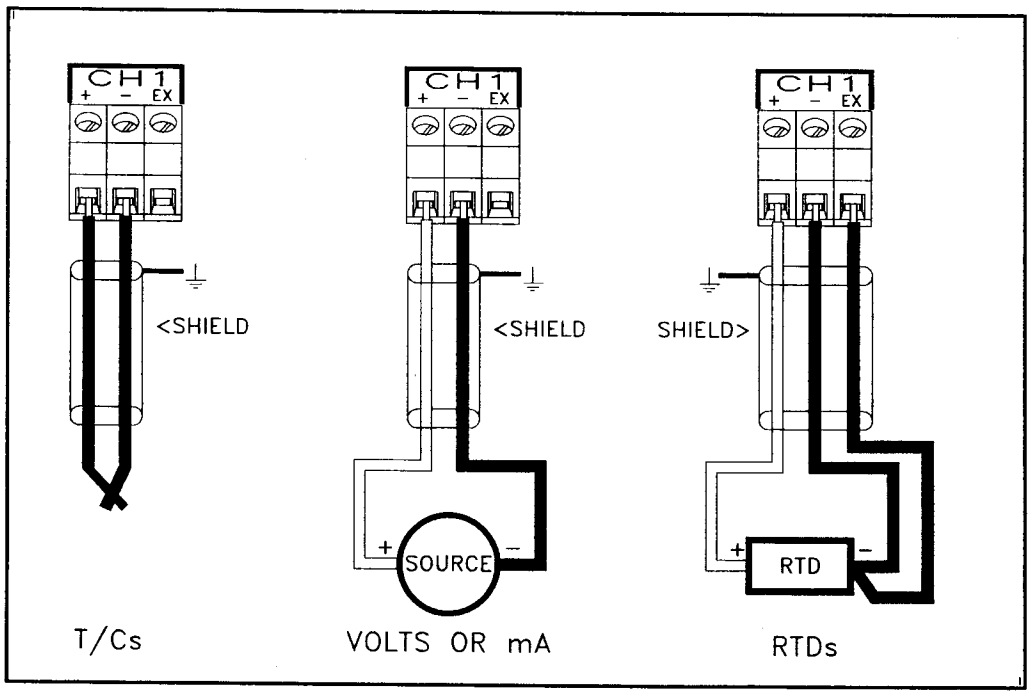


Figure 2-7 Transducer Connections

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2.3.3.1 Thermocouple Inputs - Thermocouple input connections are made as shown in Figure 2-7 above - T/Cs.

2.3.3.2 Resistance Temperature Detector (RTD) Inputs - For RTDs, use three wires having equal resistance to eliminate errors resulting from lead length variations. Use 14 AWG copper wire for any long lead runs. See Figure 2-7 above for connections and refer to RTD manufacturing specifications to determine color code polarity.

2.3.3.3 Linear Inputs - Linear inputs consist of current inputs (4 to 20 milliamps or 10 to 50 milliamps) or variable voltage input ranges (±100 millivolts, ±1 volt, ±10 volt, and normally open/closed contact inputs).

Connect **CURRENT** and **VOLTAGE** inputs as shown in Figure 2-7 above.

NOTE: CURRENT INPUTS require the user to install a precision 50 Ohm shunt resistor across the input terminals.

Signal inputs greater than 10 volts require the use of an input voltage divider (consult your local representative or the factory).

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2.3.4 Relay Output, Contact Input (Option)

WARNING

TO PREVENT THE POSSIBILITY OF ELECTRICAL SHOCK, USE EXTREME CAUTION WHEN WIRING CONTACT OUTPUT CONNECTIONS. HAZARDOUS POTENTIALS MAY EXIST ON CONTACT OUTPUT TERMINALS WHICH ARE FLOATING WITH RESPECT TO INSTRUMENT GROUND. THESE HAZARDOUS POTENTIALS MAY BE EXPOSED ON THE REAR TERMINAL PANEL OF YOUR INSTRUMENT. ANY VOLTAGE POTENTIALS AT THE CONTACT CIRCUIT WILL EXIST ON THE INSTRUMENT'S RESPECTIVE CONTACT OUTPUT TERMINALS; E.G. LINE-POWERED CIRCUITS.

The Recorder may be equipped with an optional Digital Input Output Board which has six potential free Form C relay contacts and three opto-isolated digital inputs. A terminal block as shown in Figure 2-10 below, is provided for the six-alarm output **Potential Free Form C connections: normally open (NO), common (C), and normally closed (NC),** and the three digital inputs which share a common. The relay contacts are capable of switching **250 VAC ~ at 1 Amp or 30 VDC at 1Amp. An Output Board with three potential free Form C relay contacts and NO digital inputs is also available (not shown).**

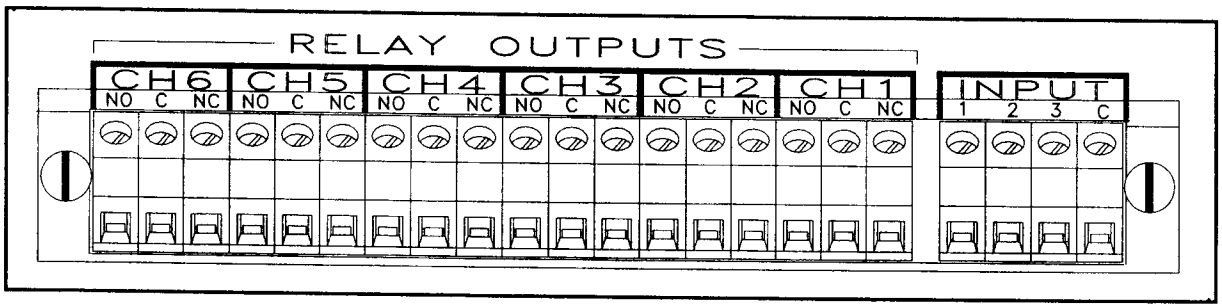


Figure 2-9 Digital I/O Connections

The potential free relay contacts are protected internally with 300 volt Metal Oxide Varistors (MOVs) to prevent contact arcing.

The opto-isolated inputs require an external potential of **5 to 12 volts DC @ 10 milliAmps.** The three inputs are isolated from the unit, but not from each other as they share a common. The positive voltage connects to the terminals marked 1, 2 or 3 and the common connects to the terminal marked C. It is possible to use potential free contacts to operate the digital inputs. This requires opening the unit and setting jumpers on the relay board. This will remove the isolation. Contact factory for detail.

The terminal strip is protected by a transparent acrylic cover held in place by two screws. This cover protects the user from accidentally touching terminals that may have hazardous potentials on them and must be removed before wires can be connected to the terminals. Loosen the two screws at either end of the cover and remove them. **Replace the cover once all connections have been made.**

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2.4 Serial Port - RS232 or RS485 (Optional)

The Recorder comes standard with an RS232 serial communication port (the RS485 is optional). The RS232 connection requires a standard DB9 Female connector and connects to an IBM PC compatible computer using a null modem cable and can support cable runs up to 50 feet (16m). The RS485 connection is via two wire (twisted pair) cable and can support cable runs up to 4000 feet (1300m).

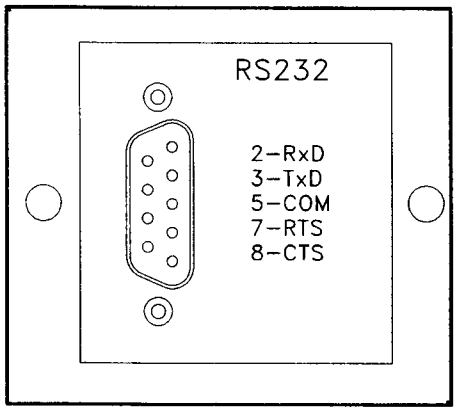


Figure 2-11 RS232 Interface Option

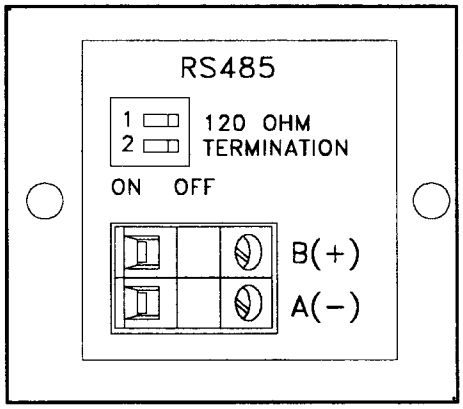


Figure 2-12 RS485 Interface Option

The RS232 Connection to the DB9 female connector are as follows:

DB9 Pin	Connection	Direction	Modem (DB25)	Computer (DB9)
2	Received Data (RxD)	In to Recorder	3	3
3	Transmit Data (TxD)	Out From Recorder	2	2
5	Common	Common for all Signals		5
7	Request to Send (RTS)	Out From Recorder (Not Used)	NC	8
8	Clear to Send (CTS)	In to Recorder	4,5	7

When connecting to a remote computer, connect that computer's RTS and CTS lines together and connect only pins 2, 3 and 5 from the Recorder. The Recorder TxD line goes to the computer RxD line, and the Recorder RxD line goes to the computer TxD line. The common is connected at both ends. A null modem cable with female connectors on both ends can be used to connect the Recorder to an IBM compatible Personal Computer. Connections to a modem are shown above.

The RS485 line connection has a positive (**B**) terminal and a negative (**A**) terminal, with the red cable going to the **A** terminal. This option has an internal terminating resistor which may be connected to the line by switching either of the two switches above the connector. Note - both switches must be off to disconnect the resistor (default position). Up to 31 Recorders and or other RS485 compatible devices may be connected to the line. Only the first (usually the controller) and last units on the line must have the terminating resistors switched in, and then only for long cable lengths. The type of cable used will limit the data rate and distance. For this unit, 24 AWG polyethylene twisted telephone cable that has a shunt capacitance of 16pF/ft (52pF/m) will allow the full distance of 4000 feet (1300m).

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2.5 Cleaning

The unit may be cleaned by wiping with a soft cloth. The front panel and display / keypad may be wiped with a slightly damp soft cloth containing soapy solution or a mild detergent. DO NOT USE ANY LEMON BASED (CITRIC ACID) PRODUCT TO CLEAN THE DISPLAY / KEYPAD.

2.6 Contrast Adjust (Monochrome Units Only)

The contrast or viewing angle of the monochrome LCD display can be adjusted from the rear panel. If not adjusted correctly, the display may look dim, dirty, completely black, washed out or blank. Insert a small star or Philips type screwdriver in the hole in the rear panel as shown in Figure 2-13 and turn to adjust the display contrast. The adjustment potentiometer has a 270° rotation - do not apply excess pressure or attempt to turn it beyond the end stops.

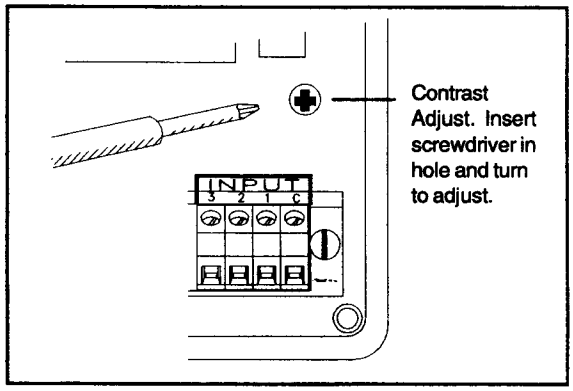


Figure 2-13 Contrast Adjust

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Chapter 3

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Chapter 3 GETTING STARTED

The Instrument is an extremely versatile solid state data recorder. It has a liquid crystal display capable of complex graphical representation and either a floppy disk drive or PCMCIA Memory Card for data storage. The unit is very programmable and the average user will probably never need to use most of the features or functions available in the recorder. This chapter will give the user a brief system overview and guide the first-time user into a simplified setup which will enable you to begin recording with the least amount of effort.

3.1 Moving About the Screen

The Recorder has an LCD Graphics Screen that also acts as a touch keypad. Areas of the screen are active as push buttons, the exact areas which are sensitive depends on what is currently displayed. The user has only to lightly touch the screen area depicting the button to activate the function. If the buzzer is turned on, the unit will provide audible feedback, as a short beep, each time a "button" press is registered. The default display is shown in Figure 3-1 below.

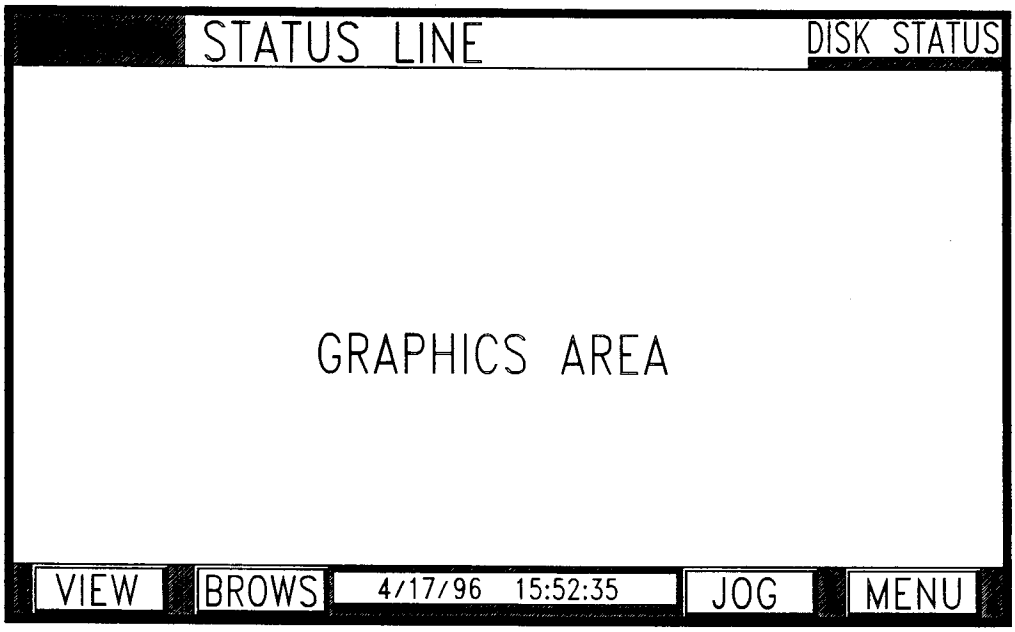


Figure 3-1 Recorder Screen

The screen is divided into three distinct areas, the **BUTTON BAR**, along the bottom of the screen (containing the time / date stamp), the **STATUS LINE**, across the top of the screen, and the **GRAPHICS AREA** between the them. Under normal operating modes, when not in a menu, the BUTTON BAR area is active for "Button" pressing. The **MENU** button on the bottom right of the screen, will bring up the command menu button bar, see below, which allows the user to do a number of functions and select the option of programming the unit. Refer to Chapters 4 and 5 for details.



Figure 3-1 The Command Menu Button Bar

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The **VIEW** button is on the lower left side of the screen, and it enables the user to scroll through the selectable display options in the graphics area of the screen. These views might be charts, bar graphs, digital or Alarm information. Each time the "button" is pressed, the next view is presented. The Graphics display can be either a full screen of information, or the screen can be split, allowing combinations of the primary screens to be displayed. The user can also choose whether the screen is horizontally or vertically oriented.

The area along the top of the display is the **Status Bar** or Status Line, and it is used to display a number of user programmed functions such as the unit tag (identification) or the digital values of the various channels or alarm status. On the right hand side of the Status Line is the **disk status** information (disk info). This displays the current condition of the disk that is currently being used to save data. When the unit is not recording, this area shows **REC OFF**. When Recording it displays **REC↑** when recording at the fast rate or **REC↓** when recording at the slow rate, as well as **XX%** used, where XX is the amount of disk space already recorded. The default display is set using the **DISPL** option on the Command Menu button bar. The **JOG** button is used to switch between channel data.

To the left of the Status Line is the position of the **ACK** button (not shown). This is the Alarm ACKnowledge and is only present when there is an alarm condition, at which time it blinks until the user presses it to acknowledge the alarm condition. Pressing the Acknowledge button will also reset any Output relays if this option is installed and programmed. Note that the **ACK** button will always be the top most button, always rising to the surface when covered by other items such as menus. The user can thus acknowledge an alarm at any time, even while in the programming mode.

As the user moves through the menu options, more or fewer buttons will be shown. The key buttons are always displayed on the button bar along the bottom of the display. **ENTER** and **EXIT** buttons are always in the same place on the button bar allowing rapid movement through menus.

The **BROWS**e button is only displayed on screen views that can actually be browsed. These are the full Chart Screen and the full Alarm Status Screen. The user can choose to browse **RAM** (Random Access Memory) which is the screen trace data, or **File**, in which case a file menu will be presented so that the user can choose a file from the disk. The **BROWS** button also allows the user to **SEARCH** historic data either by TIME or VALUE, as well as **COMPRESS** data in time.

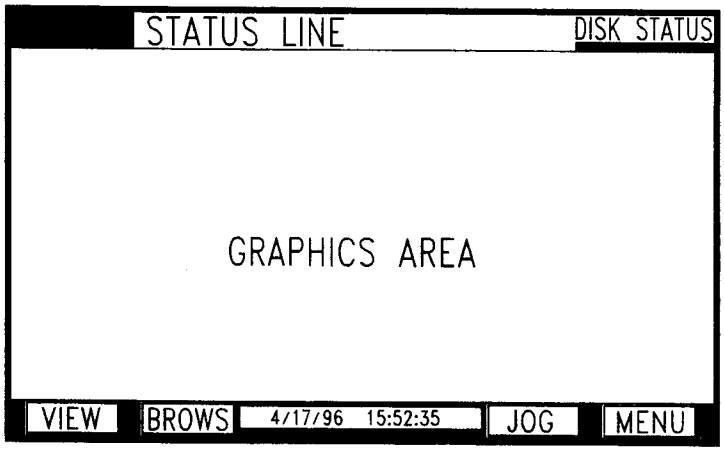
Pressing the **BROWS** button puts a freeze on real time display and allows the user to scroll back in time to browse through historical data that has passed off the screen or has been recorded previously, even on another machine. The actual Chart Screen browse buffer is dependent on the memory options installed, the number of traces being displayed and the effective chart speed. With the standard buffer, a chart speed of one inch per hour with four traces active, it is possible to browse back around 140 hours (5½ days). The user may choose to browse files on the disk rather than the current memory buffer even though the unit is currently recording. The user can then browse files that had been recorded earlier, or may even browse the file that is currently being recorded. Once the data has been recorded to disk, it is possible to use the file browser or the PC and the companion software to view data as far back as the start of recording, irrespective of how long that may be, within the constraints of disk capacity.

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3.2 What the Screens Mean

The basic screen layout is shown in Figure 3-3 below. Each area is used to present different information to the user.

3.2.1 Status Line



The Status Line is used to show the Unit Tag, Point information, rear terminal Junction Temperature or Alarm information. The choice as to what is transiently displayed is set in the DISPL menu (Chapter 4.2.1) or the user can set the default display for this line in the "PROGram - Display - Powerup disp" menu (Chapter 5.4.3). At any time the user can press the JOG button to display point data on the Status line. Each time JOG is pressed the next point data will be shown. The data can be set to auto jog from the "PROGram - Display - Powerup disp - Autojog" menu (Chapter 5.4.3.2).

Figrue 3-3 Basic Screen Layout

The Point information is displayed on the Status line as " Point No. Value Units" as shown below

1 0.496 VOLTS

The Alarm information is shown on the Status line as "Point No. Value Alarm Type/Number" - where H1 is High Alarm #1. There are 5 possible alarms per channel, H = High, L= Low R = Rate. If more than one alarm is active they will cycle on the Status Line. If there are no alarms active the Status Line will show -

1 0.496 HI

NO ALARMS

The Unit Tag is shown on the Status Line and may be up to 20 characters long. It is entered from the "PROGram - Display - Powerup disp - Unit Tag" menu (Chapter 5.4.3.1) and displays as entered -

This is a UNIT TAG

3.2.2 Disk Status

The area in the top right corner marked DISK STATUS is used to show Disk Status. The following messages may appear in this area:

OFF 15%	Unit is not recording to disk. Record Mode is OFF - Disk is 15% full.
REC↑ 15%	Unit is recording to Disk in HIGH speed mode - Disk is 15% full.
REC↓ 75%	Unit is recording to Disk in LOW speed mode - Disk is 75% full
FORMAT	Disk is being Formatted
SAVE CFG	Saving Configuration to Disk
LOAD CFG	Loading Configuration from Disk
TRIG 75%	Unit is waiting for an Event or Alarm to turn the Record Mode on - Disk is 75% full.

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3.2.3 Button Bar

The Button Bar is the area across the bottom of the screen where the main menu buttons appear. The function of these buttons varies according to which mode the unit is in. Figure 3-3 shows the Normal mode button layout.

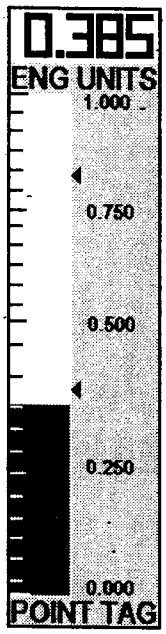
3.2.4 Date/Time Window

The Date /Time window sits at the bottom of the screen in the Button Bar and continuously shows the current date and time. Date is shown numerically in either American Month/Day/Year or European Day/ Month/Year format. The format is selected in the "PROGram - Display - Time format" menu (Chapter 5.4.2)

3.2.5 Graphics Window

The graphics window is used to display various information in different formats. The **VIEW** button is used to switch between the various graphic displays which can be Trend Charts, Bar Graphs, Digital Windows or Alarm/Event data, or combinations of these. Furthermore the graphics can tend to be horizontally or vertically oriented. The orientation is selected in the "PROGram - Chart/Pens - Direction" menu (Chapter 5.5.4)

3.2.5.1 Bar Charts



Bar graphs can be displayed on their own or as part of a split screen. Up to twelve can be displayed at a time. The user can select to display bar graphs either horizontally or vertically. The assignments of points to bar graphs is made in the "PROGram - Display - Bar assign" menu (Chapter 5.4.4). The format of the vertical bar graph is shown opposite in Figure 3-4. The very top of the bar has the actual/real time digital value of the point, in this case 0.385. Immediately below this is the Engineering Units shown as ENG UNITS. There can be a maximum of five characters. At the very bottom of the bar graph is the Point Tag shown as POINT TAG. This is a ten character description of the point. Note - not all characters can be displayed on the bar graph. Between the ENG UNITS and POINT TAG is a bar that represents the actual value as a function of the full scale value. To the right of the bar are scale values. The alarm setpoints, if any are set, are indicated on the bar by a "◀" in the text area. If any alarm is active, the bar will be blinking. The Engineering Units, Point Tag, alarm setpoints and scaling of the bar is done in the "PROGram - Points" menu (Chapter 5.6)

Figure 3-4 Bar Chart

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3.2.5.2 Digital Windows



Figure 3-5 Digital Window

Digital Windows can be displayed on their own or as part of a split screen. Up to twelve can be displayed at a time. The assignment of points to digital windows is made in the "PROGram - Display - Digital assign" menu (Chapter 5.4.5). The format of the digital window is shown opposite in Figure 3-5. The large numbers in the center of the window are the real time point value. Above this point value is the Point Tag shown as POINT TAG. This is a ten character description of the point. Below the point value is the Engineering Units shown as ENG UNITS. There can be a maximum of five characters. The Engineering Units, Point Tag, and scaling of the digital value is done in the "PROGram - Points" menu (Section 5.6).

3.2.5.3 Alarm/Events Data Window

Alarms/Events Data Log
Alarm Checks On

Date	*Time*	*Point*	*Status*	*Value*
07/28	14:58:56	Pt 1	HIGH1	0.504
07/28	14:52:09	Pt 1	*	0.492
07/28	14:51:33	Pt 5	FALSE	0.000
07/28	14:45:00	Pt 6 HI	Reset	17.427
07/28	14:35:27	Pt 6 Hi	Peak	23.568
07/28	14:40:15	Pt 1	HIGH1	0.504
07/28	14:22:56	Sw 1	CLOSE	

Figure 3-6 Alarm/Event Window

The alarm/event window is used to display alarms, events and reset information. This data may also be recorded to disk by enabling Alarm data in the "PROGram - Disk functions - Alarm on/off" menu. (Chapter 5.7.2).

The second line of the display indicates the status of the alarm checking. If alarm checking is enabled this will indicate 'Alarm Check On' or it will indicate 'Alarm Check Off' in which case no alarms will occur.

The state of alarm checking is changed in the "FUNCtion - Alarm Check" menu (Chapter 4.2.3.7).

The format for any entry in the Alarm/Event file is - Date Time Point Status Value. The Point value is shown as Pt X, where X is the point number. The Value shown is dependent on the Event. The Event can be an Alarm, an input contact closure (event) or a reset, either automatic or manual.

For linear inputs, the alarm event description is HIGH1 or LOW2, where the number is the alarm count up to a maximum of 5. For conditional inputs, the alarm event descriptions are OPEN, CLOSE, TRUE or FALSE. The value is the actual value at the time the alarm was registered. An event message of "*" is an alarm return to normal condition, the time the point came out of alarm.

Resettable points, such as totalizers, will show the event as RESET, with the actual value at the time of reset. Some Resettable point types, such as HI PEAK will have two entries (Pt 6 above). The first entry is the date and time that the high peak occurred, with the peak value, the second entry, above it, is the actual time the reset occurred, with the value at that time. Note: Resettable points will not print unless the Reset Print option is turned on in the "PROGram - Points" menu (Section 5.6)

For external events via the digital inputs, the user can define separate messages for each of the three inputs, one for input activated (Close) and one for input deactivated (Open). These event messages can be entered, up to a maximum of ten characters, in the "PROGram - Digital I/O - Event msgs" menu (Chapter 5.9.3). This message will appear in the log as - date - time - Switch number (Sw X) - Event message. Default event messages are CLOSE and OPEN as in the last line in the logger example above.

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3.2.5.4 Trend Window

The trend window is the one that looks like a "paper" recorder. It has traces or pens and emulates the paper chart, moving the "paper" across the screen, and is shown in the vertical mode in Figure 3-7 below. The direction of the trending can be vertical, from top to bottom, or horizontal, from right to left. The direction can be changed in the "PROGram - Chart/Pens - Direction" menu (Chapter 5.5.4). There may be as many as twelve pens on the chart at a given time. Pens are assigned to the chart in the "PROGram - Chart/Pens - Pens" menu (Chapter 5.5.3).

Consider the vertical chart below, the same features are found on the horizontal chart. Along the top of the chart are the pen pointers, one for each pen that is on. These track the real time value of the points and identify the origin of the trace.

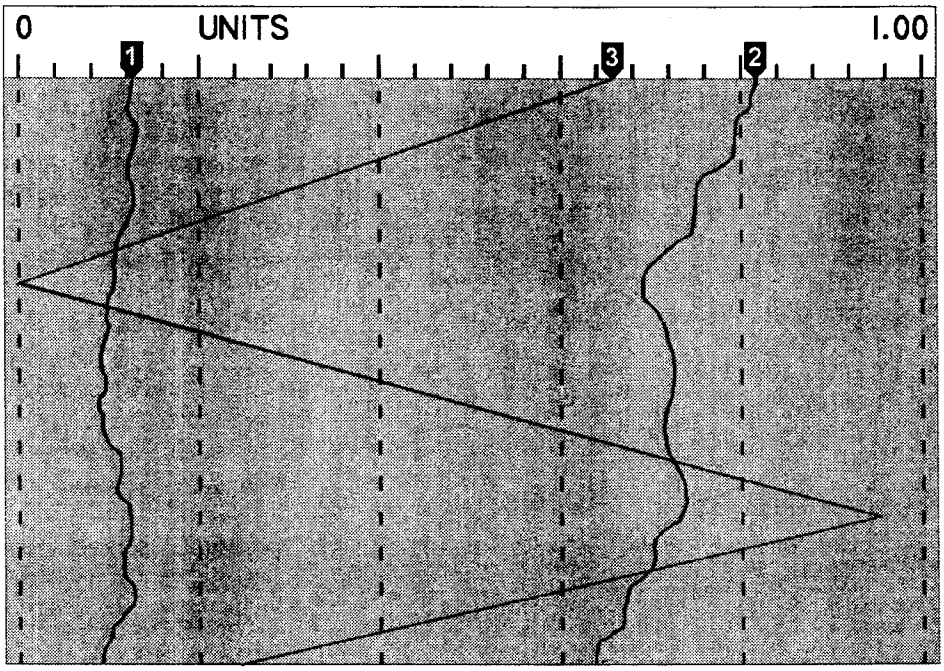


Figure 3-7 Vertical Trend Window

There are grids on the screen, both horizontal and vertical. In the above example, the vertical grid spacing is a function of the divisions on the chart scales. The horizontal grid lines indicate the scales for the chart, and if there is more than one scale set, they alternate. On the full screen trend view, the scales can be toggled through by pressing the middle of the scale (top center of the display). Each scale has its end points marked along the top of the chart with the scale value, the 0.00 and 1.00 indicating that the trace has a value of zero when it is hard to the left, and 1.00 when it is hard to the right. There is a marker on top of the pen pointers to indicate which pens reference the current scale. Thus when interpreting the data for pens 1 and 2 use a value of 0 to 1.00 full scale. When the scale changes, so will the markers on the pen pointers to indicate the pens for the next scale. Also along the top of the chart are the scale UNITS.

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3.2.5.5 Transient Windows

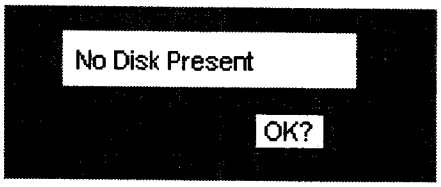


Figure 3-8 Transient Window

Transient windows are those that appear momentarily. They pop up over any existing window to inform the user of a problem or of a background task being completed. They require a user response, normally pressing the "OK?" button, to acknowledge the message.

3.3 Browsing, Compressing and Searching Data

Once at the full trend screen (using the VIEW button), the user can choose to browse, search or compress either data from the disk, including the file currently being recorded to disk, or immediate past data which is buffered to memory (RAM). The operation of browsing is the same whether the user is browsing memory or file data. When **BROWS** is pressed a new button bar is presented with three buttons, FILE , RAM and EXIT as shown in fig 3-9 below.

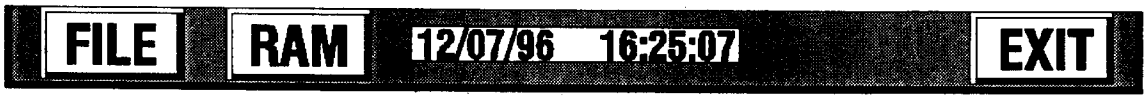


Figure 3-9 The Browse Source Button Bar

Select FILE to browse prerecorded files on the disk, RAM to browse Trend data from memory, or EXIT to return to the real time view.

Browsing allows the user to view historic data of the pens currently trending on the display or saved on the disk, without affecting any real time data acquisition. Alarm data can also be browsed from memory by selecting BROWS on the full view Alarm window. See section 3.3.5 for the added step required to browse from disk.

On the Trend screen, pressing **BROWS** brings up the Browse Source button bar. Press RAM to browse memory or FILE to browse from disk. This brings up the Browse Mode Button Bar shown below (Figure 3-10).



Figure 3-10 The Browse Mode Button Bar

The **FINDV** and **FINDT** buttons initiate the SEARCH functions. FINDV is FIND by Value, FINDT is to FIND by Time. The "→←" and "←→" are to COMPRESS and EXPAND data respectively. **BROWS** enters the interactive Browse Screen and **EXIT** returns to the prior screen.

3.3.1 Compressing Data

The data on the screen may be compressed up to 32 times the normal view, this enables long term trends to be seen on a single screen. Each time the "→←" (Compress) button is pressed the data is compressed by a factor of 2, and it may require a short time for the recorder to process the data. Five presses give the maximum 32 times compression. The data may be expanded back by pressing the "←→" (Expand) button. The user can enter the interactive browse mode with any level of compression by simply pressing the **BROWS** button.

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3.3.2 Searching Data By Time

The historic data can be searched by time, by pressing the **FINDT** (FIND Time) button. This will bring up a transient window showing the time to be searched. If the displayed time is correct press **ENTER**, if not press **NO**. This will bring up a series of windows to allow the required time to be entered. The Date will then be displayed. Press **NO** to change or **ENTER** to accept. The data will be searched and the sample corresponding to the required time and date will be placed under the cursor near the center of the screen. The search may take some time, especially if searching a large disk file. If no point is found the unit will display "No Point Found". The user can then enter the interactive browse mode by pressing the **BROWS** button.

3.3.3 Searching Data By Value

The historic data can be searched by value, by pressing the **FINDV** (FIND Value) button. This will bring up the Search Value button bar shown in Figure 3-11 below.

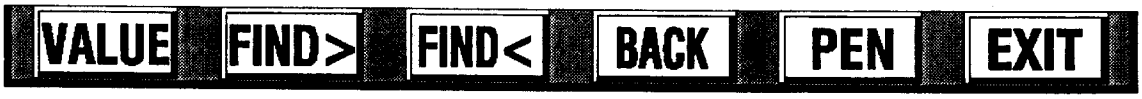


Figure 3-11 The Search Value Button Bar

To set up the actual Value to search for, press the **VALUE** button. Use the numeric keypad to enter the value to search for. Note that you cannot search for an exact match, you will be looking for a value immediately greater than or less than the value you enter. Once you have entered the value you want, press the ENTER button.

Before you begin a search, you have to decide which PEN or point you are going to use as the search reference, and which direction you wish to search in.

Use the **PEN** button to select the pen trace to search. Each time this button is pressed, the next pen is selected. The current pen is shown in the status line at the top of the screen, together with the value of the trace under the cursor and its actual time and date stamp.

The search direction is determined by the button to the left of the **PEN** button. This button toggles between **BACK** and **FWD**. BACK will search BACKWARDS in time from the current cursor position (into older data), while FWD will search FORWARDS in time from the current cursor position (into newer data).

To initiate a search press either the **FIND>** button to find the first point GREATER than the search value, or **FIND<** to find the first point LESS than the current search value. Each time either of these buttons is pressed, the next point that meets the search criteria is found. Note that once a point is found, the next point to be found will be the one that is after the first point that does not meet the criteria. The search "hops" across all other values so that you are not bogged down finding useless information. Therefore if you are searching for a point on a sine wave, for example, you will find the same point on the same phase of the wave (360° apart). Otherwise you would find every point less than or greater than the search point which could be every point in the trend.

The point that meets the search criteria will be placed under the cursor near the center of the screen. The search may take some time, especially if searching a large disk file. If no point is found the unit will display "No Point Found". The user can continue to search for other points in the same direction or change direction and search again. Once an acceptable point is found, the user can enter the interactive browse mode by first pressing the **EXIT** button to return to the Browse mode button bar (Fig 3-10 above), and then pressing the **BROWS** button.

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3.3.4 Interactive Browse

The interactive browse mode enables the user to uniquely identify points on the screen by time, date and value, and move around in time. Once the Browse source has been selected, FILE or RAM, pressing the **BROWS** button again, immediately or after a search or compress operation, will enter the Interactive Browse mode, and the Browse Button Bar shown in Fig 3-12 below will appear.



Figure 3-12 The Browse Button Bar

The cursor appears near the center of the screen and it can be moved with the ↑ (UP Arrow) and ↓ (Down Arrow) keys in the Vertical mode or with the ← (Left Arrow) and → (Right Arrow) keys in the Horizontal mode. Pressing these keys a single time, moves the cursor one sample at a time, holding these keys will cause the cursor to move in 10 sample increments. As the cursor moves, the time and date information is updated in the status window at the top of the screen. To move about more speedily, the **PAGE-** and **PAGE+** buttons move the data forward or backward an entire screen at a time.

When browsing graphics, the **Status Bar** at the top of the screen shows the Date and Time stamp and actual value for the trace data directly under the cursor. Note that if you are browsing Memory there will be an "M" in the right hand corner of this line or if browsing Files, there will be an "F" as follows:



To see the actual pen data value press the **PEN** button to toggle the data through each trace if more than one trace is displayed. As the data is toggled, the traces for all pens but the selected one, disappear. Press **EXIT** to return to real time viewing from the RAM browser or to the directory from the FILE browser.

3.3.5 File Browsing

File Browsing can be done at any time, note however that if you are browsing from disk while recording, there may be delays in retrieving data from the disk as writing to disk has priority over reading from disk. Press **BROWS** to bring up the Browse Select Button Bar and choose FILE, to browse files from the disk.

Note: Ensure that a disk is present and that it has suitable files or you will get an error message.

Once FILE has been pressed the unit will check the disk then bring up a directory. If there is more than one file per point, the files for that point will be displayed one under the other with an "<" indicating the current file selected as shown below. The list will scroll if it is longer than what will fit on the screen.

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```
                File Browser Directory
Point No: 1

BATCH1    .DT1<
BATCH2    .DT1
BATCH3    .DT1
```

If only one file is available per point, the directory selection will default to that file, if no files are available for that point, the directory will indicate "No Files Found". Use the POINT button to select the point you want.

Once you have the directory listing of files for the specific point, use the ↑ (UP Arrow) and ↓ (Down Arrow) keys to select the file you wish to browse, indicated by the "<" mark. Press the **ENTER** button to browse the selected file. Once the file is loaded, it is browsed, compressed or searched in the same manner as the memory browser described above. Press **EXIT** to select a different file or **EXIT** again to return to real time viewing.

This space intentionally left blank.

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3.4 Getting to the Points

The Instrument is a 12-channel or 12 point recorder of which up to 6 channels may be direct or real world inputs. These are typically voltages or currents. Any channel not being used to record or display live inputs may be used as a computational channel. Inputs can be conditioned or scaled to display any range of engineering units. Refer to Figure 3-13 below.

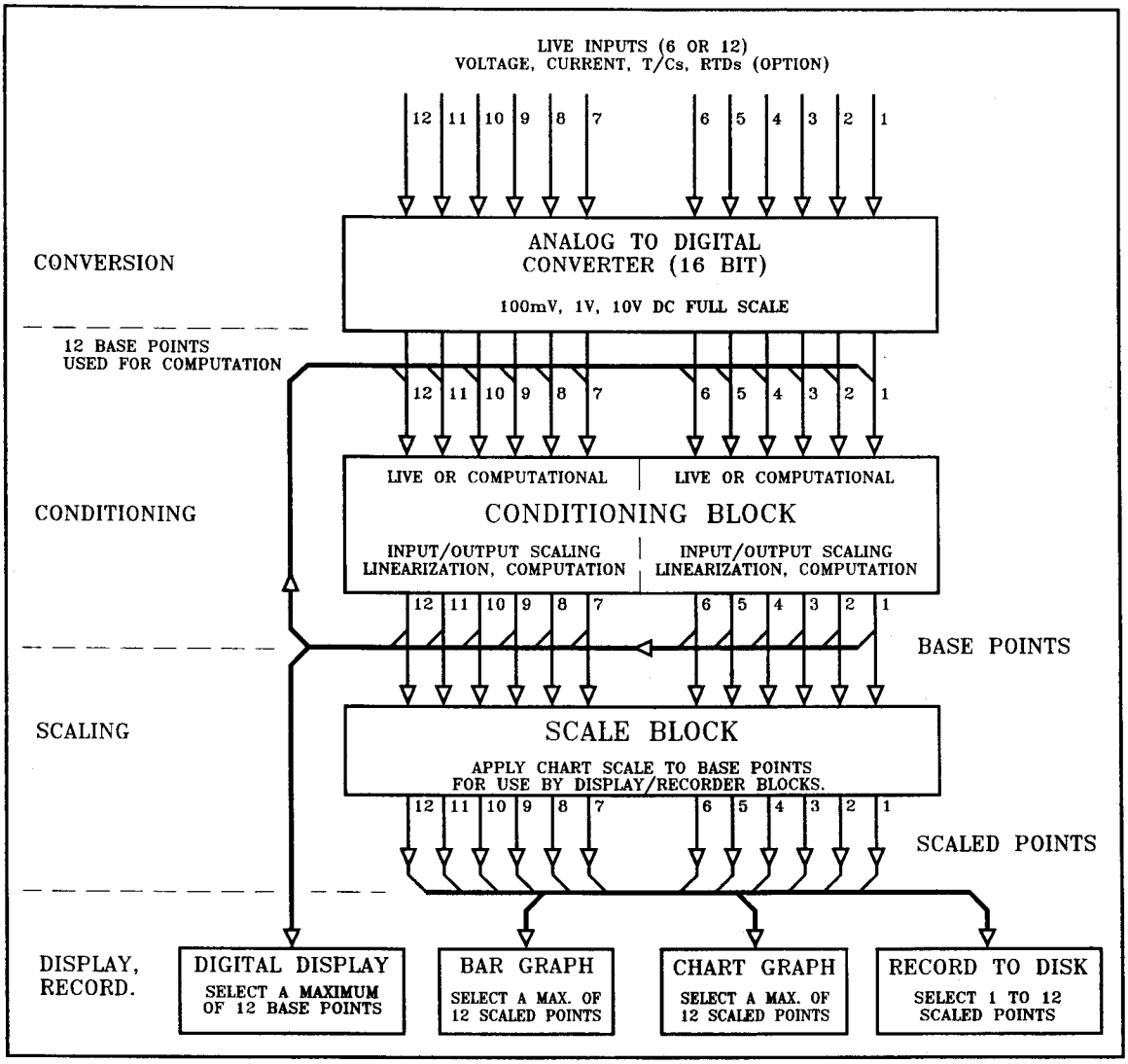


Figure 3-13 Data Flow

There are four distinct levels of data handling, namely conversion, conditioning, scaling and display/record. Conversion applies only to live inputs and is the process of converting real world analog signals into a 16-bit digital value that can be used by the Recorder. There are three full-scale ranges for all conversions, 100 milliVolts, 1 Volt or 10 Volts DC, full scale. The converted values pass to a conditioning block which converts the binary value which is effectively a percentage of full scale, into a value useful to the user. Conditioning includes converting the binary value into a representative voltage, conditioning and linearizing this voltage to represent for example, a real world temperature as might be input by a thermocouple or RTD, and applying any other computation as required. The conditioning block handles 12 channels. The outputs from the conditioning

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block are referred to as **base points** and may be fed back to the inputs of the conditioning block to form the basis (base point) for other base point computations. This includes tracking peak or valley values, doing moving averages, timed averages, difference, totalization or any other user-entered equation.

The input to any channel in the conditioning block can be any one of the base points, or it can be the live inputs. Live inputs can have input and output scaling applied in the conditioning block unless this is pre-defined by the nature of the input, i.e., thermocouples. An example of input/output scaling is given in section 3.5.

The outputs of the conditioning block are also the values represented in the Digital Windows and are real-world engineering values. The outputs of the conditioning block are also fed through to a **scale block** where a **chart scale** is applied to each point. The chart scales determine what part of the full scale range will be used by the display/record block. There are two sets of 8 scales available to the user. The second set is an alternate set which can be applied to the base points in place of the normal set when triggered by an external event. Each chart scale may be applied to any one or more of the base points to provide an output **scaled point**. These scale points are then applied to the display/record block which consists of the visual information or recorded information that the user requires. Up to twelve scaled points are applied to the bar graph display. Up to twelve may be displayed on the chart and up to twelve may be recorded to disk. Note that points recorded to disk need not be the same as points displayed on the bar graph or the chart, however, in the case of the chart, any point which is not recorded to disk will have limited browse capability. The user should also be aware that applying scaling other than full scale output to recorded data, limits the data to the range between scale endpoints. It is possible to store the base point with different scaling than is used to display it on the chart using one of the computational channels.

3.5 Using Chart Scales

To better understand the use of input and output scaling, and how scaling base points affects the data, consider the following example, highlighted by Figure 3-14.

Assume the user wants to record the output from a pressured transducer which gives a 0 to 5 volt DC output signal. This coincides to a pressure of 0 to 3000 pounds per square inch (PSI). The process being monitored typically runs at 2200 PSI ±10%, this is the area of interest. The output of the transducer which peaks at 5 volts is connected to live input channel 1 and the 10 volt full-scale range is selected to cover this range. Since the maximum input voltage will be only 5 volts on a 10 volt range, use the **input scale** option to set the low end at 0.0, and the high end at 5.000 volts. To convert this directly to PSI, the **output scale** is set at low point 0.0 and high point 3000.0. The **base point** now becomes 0 to 3000 for an input of 0 to 5 volts, scaled linearly across the range. The engineering units can be set to PSI and the point tag can be set to any label that identifies the process. All of this is accomplished in the Points menu - Section 5.6. Apply scale A to the base point, this too is selected in the Points menu.

It is then necessary to define **chart scale** A to suit the requirement - Section 5.5.2. In order to maximize the display resolution, the user is interested in pressure ranges from 2000 to 2500 only. Scale A is thus set for a low end of 2000, a mid-range of 2250 and a high end of 2500. This scale point is now assigned to the bar graph and the chart graph. The chart will thus display from 2000 to 2500 as will the bars, maximizing the display resolution for the value of interest. The user can choose to record this particular value, in other words, what you see on the chart is what is recorded to disk, values from 2000 to 2500. Or, if so desired, the user can choose to record a second point which will show pressures from 0 to 3000. To do this, use the channel 1 as a base point for a computational channel and multiply this value by 1 which is then recorded to disk.

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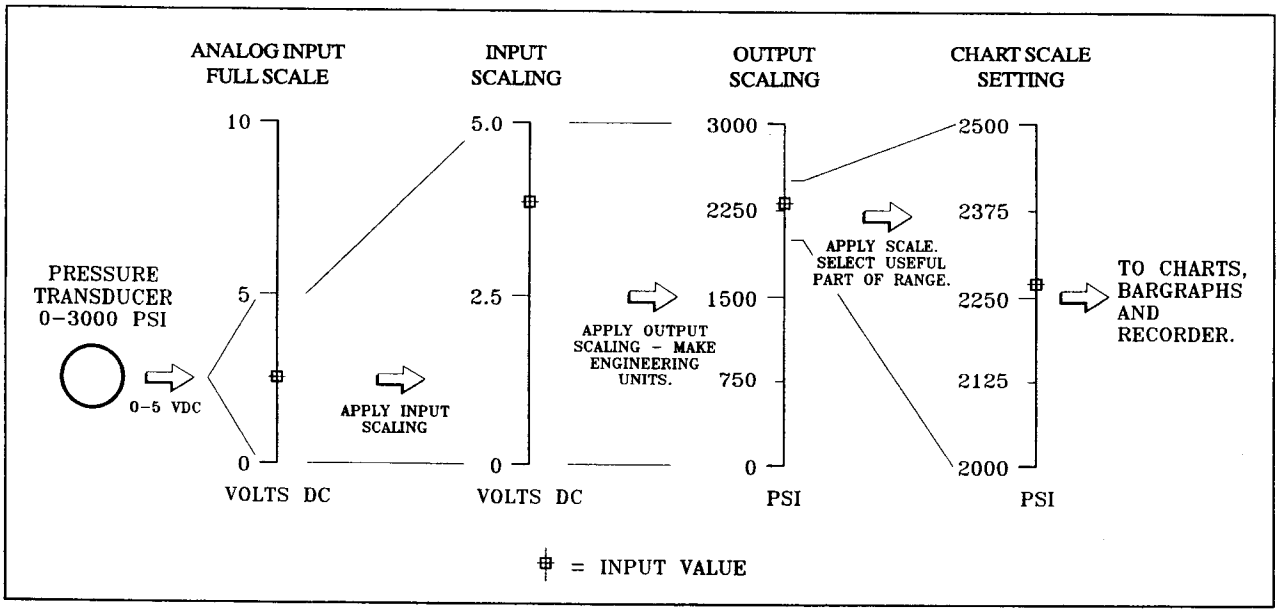


Figure 3-14 Scaling Example

3.6 Programming

While the unit may be programmed remotely, this exercise deals with manually programming the unit from the front panel using the display and the touch screen keypad. Various buttons and keys will be presented on the display. The user simply makes a choice by pressing the appropriate key or button. In some instances, direct selection is not possible but rather a series of choices is made by using an UP (↑) or DOWN (↓) arrow button, pressing ENTER or EXIT. Once programming is complete, the unit automatically LEARNS the current setup which is stored in nonvolatile memory and remembered indefinitely.

When powering up the unit for the first time or if the data in the nonvolatile memory should become corrupt, the user will be asked to perform a Smart Initialize, select **No**. The user will then be requested to perform a full initialization. Select **Yes** at this stage to reset all values to the default.

There are many parameters that can be programmed, including time and date, the display, the virtual chart and pens, the points, the recording capability, the alarms, the digital outputs and the communication port.

3.7 Programming Time and Date

Begin by programming the time and date. To enter the program mode, press the **MENU** button displayed in the bottom right corner of the screen. This will bring up the Command Button Bar. The Status Line may display "Command?" or any other preprogrammed item that the user has chosen. To enter the Programming mode, push the **PROG** button which will bring up the Program menu. The user can navigate about this menu by using the UP (↑) and DOWN (↓) arrow keys to highlight the menu choice and then pressing **ENTER**. Note that as a choice scrolls off the bottom of the menu, it reappears at the top. This is a quick way of getting around the choices. Some buttons also auto repeat. At any time, the user can exit from the menu by pushing the **EXIT** button as many times as it takes to return back to the display screen.

Use the UP (↑) and DOWN (↓) arrows to select the **Time and Date** menu choice then press **ENTER**. The current time will be displayed in 24 hour format. If the time is correct, you may choose not to program the time by pressing **YES** or **ENTER** to accept the current time. To change the time, press **NO**. You will be presented with the hours menu and a numeric keypad which will enable you to enter the current time in hours. Use the LEFT (←) and RIGHT (→) buttons to move the cursor to the digit you wish to change or simply enter the hours using the numeric keys. Use the SPACE button **(SPC)** to clear any digit. Once you have selected the correct number of hours, press **ENTER**. Note that you cannot enter an illegal value. Once the hour has been pro-

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grammed, the minutes menu will be presented. This will then be followed by the seconds menu once the minutes have been programmed.

Once the time has been programmed, the date is presented. To change the date, select No. To accept the date, select Yes or **ENTER**. Once the date has been programmed or accepted, you will be returned to the Program menu.

3.8 Programming Points

The **points** are the input or calculated channels that are assigned to the display or are recorded. In case there is any incorrect point data stored, clear all points before reassigning them. To do this, get to the Hidden menu (Press **MENU** then the **upper right-hand** button (disk status area)). Select **Initialize** then press **ENTER** and then using the UP (↑) and DOWN (↓) arrow keys select the **Clear Points** menu option by once again pressing **ENTER**. You will then be asked whether or not you wish to "clear?" the points. Select **Yes** which will return you to the menu. Press **EXIT** twice to return to the Programming menu.

From the Program menu, select **Points** and press **ENTER**. You will be given the option to either program points **(Prog point)** or program constants. Select **Prog(ram) Point** and press **ENTER**. You will be presented with an alphanumeric keypad and will be prompted for which of the twelve possible points to program. Select **1** and press **ENTER**. The Points Program menu will be presented. You can choose to either set up a point **"Setup pt"**, copy the data from another point that has already been set up **"Copy pt"**, or restore the original data you just removed **"Restore Pt"**. Select **"Setup pt"** and press **ENTER**. You now have a selection of various ways in which this point can be programmed. These include Linear, Industrial square root "Ind sqrt", Log linear, thermocouple "T/c", RTD, Calculated, Conditional, or External. Program this point as a Linear point by selecting **Linear** from the menu and pressing **ENTER**. You now have to choose the full scale input range for this point. Note that when this point is programmed as a milliamp input, it is necessary to set the switch for that channel on the rear panel to connect in the terminating resistor that allows the current to be measured as a voltage input. Read chapter 5.6 for more detail. Program this point for one volt full scale input by using the UP (↑) and DOWN (↓) arrow keys to select **"1V"** and pressing **ENTER**. You will now be presented with a menu that enables programming of various options pertaining to this particular point in the one volt full scale mode. These include the Point tag, Input scale, Output scale, Engineering units, Alarms and Chart scale. Refer to the detailed chapters for those items not covered below.

3.8.1 Point tag

This is an alphanumeric indication of what the point represents and is generally located or displayed at the bottom of the bar graphs or on the chart itself. This information is also stored to disk to uniquely identify the point. To add a point tag, select this option and press **ENTER**. You will be presented with the first page of an alphanumeric keypad. There are four pages available which includes all the upper and lower case alphabet characters, numerics and various signs and symbols for programming engineering units. Up to ten characters for the point tag may be entered (only six will be displayed on the screen). To access characters on another page, simply press the **PAGE** button. The space is **'SPC"**, the LEFT (←) and RIGHT (→) arrows move the cursor to the position you wish to edit or enter. You may exit this menu choice without programming a tag or, once programmed, press ENTER to return back one menu with the tag in place.

The way data is displayed on the chart or recorded to disk is a function of three things: the input scale, the output scale and the chart scale. These may be programmed independently to provide a full scale output of any range of the input. A description of this is given at the end of this chapter - Using Scales.

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3.8.2 Input Scale

Select Input scale from the menu and press **ENTER**. You will be presented with the value to represent the low or bottom end of the input scale and for this range, it will default to 0. Up to thirteen characters can be entered. The number can be in floating point format using the E Key. It may be positive or negative, right or left justified. For our programming example, accept 0 as the low end and press **ENTER**. You will now be presented with the option to program the high value. This value will default at 1. For the sake of our exercise, accept this value by pressing **ENTER**.

3.8.3 Output Scale

The output scale is the value that will be reflected on the display or recorded to the units and will once again be scaled by using the chart scale programmed at a later time. Select **Output Scale** by pressing **ENTER**. What we will do is program this to be 0 - 100. This first option presented is to select the number of decimal places that will be presented. This varies from 0, which is a whole number, through to 5, which is E notation. Use the UP (↑) and DOWN (↓) Arrow Keys to select three decimal places and press **ENTER**. Once selected, you will be presented with the value for the low end of the output scale. This will default to 0, select this value. You will now be presented with the high value which defaults to 1. Use the RIGHT (→) Arrow Key to move the cursor under the decimal point then press 0 twice and the period or point once so that you have 100.0 on the display, then press ENTER. You have now effectively programmed the output scale to represent 100 times the input scale.

3.8.4 Engineering Units

At the program menu, use the UP (↑) or DOWN (↓) Arrow Keys to select **Engineering Units** and press **ENTER**. You may enter up to five characters representing the Engineering Units using the alpha numeric keypad in the page mode as done for the point tag. We will use percent as the Engineering Units. Press the Page button three times until you see the '%' (percent) sign. Press the '%' (percent) button and press ENTER. We have now programmed the Engineering Units to percent.

3.8.5 Chart Scale

To finalize the display scaling, we need to set the chart scale. Select this option from the Program menu - Chart/Scales - Scales, and you will be offered a choice, Chart Scale = A by default. You can select one of eight scales numbered A - H by using the UP (↑) or DOWN (↓) Arrow Keys. For the sake of this example, select **B** as the chart scale to use and press **ENTER**. You will be returned to the Programming menu. The actual chart scale is programmed elsewhere and is covered in Section 3.9.1.

3.8.6 Alarms

There are five alarms associated with each point and these can be programmed using the Alarm menu. Select **Alarms** and press **ENTER**. At this point in time, we are not going to spend any time on programming the alarms. You may browse through it to see the capability of the instrument. Programming alarms is dealt with in Section 5.6.14. Note that in order for Alarms to be active, the user has to enable Alarm checking in the **FUNC**tion Menu. Press Exit to return to the Programming menu then press Exit one more time to exit the Programming menu. You will be asked whether or not you wish to keep Setup. Answer yes at this point in time to load the values into the system.

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3.9 Programming Point Scales

See also Section 5.5.2. From the Programming Menu use the UP(↑) or DOWN (↓) Arrow Keys to select the **Chart Pens** programming option.

3.9.1 Programming Scales

Select the **Scales** option. Here you can program to Chart scales. Two sets of eight scales are available - Set '1' labeled A - H and set '2' labeled A - H. The exact details are covered in Section 5.5.2. Right now we wish to program the scale that we assigned to the previous Point 1 we have just programmed. Use the arrows to select the scale **1B** then press **ENTER**. You are now presented with a menu which enables you to program the scales. The scale type can be programmed logarithmic or linear and defaults to linear which we will accept.

3.9.1.1 Use the arrow keys to select **Scale Ends** and press **ENTER**. You are presented with a menu to select the number of decimal places that will be presented, 0 - 5. Use the arrows to select two places and press **ENTER**. We will assume that we wish to present the percentage scale from 40 to 80 percent only across the screen effectively expanding the resolution that we can see. Enter a low value of '40' and press **ENTER**. You will then be asked for a mid-scale value. The scale can be made non-linear by entering a mid-point which in fact is not midway between the two end points. The advantages of this is described in the Using Scaling Section at the end of this chapter. Keep things linear by selecting the mid-point as being 60 which is halfway between the 40 and 80 end points we chose to select. Use the RIGHT (→) Arrow Keys to position the cursor under the '5' which is default and press '6'. The display should read '60.00'. Press **ENTER** to accept. For the high value, enter 80. Press the space twice, enter '8' so that the display shows '80.00' and press **ENTER**. You will be returned to the Scale Programming menu. Programming of other options such as scale type, scale ends, scale grid and scale units is covered in Section 5.5.2.

3.9.1.2 The Scale Units can be programmed in percent to match the output scale programmed in Section 3.8.3. Once this is done, press **Exit** twice to return to the Main Programming menu. We have just programmed Point 1 to be a live input of 0 - 1 volts which will be scaled to an output of 0 - 100% and we have chosen to display between 40 and 80% full scale on the display and this is what will be recorded to disk.

The user can now program the other points in a similar fashion, simply selecting the point number and choose to copy point 1 into points 2 and 3 or program these from scratch. It is suggested that the user fully reads the rest of the chapters of this manual to become familiar with the functions of the various menu options.

3.10 Recording Data

The recorder saves data, on command, to either 3½ inch floppy disk or PCMCIA memory card, referred to as disks, depending on which option you have. The disks are MSDOS™ compatible and can be read on any IBM PC compatible with a 3½ inch floppy drive or PCMCIA drive. Data is stored on the disks as individual pen files with additional files for configuration and alarm/event logging. Any DOS or Windows file manager can be used to move, rename, erase or archive the files. Recording may be started or stopped manually, by an external event or on internal alarm.

Each of the 12 points may be recorded at different sample rates, or the user can choose to record all points at the same rate. This enables slowly changing parameters to be recorded at a slower rate than faster changing signals. Also the user can choose whether to store data in average or instantaneous modes.

The amount of data that can be saved depends on the number of channels and the sampling rate; both parameters can be set by the user. As a guide, a typical 3½ inch 1.44 Megabyte floppy disk can hold approximately 700,000 16-bit samples, while a 4 Megabyte Flash memory PCMCIA card can hold approximately 2 million samples.

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These numbers must be divided by the number of channels and the sampling rate to determine the total storage time for the disk. For example, using a 3½ inch 1.44 Megabyte floppy disk, recording four channels at 1 sample per second, the total recording time is:

700,000 divided by 4 (channels) multiplied by 1 (second) = 175,000 seconds or 48 hours.

If the sampling rate were changed to 60 seconds, or 1 sample per channel every 1 minute, the recording time becomes 120 days.

There is an option that allows the recorder to recycle data on the disk. The user can also store other types of data on the disk. Configuration files contain information about how the recorder is set up and uses the space of around 4,000 samples. Alarm/Event log files record all alarm and/or events to disk. Each Alarm or event uses the space of 6 samples. The amount of data that can be stored on a disk is thus a variable dependent on circumstances (how many alarms occur) and what has been selected for recording.

We will use the recorder to format a disk and set it up to record four channels at a sample rate of once every five seconds.

NOTE: Before a disk can be used for recording it must be **FORMATTED**. This can be done on any IBM compatible PC or at the recorder using the Data Logger Programming Menu.

3.10.1 Formatting a disk

With the unit turned on, locate the disk drive behind the pull-down panel below the LCD screen. Ensure the disk is not write protected. The plastic slide in one corner of the floppy disk must be in a position such that it exposes the hole in the plastic cover. The PCMCIA card may have a tiny slide switch on the back end which will be marked as to which way is write protected. Insert the disk, label side up, into the drive and push home. In the case of the floppy disk, the metal slide goes into the drive first.

Press **MENU** at the bottom right corner of the LCD screen. This will bring up the command button bar. Press **PROG**ram and use the UP (↑) and DOWN (↓) Arrow keys to scroll the highlight bar to "Record Setup" then press **ENTER**. This will bring up the **Record Setup** Program Menu. Use the UP (↑) and DOWN (↓) Arrow keys to scroll the highlight bar to "Format". This will bring up a window that displays "Format = NO*". Press **YES** then **ENTER** to begin formatting. The light on the drive will come on until the format is complete and a "Format Done" message will be displayed. Press "OK?" to end the format. The disk is now formatted and ready for use.

3.10.2 Selecting the Record Mode

There are a number of parameters that need to be set up before actual recording can take place. These are - which channels or points to record, at what rate to record them and which record fill mode to use. There are basically two record fill modes - "Fill to end" and "Cyclic."

3.10.2.1 Fill to End

Data is recorded on the disk until the disk is full, then the recording stops. The status of the disk (amount of disk space used in %) is displayed on the status line.

3.10.2.2 Cyclic

Data is stored on the disk in blocks. In the cyclic mode, once the disk becomes full, the first block of data recorded is overwritten by the most current block. A block contains approximately 500 samples, thus the 500 oldest samples are replaced with 500 newest samples. This continues to happen until the recording is stopped. The recorder recycles the space on the disk and can record indefinitely. The oldest data is always replaced with newest data and you will have a record of the most current data. The amount of data that will be on the disk is calculated as described above.

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3.10.2.3 Average or Instantaneous Recording

There are two methods of storing data to the disk, average or instantaneous. Average mode will average all input data sampled at 4 times per second to the record rate being recorded. Thus if data is being stored to disk once every minute (60 seconds), 240 samples will be averaged. Instantaneous mode stores only the latest sample to the disk and is used if you have one of the special functions enabled, such as peak reading or moving average that does not need to be averaged.

3.10.3 Programming the unit for recording

To program the unit for recording, press **MENU** in the bottom right corner of the screen then press **PROG**ram. Use the UP (↑) and DOWN (↓) Arrow keys to highlight the "Record Setup" menu option. Press **ENTER** to go to the Record Setup Programming menu as shown opposite in Figure 3-15.

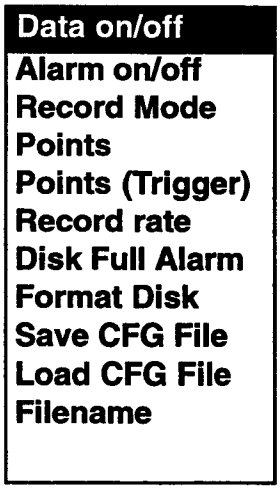


Figure 3-15 Record Setup Menu

3.10.3.1 Set the record mode

Use the UP (↑) or DOWN (↓) Arrow keys to highlight "Record Mode" and press **ENTER**. Then use the UP (↑) or DOWN (↓) Arrow keys to select "Fill Mode". Use the UP (↑) or DOWN (↓) Arrow keys to select either "Fill to End" or "Cyclic" and press **ENTER**. This will set the record mode and return to the Record Setup Menu. To select Instantaneous or Average record mode, select "Inst/Avg All" to set all channels at once to the required mode, (as opposed to Inst/Avg Indiv" to set each channel **individually**.) Use the UP (↑) or DOWN (↓) Arrow keys to select Average and press Enter to select then press EXIT to return to the Record Setup menu.

3.10.3.2 Points

Now you need to decide which points you wish to record. Use the UP (↑) or DOWN (↓) Arrow keys to highlight "Points" and press **ENTER**. A window pops up and displays "Point 1 = NO*" or "Point 1 = YES*". To record this point press **YES**, to exclude this point press **NO**, then press **ENTER** to move to the next point. There are twelve possible points, 1 - 9, A, B and C. Set points 1,2,3 and 4 to YES. Exit this menu at any time by pressing **EXIT**, or accept any entry by pressing **ENTER**.

3.10.3.3 Record Rate

The record rate is the rate at which data is recorded to disk. It may be set independently for each channel, or for all channels together, from a fastest time of four times per second by setting the record rate to 0 seconds, or the slowest rate of once every 600 seconds (ten minutes).

To set the Record Rate, use the UP (↑) or DOWN (↓) Arrow keys to highlight "Record Rate". This brings up the Record Rate menu. Use the UP (↑) or DOWN (↓) Arrow keys to highlight "All rates", ignoring Autorate and Individual Rates for now. The display will show "secs (lo) >1 <" for seconds low. Use the numeric keypad to enter the record rate 5 (5 seconds between samples, 0=4samples/sec) and press **ENTER**. This sets the record rate for all channels simultaneously. The display will then show "secs (hi)>0 <". Use the numeric keypad to enter the record rate 5 and press **ENTER**. Note for this purpose, both high and low record rates are set the same. The record rate can be changed by an external event if the digital I/O option is fitted or by an alarm event.

You need to arm the unit to record the actual data using the "Data on/off" menu selection. Use the UP (↑) or DOWN (↓) Arrow keys to highlight "Data on/off" and press **ENTER**. The current record status will be shown as "Record Data =Yes" or "Recorder Data =No". Press **YES** then **ENTER** to enable recording of data or **NO** then **ENTER** to inhibit data recording. There is also an option to enable ALARM or EVENT recording using the "Alarm on/off" menu option. To actually begin recording you must exit until you get the command button bar. Press the **FUNC**tion button and use the UP (↑) or DOWN (↓) Arrow keys to

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highlight **Record On/Off** and then press **ENTER**. There are three choices - "Record Off" will stop recording, "Record On" will start recording and "Trigger" enables automatic stop and start recording based on internal or external events that have been initiated. Ensure there is a formatted disk in the drive then select "Record On". From the pop-up window press **YES** then **ENTER** to begin recording. Once a recording is started the drive light comes on periodically as data is stored to the disk. Also, the status line at the top right of the screen will indicate the percentage of the disk used.

NOTE: NEVER REMOVE A DISK FROM THE DRIVE WHILE THE DRIVE LIGHT IS ON

To stop the recording return to the same menu and select "Record Off". From the pop-up window showing "record off?" press **YES** then **ENTER**. Wait for the disk light to go out and the status to show **REC OFF** before removing the disk.

3.11 Changing File Names

The user can name files to help identify the process being measured. The system uses a single filename for all types of files, pens, alarm, and configuration. The filename can be any DOS compatible name. To change the filename, select Record Setup from the PROGRAM menu and press Enter. Use the UP (↑) or DOWN (↓) Arrow keys to highlight "Filename" and press **ENTER**. The current filename will be displayed. Use the alphanumeric keypad to enter up to eight characters. Do not enter any file extension or ".". Press the **ENTER** button when done. Filenames can be changed as often as needed and multiple file sets can be recorded onto the same disk. Multiple configuration files may also reside on a single disk.

3.12 Setting the Disk Full Alarm

It is possible to set a threshold to indicate when the disk is full. The indication is via a pop-up window on the screen, or if the relay option is fitted, via a contact closure. The threshold limit may be set by the user to any value between 1 and 100 percent.

To set the disk full alarm value, press the MENU button and then select the PROGRAM button. Use the ↑ (up arrow) and ↓ (down arrow) buttons to select the "Record Setup" option and press the ENTER button. This brings up the Record Setup menu. Use the ↑ (up arrow) and ↓ (down arrow) buttons to highlight the "Disk Full Alarm" option and press ENTER. There are two menu options, Setpoint and Contact #. Select "Setpoint" and press ENTER. Use the alphanumeric keypad to enter the percentage point at which the disk will indicate nearly full (0 to 100 percent, where 0 implies do not indicate disk full) and press ENTER. Select "Contact #" and press ENTER. Use the numeric keypad to enter a relay contact number, 1 through 6, or 0 for no contact closure. Press ENTER to return to the Record Setup menu.

A message will pop up on the display when the disk usage equals the percentage value entered above and the corresponding relay contact will close. Note that in all cases a message will pop up on the display and the relay contact will close when the disk is full.

3.13 Loading and Saving Configuration Files

Once all the points have been set up and all other data has been programmed, it is advisable to save the configuration to disk. Thus if the user needs to change any parameters for a different recording session, the prior settings can be recovered by loading a previously saved configuration file.

To save the configuration use the ↑ (up arrow) and ↓ (down arrow) buttons to select the "Record Setup" option and press the ENTER button. This brings up the Record Setup menu. Use the ↑ (up arrow) and ↓ (down arrow) buttons to highlight the "Save CFG File" (save ConFiGuration) option and press ENTER. A pop-up window will display "Save config = NO", press YES then ENTER to save the configuration with the current filename to the disk. The disk status window will show SAVE CFG and a window will pop up when the configuration has been saved. Press OK.

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To load and existing configuration select "Load CFG File" from the Record Setup menu. A pop up window will display "load config=NO". Press the YES then ENTER buttons. The unit will look on the disk for any configuration files which will be displayed on the File Browser Directory. If more than one file exists on the disk, the directory will list them one above the other, with the current file to be loaded indicated by the "<" sign alongside it.

File Browser Directory

Config Files:

OLDFILE .CFG<
NEWFILE .CFG

If more than one configuration file exists use the ↑ (up arrow) and ↓ (down arrow) buttons to select it and press the ENTER button. This list of configuration files will scroll down if it is longer than what will fit on the display. The unit will load the selected configuration file from the disk, and a window will pop up indicated that this has been completed. Press the OK button. At this point in time the recorder has to be restated by first removing then reapplying the power, in order to recognize the new settings.

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Chapter 4

Operation

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Chapter 4 Operation

4.1 Instrument Power-up

The Recorder executes multiple tests at initial start-up. These tests are referred to as Start-up Tests. While these tests are being performed, the recorder displays "Wait.." on the status line. If the system fails any test, an error message will display and an error beep will sound. Be aware, however, that certain test failures are considered non-recoverable and will result in a complete shut-down of the system. These failures require immediate repair before the Recorder can continue to power-up.

4.1.1 Start-up Tests

The following paragraphs explain each test performed at initial start-up along with any possible error messages and recommended operator actions.

4.1.1.1 Memory Test (RAM)

This routine tests all memory (RAM). If this test fails, the unit will halt, indicating the error, and must be repaired before further operation is allowed.

4.1.1.2 ROM Test

A test is performed to verify the integrity of the system software by computing a 32-bit cyclic redundancy code (CRC) and comparing this code with a code stored in EPROM. If this test fails, the operator is given a choice to accept the fault and allow power-up to continue or not accept and power down the unit. If not accepted, the unit will halt and must be repaired. **The *only* time this fault should be accepted is after installing a software upgrade to the instrument.**

4.1.2 Load Database (user configuration)

The user configuration for the unit is stored in non-volatile battery backed memory. This memory consists of two main sections, Profile and Data Point Registers (DPR). The database is transferred from working memory areas to holding memory areas. The unit transfers this database back from the holding memory area to the working memory area during the power-up sequence. If no errors are detected, this transfer is practically instantaneous, no messages are displayed, and the recorder continues to power-up normally.

The units user Profile database is grouped into blocks. Each block contains setup parameters related to a particular instrument function (i.e. display, chart, scan, etc.) and is protected by a checksum. The DPR database is also composed of discreet blocks, each block containing all the set-up information of a particular programmed Point. Each point DPR is protected by a checksum. During the automatic Learning operation, the Profile blocks and Point DPRs along with their checksums are transferred to the holding memory area.

If the recorder finds a bad checksum in any Profile block during the power-up load database sequence, it will halt. The user is given a choice to ignore the problem or perform a Smart or Full initialization. (See Section 4.1.3 Initialize Database.)

Answering NO to both "Smart" and "Full" initialization queries forces the Recorder to continue to power-up with corrupt parameters in the User Profile Database. This may be successful or the Recorder may "hang-up" or periodically reset.

Failures in the profile database should not occur. However, "in the real world" anything is possible. If this error occurs, a Smart initialization will have the least affect on the user profile database and allow completion of the power-up sequence.

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If the Recorder finds a bad checksum in any Point DPR during the power-up load sequence, it will not issue any error message. Bad DPR's are flagged as "CORRUPT". A corrupt DPR may only be corrected by reviewing the associated point.

4.1.3 Initialize Database

Three forms of initialization (init) may be performed on the Unit's Profile database, Smart Init, Full Init and Erase Configuration. The user will not typically see these options unless the unit is being powered up for the first time, or the unit finds an error in the database. These conditions may be manually invoked using the Hidden menu option.

4.1.3.1 Smart Init

Smart Initialization verifies that each Profile database block has a correct checksum and (if incorrect) each parameter in the corrupt block(s) is verified to be within allowable boundaries. Only those parameters in corrupt blocks found to be outside these boundaries are changed. Bad parameters are always replaced with pre-defined defaults.

4.1.3.2 Full Init

If the user answers no to "Smart init?", a choice is presented to force the Recorder to do a "Full init?". Full initialization will completely clear all user-defined parameters, setting them to pre-defined defaults.

4.1.3.3 Erase Config

This option is used on first time power up and will not normally be seen by the user unless the database has been corrupted or this option is called from the SYSTEM menu. This option will clear all variables to zero, and should be used to clear memory before programming for the first time, or after upgrading the firmware. This operation is usually performed at the factory.

4.1.3.4 Init Defaults

The listing below gives the default parameters that are used by both Smart and Full initialization:

Display Block	
Power-up Display Mode =	Unit Tag
Display Rate =	1 second
Time Format =	American
Language =	English
Scan Block	
Alarm Contact Outputs =	Open on Clear, No Reflash, Failsafe off, Open on ACK
Alarm Checks =	Enabled
TCBO Test Interval =	300 seconds (5 minutes)
Serial Port	
Serial Port =	Set to Modbus RTU, 9600, 8bits, parity off, 2 stop bits
Chart Scales Block	
For Each Scale . . .	
Scale Type =	Linear
Origin =	Left
Decimal Fix =	3 places
Scale =	Low = 0.0 Mid = 50.0 High = 100.0
Engineering Units =	Set to all spaces (cleared)
Active Scaleset =	Set to scaleset 1

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Bargraph/Pens Block

Pen Assignments =	Set to Pen 1 = point 1, Pen 2 = point 2, Pen 3 = point 3, Pen 4 = point 4, Pen 5 = point 5, Pen 6 = point 6, Pen 7 = point 7, Pen 8 = point 8, Pen 9 = point 9, Pen A = point A, Pen B = point B, Pen C = point C
Bar Assignments =	Set to Bar 1 = point 1, Bar 2 = point 2, Bar 3 = point 3, Bar 4 = point 4, Bar 5 = point 5, Bar 6 = point 6, Bar 7 = point 7, Bar 8 = point 8, Bar 9 = point 9, Bar A = point A, Bar B = point B, Bar C = point C
Digital Assignments =	Set to Digital 1 = point 1, Digital 2 = point 2, Digital 3 = point 3, Digital 4 = point 4, Digital 5 = point 5, Digital 6 = point 6, Digital 7 = point 7, Digital 8 = point 8, Digital 9 = point 9, Digital A = point A, Digital B = point B, Digital C = point C

Display Chart Speed Block

Unit Tag =	Set to "Unit Tag"
Chart Speed =	Standard. High Speed, No AutoSpeed change on alarm
Lo Chart Speed =	60"/hr
Hi Chart Speed =	60"/hr

Passcode Protection Block

Program Key Passcode =	Set to None
Function Key Passcode =	Set to None

Digital Inputs (External Switches)

All 3 inputs =	Set to Events mode
All Event Messages =	Set to spaces (cleared)

Recorder

Record =	Off
Record Speed =	4 samples/second
Record Mode =	Fill to End
Pens =	None
Record Data, Alarms =	Off

File Name

Filename =	SWRevNo (Software Revision Number)

This space intentionally left blank.

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4.2 Menus

Programming procedures available through the Command Menu Button Bar are initiated by pressing the **MENU** button at the right of the Main button bar at the bottom of the display. The Command Menu button bar has entry points to DISPlay, PROGram, and FUNCtion menus. The RECORD function is accessible in the FUNCtion menu. Both the PROGram menu and the FUNCtion menu can be password protected, each with it's own password. Refer to Section 4.2.4.2. The PROGram menu is covered fully in Chapter 5, "Programming".



Figure 4-1 The Command Menu Btton Bar

Each programming procedure includes example displays of programmable parameters set to default values (values seen at the first entry into a menu item) for consistency between examples. All other values representing user-input values will be displayed with the alpha character **X**.

NOTE: Whenever programmed parameters are changed, they are saved in nonvolatile memory automatically.

4.2.1 DISPL (Display) Menu

The DISPLay MENU allows the user to access the menu items listed below. This is the information that is displayed transiently, in the STATUS line along the top of the display screen (See Fig 1-1 for location of the Status Line). This display can be used to show point data, alarm information or the unit tag. Using the AUTOJOG feature (programming menu), this display can scroll data to display more than just a single point. Note that the default display is the Unit Tag, which is programmed in the PROGram - Displays - Powerup display - Unit prompt, menu option. (Section 5.4.3).

Follow the procedures below to access the DISPLAY MENU.

4.2.1.1 Point

To display a Point value on the Status Line, press the DISPL Key and use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Point". Press **ENTER** and "point? X" will display. Use the Numeric Keypad to select the point number you wish to display and press **ENTER**. Listed below are parameters or responses that may be displayed:

Point Number, Value and **Engineering Units**

Point Number, Value and **Alarm Status** (Status Line showing Alarm)

Not Found - Point number requested does not exist in the database.

Bypassed - Point number requested is bypassed.

TCBO - Thermocouple Burnout

Invalid - ADC overrange for direct inputs

Overflow - Data of calculated points exceed the limit of the floating point math function.

Overrange - Point measurement exceeds the limit of the table.

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NOTE: To have the point information come up automatically at power up and be the default display, use the Display Programming option to set "Points" as the Powerup display default. The "Autojog" default option will cycle through all points. Refer to Section 5.4.3.

4.2.1.2 Alarms

To display an Alarm status, press the DISPL Key and use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Alarms". Press **ENTER** . The display will show the status of the alarms. If no alarms are present the display will show "NO ALARMS", if more than one alarm is active, the display will cycle through all active alarms. If the Alarm check option is turned off, this will be indicated on the display as "ALM CHKS OFF"

NOTE:. To have the Alarm information come up automatically at power up and be the default display, use the Display Programming option to set "Alarms" as the Powerup Display default. Refer to Section 5.4.3.

4.2.1.3 Junction Temp

To display Cold Reference Junction Temperature, press the DISPL Key and use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Junction Temp". Press **ENTER** . The display will show the cold reference junction temperature in degrees Fahrenheit (°F) (degrees Celceus (°C) if the time format is set to European).

NOTE:. To have the Junction Temperature information come up automatically at power up and be the default display, use the Display Programming option to set "Junction Temp" as the Powerup Display default. Refer to Section 5.4.3.

4.2.1.4 Version

This function displays the software version number in a pop-up window. To display the version of software in your unit, press the **DISPL**ay Key and use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Version". Press **ENTER** and the version of software in your unit will be displayed. Press **OK** to return to the Version menu item then EXIT to return.

4.2.1.5 Media Status

This function displays the status of a disk. To display the media status window, press the **DISPL**ay Key and use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Media Status". Press **ENTER** and a window will be displayed (Figure 4-2) showing the total size of the disk, the amount of free space available on the disk, the write protected status, the status of the format, and battery information for PCMCIA cards. To remove the media status window, press the **DISPL**ay Key and use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Media Status". Press **ENTER** and the window will clear.

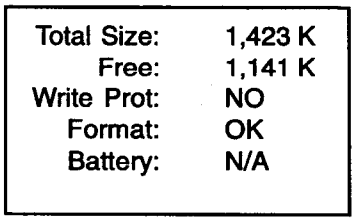


Figure 4-2 Media Status Window

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4.2.2 PROG (Program) Menu

The Program Menu allows the user to program inputs and associated parameters into the Recorder. Refer to Chapter 5 of this Manual for complete programming details.

4.2.3 FUNC (Function) Menu

The Function Menu allows the user to select the following functions:

Record On/Off
Activate Points
Bypass Points
Reset Points
Chart Speed
Record Speed
Alarm Checks ON or OFF
Scale Set one or two
Print Event Messages to the Alarm window / file

The FUNCtion menu may be password protected in which case you will be required to enter the password before proceeding. Refer to Section 4.2.4.2 - Passcodes.

4.2.3.1 Record On/Off

The Record On/Off allows the user to stop or start recording to disk. The choices are

Record off
Record on
Trigger

To select the Record On/Off menu use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Record On/Off" and press **ENTER.**

4.2.3.1.1 Record Off

This function enables the user to stop the recording to disk irrespective of the state of any record triggers. To stop a current record session use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Record Off" and press **ENTER.** A pop up window will ask to confirm the selection "record off?". Press "YES" to proceed or "No" to exit. Press EXIT to return to the FUNCtion menu.

4.2.3.1.2 Record On

Before recording data, the user must set up the record information as detailed in Chapter 5 Section 5.7 - Record Setup. Parameters which need to be set include filename, whether to record Data, Alarms or both, the record speed, which channels to record and record mode. Refer to Chapter 3 for quick set up information.

The Record On function will start recording to disk irrespective of the state of the record triggers provided the record setup has been done correctly. To begin recording use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Record On/Off" and press **ENTER.** A pop up window will ask to confirm the selection "record on?". Press "YES" to proceed or "No" to exit. Press EXIT to return to the FUNCtion menu. Any disk problem will be reported by the unit in a pop up window.

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4.2.3.1.3 Trigger

Selecting Trigger will enable the unit to record from an external event or internal alarm. Internal record on alarm triggers are set in the Record Setup menu (section 5.7.5) while external event triggers are set in the Digital Input/Output Setup menu (section 5.9.2). If the recorder is set in the record TRIGGER mode, either of these event triggers will control the record on or record off function depending on whether the events are active or inactive.

The current record status is shown in the Disk Info window in the top right corner of the screen. If the unit is not recording, this window will show **REC OFF.** To start recording, assuming all parameters have been correctly set up, press the FUNC button from the main menu bar, then "Record On/Off", then press enter to select the Record On/Off option. A window will pop up showing the current record status such as "record = NO*". To begin recording, press the YES button (or to stop recording press the NO button) then press **ENTER**. After some housekeeping, the unit will either start or stop recording, depending on your selection. The Disk Info window will show disk activity. Any disk error will be shown in a pop-up window.

4.2.3.2 Activate Point

This menu item returns temporarily bypassed points to the measurement cycle for measuring inputs and displaying information. To activate a point, press the FUNC Key (FUNCtion) on the Main Menu Bar. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Activate pt" and press **ENTER**. Use the numeric keypad to enter the point number to activate and press **ENTER**. The display then scrolls to the next point. When point activation is finished, press **EXIT** to return to the "Activate pt" display.

4.2.3.3 Bypass Point

This menu item removes active points from the measurement cycle. A bypassed point will still be in the database and the message **BYPASSED** will display when the bypassed point appears on the display or is printed. To Bypass a point or points, press the FUNCTION Key and use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Bypass pt". Press **ENTER** and the display will read "point? X". Use the numeric keypad to enter the point to bypass and press **ENTER**. The display will then scroll to the next point in sequence. Use the above procedure to bypass any additional points. When finished, press **EXIT** to return to the "Bypass pt" display.

4.2.3.4 Reset Point

This function allows certain point values to be reset without reprogramming each parameter. The value of the following types of calculated points may be reset:

Moving Average	Resets data to the current value of the base point
High Peak	Resets data to the current value of the base point
Low Peak	Resets data to the current value of the base point
Totalize	Resets to zero

Only the above listed point types will be prompted in this menu item. To reset a point, press the FUNCTION Key at the "COMMAND" prompt and use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Reset pt". Press **ENTER** and the display reads "point? X". Use the numeric keypad to select the point to reset. Press **ENTER** and the next sequential point will be displayed. When resetting points is complete, press **EXIT** to return to the "Reset pt" menu item.

4.2.3.5 Chart speed

This menu item selects between High and Lo chart speed. The actual chart speed is selected in the PROGram - Chart/Pens - Speed menu. The default setting for both high and low chart speed settings is 60 inches per hour. When the chart speed is modified, the new speed and the time is printed on the left side of the screen.

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To select the chart speed, press the FUNCTION Key at the "COMMAND" prompt and use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Chart speed". Press **ENTER** and use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Speed = HI" or "Speed = LO". When the display is highlighting correct hi or low speed, press **ENTER** to activate and **EXIT** to return to the "FUNCtion" menu.

4.2.3.6 Record speed

This menu item selects between High and Lo sample rates for record speed. The sample rates are set in the **PROG** - Data Recorder - Sample Rate menu (Section 5.7.6). These rates can also be changed via an external event (Section 5.9.2).

To change record speed, press the FUNCTION Key at the "COMMAND" prompt and use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Record speed". Press **ENTER** and use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Speed = HI" or "Speed = LO". When the display is showing the correct hi or low speed, press **ENTER** to activate and **EXIT** to return to the "FUNCtion" menu.

4.2.3.7 Alarm Checks

This menu item controls the ON/OFF status of the Alarm Checks function. If NO is selected, a point's value will *not* be compared to the programmed High or Low alarm setpoint values, NO ALARM CHECKING WILL BE PERFORMED. To change the Alarm Checks status, press the FUNCTION Key at the "COMMAND" prompt and use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Alarm checks". Press **ENTER** and use the **YES** or **NO** key to get the proper display, either "almchk=NO" or "almchk=YES", and press **ENTER**. The display will return to the "Alarm checks" menu item.

ALARMS WILL NOT BE CHECKED UNLESS THIS OPTION IS ENABLED AS "YES".

Note that the Alarm Event Window shows the current status of the Alarm Checking.

4.2.3.8 Scale Set

This menu item is used to select the active Scale Set, Scale Set 1 or 2. To select a Scale Set, press the FUNCTION Key at the "COMMAND" prompt and use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Scale set". Press **ENTER** and "scaleset=X" will display. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight set 1 or set 2 and press **ENTER**. The display will return to the "Scale set" menu item.

4.2.3.9 Trnd Message

This menu item is used to manually print one of the six Event Messages (refer to section 5.9.3) to the Alarm / Events Window and Alarm file. To select an Event Message, press the FUNCTION Key at the "COMMAND" prompt and use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Trnd Message". Press **ENTER** and "1 XXXX" will display where 1 is Event message 1 and XXXX is the Event message that will print. Use the UP (↑) or DOWN (↓) Arrow Keys to select the correct Event message and press **ENTER**. The display will return to the "Trnd Message" menu item and the Event entry will be made.

4.2.4 Hidden Menu

The Hidden menu allows the user to do the following functions:

Initialize
ADC Control
Diagnostics

The Hidden menu can only be accessed by pressing the **MENU** key immediately followed by pressing the **upper right-hand corner** of the display. This is the only combination that will work.

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4.2.4.1 Initialize

CAUTION: USE OF THESE MENU ITEMS WILL ADVERSELY AFFECT THE SYSTEM CONFIGURATION. REFER TO SECTION 4.1.3 FOR AN EXPLANATION OF THE FOLLOWING MENU OPTIONS.

To initialize the unit, use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Initialize" from the Hidden menu and press **ENTER**. There are three choices:

Init Profile	Perform a Smart or Full Initialization. Refer to Section 4.1.3 for detail.
Clear Points	Restore all points to the unprogrammed state. This will clear any invalid setup data.
Erase Config	Set all data to zero, clear all memory. **USE WITH CAUTION!** Will cause the unit to RESET.

Use the UP (↑) or DOWN (↓) Arrow Keys to highlight the menu item of choice and press ENTER. Proceed with caution. Note that any cleared point can be restored in the Point setup menu.

4.2.4.2 ADC Control

This menu item allows the user to calibrate the Analog-to-Digital Converter through the use of submenu items. If the ADC is not calibrated properly, the value of the inputs may not be correct.

CAUTION - DO NOT ATTEMPT TO CALIBRATE THE RECORDER UNLESS YOU HAVE THE CORRECT EQUIPMENT AVAILABLE. REFER TO CHAPTER 6 FOR CALIBRATION DETAIL.

To access these menu options use the UP (↑) or DOWN (↓) Arrow Keys to highlight "ADC Control" in the Hidden Menu and press **ENTER**. You will be provided with the following choice

Cal ADC

Refer to Chapter 6 for ADC Calibration.

4.2.4.3 Diagnostics

The diagnostics menu allows the user to perform diagnostics checks on parts of the recorder and media. This menu is for use by qualified service technicians only. If additional diagnostics are needed, please contact the factory.

4.2.4.3.1 Ram Test

This routine test all memory (RAM). A window will prompt "continuos test?". If YES is selected, the unit will continuously test the RAM, beeping once every time the test is passed, until the center of the screen is touched. If NO is selected, the unit will beep once and reset. In either test, the beep indicates that the test passed.

4.2.4.3.2 Rom Test

This test verifies the integrity on the system software by computing a 32-bit cyclic redundancy code (CRC) and comparing this code with a code stored in EPROM. A window showing "Test Passed" will be displayed when the test has passed.

4.2.4.3.3 Serial Test

This test verifies the RS232 port is working properly. **NOTE: A loop back test connector is needed to perform this test.** Follow the on screen instructions to run the test.

4.2.4.3.4 Media Test

This test verifies the integrity of the recordable media. **WARNING: THIS IS A DESTRUCTIVE TEST. ALL DATA WILL BE LOST**. A pattern will be written on the media and then read back.

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4.2.4.3.5 Keyboard Test

This test verifies that all touchscreen keys are working properly. The left half of the screen will display 15 buttons with "?" on them. Press each button to make them disappear. Once the left side buttons are cleared away, 15 more buttons will appear on the right side of the display. A window showing "Test Passed" will be displayed when all of the buttons are cleared.

4.2.4.3.6 Display Test

This test verifies that all the pixels on the display are working. Touch the display anywhere to go through a block pattern which will turn on all pixels.

4.2.4.3.7 Run Test Suite

This test runs all of the diagnostic tests described in sections 4.2.4.4.1 through 4.2.4.4.6 one after another.

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Chapter 5

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Chapter 5 Programming

5.1 Introduction

This chapter provides information for programming the Recorder. Custom programming is required to define functions and allows you to personalize features for performing specific applications and tasks. Programming is simplified with menu-driven prompts which minimize the amount of time required for programming. The programmed information is stored in nonvolatile memory until modified by the user. The user has to program the points or data channels for scaling, display and logging or recording. Other options allow the user to program the display, alarms and event monitoring as well as overall unit operation.

NOTE: Programming will be easier with a full understanding of the programming structure. For this reason, it is recommended that you read this entire chapter before attempting to program your Recorder.

NOTE: Menu items shown on the unit display always start with a capital letter, whereas end functions always start with a lowercase letter. This feature allows you to determine whether you are in a menu and should use the UP (↑) or DOWN (↓) Arrow Keys to find a menu item or whether you are at an end item which must be programmed.

5.1.1 Arrow Keys and ENTER Key

Use the UP (↑) and DOWN (↓) Arrow Keys to scroll through the PROGram Menu. A variety of selectable menu items and applications are available. When the function to be programmed is displayed in inverse video (highlighted), press **ENTER** and follow the prompts. The system prompts you for various parameters as you go through the programming task. On some menu items the LEFT (←) and RIGHT (→) Arrow Keys allow you to move within the current entry parameter, to edit a single character. ☺ **Note:** If the cursor is against the left end of the data string (first character) and the LEFT (←) Arrow Key is pressed three times, the entire data string will be erased.

5.1.2 EXIT Key Uses

To exit the PROGRAM Menu or any sub menu, press the EXIT Key once to return to the previous menu prompt; twice to return to the menu prompt before the last one and so on until the Main Button Bar is displayed.

NOTE: If you exit a programming sequence early, the system will not register any programming values previously done within that sequence. As you leave a menu, if any changes are made in that menu, the Recorder will prompt "Keep Setup?". Simply answer YES to save the changed parameters or NO to exit the menu and not save the changed parameters.

5.2 Program Menu

All point input programming is performed through the Program Menu shown in Figure 5-2. To enter the programming mode press the **MENU** key on the right hand side of the button bar, then press the **PROG** button. Provided the Program menu is not Pass code protected you will gain access to it. The Program Menu allows the user to scroll through the menu items using the UP (↑) or DOWN (↓) Arrow Keys and enter point input programming and operating parameters for a variety of selectable functions and applications. When the function to be programmed is displayed in inverse video (Highlighted), press the **ENTER** Key and follow the prompts. The system prompts you for various parameters as you go through the programming task.

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5.2.1 Invoking Program Menu

Press the **MENU** button to the far right of the button bar at the bottom of the screen. This will bring up the Command Button bar shown in figure 5-1 below. Press the **PROG** (for PROGram) button to select the Program Menu and the Program Menu button bar.

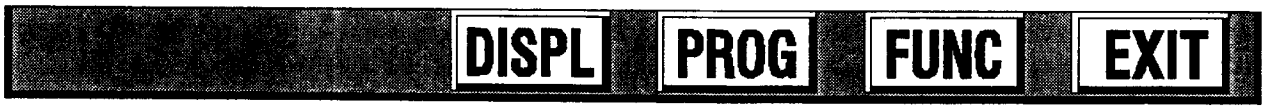


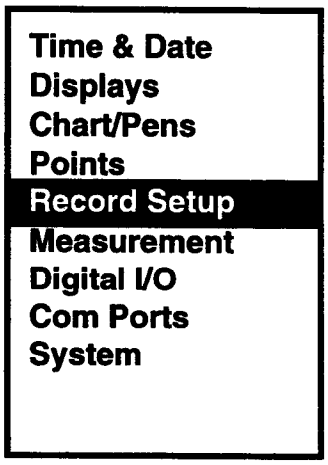
Figure 5-1 The Command Button Bar

5.2.2 Passcode Protection

It is possible to protect the programming menu with a Pass code to prevent unauthorized tampering with the unit setup. Once a Pass code is set, any attempt to enter the programming menu by pressing the PROG button, will bring up the Pass code menu. Use the numeric keypad to enter the Pass code and gain access to the programming menu. To set a Pass code or change a Pass code refer to Section 5.11.2.

Note: KEEP YOUR PASS CODE SAFE. IF YOU LOSE IT, THERE IS *NO WAY* TO CLEAR OR RESET IT.

5.2.3 Program Menu Selections



Once the **PROG** button is pressed, the Program Menu shown in figure 5-2 is displayed. One of the entries will be highlighted. This is the program item that will be activated when you press **ENTER** and is the last menu item used. Use the UP (↑) or DOWN (↓) Arrow Key on the Button Bar to scroll through the menu items available in the Program Menu then press **ENTER** to proceed or **EXIT** to return to the Command Button Bar. The system allows you to establish parameters within the following menu items:

Time & Date
Chart/ Pens
Record Setup
Digital I/O
System
Displays
Points
Measurement
Com Ports



Figure 5-2 The Programming Menu

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5.3 Time and Date

The Time and Date menu item sets the Recorder's internal clock for time and date dependent features such as recording to disk, alarm annotation and records documentation. The time is programmed and displayed in **24-hour format**. The date is programmed and displayed in a Month, Day, Year format. It is recommended that you set the time and date upon system start-up. Time and date are stored in the battery backed up real time clock. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Time & Date". Press **ENTER** to edit the time or date.

5.3.1 Changing Time

The display will show the time such as "12:30:25". If the Time is correct, press **ENTER** to display the date. If the time is incorrect, press the NO key and the display reads "hours →XX←". Use the UP (↑) or DOWN (↓) Arrow Keys to select the digit and the LEFT (←) or RIGHT (→) Arrow Keys to move to a position to enter the correct hour (23 is maximum). When the correct hour is displayed, press the **ENTER** Key to move on to the minutes (59 is maximum) and then seconds (59 is maximum). Use the same procedure used in programming hours to program the correct minutes and then seconds.

5.3.2 Changing Date

After the correct seconds is displayed and **ENTER** is pressed, the date will be displayed similar to this example: "01/01/95". If the date is correct, press **ENTER** or **EXIT** to return to the Date & Time display. If the date is incorrect, press the NO key and the display reads "month? →XX←". Use the UP (↑) or DOWN (↓) Arrow Keys to select the digit and the LEFT (←) or RIGHT (→) Arrow Keys to move to a position to enter the correct month number (12 is maximum). When the correct month is displayed, press the **ENTER** Key to move on to the day (31 is maximum) and then year (no maximum). Use the same procedure used in programming the month to program the correct day and year.

5.4 Displays

This menu item allows the user to program several items dealing with the way data is displayed on the screen. The display menu is shown in Figure 5-3. Use the UP (↑) and DOWN (↓) Arrow keys to select the option you wish to program then press **ENTER**. The selections are detailed as follows.

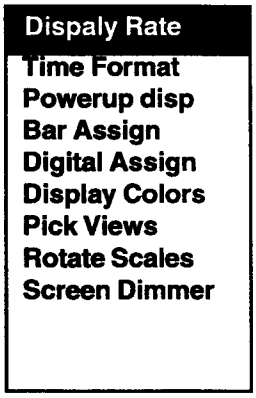


Figure 5-3 Display Menu

5.4.1 Display Rate

The Display Rate determines the time lapse between consecutive display updates in the Status Line window when you have chosen to display information other than time and date, such as Point or Alarm information. The display rate controls the AUTO JOG function jog rate, and the display update of a single point or alarm being displayed. The display rate is programmable from 1 to 60 seconds in one second intervals. The factory default display rate is one second.

When this option is selected, the display will show the current display rate such as "seconds →10←". If the display rate is correct, press **ENTER** to return to the 'Display rate' menu item, or use the numeric keypad to change the update time, press **ENTER** to accept the programmed display rate and the display will return to the "Display Rate" menu item. Press **EXIT** twice to return to the "COMMAND" prompt.

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5.4.2 Time Format

This menu item allows the user to program either American or European time format for the display. The difference is in the way date is displayed; American format is Month/Day/Year while European format is Day/Month/Year. Select this menu option and the current selection will be shown highlighted. Use the arrow keys to select either American or European, press **ENTER** to accept it then **EXIT** to return to the Display menu.

5.4.3 Power Up Display

The unit display at Power Up may be changed to one of five different displays; Unit Tag, Autojog, Point, Alarms or Junction Temp. When entering this programming option, the current setting will be highlighted. A description of these types of displays are as follows;

5.4.3.1 Unit Tag

The unit Tag is the default display that shows in the Status Line at the top of the Display. It may be used to identify a place or process being monitored by the recorder. The unit tag can be any number or alpha character string of up to 20 characters. When selected, you will be provided with an alphanumeric keypad. Enter the prompt you wish to display, using the LEFT (←) and RIGHT (→) Arrow keys to move the cursor to the edit position. PAGE selects the next page of characters, SPC enters a Space. Press **ENTER** when completed, or **EXIT** to quit at any time without changing the current setting.

5.4.3.2 Autojog

The Autojog Power Up display jogs each programmed point with the point status and value at the programmed display rate. The programmed display rate can be 1 to 60 second intervals, programmed in the Display Program Menu - "Display rate" (5.4.1 above). To select Autojog as the Power up display use the UP (↑) or DOWN (↓) Arrow Keys to highlight it, then press **ENTER**. Press **EXIT** to return to the Display menu.

5.4.3.3 Point

The Point Power Up display allows a programmed point to be displayed as the default Status Window value or the unit prompt. The point number programmed, the current value of that point, and the engineering units will be displayed as the unit Power Up prompt in the status window. To program a programmed point to act as the unit prompt, use the UP (↑) or DOWN (↓) Arrow Keys to highlight it, then press **ENTER**. You will be provided with a keypad to select the point you wish to use, 1 through C. Select the point you want and press **ENTER**, or press **EXIT** to return without changing the point. Press **EXIT** again to return to the Display menu.

5.4.3.4 Alarms

The Alarms Power Up display will jog all points in alarm at the programmed display rate. If all points are in alarm, each point will be displayed at the display rate in the Status Window. If no points are in alarm, the unit Power Up display prompt will be "NO ALARMS". To select ALARMS as the Power up display, use the UP (↑) or DOWN (↓) Arrow Keys to highlight it, then press **ENTER**. Press **EXIT** to return to the Display menu.

5.4.3.5 Junction Temp

The Junction Temp Power Up display will display the temperature in Degrees F (°F) (Degrees C (°C) with European Time format selected) of the cold junction reference compensator in the Status Window. To select JUNCTION TEMP as the Power up display, use the UP (↑) or DOWN (↓) Arrow Keys to highlight it, then press **ENTER**. Press **EXIT** to return to the Display menu.

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5.4.4 Bar Assign

The Bar Assign menu option allows the user to assign specific points to the individual bars in the bar graph display. In the Display menu, use the UP (-) or DOWN (¯) Arrow Keys to highlight the Bar Assign menu option and press **ENTER**. "Bar 1 = PT X" will be displayed. Use the UP (-) or DOWN (¯) Arrow Keys to select the point corresponding to Bar 1 and press **ENTER** or **EXIT** to return without affecting the bar. Do the same for Bars 2 - C. Note that selecting point 0 effectively turns the bar off but does not remove it from the display. If "Bar X = PT 0" is selected, the top of Bar X will be blank. Once all bars have been assigned, press **EXIT** to return to the Display menu.

5.4.5 Digital Assign

The Digital Assign menu option allows the user to assign specific points to the individual Digital Displays (Total of 6) in the Digital Window display. The Digital Windows are displayed as two rows of three displays, numbered 1 to 3 across the top, and 4 to 6 across the bottom or four rows of 3 for twelve channels. In the Display menu, use the UP (↑) or DOWN (↓) Arrow Keys to highlight the **Digital Assign** menu option and press **ENTER**. "Digital 1 = PT X" will be displayed. Use the UP (↑) or DOWN (↓) Arrow Keys to select the point corresponding to Digital Window 1 and press **ENTER** or **EXIT** to return without affecting the display. Do the same for Windows 2 to C. Note that selecting point 0 effectively turns the Digital Display off but does not remove it from the display. If "Digital X = PT 0" is selected, the digital window X will be blank. Once all Digital Windows have been assigned, press **EXIT** to return to the Display menu.

5.4.6 Display Colors

The Display Colors menu option allows the user to customize the color of specific items on the trend (or graph view), the bar charts and the digital windows. In the Display menu, use the UP (↑) or DOWN (↓) Arrow Keys to highlight the **Display Colors** menu option and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to select the display option to customize. A window will apear with a color band. Use the UP (↑) or DOWN (↓) Arrow Keys to select a color and press **ENTER** or **EXIT** to return without affecting the display. Do the same for the other display color options. Once all colors have be modified, press **EXIT** to return to the Dispaly menu.

5.4.7 Pick Views

The Pick Views menu option allows the user to select the desired screen views when the view button is pressed. The trend view and the Alarm window are always active. In the Display menu, use the UP (↑) or DOWN (↓) Arrow Keys to highlight the **Pick Views** menu option and press **ENTER**. At each view, press **YES** if you want to see the current view when toggling, or press **NO** if you do not want see the current view when toggling. Once you go through all the views, you will be returned to the Display menu.

5.4.8 Rotate Scales

The Rotate Scales menu option allows the user to select whether or not the different scales rotate on the graph automatically or manualy. In the manual mode, the displayed scale will not change until the center of the scale is pressed. This will rotate through all programmed scales. In the automatic mode, all programmed scales will rotate at a set interval automatically. NOTE: At any time, the center of the scale can be pressed to rotate to the next programmed scale. In the Display menu, use the UP (↑) or DOWN (↓) Arrow Keys to highlight the **Rotate Scales** menu option and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to select either manual or automatic and press **ENTER.** Press **EXIT** to return to the Display menu.

5.4.9 Screen Dimmer

The Screen Dimmer menu option dims the backlight after a user specified time. The screen saver time out is programmable from 0 to 720 minutes in one minute intervals. In the Display menu, use the UP (↑) or DOWN (↓) Arrow Keys to highlight the "Screen Dimmer" menu option and press **ENTER**. A window will pop up

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prompting for the "Bright Level". Use the UP (↑) or DOWN (↓) Arrow Keys to select a brightness level and press **ENTER.** A window will now pop up prompting for the "Dim Level". ". Use the UP (↑) or DOWN (↓) Arrow Keys to select a brightness level and press **ENTER.** Next enter the time out interval in minutes - "minutes →XXX". Setting the time out value to 0 never dims the backlight.

NOTE: The display will go to the "Bright Level" when ACK button is flashing or when the touch screen is pressed. If an alarm regularly goes off within the screen dimmer time out interval, the display will never go to the "Dim Level".

5.5 Charts/Pens

This Programming menu item allows the user to program parameters directly affecting charts or pens. The Chart/Pens programming menu is shown in Figure 5-4. Each programming item shown has further programming options as listed below.

Speed	Set speeds
	Autospeed
Scales	Scale #
	Scale type
	Scale ends
	Scale grid
	Scale units
Pens	Pens assign
	Abnorm. pen
Direction	Vertical
	Horizontal

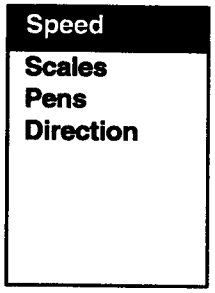


Figure 5-4 Chart/Pens Menu

5.5.1 Speed

This menu item establishes the Virtual Chart Speed and Units (Inches/Hour - Standard or Millimeters/Hour - Metric) at which the virtual chart paper will advance. Display Update Rate or Virtual Chart Speed may be set to Autospeed which enables chart speed to be changed via Alarm condition or external input. Set Speeds enables the user to select the virtual chart speed. Virtual Chart Speeds are programmable within the following limits:

Standard	0.5 in/hr to 600 in/hr
Metric	10 mm/hr to 15000 mm/hr

Programming the Display Update Rates or virtual chart speeds - When in the Chart/Pens programming menu, use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Speed" and press **ENTER** to select then use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Set speeds", or "Autospeed". Press **ENTER** to accept the displayed speed control of Autospeed or Set speeds. If Autospeed is selected, use the YES or NO keys to change the display to read "autospeed = NO" or "autospeed = YES". When the desired Autospeed function is displayed, press **ENTER** to invoke the autospeed selection and return to the "Speed" menu item.

If Set speeds is selected, either the "Standard?" or "Metric?" menu item will appear. Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired selection. Press **ENTER** at the desired speed type to set the low chart speed. When "lo spd = X.X" appears, use the UP (↑) or DOWN (↓) Arrow Keys to select the desired low chart speed. Press **ENTER** and "hi spd= X.X" will be displayed. Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired high chart speed. Press **ENTER** when programming high chart speed is complete and the display returns to the "Set speeds" menu item. Press **EXIT** three times to return to the Main Programming Button Bar.

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5.5.2 Scales

Scales are used to display and record all or part of the preselected Output Scale. The user can effectively zoom all or part of the available range. The user can also configure the grids printed on the display. Two sets of 8 scales A through H can be programmed. Only one of the two sets is active at any given time. The active set can be selected via remote switches or from the front panel using the FUNCtion programming option.

Each BAR GRAPH and/or pen is driven by a point. Any point in the system can be assigned to one or more of the pens and/or bar graphs. A scale from A through H is selected for each point during point programming. Since more than one point can be assigned to each scale, programming of the scale parameters is done separately in the Scales menu. The point assignment connects the bar graphs, pens and display grids with the corresponding scale.

To enter the SCALE menu use the UP (↑) or DOWN (↓) Arrow Keys to select the "Scales" and press **ENTER**. The display will read "scale? XX". Use the UP (↑) or DOWN (↓) Arrow Keys to select the scale to program, 1A through 1H or 2A through 2H, and press **ENTER**.

Pressing **ENTER** will provide the following programming choices for the SCALE.

5.5.2.1 Scale Type

The scale type can be LINEAR or LOG. For linear scales, the point data is interpolated linearly across the defined segments. For log scales, the log 10 of the data is used in the interpolation.

Use the UP (↑) or DOWN (↓) Arrow Keys to select the "Scale type" and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to select the "type LIN" for LINEAR or "type Log" for LOGARITHMIC and press **ENTER** to select the displayed Scale type. The display will return to the "Scale type" menu item.

5.5.2.2 Scale Ends

A low, mid and high end point is programmed for each scale. The low and high end points indicate the values at the left and right margins of the chart and the bottom-most and top-most segments of the bar graph display. The mid point defines the center of the chart and need not be the halfway between the low and high values of the scale. If the point data is outside the range between the low and high end-points, the pen is positioned in one of the chart ends and the bar-graph is all-on or all-off. In the case of LOG scales, these end points are programmed in exponents with an implicit base 10 in the range 10^{-25} to 10^{25}. The graph will be linear between the low and mid points, and the mid and high points and the mid point need not be midway between the low and high points. The graph can thus be made to amplify data by offsetting the midpoint for example, if the full scale is zero to 10, and low = 0, high = 10 and mid = 8, half the display will show 0 to 8 and the other half will show 8 to 10. Thus the upper half of the display represents only 20% of the chart and will have four times the resolution of the lower half of the display as shown below:

Scale: **0|__|__|2__|__|4__|__|6__|__|8__|__|__|__|9__|__|__|__|10**
0 —— 1 per division —— **50** — 0.25 per division — **100%**

Use the UP (↑) or DOWN (↓) Arrow Keys to select the "Scale ends" and press **ENTER**. The display will prompt for the number of decimal places desired, "places? X". Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired number of decimal places and press **ENTER**. The display will prompt for low scale value, "low→XXX←". Use the numeric keypad to set the low scale value and press **ENTER**. The display will prompt for low scale value, "mid→XXX←". Use the numeric keypad to set the mid scale value and press **ENTER**. The display will prompt for high scale value. "hi→XXX←". Use the numeric keypad to set the high scale value and press **ENTER**. The display will return to the scale ends menu item.

NOTE: If the point data falls outside the programmed range of a selected scale, the information recorded will only reflect the upper or lower most value on the scale.

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5.5.2.3 Scale Grid

The scales are shown on top of the chart with the major and minor divisions. The grid printed on the chart is the vertical continuation of the major divisions. For the log scales, the major and minor divisions are fixed with nine minor and one major division for each decade.

NOTE: If the number of decades between the ends and the mid point of the scale is greater than eight, the minor and major divisions are not printed. If the grids are too fine they may appear as a solid line on the display which may not be able to resolve them.

To program the grid use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Scale grid" and press **ENTER**. The display will show "Major→XX←" which is the number of vertical grids that will be printed on the screen. Use the numeric keypad to enter the number of major grids and press ENTER. The display will show "Minor→XX←" which is the number of vertical stripes that will be printed between the major grids on the screen. Use the numeric keypad to enter the number of minor grids and press ENTER.

5.5.2.4 Scale Units

A five character engineering units field can be programmed for each scale, which is shown at the top of the graph (see Section 3.2.5.4). This scale unit along with the Engineering units is also recorded to disk. The same line also identifies the pens trending in the scale with the point number associated to each pen. Refer to Section 3.5 for an example.

Use the UP (↑) or DOWN (↓) Arrow Keys to select the "Scale units" and press **ENTER**. The display prompts for "units→XXXXX←". Use the Alphanumeric Keypad to enter the Scale Units and press **ENTER**. The display returns to the Scale Units menu item. Press **EXIT** three times to return to the "COMMAND" prompt. The rest of the scales are programmed in the same way.

5.5.3 Pens

In the Pens menu, any point programmed into the Recorder can be assigned to any of the pens. The pens draw the actual traces on the display and are not necessarily the points recorded to disk. You also have the option to assign any abnormal pen condition (Overange, TCBO, etc.) to go hi or go low and to select the width of the pen being displayed on the graph.

Programming from COMMAND Prompt - From the Main Programming Button Bar, press the PROGram Key- The display will show the Program menu. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Chart/Pens"- Press **ENTER** to invoke the chart/pens menu and the Chart/Pens menu will be displayed. Use the UP (↑) or DOWN (↓) Arrow Keys to select "Pens". Press **ENTER** to enter the Pens menu.

5.5.3.1 Pens Assign

Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Pens assign" and press **ENTER**. The display will read "Pen 1= pt X". Use the UP (↑) or DOWN (↓) Arrow Keys to select the point to assign to this pen and press **ENTER**. Follow these instructions to assign points to pens 2-C. You need not program all pens, any pen programmed to point 0 will be turned off. At any time you may press **EXIT** to leave the Pens Assign menu and return to the Pens Assign menu prompt.

5.5.3.2 Abnorm. Pen

Any time a pen goes into an abnormal condition (Overange, TCBO, etc.), the pen can go full scale if hi is selected of low scale if low is selected. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Abnorm. Pens" and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "abnorm. pen high" or "abnorm. pen low" and press **ENTER**. At any time you may press **EXIT** to leave the Pens Assign menu and return to the Pens Assign menu prompt.

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5.5.3.3 Trace Width

The pen trace widths can be changed from 1 to 7 pixels wide. This value changes all pens displayed. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Trace Width" and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to select a width value (in pixels) and press **ENTER**. At any time you may press **EXIT** to leave the Pens Assign menu and return to the Pens Assign menu prompt.

5.5.4 Direction

Direction determines whether the traces on the Trend View move in a vertical or horizontal direction. The direction may be changed at any time without affecting the recording or the browse buffer.

To change the direction of the chart from the Chart/Pens menu, use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Direction" and press **ENTER**. Then use the UP (↑) or DOWN (↓) Arrow Keys to highlight either "vertical" or "horizontal" and press **ENTER.** The chart will change direction immediately, clearing the screen and beginning a new trace. Press EXIT four times to return to the Viewing Button Bar.

5.6 Points

This Programming menu item allows the user to program parameters directly affecting Points. The Points are the actual Channels in the recorder and may be direct inputs, conditioned direct inputs (scaled or adjusted), computational channels or external (serial) inputs for a total of 12. The menu options are as follows:

Program point
- Point #
- Setup point #
- Copy point #
- Restore point #
- Modify point #
- Delete point #

Setup, Copy, Restore, and Modify all lead to the Point Type menu as follows:

- Linear type
- Industrial square root type
- Log linear type
- Thermocouple type
- RTD type
- Calculated type
- Conditional type
- External type

Additional menus and menu items are contained under each Point Type menu item.

Constants
Define constant

5.6.1 Constants

This menu item is available through the Program Menu - Points, and allows the user to program up to twelve different constants for use in equations for point programming. These constants, referred to as Kx (where x = 1 to 9, A to C), are substituted into equations instead of writing the constant value. This simplifies programming an equation.

Programming Constants - From the Program menu use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Points" and press ENTER. Then use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Constants" and press

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ENTER. The display shows a list of the constants as "Define KX'. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight the Constant to be programmed, K1 to K9 or KA to KC. Press **ENTER** to accept the displayed Constant number to program and to set Constant value.

The display reads 'KX➔XXXXXXXXXXXX←' (only a total of 13 characters will show on display). Press **ENTER** to accept the displayed Constant Value or use the Numeric Keypad to program the desired Constant Value (13 is maximum number of places, including decimal points, available). The constants are entered in decimal (0.002345) or exponential (2.345E-3) and may be positive or negative. When the desired value for the constant is programmed, press **ENTER** or **EXIT** to return to the "Define KX" menu item. Press **EXIT** once more to return to the Point Programming menu.

5.6.2 Programming Points

This menu item is available through the Program Menu and allows the user to setup, copy, restore, modify, or delete a point's parameters. The programming sequence follows a general order for custom programming and the system prompts you to submit various parameters.

Programming Points - At the Main Program Button Bar, press the PROGram Key. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Points" and press **ENTER.**. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Prog point" and press **ENTER**.

5.6.2.1 Choosing a Point Number

The display reads "point? x". Use the numeric keypad (1 - 9, A - C) to enter the point to be programmed or modified.

Press **ENTER** to accept the displayed point number and the display reads one of the followings menu items:

Setup pt
Copy pt
Restore pt

or, if the point has already been setup:

Modify pt
Delete pt

5.6.2.2 Setup an Unprogrammed Point

Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Setup pt" and press **ENTER**. The display reads the Point Type Menu as follows:

Linear
Ind sqrt
Log linear
T/c
Rtd
Calculated
Conditional
External

Refer to the appropriate Options below to continue programming points.

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5.6.3 Point Options

After a point number is chosen, if the point is a new point to program, the point can be setup from scratch, copied from another point already setup, or restored if the point had been setup previously and then deleted. If the point chosen has already been setup, the point parameters may be modified, or the point may be deleted.

5.6.3.1 Setup a Point by Copying

At the "point? X" display, use the Numeric Keypad to enter the point number desired and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Key to highlight "Copy pt" menu option and press **ENTER**. The display will read "from pt? X". Use the UP (↑) DOWN (↓) Arrow Keys to select the desired point number, 1 - 9 or A - C, from which to copy the parameters. When the point number desired to copy from is displayed, press **ENTER**. The display reads one of the menu items in the Point Type Menu. You may continue programming to change the point parameters as needed.

5.6.3.2 Setup a Point by Restoring

At the "point? X" display, use the numeric keypad to enter the point number desired to restore and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Restore pt" menu option and press **ENTER**. You may continue programming to change the point parameters as needed.

NOTE: To restore a point, that point must have been previously programmed and still be in the system memory. If the point was not previously programmed you will get a "PT NEVER SET" message.

5.6.3.3 Modify an Existing Point

At the "point? X" display, use the numeric keypad to enter the point number desired to modify and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Modify pt x" and press **ENTER**. You may continue programming to change the point/parameters as needed.

5.6.3.4 Delete an Existing Point

At the "point? X" display, use the numeric keypad to enter the point number desired to modify and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Delete pt" and press **ENTER**. The display will read "confirm del?". Press **ENTER** or **YES** to delete the point. Press **NO** to exit the delete point menu without deleting the point.

5.6.4 Programming Point Types

There are various point types that can be selected, from simple Linear to complex equations. Once a point has been selected to Setup or Modify, the user will be presented with the Point Type menu shown in Figure 5-6. The various choices are:

Linear - Basic voltage and current input with linear scaling or dry contacts.
Industrial Square Root - Performs square root extraction on input.
Log Linear - Performs inverse logarithm on input.
T/c - Thermocouples as defined.
Rtd - Resistance Temperature Devices as defined.
Calculated - Derived channels from user entered algorithms.
Conditional - Boolean logic channels.
External - input channel via comm port.

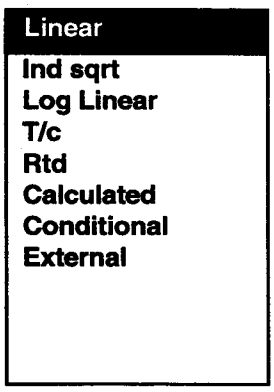


Figure 5-6 Point Type Menu

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At any point, if you exit the Points programming menu after having made any changes, (repeatedly pressing exit) you will be prompted with a message "keep setup?". If you select NO at this time, any changes you have just made will be lost. If you choose YES, the changes you made will be applied to the point.

5.6.5 Programming Parameters

Once a point type is selected, the following programming parameters will be available:

Parameters for Live Inputs (Voltage/Current, Thermocouples and RTDs):

Point Tag
Input Scale
Output Scale
Decimal fix
Currents
Filter
Compensation
Span/Offset
Alarms
Chart Scale

Parameters for Calculated, Conditional and External Point Types:

Basepoint
Reset Control
Time Period
Gate Control
Flow Rate
Low Cutoff
Set Equation
Set Cndtionl
Timeout

Each of above parameters is described in the following paragraphs:

5.6.5.1 Point Tag

A Point Tag is a name used to identify the point on the display or recorded file and may be up to ten characters long. The point tag appears on the bar graphs and Digital displays. To program a point tag use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Point tag" on the above menu and press **ENTER**.

The display will show the existing Point Tag if any as "➔POINT TAG ←". Use the Alphanumeric keypad to enter up to ten characters for desired Point Tag then press **ENTER** to return to the Point Setup Menu.

5.6.5.2 Input Scale

Low and high input scale is used for configuring the Recorder for the actual input provided by the transducer. If the input range full scale, e.g. 10V, exceeds the actual input signal, say 5V, only half the input range is actually used. By adjusting the Input scale setting to be 0 to 5V, the entire input range is used for 5V. Note that the resolution is halved. Only voltage inputs require setting low and high input range values.

NOTE: During point programming, input range voltages are programmed in the same engineering units as the voltage range selected, i.e. mV or Volts.

Programming Input Scale - Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Input scale". Press **ENTER** and the display reads "lo➔XXXXXXXXXXXXX←" (13 places possible). Use the numeric key-

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pad to enter the low end scale value, the default is zero. Press **ENTER** when the desired Lo Scale value is displayed and the display reads "hi→XXXXXXXXXXXXX←". Use the numeric keypad to enter the high end scale value, the default is the full scale value of the range selected. Press **ENTER** when the desired Hi Scale value is displayed and the display will return to the "Input scale" Menu item.

5.6.5.3 Output Scale

All linear current and voltage inputs must be assigned low and high output scale endpoints. The output scale is used to linearly map the input range (set with the Input scale option) to an Output range set with the Output Scale option. For example, if a transducer has a 1 volt output equivalent to 5000 PSI, use the 1V input range with an Input Range setting of 0 to 1.00 V and program the Output Range to be 0 to 5000. The actual readings on the display will now be in PSI.

Programming Output Scale - Use the UP (↑) or DOWN (↓) Arrow Keys to scroll through the menu items in the Point Setup Menu and highlight "Output scale". Press **ENTER** and the display reads "places? X". Use the UP (↑) or DOWN (↓) Arrow Keys to scroll through the menu items to set the number of decimal places (up to a maximum of 4 - NOTE 5 = E notation) and press **ENTER**. The display will read "lo→XXXXXXXXXXXXX←" (13 places possible). Use the numeric keypad to enter the low end scale value, the default is zero. Press **ENTER** when the desired Lo Scale value is displayed and the display reads "hi→XXXXXXXXXXXXX←". Use the numeric keypad to enter the high end scale value, the default is the full scale value of the range selected, which is a direct linear mapping or a scaling of 1. Press **ENTER** when the desired Hi Scale value is displayed and the display will return to the "Output scale" Menu item.

5.6.5.4 Decimal Fix

Certain points must be assigned a decimal place of up to four places or scientific notation. The choices are:

0 = X (no decimal places)
1 = X.X
2 = X.XX
3 = X.XXX
4 = X.XXXX
5 = Scientific Notation

Decimal places affect displayed point data values only.

Programming Decimal Fix - Use the UP (↑) or DOWN (↓) Arrow Keys to scroll through the menu items in the Point Setup Menu until "Decimal fix" appears. Press **ENTER** and the display reads "places? X". Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired number of decimal points required. When the desired Decimal Fix is displayed, press **ENTER** to invoke. The display returns to "Decimal fix" in the Point Setup Menu.

NOTE: Thermocouple (T/C) points must be assigned a decimal place of either 1 or 0. This enables temperature to be displayed with a resolution on either 1 degree (0) or 0.1 degree (1).

5.6.5.5 Exc. Currents

Currents are used to measure a resistance input on the back of the Recorder. If a resistance other than an RTD is plugged into an input, Exc. Currents must be enabled. The current is typically 2.00mA. The procedure to enable or disable currents follows.

Enabling or Disabling Currents - Use the UP (↑) or DOWN (↓) Arrow Keys to scroll through the menu items in the Point Setup Menu and highlight "Currents". Press **ENTER** and the display reads either "currents=NO" or "currents=YES". Use the YES or NO Key to change the display to the desired state of Currents. When the desired Currents state is displayed, press **ENTER** to invoke and the display returns to "Currents" in the Point Setup Menu.

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5.6.5.6 Filter

The digital filter smooths noisy or erratic signals by attenuating the effects of sudden transitions. The digital filter is programmable from 0 to 30 seconds in one second increments (nominal).

Programming Filter Seconds - Use the UP (↑) or DOWN (↓) Arrow Keys to scroll through the menu items in the Point Setup Menu and highlight "Filter". Press **ENTER** and the display reads "seconds→XX←. Use the numeric keypad to enter the required number of seconds (maximum 30) then press **ENTER** to return to the "Filter" menu item.

5.6.5.7 Compensation

Thermocouple compensation can be local, from the cold referance junction temperature sensor built into the Recorder, or external through a direct input. When thermocouples are compensated locally, the temperature sensor (located on the rear terminal panel of the Recorder) measures the ambient temperature of the cold junction. For remote compensation, a single Thermocouple or RTD can be used to measure the ambient temperature of the remote junction box. This method allows several thermocouple points to be measured without using thermocouple extension wire for each input. The point used as the measurement source of the remote cold junction source is referred to as the compensation channel. The point used as the compensation channel must be programmed before the Thermocouple or RTD input is assigned to it. When the system prompts for compensation parameters, the UP (↑) or DOWN (↓) Arrow Key allows you to define this parameter (local or remote). Once thermocouple compensation has been set, continue the programming sequence.

Programming Compensation - Use the UP (↑) or DOWN (↓) Arrow Keys to scroll through the menu items in the Point Setup Menu and highlight "Compensation" and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight either "Local comp" or "Ext comp". If "Local comp" is chosen, press **ENTER** and the display returns to the "Compensation" prompt in the Point Setup Menu. If "Ext comp" is chosen, press **ENTER** and the display prompts for "ext point? X". Use the UP (↑) or DOWN (↓) Arrow Keys to scroll through the point numbers to choose the input where the external compensation is input. When the desired point number is displayed, press **ENTER** and the display returns to the "Compensation" menu item in the Point Setup Menu.

5.6.5.8 Span/Offset

In order for the Span/Offset menu option to be available, the user must turn this feature on in the Measurement Program menu, refer to Section 5.8.2, Span and Offset. Once this option has been turned on, the user can use Span and Offset to compensate for long thermocouple cable runs or thermocouple inaccuracies. The default value for offset is 0 and the default value for span is 1. The offset is a value of absolute degrees which is added or subtracted to the thermocouple reading. The span is a multiplier of the absolute thermocouple range. Once span and offset have been entered, the new adjusted range will be

$$\text{New T/C Range} = (\text{Full Scale} * \text{SPAN}) + \text{OFFSET}$$

Note that span is a multiplier while offset is an additive.

To adjust the span and offset (this assumes this option has been turned on in the Measurement menu) use the UP (↑) or DOWN (↓) Arrow Keys in the Thermocouple option menu to select Span/Offset and press **ENTER**. The display will show "Ofs → 0.0000←". Use the numeric keys to enter a value for the offset which will be added or subtracted to the thermocouple value. Note that offset is typically measured around the ice point which should be 0° C or 32°F. The offset would be typically the difference between the thermocouple reading at this point and the true ice point value. Press **ENTER**. The display will then show "Spn → 1.00000←". Use the numeric keypad to enter the new span value. The span should typically be measured near the full scale value of the thermocouple using a known temperature or reference. The span would be the absolute value of the reference divided by the reading of the thermocouple. Press **ENTER** to register these values and return to the Thermocouple option menu.

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5.6.5.9 Eng Unit

A maximum five-character alphanumeric engineering units message may be assigned for voltage and current inputs to identify the point, e.g. PSI or mADC

Programming Engineering Units - Use the UP (↑) or DOWN (↓) Arrow Keys to scroll through the menu items in the Point Setup Menu to highlight "Eng units". Press **ENTER** and the display reads "units→XXXXX←". Use the alphanumeric keypad to enter up to five characters for desired Engineering Units then press **ENTER** to return to the Point Setup Menu.

5.6.5.10 Alarms

A total of five alarms can be set for each point programmed. These alarms can be any mixture of the following alarm types:

None	no alarm set
High	set high alarms (up to five). Alarm will occur if input is greater than the Alarm set point.
Low	set low alarms (up to five). Alarm will occurs if input is less than the Alarm set point.
Rate	set rate alarms (up to five). Alarm will occur if the input changes by more than the set point value in the specified time.
Abnormal	set alarms for abnormal conditions (TCBO, Overflow, invalid etc.)

In the case of Linear Dry Contact Inputs the choice is

None	no alarm set
Open	set Alarm on open contact
Close	set Alarm on closed contact

In the case of Conditional Inputs the choice is

None	no alarm set
True	set Alarm if condition is true as defined
False	set Alarm if condition is false as defined

If you try to program an alarm with an illegal condition, for example, setting a Linear Voltage input alarm to "type=close", you will get an ILLOGICAL error.

Alarms programming also allows the user to program an Alarm Deadband and Alarm Delay for each alarm set. The Alarm Deadband is the hysteresis.

Programming Parameters - Alarms programming requires setting parameters for:

Alarm Limits
Alarm Deadband
Alarm Delay

5.6.5.10.1 Alarm Limits

Five alarms can be set for each point programmed. These five alarms can be any combination of Alarm Types except Open, Closed, True, and False, for any input other than Linear Dry Contact or Conditional point types. Open and Closed and Abnormal Alarm Types are used for Linear - Dry Contacts only, and True, False and abnormal Alarm Types are used for Conditional Point Types only. Actual Alarm values are entered in the same Engineering Units that the point is programmed as.

Programming from "Alarms" prompt - At the "Alarms" prompt in the Point Setup Menu, press **ENTER**. The display will show a menu item in the Alarms Setup Menu. Use the UP (↑) or DOWN (↓)

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Arrow Keys to scroll through the menu items and highlight "alm limits" appears. Press **ENTER** and the display reads "alarm # X". Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired Alarm Number (1 through 5) and press **ENTER**. The display will show the alarm type menu with the current setting highlighted as in figure 5-8 opposite.

a. Type = None

Selecting "Type=none" will disable the alarm function. Use the UP (↑) or DOWN (↓) Arrow Keys to scroll through the Alarm Types and highlight "Type=none". Press **ENTER** to accept the EXIT to return to the "alm limits" prompt in the Alarms Setup Menu Programming

b. High Alarm Type

High alarms become active when the input exceeds (is greater than) the set point. To set the alarm type as high, use the UP (↑) or DOWN (↓) Arrow Keys to scroll through the Alarm Types and highlight "Type=high". Press **ENTER** and the display reads "high→XX...XX←". Use the numeric keypad to enter the High Alarm Value. Press **ENTER** and the display reads "contact #? X". This is the contact output that will respond to this alarm provided the relay option is fitted. If no contact output is required select contact #0. Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired Contact Number (0 to 6) and press **ENTER**. The display will return to the Alarm type menu. Press EXIT to return to the "alm limits" prompt in the Alarms Setup Menu.

c. Low Alarm Type

Low alarms are active if the input is lower than the set point. To set a low alarm, use the UP (↑) or DOWN (↓) Arrow Keys to scroll through the Alarm Types and highlight "Type=low". Press **ENTER** and the display reads "low→XX...XX←". Use the numeric keypad to enter the Low Alarm Value. Press **ENTER** and the display reads "contact #? X". This is the contact output that will respond to this alarm provided the relay option is fitted. If no contact output is required select contact #0. Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired Contact Number (0 to 6) and press **ENTER**. The display will return to the Alarm type menu. Press EXIT to return to the "alm limits" prompt in the Alarms Setup Menu.

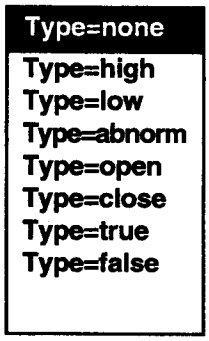


Figure 5-8 Alarm Type Menu

d. Rate Alarm Type

Rate alarms become active when the input changes more than the set amount within the set time frame. In other words the rate of change of the input exceeds the set point. The rate alarm requires the user to enter a value and a time. To set the alarm type to rate, use the UP (↑) or DOWN (↓) Arrow Keys to scroll through the Alarm Types and highlight "Type=rate". Press **ENTER** and the display reads "rate→XX...XX←". This is the value of change per time. Use the numeric keypad to enter the Rate Alarm Value. Press **ENTER** and the display reads "seconds→XX←" where XX is 1 by default for a new alarm. Use the numeric keypad to enter the time period for evaluating the rate change, up to a maximum of 600 seconds (ten minutes). Press **ENTER** and the display shows "contact #? X". This is the contact output that will respond to this alarm provided the relay option is fitted. If no contact output is required select contact #0. Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired Contact Number (0 to 6) and press **ENTER**. The display will return to the Alarm type menu. Press EXIT to return to the "alm limits" prompt in the Alarms Setup Menu.

e. Abnormal Alarm Type

An abnormal alarm is a condition that exceeds any of the bounds of normal operation. This includes overflow and underflow errors, invalid data and TCBO (ThermoCouple Burn Out). To set an abnormal alarm, use the UP (↑) or DOWN (↓) Arrow Keys to scroll through the Alarm

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Types and highlight "Type=abnorm". Press **ENTER** and the display reads "contact #? x". This is the contact output that will respond to this alarm provided the relay option is fitted. If no contact output is required select contact #0. Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired Contact Number (0 to 6) and press **ENTER**. The display will return to the Alarm type menu. Press EXIT to return to the "alm limits" prompt in the Alarms Setup.

f. Open or Closed Alarm Types

NOTE: Open and Close Alarm Types are available for Linear - Dry Contact Point type only. Trying to use them for any other point type will result in an "Illogical" error message.

Open and closed alarms are active when an input is open or closed respectively. No set point is required. To set this type of alarm, use the UP (↑) or DOWN (↓) Arrow Keys to scroll through the Alarm Types and highlight "Type=open" or "Type=closed" as desired. Press **ENTER** and the display reads "contact #? X". This is the contact output that will respond to this alarm provided the relay option is fitted. If no contact output is required select contact #0. Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired Contact Number (0 to 6) and press **ENTER**. The display will return to the Alarm type menu. Press EXIT to return to the "alm limits" prompt in the Alarms Setup.

g. True or False Alarm Types

NOTE: True and False Alarm Types are available for Conditional Point Types only. Trying to use them for any other point type will result in an "Illogical" error message.

True and false alarm conditions are active when a Boolean expression is true or false respectively. No set point is required. To set this type of alarm, use the UP (↑) or DOWN (↓) Arrow Keys to scroll through the Alarm Types and highlight "Type=true" or "Type=false" as desired. Press **ENTER** and the display reads "contact #? X". This is the contact output that will respond to this alarm provided the relay option is fitted. If no contact output is required select contact #0. Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired Contact Number (0 to 6) and press **ENTER**. The display will return to the Alarm type menu. Press EXIT to return to the "alm limits" prompt in the Alarms Setup.

5.6.5.10.2 Alarm Deadband

An Alarm Deadband can be set for each alarm set. The alarm Deadband is also called hysteresis and is an amount added or subtracted (depending whether the alarm is low or high) to the actual set point to determine the reset point. It is primarily intended to reject noise about a set point. For example, if a high alarm set point is at 50, and the deadband is set at 5, the alarm will trigger when the input exceeds 50 but will not clear (reset) until the input reaches 45 (Set point minus hysteresis).

Programming Alarm Deadband - At the "Alarms" prompt in the Point Setup Menu, press **ENTER**. The display will show the Alarms Setup Menu. Use the UP (↑) or DOWN (↓) Arrow Keys to scroll through the menu items in the Alarms Setup Menu and highlight "alm deadband". Press **ENTER** and the display reads "db→XX...XX←". Use the numeric keypad to enter the desired deadband in absolute engineering units. Press **ENTER** and the display returns to the "Alm deadband" option in the Alarms Setup Menu.

5.6.5.10.3 Alarm Delay

An Alarm Delay can be set for each alarm. This delay prevents the alarms from activating until the set time has elapsed from an alarm active condition. If the alarm condition goes away before the delay is up, the alarm will not respond. The delay retriggers. If the alarm condition goes away before the delay is up and then return, the delay is reset and the full delay period will expire before the alarm becomes active. This feature can be used to overcome spurious or transient alarm conditions.

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Programming Alarm Delay. At the "Alarms" prompt in the Point Setup Menu, press **ENTER**. The display will show the Alarms Setup Menu. Use the UP (↑) or DOWN (↓) Arrow Keys to scroll through the menu items in the Alarms Setup Menu and highlight "alm delay". Press **ENTER** and the display reads "seconds→XX...XX←". Use the numeric keypad to enter the desired delay up to a maximum of 600 seconds (ten minutes). Press **ENTER** and the display returns to the "Alm delay" option in the Alarms Setup Menu.

5.6.5.11 Chart Scale

Each point must be assigned to a Chart Scale. The chart scale is used to control the display of the output signal and can be used to display or record only part of the output, the area of interest, across the entire range. There are two sets of eight Chart Scales available. A Chart Scale can be assigned to multiple points.

Programming Chart Scale - Use the UP (↑) or DOWN (↓) Arrow Keys to scroll through the menu items in the Point Setup Menu and highlight "Chart scale". Press **ENTER** and the display reads "chart scl= X". Use the UP (↑) or DOWN (↓) Arrow Keys to select the Chart Scale numeral. When the desired numeral is displayed, press **ENTER** and the display returns to the "Chart scale" menu item in the Point Setup Menu. To leave the programming menu, press **EXIT** until the Main Button Bar is displayed.

5.6.5.12 Basepoint

A Basepoint must be established on which to perform the Hi Peak, Lo Peak or Time Average calculations. Establish a Basepoint by following the instructions below.

Programming Basepoint - In the Point Setup Menu, use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Basepoint" and press **ENTER.** The display will read "base pt? X". Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired point to be the basepoint and press **ENTER**. The will return to the "Basepoint" Point Setup Menu item.

5.6.5.13 Reset Control

Reset Control applies only to Calculated Point Types of the following Point Ranges:

Hi Peak
Lo Peak
Time Average
Gated Timer
Totalize

Reset control does not apply to:

Moving Average
Equation
Hilo Difference

The Reset Control Menu allows programming of an Event Reset, printing of the reset data, and setting Auto Reset time intervals. The user can choose to have a totalizer for example, automatically reset to zero every hour, or have it reset only by means of an external event (digital input).

Programming Parameters - Once a point has been selected and defined as Calculated, the Calculation Type Programming menu appears. Select the calculated point type using the UP (↑) or DOWN (↓) Arrow Keys to highlight "Hi peak", "Lo peak", "Time avg", "Gated timer", or "Totalize" and press **ENTER.** This will bring up the Calculated Point Type programming menu.

Selecting Reset Control - Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Reset control" in the Calculated Point Type programming Menu and press **ENTER.** There are three options.

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a. Event Reset

Event Reset allows Calculated Points to be reset upon some external event via the optional digital inputs on the rear panel. When programming Event Reset, the Event Number is the digital input number for that external event, 1, 2 or 3. Selecting 0 disables Event reset.

Programming Event Reset - Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Event reset" in the Reset Control Setup Menu and press **ENTER**. The display will read "event? X". Use the UP (↑) DOWN (↓) Arrow Keys to select the desired event input number and press **ENTER**. The display will return to the "Event reset" prompt in the Reset Control Setup Menu.

b. Reset print

The program in the Recorder allows point reset data to be printed on the Alarm/Event Data Log, at the time of the reset, or if enabled, be stored to disk (5.7.2). This option can be toggled ON or OFF for each resettable point.

Programming Reset Print - From the Reset Control Setup Menu, use the UP (↑) DOWN (↓) Arrow Keys to highlight "Reset print" and press **ENTER**. The display will read either "print=YES" or "print=NO". Use the **YES** or **NO** Key to select either "print=YES" "print=NO" and press **ENTER**. The display will return to "Reset print' in the Reset Control Setup Menu.

c. Auto Reset

When programming High Peak, Low Peak, Totalize, Time Average, and Gated Timer points, the system allows an Auto Reset function. If Auto Reset is set up, the point being programmed will reset at programmed intervals, from once a minute to once a month. The system will prompt for the Start Time and Interval for which that point will reset.

NOTE: If Auto Reset is disabled, resettable points may only be reset manually.

NOTE: Moving Average, High Peak, and Low Peak points reset to the current value of the base point. Totalize points reset to zero.

Selecting Auto Reset - From the Reset Control Setup Menu, use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Auto reset" in the Reset Control Setup Menu and press **ENTER**. The display will read either "Auto off", "Daily", "Weekly", or "Monthly".

Selecting Auto Off - Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Auto off" and press **ENTER**. The display will return to "Auto reset" in the Reset Control Setup Menu. Automatic reset of the programmed point is now disabled.

c.1 Daily Auto Reset

Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Daily" and press **ENTER**. The display will read "start XX:XX". The Start Time is entered in a 24-hour clock format in Hours (00 through 23) and Minutes (00 through 59). This is the time the first reset will begin, after this the point will reset at the "interval" rate. (see below).

Setting Up Start Time - If the Start Time is correct, press **ENTER** and proceed to Interval. If the Start Time is not correct, press **NO** and the display reads "str hrs →XX←". (for STaRt hours). Use the Numeric Keypad to enter the desired Start Hours. Up to 23 hours may be programmed. When the correct Start Hours are displayed press **ENTER** and the display reads "str mins →XX←". Use the Numeric keypad to enter the desired Start Minutes. Up to 59 minutes may be programmed. When the correct Start Minutes are displayed, press **ENTER** and the display returns to "start XX:XX". If the Start Time displayed is correct, press **ENTER** and the display reads "intrvl XX:XX".

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Setting Up Interval Time - It the displayed Interval Time is correct, press **ENTER** and the display returns to "Auto reset" in the Reset Control Setup Menu. If the Interval Time is not correct, press **NO** and the display reads "int hrs→XX←". Use the Numeric keypad to enter the desired Interval Hours. Up to 23 hours may be programmed. When the correct Interval Hours are displayed press **ENTER** and the display reads "int mins→XX←". Use the Numeric keypad to enter the desired Interval Minutes. Up to 59 minutes may be programmed. When the correct Interval Minutes are displayed, press **ENTER** and the display returns to "intrvl XX:XX". If the Interval Time displayed is correct, press **ENTER** and the display returns to the "Auto reset" prompt in the Reset Control Setup Menu.

Interval Programming for Totalize Point Types - When programming a Totalization Point, the Interval represents the frequency of which the Totalization value will be reset to zero. The Totalization value will be logged on the Alarm/Event Data Log before the value is reset if the reset print is enabled. The interval time is entered in a 24-hour clock format in Hours (00 through 24) and Minutes (00 through 59). The longest time interval that can be entered is 24:00 which represents a reset interval of once every 24 hours.

Interval Programming for Hi Peak / Lo Peak Point Types - When programming a High Peak/ Low Peak Point, the Interval represents the frequency the High or Low Peak value will be reset to the value of the base point. The High or Low Peak value will be logged on the Alarm/Event Data Log before the value is reset is the reset print is enabled. The interval time is entered in a 24-hour clock format in Hour (00 through 24) and Minutes (00 through 59). The longest time interval that can be entered is 24:00 which represents a reset interval of once every 24 hours.

For the Interval Log function and Auto Resettable point types, the programmable Start Time is not necessarily the time at which the first log / reset will occur. However, a log / reset will always occur at the Start Time every day. The actual first log / reset depends upon the current time and the assigned Interval. The Recorder calculates the first log / reset by repeatedly adding the interval to the Start Time until the current time is met or exceeded. See the example below:

Current Time: 07:30
Start Time: 09:15
Timed Interval: 1 Hour

09:15 Programmed Start Time
10:15
11:15
12:15 Note: The Interval (1 hour) added to the Start Time yields log/reset times.
.
.
23:15
00:15
01:15
.
.
07:15 07:30 (Current Time)
08:15 Time of the first log / reset for this example

c.2 Weekly Auto Reset

To reset the point once a week use the Weekly reset option. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Weekly" and press **ENTER**. The display will read a day of the week, Monday - Tuesday - Wednesday - Thursday - Friday - Saturday - or Sunday.

Selecting the Week Day - Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired day of the week and press **ENTER**. The display will read "start XX:XX".

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Selecting Start Time - It the Start Time displayed is correct, press **ENTER** and the display returns to the "Auto reset" prompt in the Reset Control Setup Menu. If the displayed time is not correct, press **NO** and the display reads "str hrs→XX←". Use the Numeric keypad to enter the desired Start Hours. Up to 23 hours may be programmed. When the correct Start Hours are displayed press **ENTER** and the display reads "str min→XX←". Use the Numeric keypad to enter the desired Start Minutes. Up to 59 minutes may be programmed. When the correct Start Minutes are displayed, press **ENTER** and the display returns to "start XX:XX". If the Start Time displayed is correct, press **ENTER** and the display returns to the "Auto reset" prompt in the Reset Control Setup Menu.

c.3 Monthly Auto Reset

To reset the point once a month use the Monthly reset option. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Monthly" and press **ENTER**. The display reads "first day→XX←". Use the Numeric keypad to enter the desired day of the month on which to reset. Up to 31 may be entered in this block to represent the number of the day in the month. When the correct day of the month number is displayed, press **ENTER** and the display reads "Start XX:XX". If the Start Time displayed is correct, press **ENTER** and the display returns to the "Auto reset" prompt in the Reset Control Setup Menu.

Selecting Start Hours - If the displayed Start Time is not correct, press **NO** and the display reads "str hrs→XX←". Use the Numeric keypad to enter the desired Start Hours. Up to 23 hours may be programmed here. When the correct Start Hours is displayed, press **ENTER** and the display reads "str mins→XX←".

Selecting Start Minutes - Use the Numeric keypad to enter the desired Start Minutes. Up to 59 minuets may be programmed here. When the correct Start Minutes is displayed, press **ENTER** and the display reads "str mins→XX←". If the correct Start Time is displayed, press **ENTER** and the display returns to the "Auto reset prompt in the Reset Control Setup Menu.

5.6.5.14 Time Period

The Time Period is the time base used to set the duration (time) of the moving window. The point average is set for this period of time (a maximum 1440 minutes of time is possible) and then the first scan is dropped off and a new scan is averaged in.

Programming Time Period - Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Time period" and press **ENTER**. The display reads "minutes→XXXX←". Use the UP (↑) or DOWN (↓) Arrow Keys to select the digit and the LEFT (←) or RIGHT (→) Arrow Keys to move to a position to enter the desired Time Period. A maximum 1440 minutes (24 hours) may be entered. When the desired Time Period is displayed, press **ENTER** and the display returns to "Time Period".

5.6.5.15 Gate Control

Gate Control can be turned on, "Gate=YES", or off, "Gate=NO". If Gate Control is turned on, a base point must be established. If Gate Control is turned off, this Point Range can be used as a timer for calculations, etc.

Programming Gate Control - Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Gate control" and press **ENTER**. Use the **YES** or **NO** keys to select the desired state and press **ENTER**. If "Gate=NO" is selected, the display returns to the "Gate control" menu item in the Point Setup Menu. If "Gate=YES" is selected, pressing **ENTER** will cause the program to prompt for a Base Point and the display will read "base pt? X". Use the UP (↑) or DOWN (↓) Arrow Keys to highlight the desired point character and press **ENTER**.

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5.6.5.16 Flow Rate

This function allows different Flowrates to be set which can affect accuracy of the totals.

Selecting Flowrate - In the Point Setup Menu, use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Flowrate" and press **ENTER**. The display will read "flow=/sec". Use the UP (↑) or DOWN (↓) Arrow Keys to highlight the desired flowrate of /sec, /min, /hr, or /day and press **ENTER.**

5.6.5.17 Low Cutoff

This function allows the user to program a low flow cutoff. If Totalization is not wanted below a predetermined flow rate, Low Cutoff can be set at that rate and Totalization will be shut off if the point level falls below the preset value.

Selecting Low Cutoff - Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Low cutoff" and press **ENTER.** The display reads "cut→XXXXXXXXXXXX←". Use the Numeric keypad to move to a position to enter the desired Low Cutoff value. Press **ENTER** and the display returns to "Low cutoff".

5.6.5.18 Set Equation

This Point Setup Menu item allows the user to program the desired equation.

Programming Set Equation - Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Set Equation" and press **ENTER**. The display reads "XXX...XX". The LEFT (←) or RIGHT (→) Arrow Keys move to a position to enter the desired Equation. Forty (40) positions are available for equation operators, and the display will scroll to the left or right to allow entry. Use the UP (↑) or DOWN (↓) Arrow Keys to select the functions as follows

P1 to PC	are used to represent Points (must be previously programmed)
K1 to KF	are used to represent Constants (must be previously programmed)
)	is a RIGHT Parenthesis
+	is Add
-	is Subtract
*	is Multiply
/	is Divide
^	is Fractional
**	is Raise to the Power (X^y)
Sq	is Square Root
Ln	is Natural Logarithm
Lg	is Base Ten Logarithm
Ex	is Exponentiation (e^x)
(	is a LEFT Parenthesis

Any equation entered is parsed from left to right. That part of the equation between parenthesis is calculated first, then the basic rules of mathematics are obeyed. When the desired equation is displayed, press **ENTER** and the display returns to the "Set equation" menu item in the Point Setup Menu.

5.6.5.19 Set Cndtionl

This menu item allows the user to program a set of conditions for a point. Up to 40 operators can be programmed in any one conditional statement.

Programming Set Conditional - Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Set cndtionl" and press **ENTER**. Use the LEFT (←) or RIGHT (→) Arrow Keys to move to a position to enter the desired conditional statement. Forty positions or operators are possible. The display will scroll to accommodate all forty operators. Use the UP (↑) or DOWN (↓) Arrow Keys to select the operators as follows:

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P1 to PC	are used to represent Points (Must be pre programmed)
K1 to KF	are used to represent Constants (Must be pre programmed)
)	is a RIGHT Parenthesis
|	is or
&	is and
<	is less than
>	is greater than
=	is equal to
!=	is not equal to
<=	is less than or equal to
>=	is greater than or equal to
!	is not
(	is a LEFT Parenthesis

When the desired conditional statement is displayed, press **ENTER** and the display returns to "Set cndtionl". The conditional statement is evaluated from left to right. Use parenthesis to change the order of evaluation. The result of any conditional statement evaluation is either TRUE or FALSE.

5.6.5.20 Timeout

Timeout sets a maximum time period between signal updates from the external source before flagging the point as invalid. The point is flagged Invalid if no update is received within the specified time-out period. Programming 0 for timeout disables it. To program Timeout, follow the instructions below.

Programming Timeout - Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Timeout" and press **ENTER.** The display reads "minutes→XXXX←". Use the UP (↑) or DOWN (↓) Arrow Keys to select the digit and the LEFT (←) or RIGHT (→) Arrow Keys to move to a position to enter the desired Timeout value. A maximum 1440 minutes (24 hours) may be entered. When the desired Timeout value is displayed, press **ENTER** and the display returns to "Timeout".

5.6.6 Linear Current/Voltage Point Types

The Recorder accepts two standard types of linear current inputs: 4 to 20mA and 10 to 50mA and three voltage ranges: ±100mV , ±1 Volt ±10 Volt

Dry Contact will be covered later in this chapter.

Deciding Which Voltage Range to Use - In deciding which of the voltage ranges to use, select the smallest range that will accommodate the full span of the input signal for the best resolution and accuracy of the Analog-to-Digital Converter (ADC).

Current Inputs Voltage Shunt - Current inputs are converted to voltage by means of an external 50 ohm shunt resistor supplied by the user. The following formula is used to determine the appropriate low and high end input voltage for non-standard current inputs:

Ohms Law: E = I * R
E = Equivalent voltage inputs
I = Current in milliamps
R = Precision shunt resistance value

Shunt Resistor Example - The following example shows a low and high end input voltage for a 0 to 1mA input with a precision shunt resistance of 1000 ohms with the measurement done on the 1V range.

E = 0 x 1000 = 0mV = 0 V (Low input)
E = 1 x 1000 = 1000mV = 1 V (High input)

Using the Input and Output scaling, the user can program full scale ranges for the above input.

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Programming Parameters - Once a point has been programmed as Linear and a current or voltage mode selected, the user is presented with the following parameters:

Point Tag	Section 5.6.5.1
Input Scale	Section 5.6.5.2
Output Scale	Section 5.6.5.3
Exc. Currents	Section 5.6.5.5
Filter Seconds	Section 5.6.5.6
Engineering Units	Section 5.6.5.9
Alarm Setpoints	Section 5.6.5.10
Chart Scale	Section 5.6.5.11

Not all the above options will be available. It depends on the choice of input range.

5.6.7 Dry Contact Point Type

The Dry Contact Point Range type allows a point to be programmed and act like an open or closed contact. The input can be a set of potential free contacts. Logically an open contact is equal to 0 (zero) and a closed contact is equal to 1.

Once a point has been selected as Linear as described above (5.6.6) use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Dry contact" as the linear type and press **ENTER**. The display will show a reduced Point Setup menu - the Dry Contact Point Setup Menu. The user can then set the following parameters:

Point tag	Section 5.6.5.1
Eng units	Section 5.6.5.9
Alarms	Section 5.6.5.10
Chart Scale	Section 5.6.5.11

5.6.8 Industrial Square Root Current/Voltage Point Types

The Recorder accepts three voltage square root extraction ranges:

±100mV sqrt, ±1 Volt sqrt and ±10 Volt sqrt

and two types of linear current square root extraction ranges:

4 to 20mA sqrt and 10 to 50mA sqrt.

This function is used for inputs which require the Industrial Square Root of the input signal (i.e. flow measurement). The system calculates the square root of the percentage of input scale and multiplies this value by the high end scale to produce the value of the point displayed. In the following example, the input is 4 to 20mA and the scaling is such that 0 = Low End of Scale and 1000 = High End of Scale.

High End Scale = 1000 gallons per minute

Input Signal = 12mA or 50% of scale which is equal to 0.5

Square Root of 0.5 = 0. 707

Actual value displayed is 0.707 x 1000 = 707 GPM (with decimal fix of 0)

Current input signals requires that the user provides an external resistor.

Programming Parameters - Selecting Industrial Square Root point types requires setting up parameters like regular Programming linear point types. From the Point Type menu use the UP (↑) or DOWN (↓) Arrow

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Keys to highlight "Ind sqrt" and press **ENTER**. The Point Setup menu for Industrial Square Root will be displayed and may require programming the following parameters:

Point tag	Section 5.6.5.1
Input Scale	Section 5.6.5.2
Output Scale	Section 5.6.5.3
Exc. Currents	Section 5.6.5.5
Filter	Section 5.6.5.6
Engineering Units	Section 5.6.5.9
Alarm Setpoints	Section 5.6.5.10
Chart Scale	Section 5.6.5.11

5.6.9 Logarithmic Linear Point Types

Five types of Log Linear point types can be selected, three linear voltage logarithmic ranges:

±100mV log, ±1 Volt log and ±10 Volt log,

and two types of linear current logarithmic ranges:

4 to 20mA log and 10 to 50mA log

Programming Parameters - Selecting Log Linear point types requires setting up parameters like regular Programming linear point types except that the Low and High Exponents must be set in Output Scales. From the Point Type menu use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Log Linear" and press **ENTER**. The Point Setup menu for Log Linear will be displayed and may require programming the following parameters:

Point Tag	Section 5.6.5.1
Input Scale	Section 5.6.5.2
Output Scale	Section 5.6.5.3 (Lo and Hi Exponents)
Exc. Currents	Section 5.6.5.5
Filter	Section 5.6.5.6
Engineering Units	Section 5.6.5.9
Alarm Setpoints	Section 5.6.5.10
Chart Scale	Section 5.6.5.11

Output Scale - All Log linear current and voltage inputs must be assigned low and high output scale endpoints. The endpoints are the exponent values (the x in 10^x) between +25 to -25.

5.6.10 Thermocouple (T/C) Point Types

Several Thermocouple type points are available for use. From the Point Type menu (Figure 5-6) use the UP (↑) or DOWN (↓) Arrow Keys to highlight "T/C" and press **ENTER**. A list of available thermocouple types is presented. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight the desired thermocouple type:

J, K, T, E, R, S, B, C, Ninimo, or Nicro

and press **ENTER**. The Point Setup menu for Thermocouples will be displayed and may require programming the following parameters:

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Point Tag	Section 5.6.5.1
Decimal fix	Section 5.6.5.2
Filter	Section 5.6.5.3
Compensation	Section 5.6.5.7
Span/Offset	Section 5.6.5.8
Engineering Units	Section 5.6.5.9
Alarm Setpoints	Section 5.6.5.10
Chart Scale	Section 5.6.5.11

5.6.11 Resistance Temperature Detector (RTD)

Several types of RTD's are available for selection. From the Point Type menu (Figure 5-6), use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Rtd" and press **ENTER**. A list of available RTD types is presented. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight the desired RTD type:

10Ω Cu, 100Ω PT 385, 100Ω PT 392, 200Ω PT 385, 200Ω PT 392, or 120Ω ni

and press **ENTER**. The Point Setup menu for Rtd's will be displayed and may require programming the following parameters:

Point Tag	Section 5.6.5.1
Decimal fix	Section 5.6.5.2
Filter	Section 5.6.5.3
Span/Offset	Section 5.6.5.8
Engineering Units	Section 5.6.5.9
Alarm Setpoint	Section 5.6.5.10
Chart Scale	Section 5.6.5.11

5.6.12 Calculated Point Types

The following menu items are available through the Calculated Point Type menu:

Equation	High Peak
Low Peak	High/Low Difference
Moving Average	Time Average
Gated Timer	Totalize

Calculations may be performed on current point values of a single point or a group of points if set in Equations. The calculations are performed after each scan of all measured points and the results are stored until the next point scan.

NOTE: Moving Average can be set on channels A, B and C ONLY.

5.6.12.1 Equation

This Point Range of Calculated Point Types allows the user to program an equation to calculate a value of one or more points and/or constants.

Operators Used for Equations - Forty operators are allowed in any one formula programmed. If the equation does not compute, the display will read "bad operand". The following operators are used:

P1 to PC	are used to represent Points
K1 to KF	are used to represent Constants
)	is a RIGHT Parenthesis
+	is Add
-	is Subtract

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*	is Multiply
/	is Divide
^	is Fractional
**	is Raise to the Power (X^y)
Sq	is Square Root
Ln	is Natural Logarithm
Lg	is Base Ten Logarithm
Ex	is Exponentiation (e^x)
(	is a LEFT Parenthesis

The Point Setup menu for Equation will be displayed and may require programming the following parameters:

Point Tag	Section 5.6.5.1
Decimal fix	Section 5.6.5.4
Set Equation	Section 5.6.5.18
Engineering Units	Section 5.6.5.9
Alarm Setpoint	Section 5.6.5.10
Chart Scale	Section 5.6.5.11

5.6.12.2 Hi Peak

Calculated Point Types with a Point Range of Hi Peak keep track of the highest data of a given point. This data is stored until some form of reset occurs. When the data is reset, the Hi Peak Point data is printed on the Alarm log along with the current time and the time the peak value occurred if Reset print is enabled. The Point Setup menu for Hi Peak will be displayed and may require programming the following parameters:

Point Tag	Section 5.6.5.1
Decimal fix	Section 5.6.5.4
Basepoint	Section 5.6.5.12
Engineering Units	Section 5.6.5.9
Reset Control	Section 5.6.5.13
Alarm Setpoint	Section 5.6.5.10
Chart Scale	Section 5.6.5.11

NOTE: When Calculated Point Types of Hi Peak, Lo Peak, or time Average point ranges are reset, the new value will be the current base point value at the time of reset.

5.6.12.3 Lo Peak

Calculated Point Types with a Point Range of Lo Peak keep track of the lowest data of a given point. This data is stored until some form of reset occurs. When the data is reset, the Low Peak Point data is printed on the chart along with the current time and the time the peak value occurred if reset print is enabled. The Point Setup menu for Lo Peak will be displayed and may require programming the following parameters:

Point Tag	Section 5.6.5.1
Decimal fix	Section 5.6.5.4
Basepoint	Section 5.6.5.12
Engineering Units	Section 5.6.5.9
Reset Control	Section 5.6.5.13
Alarm Setpoint	Section 5.6.5.10
Chart Scale	Section 5.6.5.11

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5.6.12.4 HiLo Difference

This Calculated point type takes the difference between the lowest and highest values in a group of points. A First Point number is assigned and a Last Point number is assigned. The difference is taken from those points inclusive. This point must be outside of the group of points. The Point Setup menu for HiLo Difference will be displayed and may require programming the following parameters:

Point Tag	Section 5.6.5.1
Decimal fix	Section 5.6.5.4
Basepoints	Section 5.6.5.12 (Pick starting and ending Basepoints)
Engineering Units	Section 5.6.5.9
Alarm Setpoint	Section 5.6.5.10
Chart Scale	Section 5.6.5.11

5.6.12.5 Moving Average

A Calculated Moving Average point calculates the continuous average of the measured or processed value of a selected point. The result is the weighted average of the present reading and the previous average value. Therefore, this type of point can be used to smooth out noisy or erratic signals and to attenuate the effects of sudden transitions. **Calculated Moving Average Points are only programmable for point numbers A through C**. The Point Setup menu for Moving Average will be displayed and may require programming the following parameters:

Point Tag	Section 5.6.5.1
Decimal fix	Section 5.6.5.4
Basepoints	Section 5.6.5.12 (Pick starting and ending Basepoints)
Time Period	Section 5.6.5.14
Engineering Units	Section 5.6.5.9
Alarm Setpoint	Section 5.6.5.10
Chart Scale	Section 5.6.5.11

5.6.12.6 Time Average

Calculated Point Types with a Point Range of Time Average calculate a continuous average of the measured or processed value of a selected point. The result is a weighted average of the present reading and the previous average value. This value can be used to smooth out noisy or erratic signals and to attenuate the effects of sudden transitions. The Point Setup menu for Time Average will be displayed and may require programming the following parameters:

Point Tag	Section 5.6.5.1
Decimal fix	Section 5.6.5.4
Basepoint	Section 5.6.5.12
Engineering Units	Section 5.6.5.9
Reset Control	Section 5.6.5.13
Alarm Setpoint	Section 5.6.5.10
Chart Scale	Section 5.6.5.11

5.6.12.7 Gated Timer

The Gated Timer function allows a timer, measuring in seconds, to be controlled by a 'gate' from a logic point. For example, if a point is measuring temperature and you wanted to know the total amount of time the temperature measured by this point is above or below a certain level, a Conditional Point can be programmed to be 'true' only when the temperature is above or below a set level. A Gated Timer Point can then be programmed to be turned ON only when the Conditional Point is in the true state. The Gated Timer Point will then only be timing when the temperature is above or below a set level. The timer will continue to accumulate time, in seconds, each time it is turned on. The Gated Timer Point can be reset at programmable time intervals and alarms can be set to alarm if the timer total goes above a pro-

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grammed time interval in seconds. The Point Setup menu for Gated Timer will be displayed and may require programming the following parameters:

Point Tag	Section 5.6.5.1
Gate Control	Section 5.6.5.15
Engineering Units	Section 5.6.5.9
Reset Control	Section 5.6.5.13
Alarm Setpoint	Section 5.6.5.10
Chart Scale	Section 5.6.5.11

5.6.12.8 Totalize

The totalize calculation keeps a running total of the value of a point sampled at a programmed rate. This will continue until the programmed reset interval time is reached at which time the value is logged on the alarm/event log window (if reset print is enabled), is reset to zero, and the Totalization calculation begins again. However, a low-flow cutoff provision prevents totalization on flow rates that meet or fall below the cutoff point. The data will also be recorded to disk if alarm/event logging is enabled. **The totals are non-volatile for channels A, B, and C unless auto reset is active.** The Point Setup menu for Totalize will be displayed and may require programming the following parameters:

Point Tag	Section 5.6.5.1
Decimal fix	Section 5.6.5.4
Basepoint	Section 5.6.5.12
Flowrate	Section 5.6.5.16
Engineering Units	Section 5.6.5.9
Reset Control	Section 5.6.5.13
Low Cutoff	Section 5.6.5.17
Alarm Setpoint	Section 5.6.5.10
Chart Scale	Section 5.6.5.11

5.6.13 Conditional Point Types

These point types are used when the operator needs to set a list of operating conditions for a point.

Operators Used for Setting Conditions - Forty operators are allowed in any one formula programmed. If the conditions equation does not compute, the display will read "bad operand". The following operators are used:

P1 to PC	are used to represent Points (Must be pre programmed)
K1 to KF	are used to represent Constants (Must be pre programmed)
)	is a RIGHT Parenthesis
|	is or
&	is and
<	is less than
>	is greater than
=	is equal to
!=is	not equal to
<=	is less than or equal to
>=	is greater than or equal to
!	is not
(	is a LEFT Parenthesis

The Point Setup menu for Conditional Points will be displayed and may require programming the following parameters:

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Point Tag	Section 5.6.5.1
Set Cndtionl	Section 5.6.5.19
Engineering Units	Section 5.6.5.9
Alarm Setpoint	Section 5.6.5.10
Chart Scale	Section 5.6.5.11

5.6.14 External Point Types

External Point Types use data sent via the Com port to the Recorder for trending or other uses. The Point Setup menu for External Points will be displayed and may require programming the following parameters:

Point Tag	Section 5.6.5.1
Input Scale	Section 5.6.5.2
Output Scale	Section 5.6.5.3
Timeout	Section 5.6.5.20
Engineering Units	Section 5.6.5.9
Alarm Setpoint	Section 5.6.5.10
Chart Scale	Section 5.6.5.11

5.7 Record Setup

This section deals with setting up the recording of data to the disk, either floppy disk or PCMCIA memory card. The Programming menu for Record Setup is shown in Figure 5-9. The user can choose whether to record only data (*Data on/off*) and which points to record (*Points*), or to record only Alarm/Event information (*Alarm on/off*), or record both data and alarm/event information. *Points (Trigger)* enables the user to set up which alarm points will stop or start recording. The *Record Mode* sets up whether data is recorded to fill the disk and stop, or to cycle around continuously, replacing the oldest data with the newest, as well as setting the average or instantaneous sample storage method. The *Disk Full Alarm* option allows the user to set the full threshold to alarm the fact that the disk is getting full, while the *Filename* option allows the user to enter a unique file name for each recording session. The exact details of each menu option is given below.

NOTE: THE MENU OPTIONS CANNOT BE ACCESSED WHILE THE UNIT IS RECORDING. USE THE Record On/Off OPTION IN THE FUNCtion MENU TO STOP THE UNIT RECORDING PRIOR TO ATTEMPTING TO ACCESS THIS MENU!

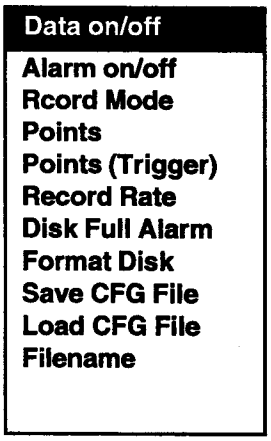


Figure 5-9 Record Setup Menu

5.7.1 Data on/off

This option enables the user to enable or disable the recording of Point Data to disk. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight this menu choice and press **ENTER**. A window will pop up and show the current recording status, "record data =NO*" if the unit will not record data, or "record data =YES*" if the unit is to record data. Enable Data to be recorded by pressing **YES** or prevent it from being recorded by pressing **NO** then press **ENTER** to activate and return to the Record Setup program Menu. If you enable Data and no points are turned on, you will get an error message.

NOTE: **The actual record mode is initiated in the "FUNCtion" menu (accessed from the main button bar) using the "Record on" menu option.** Refer to 4.2.3.

NOTE: Floppy Disk models - Use only formatted 1.44 Meg Floppy disks (High Density) and ensure they are not write protected. The disks can be formatted using the Format menu option.

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5.7.2 Alarm on/off

This option enables the user to enable or disable the recording of Alarm and Event information to Disk. Use the Up (↑) or DOWN (↓) Arrow Keys to highlight this menu choice and press **ENTER**. A window will pop up and show the current recording status "Alarm data =NO*" if the unit will not record Alarm data, or "Alarm data =YES*" if the unit is to record Alarm data. Enable Alarm Information to be recorded by pressing **YES** or prevent it from being recorded by pressing **NO** then press **ENTER** to activate and return to the Record Setup program Menu. No data will actually be stored until the Record mode is turned on in the **FUNC**tion Menu.

5.7.3 Record Mode

There are three options "Fill Mode", "Inst/Avg All" and Inst/Avg Indiv". The "Fill Mode" determines whether files are to be recorded to fill the disk and stop, or recycle, deleting the oldest data and replacing it with new. The **Inst**antaneous/**Aver**age options determine whether data will be averaged over the record interval or whether the latest data only is stored. If you are using one of the intrinsic functions of the unit, for example Peak Values, you must set the sample mode to instantaneous or you will "average" your "peaks" if you have a slow sample storage rate.

5.7.3.1 Fill Mode

Use the Up (↑) or DOWN (↓) Arrow Keys to highlight "Fill Mode" from the Record Mode Menu. There are two options available, "Fill to End" and "Cycle Data".

5.7.3.1.1 Fill to End

The unit will record to disk until the disk is full, and then it will shut the recording off.

5.7.3.1.2 Cycle Data

The unit will continue to record to disk until the disk is almost full and then it will start to write over the earliest data a block at a time (about 500 samples at a time). The disk will always contain the most current data, and the oldest data will be lost. All points respect the integrity of data for other points, each point will only replace it's own data.

NOTE: Set the disk full threshold to 100% when running in the cyclic mode to prevent the disk full alarm from activating.

To program the Fill Mode use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Fill Mode" on the menu and press **ENTER**. The current Record mode will appear highlighted. To change it, use the UP (↑) or DOWN (↓) Arrow Keys to highlight either "Fill to End" or "Cycle Data" as required and press **ENTER** to activate. Press **EXIT** to return to the Record Setup Program menu.

5.7.3.2 Instantaneous/Average Mode

The instantaneous or average method of recording can be made to apply to all points simultaneously, or it can be set independently for each individual point. Use "Inst/Avg All" to set a single mode for all points, or "Inst/Avg Indiv." to set the mode individually for each point.

5.7.3.2.1 Inst/Avg All

The user has the option to select Instantaneous or Average which is applied to all points simultaneously.

Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Inst/Avg All" on the Record Mode menu. The current Record mode will appear highlighted. To change it, use the UP (↑) or DOWN (↓) Arrow Keys to highlight either "Instantaneous" or "Average" as required and press **ENTER** to activate. Press **EXIT** to return to the Record Setup Program menu

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5.7.3.2.1 Inst/Avg Indiv.

The user has the option to set the Instantaneous or Average mode for each channel individually.

Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Inst/Avg Indiv." on the Record Mode menu. This will bring up a point selection keypad which allows selection of the relevant point. Choose the point to edit and press ENTER. The current Record mode will appear highlighted. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight either "Instantaneous" or "Average" and press **ENTER** to select, or **EXIT** to quit. Repeat this process for each point you want to set then press **EXIT** to return to the Record Mode menu.

To program the Instantaneous/Average Mode use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Inst/Avg All" or "Inst/Avg Indiv" on the Record Mode menu and press **ENTER**. Refer to the detail above.

5.7.4 Points

The user may select which of the twelve available points are to be recorded to disk. Any or all points may be recorded, however the recording time available on the disk is divided among the number of points being recorded. Ensure that points you do not wish to record, or that have no data attached, are not turned on to record.

To turn the points on or off use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Points" on the menu and press **ENTER**. A window will be presented displaying "point X=YES*" or "point X=NO*". Use the UP (↑) or DOWN (↓) Arrow Keys to select the point you wish to turn on or off, then press **NO** to turn it off, or **YES** to turn it on. Press the **ENTER** button to activate your choice and automatically select the next point. Press **EXIT** to return to the Record Setup Programming menu.

5.7.5 Points (Trigger)

The user may select which of the twelve available points are to be used to trigger the record mode on or off. Any or all points may be used to trigger recording. When activated, any alarm condition for the point in question will start the unit recording, provided the unit is armed to trigger. Refer to Section 4.2.3.1.3. The unit will record as long as the alarm is true.

To enable the points to trigger recording, use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Points (Trigger)" on the menu and press **ENTER**. A window will be presented displaying "point X=YES*" or "point X=NO*". Use the UP (↑) or DOWN (↓) Arrow Keys to select the point you wish to activate (yes) or deactivate (no), then press **NO** to disable triggering, or **YES** to enable triggering. Press the **ENTER** button to activate your choice and automatically select the next point. Press **EXIT** to return to the Record Setup Programming menu.

5.7.6 Record rate

The user can select the rate at which data is stored to disk independently to the rate at which it is displayed on the chart. The rate can be set for all channels at once or it can be set for each channel individually. The rate can be set from the fastest rate of 4 times per second to the slowest rate of once every 600 seconds or once every ten minutes. The rate you choose is dependent on how dynamic the process that you are measuring is. If you are recording temperature which varies slowly, you can maximize the amount of data that is stored on the disk by keeping the record rate slow. If you are measuring variables that change rapidly, you may need to set the record rate at once per second. Thus if you have one channel that is recording a rapidly changing input and one that is recording an input that changes slowly, you can optimize the record rate for each.

There are two record rates for each channel or point, a low rate and a high rate. The default rate is set in the **FUNC**tion menu - Record Speed. The record rate can be changed by an external event if the digital I/O option is fitted. Refer to 5.9.2. External speed change is enabled in the Autorate option.

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To set record rates use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Record Rate" on the menu and press **ENTER.** There are three options:

Autorate
Individual Rate
All rates

5.7.6.1 Autorate

Autorate enables the record rate to be changed on an Alarm event. To enable auto rate change, use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Autorate" and press **ENTER**. You will be presented with a display that shows "autorate=NO" or "autorate=YES". Press the YES or NO keys to enable or disable the autorate change on alarm option then press **ENTER** to return to the record rate menu

5.7.6.2 Individual Rates

To set the individual record rates per channel use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Individual Rate" and press **ENTER**. You will be presented with a point selection keypad that enables the selection of the specific point to be programmed. Enter the point number and press **ENTER.** This brings up the record rate entry keypad and a display that shows "secs(lo)→XXX←" where XXX is the current sampling rate in seconds. Use the numeric keypad to enter the record rate from 0 to a maximum of 600 seconds, then press **ENTER** to activate. The display will show "secs(hi)→XXX←" where XXX is the current record rate in seconds. Use the numeric keypad to enter the record rate from 0 to a maximum of 600 seconds, then press **ENTER** to activate and return to the Record Speed menu. Repeat the above procedure for each point to be programmed. Press **EXIT** at any time to return without altering the setting and to return to the Record Setup menu.

5.7.6.3 All Rates

To set the record rates for all channels at once, use the UP (↑) or DOWN (↓) Arrow Keys to highlight "All Rates" and press **ENTER**. You will be presented with a display that shows "secs(lo)→XXX←" where XXX is the current record rate in seconds. Use the numeric keypad to enter the record rate from 0 to a maximum of 600 seconds, then press **ENTER** to activate. The display will show "secs(hi)→XXX←" where XXX is the current record rate in seconds. Use the numeric keypad to enter the record rate from 0 to a maximum of 600 seconds, then press **ENTER** to activate and return to the Record Rate Programming menu. Press **EXIT** at any time to return without altering the setting and to return to the Record Setup menu.

NOTE: To set the record rate to 4 times a second (once every 0.25 second) select **0** seconds

NOTE: Although the record rates are shown as low and high, the "low" rate can in fact be faster than the "high" rate. The low and high rates are defined by selection in the FUNC menu. If the digital I/O option is fitted the switch inputs can be set to change record speed. An active input selects the "high" speed, an inactive input selects the "low" speed. The current record rate (high or low) is indicated in the Disk Status Window, the high rate being indicated by **REC↑** and the low rate indicated by **REC↓.** The inputs can be overridden by the FUNC menu until a change of input state takes place. If you do not plan to use the change record rate option, set both record rates to the same value.

The logic for external record rate change is as follows

FUNC	SWITCH	RECORD RATE
high	lo to hi	high
high	hi to lo	low
low	lo to hi	high
low	hi to lo	low

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5.7.7 Disk Full Alarm

It is possible to set a threshold to indicate when the disk is full. The indication is via a pop-up window on the screen, or if the relay option is fitted, via a contact closure. The threshold limit may be set by the user to any value between 1 and 100 percent. NOTE: Setting the limit to 100% prevents the disk full alarm from activating.

To set the disk full alarm value use the UP (↑) or DOWN (↓) Arrow Keys to highlight the "Disk Full Alarm" option and press **ENTER**. There are two menu options

Setpoint
Contact #.

5.7.7.1 Disk Full Setpoint

To change the disk full alarm threshold use the UP (↑) or DOWN (↓) Arrow Keys to highlight the "Disk Full Alarm" option and press **ENTER**. Select "Setpoint" and press ENTER. Use the alphanumeric keypad to enter the percentage point at which the disk will indicate nearly full (1 to 100 percent) and press ENTER.

5.7.7.2 Disk Full Alarm Output

Use the UP (↑) or DOWN (↓) Arrow Keys to highlight the "Contact #" option and press **ENTER** Use the keypad to select a relay contact number, 1 through 6, or 0 for no contact closure. Press ENTER to return to the Data Recorder menu.

Note: If the relay output option is installed, the contact selected above will close when the disk full threshold is reached. Once a contact has been selected, all disk errors (e.g. Read/write, File not found etc.) will also cause the same contact to close.

5.7.8 Format Disk

The floppy disk or PCMCIA card must first be formatted before being used. This can be done in the unit, or on any IBM compatible PC running MSDOS. The disks are formatted in MSDOS compatible format. Note that only 1.44 Meg (High Density) 3½ inch floppy disks can be used.

To format a disk, first ensure the disk is not write protected, (the write protect slide must expose the hole in the floppy disk). Open the door flap on the lower front panel to expose the drive. Insert the floppy disk, label side up with the metal toward the drive opening. Insure the disk is pushed fully into the drive - it will be pulled in and down.

Use the UP (↑) or DOWN (↓) Arrow Keys to highlight the "Format Disk" menu choice and press **ENTER**. You will be presented with a display window that shows "format=NO*". Press **YES** and then **ENTER** to start formatting. You will be returned to the Record Setup Programming menu. The light on the disk drive will come on and the disk will be formatted. The disk status window will indicate FORMAT while the disk is formatting. Once formatting has been completed a window will pop up to announce "Format Complete" or it will indicate any error if the disk could not be formatted. Press the "OK?" button to accept.

5.7.9 Save ConFiGuration File

This function permits the saving of the unit configuration to the disk for later retrieval or archiving. This saves the entire user configuration database which is usually stored in nonvolatile memory. It is recommended that the user perform this function after fully setting up the unit for the first time. This allows the user to return at any stage to a known, good configuration setup or may be used to transfer this setup to other machines. The file will be saved with the current filename as set by the user. Any existing configuration file on the disk with the same name will be overwritten.

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To save the configuration file, ensure that a formatted disk is in the drive. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight the "save CFG File" menu choice and press **ENTER**. You will be presented with a display window that shows "save config=NO*". Press **YES** and then **ENTER** to save the configuration with the current filename to the disk. The disk status window will show SAVE CFG and a window will pop up when the configuration has been saved to indicate "Configuration Saved". Press OK? when done to return to the Record Setup menu.

5.7.10 Load ConFiGuration File

It is possible to load a previously saved configuration file or a configuration file that has been generated at a remote PC, to automatically set up the unit. There may be more than one named configuration file on the disk enabling the user to quickly customize set up for various applications. To load and existing configuration use the UP (↑) or DOWN (↓) Arrow Keys to highlight the "Load CFG File" menu choice and press **ENTER**. A pop up window will display "load config=NO". Press the YES then ENTER buttons. The unit will look on the disk for any configuration files which will be displayed on the File Browser Directory. If more than one file exists on the disk, the directory will list them one above the other, with the current file to be loaded indicated by the "<" sign alongside it as shown below. If no configuration file is found the unit will indicate (No Files Found). The Config file directory looks like this:

File Browser Directory

Config Files:

OLDFILE .CFG<
NEWFILE .CFG

If more than one configuration file exists use the (↑) (up arrow) and (↓) (down arrow) buttons to select it and press the ENTER button. If there are more files on the disk than what will show on the screen, the list will scroll down with the "<" sign. The unit will load the selected configuration file from the disk and the disk status window will show LOAD CFG. If the load is successful, a window will pop up indicating "Configuration Loaded". Press the "OK?" button. At this point the unit will automatically RESET and begin with the newly loaded parameters

Note: **Once the configuration load has been initiated, the unit will automatically load and restart. Be sure you select the correct configuration file. It is advisable to save your current con figuration before loading a new one. Use a new disk or different filename to save the old configuration.**

☞ **The pass codes and calibration constants are NOT loaded from the configuration file to maintain access and calibration integrity.**

5.7.11 Filename

The user can enter a filename to identify the recordings he is making. The filename can be any valid DOS filename up to a maximum of 8 characters, e.g. BATCH1 or SAMPLE5. This filename is applied to all pen files, the alarm file and the configuration file. Thus if the name "BATCH1" is entered, pen 1 file will be BATCH1.DT1, pen 2 file will be BATCH1.DT2 and so on, the alarm file will be BATCH1.ALM and the configuration file will be BATCH1.CFG. A disk can hold files with different names. For example, you may run three batches and name files for each batch, BATCH1, BATCH2 and BATCH3 all on the same disc.

To enter a filename use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Filename" and press **ENTER**. You will be presented with a display that shows "→FILENAME←" where FILENAME is the current file name. Use the alphanumeric keypad to enter a new file name. Note that the file name cannot contain spaces and must consist of the letters A through Z, the numbers 0 through 9 and the characters #, %, &, (,), @. Do not try to type DOS extensions. Once you have entered a file name, press the **ENTER** key to save it and return to the recorder menu.

Note: **The default file name is the version with an "@" sign used as a decimal point. E.g. VM1@1A for Version 2.1a.**

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5.8 MEASUREMENT

This menu item allows the user to program items directly affecting measurement of Inputs. The following programming options are available in the Measurement Menu:

TCBO Interval - Allows the user to change the Thermocouple Burn Out (TCBO) check time interval. This is how often the recorder checks whether or not there is an open circuit on a thermocouple input by injecting a small current onto the input.

Span & Offset - Allows the user to turn Span and Offset off or on for RTDs and Thermocouples.

Demo Mode - Allows the user to turn on the Demo mode using internally generated signals

5.8.1 TCBO Interval

This function allows defining the TCBO check time interval. Disabling TCBO is accomplished by setting the TCBO Interval to zero seconds. The default value is 300 seconds (5 minutes).

Selecting TCBO Interval - From the Measurement menu, use the UP (↑) or DOWN (↓) Arrow keys to highlight "Tcbo intervl" and press **ENTER**. The display will read "seconds→XXX←".

Programming TCBO Interval - Use the Numeric keypad to enter the TCBO interval in seconds up to a maximum of 600. When the desired interval is displayed, press **ENTER** and the display returns to the "Tcbo intervl" prompt in the Measurement Setup Menu.

5.8.2 Span & Offset

This function enables Span and Offset compensation to allow for correction of known inaccuracies in Thermocouples and RTD's.

Selecting Span & Offset - From Measurement menu, use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Span&offset" and press **ENTER.** The display will read either "spnofs=NO" or "spnofs=YES".

Enabling Span & Offset - Press the YES to change the display to "spnofs=YES". Press **ENTER** and the display returns to the "Span&offset" menu prompt. Span & Offset are enabled.

Disabling Span & Offset- Press the NO key to change the display to "spnofs=NO". Press **ENTER** and the display returns to the "Span&offset" menu prompt. Span & Offset are disabled.

If enabled, a SPAN and OFFSET compensation menu item will be displayed in the **POINT SETUP** menu for Thermocouples and RTDs.

5.8.3 Demo Mode

Demo Mode allows the user to put the Recorder in the Demo Mode of operation. In the Demo Mode, direct inputs are ignored and calculated points use internally generated waveforms.

Selecting Demo Mode of Operation - At the "Demo control" prompt, press **ENTER** and the display reads either "Demo = YES" or "Demo = NO". If needed, change the current setting using the keypad then press **ENTER**. The Demo mode is suited to the 1 volt scale. It is advisable to set up a demo mode then save the configuration to disk. This can be loaded anytime the demo mode is required.

NOTE: In the Demo Mode of operation, the Recorder ignores all direct inputs and uses an internal generator for external or calculated points.

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Deselecting Demo Mode of Operation - At the "Demo control" prompt, press **ENTER** and the display reads either "Demo=YES" or "Demo=NO". Use the YES or NO keys to select the Demo mode ON or OFF and press **ENTER**. The display will return to the "Demo control" prompt. Powering the unit off loses the Demo mode.

5.9 DIGITAL I/O

The Digital I/O (Relay Outputs, Optocoupled inputs) option must be fitted in order for the following to work. If you do not have the option fitted you should ensure that all inputs are programmed off. To turn event messages off set the message to "" (null). The Digital I/O menu selection in the Program Menu, allows the user to select what type of signal opens the output contacts and what function the input signals will perform. The user can also program custom event messages. The following programming options are available from the Digital I/O Menu:

Contacts Out - Allows the user to select what type of signal controls the Contact Out relays.
Switches In - Allows the user to select a Function for the switch to activate.
Event msgs - Allows the user to enter custom messages for events.

5.9.1 Contacts Out

This menu contains four options as follows:

*** Alarms clear** Opens the Contacts Out when the alarms are cleared (default), else they remain latched.
*** ACK key** Opens the Contacts Out when the ACKnowledge Key is pressed.
*** Failsafe** Allows the Contacts Out to function as Failsafe Contacts. Reverses the logic so a contact which is normally OPEN will be energized. This will drop out in the event of a power failure and indicate an alarm.
*** Reflash** Programs the Contacts Out to momentarily open and reclose each time an additional alarm is acquired, which is programmed to close the contacts.

To program the Contacts out, use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Contact outs". Press **ENTER** to invoke the Contact Outs Menu and the following options are available.

5.9.1.1 Alarms Clear

Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Alarms clear" and press **ENTER**. The display will read either "opn clr=NO"' or "opn clr=YES" (default). Use the YES or NO key to select whether the contact outs should open when the alarms are cleared, "opn clr=YES" or not open, "opn clr=NO". When the desired selection is displayed, press **ENTER** and the display returns to the "Alarms clear" menu item. To make the outputs latching, set Alarms Clear to NO and ACK key to yes.

5.9.1.2 ACK Key

Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "ACK key" and press **ENTER**. The display will read either "opn ack=NO"' or "opn ack=YES". Use the YES or NO key to select whether the contact outs should open when the ACK Key is pressed, "opn ack=YES" or not open, "opn ack=NO". When the desired selection is displayed, press **ENTER** and the display returns to the "ACK key" menu item.

NOTE: The ACK button position, top left corner of the screen is always active, so even though the ACK button is not blinking, the contacts can still be reset by pressing this area of the screen.

5.9.1.3 Selecting and Programming Failsafe

Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Failsafe" and press **ENTER**. The display will read either "flsafe=NO", or "flsafe=YES". Use the YES or NO key to select whether the contact outs should be Failsafe or not Failsafe. When the desired selection is displayed, press **ENTER** and the display returns to the "Failsafe" menu item.

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5.9.1.4 Selecting and Programming Reflash

Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Reflash" and press **ENTER**. The display will read either "reflash=NO" or "reflash=YES". Use the YES or NO key to select whether the Reflash should be enabled, "reflash=YES" or not enabled, "reflash=NO". When the desired selection is displayed, press **ENTER** and the display returns to the "Reflash" menu item.

5.9.2 Switches In

This menu item allows the user to program the switch function for each of the three switch inputs. Any one of the following functions may be assigned to each switch, the functions are mutually exclusive.

- Event - An input switch can be used to log an event to the Alarm/Event data log, or if enabled in the RECord menu, to the disk, or reset a resettable point type
- Chart speed - An input switch can be used to alter chart speeds (on the graphics screen). The chart speeds are set in the Chart/Pens menu.
- Recorder on/off - An input switch can be used to stop and start the recording to disk
- Alarm acknowledge - an input switch can be used to acknowledge alarms.
- Scale set - An input switch can be used to change scale sets. The scales are programmed in the Chart/Pens - Scales menu.
- Record Rate - An input switch can be used to change the record sampling rate. The record rate is set in "Record Setup - Record rate"

Programming Switches In - Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Switches in" and press **ENTER.** The display will show the three available switches in the Switches In Menu.

Selecting and Programming Switch 1 - Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Switch? 1" and press **ENTER**. The display will show one of the items in the Switch 1 menu as shown below:

5.9.2.1 Event

The external inputs can be used to trigger an event or reset a resettable point type. The user can program event messages for switch open (inactive) and switch closed (active). The event messages are printed on the alarm screen and if enabled, are recorded to disk. Refer to Section 5.9.3 for event message entry. Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired input switch function and press **ENTER**. The display will return to the "Switch? 1" display.

5.9.2.2 Chart Speed

The external inputs can be used to alter the speed of the chart screen. There are two speed settings, high and low. If the switch is open (inactive) the low speed setting is selected, if the switch is closed (active) the high speed setting is active. This works in conjunction with the selection in the **FUNC**tion menu. Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired input switch function and press **ENTER**. The display will return to the "Switch? 1" display.

5.9.2.3 Record on/off

The external inputs can be used to stop or start recording. If the switch is open (inactive) the recording is stopped, if the switch is closed (active) the recording is started. This works in conjunction with the **REC**ord menu start or stop recording function. The last operation is current - that is if an external event started the recording then the user used the menu to stop recording, the recording remains stopped until the external event is reasserted (in this case inactive then active again to restart). Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired input switch function and press **ENTER**. The display will return to the "Switch? 1" display.

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5.9.2.4 Alarm Acknowledge

The external event can be used as an Alarm Acknowledge. This has the same effect as pushing the ACK button on the display. Input closed (active) acknowledges an alarm. Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired input switch function and press **ENTER**. The display will return to the "Switch? 1" display.

5.9.2.5 Scale Set

The external event can be used to select which chart scale to use, Scale set 1 or Scale set 2. This works in conjunction with the Scale Set option in the **FUNC**tion menu. Scale set 2 can be used for example to expand the scale values in scale set 1. Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired input switch function and press **ENTER**. The display will return to the "Switch? 1" display.

5.9.2.6 Record Rate

The external event can be used to alter the record sample. If the switch is open (inactive) the recording at the low record rate, if the switch is closed (active) the recording is at the high record rate. The external input works in conjunction with the Record Speed option in the **FUNC**tion menu. The last operation is current - that is if an external event set the high speed then the user used the menu to set the low speed, the recording remains at the low speed until the external event is reasserted (in this case inactive then active again to change back to high speed). Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired input switch function and press **ENTER**. The display will return to the "Switch? 1" display.

Switch 2 and Switch 3 are programmed in the same way as Switch 1 was programmed

5.9.3 Event Messages

The Recorder has three switch inputs that can trigger an event each time the switch opens or closes. Each time an event occurs a message will be printed on the Alarm/Event Data Log Window and if enabled, is logged in the Event file on the disk. These messages can be customized by the user. Each message may be 10 characters in length. An Event Message can be programmed for each switch opening and for each switch closing. The default messages are OPEN and CLOSE, if a message is erased, it will not be displayed or logged.

Note: If the event messages are changed after an event file has been opened on the disk, it is necessary to rename the alarm file, or use a new disk, in order to reflect the new event message in the file.

Programming Event Messages - To program the event messages use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Event msgs" then press **ENTER**.

Event 1 Open - Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Event1 open" and press **ENTER**. The display will read "➔XXXXXXXXXX← ". Use the Alphanumeric Keypad to enter an Event OPEN Message. Press **ENTER** and the display returns to the "Event1 open" menu display.

Event 1 Close - Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Event1 close" and press **ENTER**. The display will read "➔XXXXXXXXXX← ". Use the Alphanumeric keypad to enter the desired Event CLOSE Message. Press **ENTER** and the display returns to the "Event1 close" menu display.

Events 2 and 3 - Follow the instructions in the preceding steps to assign Event Messages to Events 2 and 3 open and close. At any time you may press **EXIT** to return to the Event Messages menu prompt.

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5.10 COM PORTS

The Com Ports Menu selection, in the Program Menu, allows the user to select and set up the communication port to use and to assign a network ID number to the Recorder, and to set up a modem attached to the RS232 port. The menu options are identical for either type of communication option, if any, fitted to the recorder. There are two choices of communication options - RS232 or RS485, however the modem will only function with the RS232 option.

There are three basic menu options

Com Port	Set up the serial port options
Network ID	Set up the Modbus address
Modem Setup	Set up the modem initialization string.

5.10.1 Com Port

This option allows the user to configure the serial port. The options are:

- Protocol - can assign the Protocol as Modbus RTU, Modbus ASCII.
- Port Setup - can assign the baud rate of 300, 1200, 2400, 4800, 9600, or 19200 and assign Bits per Character, Parity, and Stop Bits.

To program the Com Port from the "Com Ports" menu, use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Com Port" and press **ENTER.** The following choices are available.

5.10.1.1 Protocol

Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Protocol" and press **ENTER**. The display will show one of the two Protocol Types. Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired protocol, "Modbus RTU" (default) or "Modbus ASCII" and press **ENTER**. Press **EXIT** to return to the Com Port menu.

5.10.1.2 Port Setup

Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Port Setup" and press **ENTER**.

a. Baud Rate

The display will show one of the six baud rates. Use the UP (↑) or DOWN (↓) Arrow Keys to select the desired baud rate, 300, 1200, 2400, 4800, 9600 (default), or 19200, and press **ENTER**. The display will read "parity? N"

b. Parity

Use the UP (↑) or DOWN (↓) Arrow Keys to select either **N** NONE, **E** EVEN, or **O** ODD, to match your communications device, and press **ENTER**. The display reads "stop bits? X".

c. Stop Bits

Use the UP (↑) or DOWN (↓) Arrow Keys to select either 1 or 2, to match your communications device, and press **ENTER**. The display returns to the "Port setup" menu item. By default the com port uses 8 bits of data for the character size.

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5.10.2 Network ID

The Network ID, or unit address, assigns a user programmed Recorder ID number for use in multidrop Modbus environments.

To Program the Network ID use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Network ID". Press **ENTER** to invoke the Network ID menu, "net id→XXX←" will be displayed. Use the Numeric Keypad to enter a Network ID between 1 (default) and 255. When the correct Network ID is displayed, press **ENTER** and the display returns to the "Network ID" prompt. Even if you are not using the unit in a Modbus environment it still requires a network ID to communicate with the Companion Software.

5.10.3 Modem Setup

This menu option allows the user to enable and set up a modem string for a modem connected to the RS232 port. A modem is not supported on the RS485 port. If enabled, the start up string is sent to the modem to set it in the following mode:

- Use factory defaults
- Assume DTR is always on
- Disable ALL responses to the com port
- Auto answer on the first ring
- Connect at 9600 baud
- Use memory profile 0
- Store setup in memory profile zero

Not all modems obey the same instructions. The user can edit the default initialization string to work with any "Hayes Extended Mode compatible" modem which may not be that compatible. There are two menu choices:

Modem Enable	Enable or disable modem support
Modem String	Edit the initialization string sent to the modem

5.10.3.1 Modem Enable

From the modem setup menu, use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Modem Enable" and press ENTER. A window will pop up and the display will show "modem=YES*" if the modem is enabled or "modem=NO*" if the modem is disabled. Enable or disable the modem by pressing the YES or NO button then press ENTER.

5.10.3.2 Modem String

From the modem setup menu, use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Modem String" and press ENTER. The display will show "→XXXXXXXXXX←". Use the alphanumeric keypad to enter the initialization string for the modem. A maximum of 30 characters may be entered.

For a Zoom™ VFX modem, the string is **AT&F&D0Q1S0=1F8&Y0&W0**.
For a US Robotics Sportster™ the string is **AT&F&D0Q1S0=1&N6Y0&W0**

Refer to the modem manual for other modems. The modem needs to be set up as follows.

• Modem Attention call	AT	(starts every string)
• Restore factory defaults	&F	(may require &F0)
• Assume DTR is always on	&D0	
• Disable ALL responses to the com port	Q1	
• Auto answer on the first ring	S0=1	(number of rings is in Register 0)
• Connect at 9600 baud	&N6	(modem specific)
• Use memory profile 0 on reset	Y0	(modem specific)
• Store setup in memory profile zero	&W0	

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The entire string may not fit in the display window. Use the LEFT (←) and RIGHT (→) Arrow keys to navigate through the string. When the string has been correctly entered, press ENTER to return to the Modem Setup menu. Press EXIT until you reach the main programming menu. The modem string is then sent at this time or whenever power is applied to the recorder. Refer to Chapter 2.4 for modem connection.

5.11 SYSTEM

The System selection, in the Program Menu, allows the user control the Beeper. To modify this parameter select the PROG menu and use the UP (↑) or DOWN (↓) Arrow Keys to highlight "System" and press ENTER.

5.11.1 Beeper

This menu item allows the user to turn the Beeper on or off. If on, the beeper provides audible feedback to key presses, indicates errors and beeps on alarm condition. Use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Beeper" and press ENTER. The display shows "Beeper=No*" or "Beeper=YES*" depending on the current state of the beeper. Press YES to turn it on, or NO to turn it off and press ENTER to return to the System Menu.

5.11.2 Passcodes

Passcodes allows the user to protect the setup from unauthorized change. Once set, the pass code must be entered to gain access to either the PROGram menu or the FUNCtion menu. Separate Pass codes can be set for each. Note that if a pass code is forgotten, you will not be able to change the configuration of the unit. The only way to change or delete a pass code is to know the present pass code. Treat pass codes with respect.

To enter a pass code (or change a pass code), use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Passcodes" from the Hidden menu and press ENTER. There are two options:

Function	Enter a pass code to protect the FUNCtion menu
Program	Enter a pass code to protect the PROGram menu and Hidden menu.

The two pass codes may be the same, or different, or may be disabled. The pass code may be 1 to 6 numeric characters. Entering a pass code of 000000 or all spaces, is equivalent to setting NO Pass code. The pass code is displayed as you enter it so that you may check it for accuracy. Once entered, you will not be asked to verify it, but you may re-enter it.

Use the UP (↑) or DOWN (↓) Arrow Keys to select which pass code you want to enter and press the ENTER button. The display will show a blank Pass code. If you press ENTER at this stage you will clear the pass code. Use the numeric keypad to enter a pass code from 1 to 6 characters in length. **WRITE THE PASS CODE DOWN AND KEEP IT SOMEPLACE SAFE**. Press the ENTER key to accept the pass code and return to the Passcode menu. Repeat the above for the other menu option.

Once a pass code is entered, you will be prompted for it the next time you try to enter the main menu. If you do not enter it correctly, you will be denied access to the menu.

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5.11.3 Alternate Language

The Alternate Language selection allow the user to load, select and save language files.

5.11.3.1 Select Lang.

Select Lang. Allows the user to toggle between the English language and an alternate language. Use UP (↑) or DOWN (↓) Arrow Keys to highlight "Select Lang." and press ENTER. This will toggle between English and the loaded alternate language. If an alternate language is not loaded, the error message "No Language Loaded" will be displayed.

5.11.3.2 Load Alt. Lang.

Load Alt. Lang. allows the user to load an alternate language. To load an existing language file, the UP (↑) or DOWN (↓) Arrow Keys to highlight "Load Alt. Lang." and press **ENTER**. A pop up window will display "load language=NO*". Press the **YES** then **ENTER** buttons. The unit will look on the disk for any language files which will be displayed on the File Browser Directory. If more than one language file exisits use the UP (↑) or DOWN (↓) Arrow Keys to select it and press the **ENTER** button. If there are more files on the disk than what will show on the screen, the list will scroll down with the "<" sign. The unit will load the selected language file from the disk.

5.11.3.3 Save English

This menu item saves the English language file to disk for editing. To save the English language file to disk, use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Save English" and press **ENTER**. The disk status window will show SAVE LANG and a window will pop up when the configuration has been saved to indicate "Language Saved". Press OK? when done.

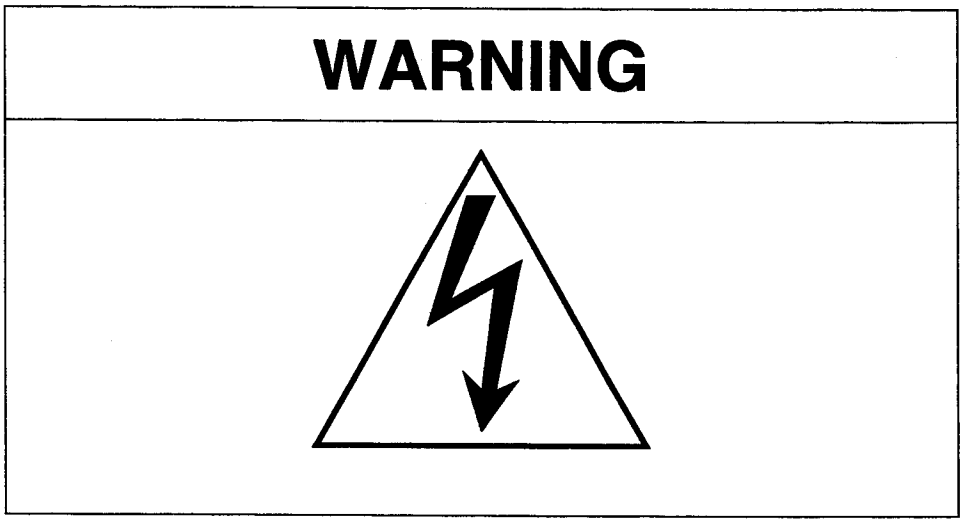
5.11.3.4 Save Alt. Lang.

This menu item saves the alternate language file to disk. To save the alternate language file to disk, use the UP (↑) or DOWN (↓) Arrow Keys to highlight "Save Alt. Lang." and press **ENTER**. The disk status window will show SAVE LANG and a window will pop up when the configuration has been saved to indicate "Language Saved". Press OK? when done.

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SAFETY NOTICE

This Safety Notice has been included to emphasize the **DANGER OF HAZARDOUS VOLTAGES** on the **REAR TERMINAL PANEL** of your instrument. **USE EXTREME CAUTION WHEN INSTALLING OR SERVICING** your instrument. Please read the entire contents of the Installation and Wiring Chapter of this manual before attempting to install or service you instrument.



Use Extreme caution when servicing the rear terminal of your instrument.

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Chapter 6

Calibration

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Chapter 6 Calibration

6.1 Introduction

This chapter includes the procedures to calibrate the Analog-to-Digital Converter (ADC) circuit board and the RTD current source.

DO NOT ATTEMPT TO PERFORM CALIBRATION UNLESS YOU ARE FULLY PREPARED TO DO SO. INCORRECT PROCEDURES CAN DESTROY FACTORY CALIBRATION. READ THIS ENTIRE CHAPTER BEFORE ATTEMPTING TO CALIBRATE THE UNIT.

ALLOW THE RECORDER TO WARM UP AND STABILIZE BEFORE ATTEMPTING CALIBRATION. 15 MINUTES WARM UP TIME AT ROOM TEMPERATURE IS RECOMMENDED.

6.1.1 Routine Calibration

Routine calibration should be performed to maintain the accuracy of the instrument. The following items must be performed for a routine calibration:

- Calibrate the ADC Scales (and RTD Current)

6.1.2 Calibration Equipment

The following equipment items are necessary to calibrate the instrument:

- One precision voltage source (accurate to ± 5 microvolts) adjustable from 10 microvolts to 10 Volts.
- One precision resistor 250 ohms 0.05% - Required for calibrating RTD.

6.2 Scale Calibration

The Recorder menu supports full calibration for the voltage and current input ranges of the instrument. Each range requires a unique calibration constant, which is automatically calculated during the calibration of each range.

Twelve channel units have two analog boards and therfore require two sets of calibrations. One for channels 1 though 6 AND one for channels 7 through C.

NOTE: Actual voltage calibration constants are automatically stored in EEPROM on the analog to digital converter boards.

6.2.1 Calibration Scales

Follow the procedures below to calibrate scales. For twelve channel units this procedure has to be performed twice, once for the upper set of inputs, channels 1 through 6, and once for the lower set of inputs, channels 7 though C. Instructions in parentheses () refer to the lower input board, channels 7 though C in twelve channel units. The programming steps are as follows:

6.2.1.1 Connecting Voltage Source

Connect the precision voltage source to any available direct input at the rear upper (lower) analog Input terminals. Select any of channels 1 through 6 (7 through C) and connect the voltage source to the + and - inputs ensuring the correct polarity. Turn on the Voltage Source and allow 10 minutes for it to warm up and stabilize.

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6.2.1.2 Programming from COMMAND Prompt

In the Hidden menu use the UP (↑) or DOWN (↓) Arrow Keys to select "ADC Control" and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to select "Cal ADC" and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to select "Cal Scale" and press **ENTER**.

6.2.1.3 Calibrating the 100mV Range

To calibrate the 100mV Range, an input of a known good 105mV must be supplied to the Recorder. The following steps are used to guide the user through calibration of the 100mV Range.

Set the precision Voltage Source to +105.00 mV. Use the UP (↑) or DOWN (↓) Arrow Keys to select "Scale 105 mV" and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to select to select the Channel Input Number 1, 2, 3, 4, 5 or 6 (7, 8, 9, A, B or C) to which the voltage source is connected and press **ENTER**. With an input of 105 mV, press **ENTER**. A window will appear showing the reading of the voltage source connected. *NOTE:* If the calibration is not correct, the value shown in the window will not be correct. You will then be prompted with an "Are you sure?" message. Select **YES** to continue the calibration or **NO** to abort. If **YES** is selected, the Recorder program will calibrate the ADC 100mV range. Calibration of the 100 mV Range is now complete. Continue calibration of the 1 Volt, 10 Volt, and current Ranges.

6.2.1.4 Calibrating the 1 Volt Range

Calibration of the 1 Volt Range is almost identical to calibration of the other voltage ranges. A known good +1.05 Volts must be supplied to the input of the Recorder. The following steps are used to guide the user in calibrating the 1 Volt Range.

Set the precision Voltage Source to +1.0500 Volts. Use the UP (↑) or DOWN (↓) Arrow Keys to select Scale 1.05 V and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to select the Channel Input Number 1, 2, 3, 4, 5 or 6 (7, 8, 9, A, B or C) to which the voltage source is connected and press **ENTER**. With an input of 1.05 mV, press **ENTER**. A window will appear showing the reading of the voltage source connected. *NOTE:* If the calibration is not correct, the value shown in the window will not be correct. You will then be prompted with an "Are you sure?" message. Select **YES** to continue the calibration or **NO** to abort. If **YES** is selected, the Recorder program will calibrate the ADC 1.0V range. Calibration of the 1 Volt Range is now completed. Continue calibration of the 10 Volt Range and the Current.

6.2.1.5 Calibrating the 10 Volt Range

Calibration of the 10 Volt Range is almost identical to calibration of the other voltage ranges. A known good 10 Volts must be supplied to the input of the Recorder. The following steps are used to guide the user in calibrating the 10 Volt Range.

Set the precision Voltage Source to +10.0000 Volts. Use the UP (↑) or DOWN (↓) Arrow Keys to select "Scale 10V" and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to select the Channel Input Number 1, 2, 3, 4, 5 or 6 (7, 8, 9, A, B or C) to which the voltage source is connected and press **ENTER**. With an input of 10.0V, press **ENTER**. A window will appear showing the reading of the voltage source connected. *NOTE:* If the calibration is not correct, the value shown in the window will not be correct. You will then be prompted with an "Are you sure?" message. Select **YES** to continue the calibration or **NO** to abort. If **YES** is selected, the Recorder program will calibrate the ADC 10.0V range. Calibration of the 10.0 V Range is now complete. Continue calibration of the current Range.

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6.3 RTD Current Calibration

The ADC current source is used for RTD measurements and needs calibration for the RTD's.

6.3.1 Calibrating the RTD Current

The following procedure contains step-by-step instructions on calibrating the current source. A 250Ω ±0.05% resistor must be connected across the + and - terminals of a free input on channel 1, 2, 3, 4, 5 or 6 (7, 8, 9, A, B or C) and the current source return path **EX** (EXcitation) must be connected to the - input terminal. The Recorder then applies 2mA of current through the resistance to calibrate current. These programming steps are discussed in menu order.

NOTE: Before calibrating currents, ensure the 1.05 Volt Scale range has been calibrated per the above, as this will affect the accuracy of Current Calibration.

6.3.1.1 Connecting Resistance

Select a free set of input terminals on the rear of the unit, or remove any connections from the set of terminals to be used. Connect the 250Ω ±0.05% resistor across the + and - terminals of this input and connect the current source return path **EX** (EXcitation) to the - input terminal.

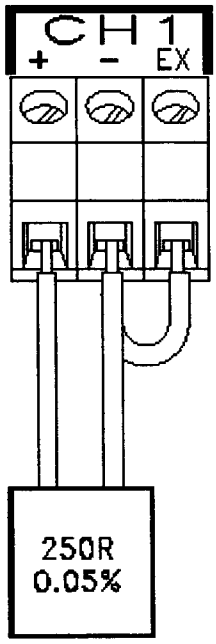


Figure 6-1 Calaibration Resistor Connection

6.3.1.2 Calibrating the RTD Current

The following steps are used to guide the user in calibrating current.

In the Hidden Menu, use the UP (↑) or DOWN (↓) Arrow Keys to select "ADC control" and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to select "Cal ADC" and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to select "Cal Currents" and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to select the Input Number to which the resistor is connected, 1, 2, 3, 4, 5 or 6 (7, 8, 9, A, B or C) and press **ENTER**. To allow the Recorder to detect the actual value of the current, press **ENTER**. The Recorder program will store the adjusted value from a nominal 2mA of current. Calibration of Currents is complete.

6.4 Calibration Recall

If the calibration equipment listed above is not available, the factory calibration for the scales (section 6.2) can be recalled. **All channels will be recalled.**

In the Hidden Menu, use the UP (↑) or DOWN (↓) Arrow Keys to select "ADC control" and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to select "Cal ADC" and press **ENTER**. Use the UP (↑) or DOWN (↓) Arrow Keys to select "Cal Recall" and press **ENTER**. At the prompt "Are You Sure?", press YES to retrieve the factory calibration settings or press NO to exit without changing the calibration settings.

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Chapter 7

Communications Interface

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Chapter 7 Communications Interface

This chapter primarily describes the communications interface protocol for the Recorder.

7.1 Description

The Communications Interface is a field installable option. The user can choose either an RS232 compatible communications port, or an RS485 compatible communications port. An RS232C interface allows a single Data Recorder to communicate with a computer at a distance of up to 50 feet (16m). An RS485 interface is required for distances up to 4000 feet (1300m).

An RS485 interface will support up to 31 Data Recorders linked to a single computer. Each of the Recorders will be identified by a unique unit address (programmed under "Com Ports" in the Programming Menu).

Two modes of operation, Modbus RTU and Modbus ASCII, are supported in RS232C and RS485 communication interfaces.

7.1.1 Port Set Up

Refer to Chapter 5-10 Programming - Com Ports, for communications setup programming information.

7.1.2 Port Communications Wiring

Refer to Chapter 2-4, Installation and Wiring - Serial Ports, for wiring instructions of the communications port.

7.1.3 Modbus RTU and ASCII Functions

This Recorder supports a subset of the Modbus protocol ASCII and RTU. The functions included in the subset are:

Function 1 - Read Coil Status
Function 2 - Read Input Status
Function 3 - Read Holding Registers
Function 4 - Read Input Registers
Function 5 - Force Single Coil
Function 6 - Preset Single Register
Function 15 - Force Multiple Coils
Function 16 - Preset Multiple Registers

NOTE: Many registers are reserved or are not used. Use the defined registers only.

7.1.4 Modbus Registers

Tables 7-1 through 7-8 show the mapping of the recorder parameters into Modbus registers. Knowledge of these Modbus register assignments is only needed to make use of third party communications software.

NOTE: The Registers flagged as "Reserved" are intended for the Companion software only and should not be used with any other software.

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7.1.5 Modbus Floating Point Formats

The registers most users will be interested in are the Point 1-C Data Registers. These registers hold the current floating point value for each data point. The actual Modbus specification has no mention of floating point numbers. Therefore several common methods of transferring a floating point number has emerged. We support two of those methods. One method is compatible with the Modicon 984 PSC and the other is sometimes referred to as the Daniel's Extension.

IEEE floating point number requires 4 bytes (2 words). The modbus registers are all 2 bytes (1 word).

Sign Bit	Exponent (+127 biased)	Mantissa (extra implied 1 bit)	
1 bit	8 bits	23 bits	
SEEEEEEE	I EMMMMMMM	I MMMMMMMM	I MMMMMMMM
Byte 0	I Btye 1	I Byte 2	I Byte 3
	I		
	High Word	I	Low Word

Modicon 984 PLC Compatible Format (2 register addresses for one floating point number):
The two words MUST always be accessed together to ensure valid values.

Register 1	Low Word
Register 2	High Word

Registers 3081 – 30a4 store Points 1 – C Data in this format
Registers 4361 – 4384 store Points 1 – C Data in this format

Daniel's Extension (1 register for one floating point number)

Register 1	Byte 0, Byte 1, Byte 2, Byte 3

Registers 7001 – 7012 store Points 1 – C Data in this format

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NOTE: Momentary coils activate the corresponding function every time a one is written to them.

Table 7-1 COILS 0XXX READ/WRITE (Use Functions 1, 5 or 15 to Access)			
COIL #	FUNCTION AND STATE		
1	Alarm Relay Latched	0=Off	1=On
2	Alarm Reflash	0=Off	1=On
3	Alarm Fail Safe	0=Off	1=On
4	Alarm Open On Ack	0=Off	1=On
5	Reserved		
6	Reserved		
7	Reserved		
8	Alarm Check	0=Enabled	1=Disabled
9	Span and Offset	0=Off	1=On
10	Reserved		
11	ADC Frequency	0=60 Hz	1=50 Hz
12	Reserved		
13	Reserved		
14	Reserved		
15	Reserved		
16	Reserved		
17	Ack Alarms (momentary)		
18	Reserved		
19	Chart Control	0=Chart Off	1=Chart On
20	Toggle Chart Speed	(Momentary)	
21	Scale Set	0=Set 1	1=Set 2
22	Learn Database	(Momentary)	
23	Reserved		
24	Reserved		
25	Chart Speed	0=Low	1=High
26	Auto Speed	0=Fix	1=Auto
27 - 63	Reserved		

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Table 7-1 COILS 0XXX READ/WRITE (Use Functions 1, 5 or 15 to Access)			
COIL #	FUNCTION AND STATE		
64	Clear All Points	(Momentary)	
65	Bypass/Activate Point 1	1=Bypass	0=Activate
66	Bypass/Activate Point 2	1=Bypass	0=Activate
67	Bypass/Activate Point 3	1=Bypass	0=Activate
68	Bypass/Activate Point 4	1=Bypass	0=Activate
69	Bypass/Activate Point 5	1=Bypass	0=Activate
70	Bypass/Activate Point 6	1=Bypass	0=Activate
71	Bypass/Activate Point 7	1=Bypass	0=Activate
72	Bypass/Activate Point 8	1=Bypass	0=Activate
73	Bypass/Activate Point 9	1=Bypass	0=Activate
74	Bypass/Activate Point A	1=Bypass	0=Activate
75	Bypass/Activate Point B	1=Bypass	0=Activate
76	Bypass/Activate Point C	1=Bypass	0=Activate
77	Reserved		
78	Reserved		
79	Reserved		
80	Reset Point 1	(Momentary)	
81	Reset Point 2	(Momentary)	
82	Reset Point 3	(Momentary)	
83	Reset Point 4	(Momentary)	
84	Reset Point 5	(Momentary)	
85	Reset Point 6	(Momentary)	
86	Reset Point 7	(Momentary)	
87	Reset Point 8	(Momentary)	
88	Reset Point 9	(Momentary)	
89	Reset Point A	(Momentary)	
90	Reset Point B	(Momentary)	
91	Reset Point C	(Momentary)	
92	Reserved		
93	Reserved		
94	Reserved		

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Table 7-2 Status Inputs 1XXX Read Only (Use Function 2 to Access)		
Register #	FUNCTION AND STATE	
1001	0=No Alarms Present	1=Alarm(s) Present
1002-1008	Reserved	
1009	Digital Input 1	
1010	Digital Input 2	
1011	Digital Input 3	
1012	Reserved	
1013	Reserved	
1014	Reserved	
1015	Reserved	
1016	Reserved	
1017	Point 1 Status	1=Invalid
1018	Point 1 Status	1=Overflow
1019	Point 1 Status	1=Overrange
1020	Point 1 Status	1=T.C.B.O.
1021	Point 1 Status	1=Bypassed
1022	Reserved	
1023	Reserved	
1024	Reserved	
1025	Point 1 Status	1=Alarm #1
1026	Point 1 Status	1=Alarm #2
1027	Point 1 Status	1=Alarm #3
1028	Point 1 Status	1=Alarm #4
1029	Point 1 Status	1=Alarm #5
1030	Reserved	
1031	Reserved	
1032	Reserved	
1033	Point 2 Status	1=Invalid
1034	Point 2 Status	1=Overflow
1035	Point 2 Status	1=Overrange
1036	Point 2 Status	1=T.C.B.O.
1037	Point 2 Status	1=Bypassed

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Table 7-2 Status Inputs 1XXX Read Only (Use Function 2 to Access)		
Register #	FUNCTION AND STATE	
1038	Reserved	
1039	Reserved	
1040	Reserved	
1041	Point 2 Status	1=Alarm #1
1042	Point 2 Status	1=Alarm #2
1043	Point 2 Status	1=Alarm #3
1044	Point 2 Status	1=Alarm #4
1045	Point 2 Status	1=Alarm #5
1046	Reserved	
1047	Reserved	
1048	Reserved	
1049	Point 3 Status	1=Invalid
1050	Point 3 Status	1=Overflow
1051	Point 3 Status	1=Overrange
1052	Point 3 Status	1=T.C.B.O.
1053	Point 3 Status	1=Bypassed
1054	Reserved	
1055	Reserved	
1056	Reserved	
1057	Point 3 Status	1=Alarm #1
1058	Point 3 Status	1=Alarm #2
1059	Point 3 Status	1=Alarm #3
1060	Point 3 Status	1=Alarm #4
1061	Point 3 Status	1=Alarm #5
1062	Reserved	
1063	Reserved	
1064	Reserved	
1065	Point 4 Status	1=Invalid
1066	Point 4 Status	1=Overflow
1067	Point 4 Status	1=Overrange

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Table 7-2 Status Inputs 1XXX Read Only (Use Function 2 to Access)		
Register #	FUNCTION AND STATE	
1068	Point 4 Status	1=T.C.B.O.
1069	Point 4 Status	1=Bypassed
1070	Reserved	
1071	Reserved	
1072	Reserved	
1073	Point 4 Status	1=Alarm #1
1074	Point 4 Status	1=Alarm #2
1075	Point 4 Status	1=Alarm #3
1076	Point 4 Status	1=Alarm #4
1077	Point 4 Status	1=Alarm #5
1078	Reserved	
1079	Reserved	
1080	Reserved	
1081	Point 5 Status	1=Invalid
1082	Point 5 Status	1=Overflow
1083	Point 5 Status	1=Overrange
1084	Point 5 Status	1=T.C.B.O.
1085	Point 5 Status	1=Bypassed
1086	Reserved	
1087	Reserved	
1088	Reserved	
1089	Point 5 Status	1=Alarm #1
1090	Point 5 Status	1=Alarm #2
1091	Point 5 Status	1=Alarm #3
1092	Point 5 Status	1=Alarm #4
1093	Point 5 Status	1=Alarm #5
1094	Reserved	
1095	Reserved	
1096	Reserved	
1097	Point 6 Status	1=Invalid
1098	Point 6 Status	1=Overflow

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Table 7-2 Status Inputs 1XXX Read Only (Use Function 2 to Access)		
Register #	FUNCTION AND STATE	
1099	Point 6 Status	1=Overrange
1100	Point 6 Status	1=T.C.B.O.
1101	Point 6 Status	1=Bypassed
1102	Reserved	
1103	Reserved	
1104	Reserved	
1105	Point 6 Status	1=Alarm #1
1106	Point 6 Status	1=Alarm #2
1107	Point 6 Status	1=Alarm #3
1108	Point 6 Status	1=Alarm #4
1109	Point 6 Status	1=Alarm #5
1110	Reserved	
1111	Reserved	
1112	Reserved	
1113	Point 7 Status	1=Invalid
1114	Point 7 Status	1=Overflow
1115	Point 7 Status	1=Overrange
1116	Point 7 Status	1=T.C.B.O.
1117	Point 7 Status	1=Bypassed
1118	Reserved	
1119	Reserved	
1120	Reserved	
1121	Point 7 Status	1=Alarm #1
1122	Point 7 Status	1=Alarm #2
1123	Point 7 Status	1=Alarm #3
1124	Point 7 Status	1=Alarm #4
1125	Point 7 Status	1=Alarm #5
1126	Reserved	
1127	Reserved	
1128	Reserved	
1129	Point 8 Status	1=Invalid

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Table 7-2 Status Inputs 1XXX Read Only (Use Function 2 to Access)		
Register #	FUNCTION AND STATE	
1130	Point 8 Status	1=Overflow
1131	Point 8 Status	1=Overrange
1132	Point 8 Status	1=T.C.B.O.
1133	Point 8 Status	1=Bypassed
1134	Reserved	
1135	Reserved	
1136	Reserved	
1137	Point 8 Status	1=Alarm #1
1138	Point 8 Status	1=Alarm #2
1139	Point 8 Status	1=Alarm #3
1140	Point 8 Status	1=Alarm #4
1141	Point 8 Status	1=Alarm #5
1142	Reserved	
1143	Reserved	
1144	Reserved	
1145	Point 9 Status	1=Invalid
1146	Point 9 Status	1=Overflow
1147	Point 9 Status	1=Overrange
1148	Point 9 Status	1=T.C.B.O.
1149	Point 9 Status	1=Bypassed
1150	Reserved	
1151	Reserved	
1152	Reserved	
1153	Point 9 Status	1=Alarm #1
1154	Point 9 Status	1=Alarm #2
1155	Point 9 Status	1=Alarm #3
1156	Point 9 Status	1=Alarm #4
1157	Point 9 Status	1=Alarm #5
1158	Reserved	
1159	Reserved	
1160	Reserved	

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Table 7-2 Status Inputs 1XXX Read Only (Use Function 2 to Access)		
Register #	FUNCTION AND STATE	
1161	Point A Status	1=Invalid
1162	Point A Status	1=Overflow
1163	Point A Status	1=Overrange
1164	Point A Status	1=T.C.B.O.
1165	Point A Status	1=Bypassed
1166	Reserved	
1167	Reserved	
1168	Reserved	
1169	Point A Status	1=Alarm #1
1170	Point A Status	1=Alarm #2
1171	Point A Status	1=Alarm #3
1172	Point A Status	1=Alarm #4
1173	Point A Status	1=Alarm #5
1174	Reserved	
1175	Reserved	
1176	Reserved	
1177	Point B Status	1=Invalid
1178	Point B Status	1=Overflow
1179	Point B Status	1=Overrange
1180	Point B Status	1=T.C.B.O.
1181	Point B Status	1=Bypassed
1182	Reserved	
1183	Reserved	
1184	Reserved	
1185	Point B Status	1=Alarm #1
1186	Point B Status	1=Alarm #2
1187	Point B Status	1=Alarm #3
1188	Point B Status	1=Alarm #4
1189	Point B Status	1=Alarm #5
1190	Reserved	
1191	Reserved	

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Table 7-2 Status Inputs 1XXX Read Only (Use Function 2 to Access)		
Register #	FUNCTION AND STATE	
1192	Reserved	
1193	Point C Status	1=Invalid
1194	Point C Status	1=Overflow
1195	Point C Status	1=Overrange
1196	Point C Status	1=T.C.B.O.
1197	Point C Status	1=Bypassed
1198	Reserved	
1199	Reserved	
1200	Reserved	
1201	Point C Status	1=Alarm #1
1202	Point C Status	1=Alarm #2
1203	Point C Status	1=Alarm #3
1204	Point C Status	1=Alarm #4
1205	Point C Status	1=Alarm #5
1206-1256	Reserved	

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Table 7-3 Input Registers 3XXX 16 Bits Integers Read Only (Use Function 4 to Access)			
Register #	FUNCTION AND STATE		
3001-3040	Reserved		
3041	Point 1	Point Number 0=Not Programmed	
3042	Point 2	Point Number 0=Not Programmed	
3043	Point 3	Point Number 0=Not Programmed	
3044	Point 4	Point Number 0=Not Programmed	
3045	Point 5	Point Number 0=Not Programmed	
3046	Point 6	Point Number 0=Not Programmed	
3047	Point 7	Point Number 0=Not Programmed	
3048	Point 8	Point Number 0=Not Programmed	
3049	Point 9	Point Number 0=Not Programmed	
3050	Point A	Point Number 0=Not Programmed	
3051	Point B	Point Number 0=Not Programmed	
3052	Point C	Point Number 0=Not Programmed	
3053-3055	Reserved		
3056	Point 1 Status Word	Status Word Format	
3057	Point 2 Status Word	Bit 0 1=Invalid	Bit 11 = Alarm #4
3058	Point 3 Status Word	Bit 1 1=Overflow	Bit 12 = Alarm #5
3059	Point 4 Status Word	Bit 2 1=Overrange	
3060	Point 5 Status Word	Bit 3 1=T.C.B.O.	
3061	Point 6 Status Word	Bit 4 1=Bypass	
3062	Point 7 Status Word	Bit 5 Reserved	
3063	Point 8 Status	Bit 6 Reserved	
3064	Point 9 Status	Bit 7 Reserved	
3065	Point A Status	Bit 8 1=Alarm #1	
3066	Point B Status	Bit 9 1=Alarm #2	
3067	Point C Status	Bit 10 1=Alarm #3	
3068-3070	Reserved		
3071	Software Bit 0 Options Bit 1	1 = Totalizer Option 1 = Logarithmic Inputs Option	
3072	Relay Status	Bit 0= Relay 1 – Bit 5 = Relay 6 (0 = Open, 1 = Close)	

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Table 7-3 Input Registers 3XXX 16 Bits Integers Read Only (Use Function 4 to Access)		
Register #	FUNCTION AND STATE	
3073	% Media Full	0 – 100%
3074	Recorder Firmware Version	The High byte is a BCD number. The Low byte is an ASCII character. Example: Version 1.2A would be 0x1241
3081-30A4	32 Bits Modicon Format Floating Point Data	Same as Registers 4361 - 4384

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Table 7-4 Input Registers 7XXX 32 Bits IEEE Floating Point Read Only (Use Function 4 to Access)		
Register #	FUNCTION AND STATE	
7001	Point 1 Data	
7002	Point 2 Data	
7003	Point 3 Data	
7004	Point 4 Data	
7005	Point 5 Data	
7006	Point 6 Data	
7007	Point 7 Data	
7008	Point 8 Data	
7009	Point 9 Data	
7010	Point A Data	
7011	Point B Data	
7012	Point C Data	
7013	Reserved	
7014	Reserved	
7015	Reserved	
7016	Point 1 Output Scale	Low End
7017	Point 1 Output Scale	High End
7018	Point 2 Output Scale	Low End
7019	Point 2 Output Scale	High End
7020	Point 3 Output Scale	Low End
7021	Point 3 Output Scale	High End
7022	Point 4 Output Scale	Low End
7023	Point 4 Output Scale	High End
7024	Point 5 Output Scale	Low End
7025	Point 5 Output Scale	High End
7026	Point 6 Output Scale	Low End
7027	Point 6 Output Scale	High End
7028	Point 7 Output Scale	Low End
7029	Point 7 Output Scale	High End
7030	Point 8 Output Scale	Low End
7031	Point 8 Output Scale	High End

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Table 7-4 Input Registers 7XXX 32 Bits IEEE Floating Point Read Only (Use Function 4 to Access)		
Register #	FUNCTION AND STATE	
7032	Point 9 Output Scale	Low End
7033	Point 9 Output Scale	High End
7034	Point A Output Scale	Low End
7035	Point A Output Scale	High End
7036	Point B Output Scale	Low End
7037	Point B Output Scale	High End
7038	Point C Output Scale	Low End
7039	Point C Output Scale	High End
7040	Reserved	
7041	Reserved	
7042	Reserved	
7043	Reserved	
7044	Reserved	
7045	Reserved	
7046	Reserved	
7047	Reserved	
7048	Reserved	
7049	Reserved	
7050	Reserved	
7051	Reserved	
7052	Reserved	
7053	Reserved	
7054	Reserved	
7055	Reserved	
7056	Reserved	
7057	Reserved	
7058	Reserved	
7059	Reserved	
7060	Reserved	
7061	Reserved	
7062	Reserved	

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Table 7-5 Holding Registers 4xxx 16 Bits Integers (Use Functions 3, 6 and 16 to Access)			
Register #	FUNCTION AND STATE		
4001-4051	Reserved		
4052	Unit Tag	2 ASCII Characters [00] [01]	
4053	Unit Tag	2 ASCII Characters [02] [03]	
4054	Unit Tag	2 ASCII Characters [04] [05]	
4055	Unit Tag	2 ASCII Characters [06] [07]	
4056	Unit Tag	2 ASCII Characters [08] [09]	
4057	Unit Tag	2 ASCII Characters [00] [01]	
4058	Unit Tag	2 ASCII Characters [00] [01]	
4059	Unit Tag	2 ASCII Characters [02] [03]	
4060	Unit Tag	2 ASCII Characters [04] [05]	
4061	Unit Tag	2 ASCII Characters [06] [07]	
4062	Power-Up Display Mode	0 = Unit Tag 3 = Alarms	1 = Autojog 4 = Point
4063	Point Number for Display Point Power-Up Mode		
4064	Display Update Rate in Seconds		
4065	Reserved		
4066	T.C.B.O. Check Interval in Seconds		
4067	Input Switch #1 Definition	1 = Event	5 = Chart Speed
4068	Input Switch #2 Definition	2 = Record on/off	3 = Alarm Ack
4069	Input Switch #3 Definition	4 = Scale Set	6 = Record rate
4070	Reserved		
4071	Event #1 Open Message	2 ASCII Characters [00] [01]	
4072	Event #1 Open Message	2 ASCII Characters [02] [03]	
4073	Event #1 Open Message	2 ASCII Characters [04] [05]	
4074	Event #1 Open Message	2 ASCII Characters [06] [07]	
4075	Event #1 Open Message	2 ASCII Characters [08] [09]	
4076	Event #1 Close Message	2 ASCII Characters [00] [01]	
4077	Event #1 Close Message	2 ASCII Characters [02] [03]	
4078	Event #1 Close Message	2 ASCII Characters [04] [05]	
4079	Event #1 Close Message	2 ASCII Characters [06] [07]	
4080	Event #1 Close Message	2 ASCII Characters [08] [09]	

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Table 7-5 Holding Registers 4xxx 16 Bits Integers (Use Functions 3, 6 and 16 to Access)		
Register #	FUNCTION AND STATE	
4081	Event #2 Open Message	2 ASCII Characters [00] [01]
4082	Event #2 Open Message	2 ASCII Characters [02] [03]
4083	Event #2 Open Message	2 ASCII Characters [04] [05]
4084	Event #2 Open Message	2 ASCII Characters [06] [07]
4085	Event #2 Open Message	2 ASCII Characters [08] [09]
4086	Event #2 Close Message	2 ASCII Characters [00] [01]
4087	Event #2 Close Message	2 ASCII Characters [02] [03]
4088	Event #2 Close Message	2 ASCII Characters [04] [05]
4089	Event #2 Close Message	2 ASCII Characters [06] [07]
4090	Event #2 Close Message	2 ASCII Characters [08] [09]
4091	Event #3 Open Message	2 ASCII Characters [00] [01]
4092	Event #3 Open Message	2 ASCII Characters [02] [03]
4093	Event #3 Open Message	2 ASCII Characters [04] [05]
4094	Event #3 Open Message	2 ASCII Characters [06] [07]
4095	Event #3 Open Message	2 ASCII Characters [08] [09]
4096	Event #3 Close Message	2 ASCII Characters [00] [01]
4097	Event #3 Close Message	2 ASCII Characters [02] [03]
4098	Event #3 Close Message	2 ASCII Characters [04] [05]
4099	Event #3 Close Message	2 ASCII Characters [06] [07]
4100	Event #3 Close Message	2 ASCII Characters [08] [09]
4100-4150	Reserved	
4151	Constant 1	Display Decimal Fix
4152	Constant 2	Display Decimal Fix
4153	Constant 3	Display Decimal Fix
4154	Constant 4	Display Decimal Fix
4155	Constant 5	Display Decimal Fix
4156	Constant 6	Display Decimal Fix
4157	Constant 7	Display Decimal Fix
4158	Constant 8	Display Decimal Fix
4159	Constant 9	Display Decimal Fix
4160	Constant A	Display Decimal Fix

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Table 7-5 Holding Registers 4xxx 16 Bits Integers (Use Functions 3, 6 and 16 to Access)			
Register #	FUNCTION AND STATE		
4161	Constant B	Display Decimal Fix	
4162	Constant C	Display Decimal Fix	
4163-4174	Reserved		
4175	Low Chart Speed Table Index		
4176	High Chart Speed Table Index		
4177	Time Format	5=U.S.	7=International
4178-4189	Reserved		
4201	Pen 1 Assignment	0 = No Point	
4202	Pen 2 Assignment	0 = No Point	
4203	Pen 3 Assignment	0 = No Point	
4204	Pen 4 Assignment	0 = No Point	
4205	Pen 5 Assignment	0 = No Point	
4206	Pen 6 Assignment	0 = No Point	
4207	Pen 7 Assignment	0 = No Point	
4208	Pen 8 Assignment	0 = No Point	
4209	Pen 9 Assignment	0 = No Point	
4210	Pen A Assignment	0 = No Point	
4211	Pen B Assignment	0 = No Point	
4212	Pen C Assignment	0 = No Point	
4213-4220	Reserved		
4221	Bar 1 Assignment	0 = No Point	
4222	Bar 2 Assignment	0 = No Point	
4223	Bar 3 Assignment	0 = No Point	
4224	Bar 4 Assignment	0 = No Point	
4225	Bar 5 Assignment	0 = No Point	
4226	Bar 6 Assignment	0 = No Point	
4227	Bar 7 Assignment	0 = No Point	
4228	Bar 8 Assignment	0 = No Point	
4229	Bar 9 Assignment	0 = No Point	
4230	Bar A Assignment	0 = No Point	
4231	Bar B Assignment	0 = No Point	
4232	Bar C Assignment	0 = No Point	

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Table 7-5 Holding Registers 4xxx 16 Bits Integers (Use Functions 3, 6 and 16 to Access)		
Register #	FUNCTION AND STATE	
4233-4240	Reserved	
4241	Digital Window 1 Assignment	0 = No Point
4242	Digital Window 2 Assignment	0 = No Point
4243	Digital Window 3 Assignment	0 = No Point
4244	Digital Window 4 Assignment	0 = No Point
4245	Digital Window 5 Assignment	0 = No Point
4246	Digital Window 6 Assignment	0 = No Point
4247	Digital Window 7 Assignment	0 = No Point
4248	Digital Window 8 Assignment	0 = No Point
4249	Digital Window 9 Assignment	0 = No Point
4250	Digital Window A Assignment	0 = No Point
4251	Digital Window B Assignment	0 = No Point
4252	Digital Window C Assignment	0 = No Point
4253-4274	Reserved	
4275	Recorder Mode	Bit 0 = Recording on/off Bit 3 = Format in process Bit 4 = Alarm Recording on/off Bit 5 = Save config in progress Bit 6 = Load config in progress Bit 7 = Data Record on/off
4276	Record Fill Mode	0 = Fill to end, otherwise Cyclic
4277	Record Mode 2	Each bit corresponds to a Point. (Bits 0-11) 0 = instantaneous, 1 = average
4278	Auto Record Points	Each bit corresponds to a Point. 1 = Alarm triggered Recording
4279	Record point enable	Each bit corresponds to a Point. 1 = Record
4280	Speed Control	Bit 0: 0 = Low Speed, 1 = High Speed Bit 1: 0 = Fixed Chart Speed, 1 = Auto Bit 2: 0 = Low Record Speed, 1 = High Record Speed Bit 3: 0 = Fixed Record Speed, 1 = Auto
4281	Filename	2 chars [00] [01]
4282	Filename	2 chars [02] [03]
4283	Filename	2 chars [04] [05]
4284	Filename	2 chars [06] [07]
4285-4360	Reserved	

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Table 7-5 Holding Registers 4xxx (Use Function 3 to Access) 32 Bits Modicon Format Floating Point Writing to these registers has no effect	
Register #	FUNCTION AND STATE
4361	Point 1 Data Low Word
4362	Point 1 Data High Word
4363	Point 2 Data Low Word
4364	Point 2 Data High Word
4365	Point 3 Data Low Word
4366	Point 3 Data High Word
4367	Point 4 Data Low Word
4368	Point 4 Data High Word
4369	Point 5 Data Low Word
4370	Point 5 Data High Word
4371	Point 6 Data Low Word
4372	Point 6 Data High Word
4373	Point 7 Data Low Word
4374	Point 7 Data High Word
4375	Point 8 Data Low Word
4376	Point 8 Data High Word
4377	Point 9 Data Low Word
4378	Point 9 Data High Word
4379	Point A Data Low Word
4380	Point A Data High Word
4381	Point B Data Low Word
4382	Point B Data High Word
4383	Point C Data Low Word
4384	Point C Data High Word
4385	Reserved
4386	Reserved
4387	Reserved
4388	Reserved
4389	Reserved
4390	Reserved

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Table 7-6 Holding Registers 6XXX 32 Bits Integers (Use Functions 3 and 16 to Access)	
Register #	FUNCTION AND STATE
6001	Date 4 Bytes [] [Year] [Month] [Day]
6002	Time 4 Bytes [] [Hours] [Minutes] [Seconds]
6015	Low Record Sample Rate Point 1
6016	High Record Sample Rate Point 1
6017	Low Record Sample Rate Point 2
6018	High Record Sample Rate Point 2
6019	Low Record Sample Rate Point 3
6020	High Record Sample Rate Point 3
6021	Low Record Sample Rate Point 4
6022	High Record Sample Rate Point 4
6023	Low Record Sample Rate Point 5
6024	High Record Sample Rate Point 5
6025	Low Record Sample Rate Point 6
6026	High Record Sample Rate Point 6
6027	Low Record Sample Rate Point 7
6028	High Record Sample Rate Point 7
6029	Low Record Sample Rate Point 8
6030	High Record Sample Rate Point 8
6031	Low Record Sample Rate Point 9
6032	High Record Sample Rate Point 9
6033	Low Record Sample Rate Point A
6034	High Record Sample Rate Point A
6035	Low Record Sample Rate Point B
6036	High Record Sample Rate Point B
6037	Low Record Sample Rate Point C
6038	High Record Sample Rate Point C

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Table 7-7 Holding Registers 8xxx 32 Bits IEEE Floating Point (Use Functions 3 and 16 to Access)	
Registers #	FUNCTION AND STATE
8001	User Programmable Constant 1
8002	User Programmable Constant 2
8003	User Programmable Constant 3
8004	User Programmable Constant 4
8005	User Programmable Constant 5
8006	User Programmable Constant 6
8007	User Programmable Constant 7
8008	User Programmable Constant 8
8009	User Programmable Constant 9
8010	User Programmable Constant A
8011	User Programmable Constant B
8012	User Programmable Constant C
8013-8015	Reserved
8016	External Point 1
8017	External Point 2
8018	External Point 3
8019	External Point 4
8020	External Point 5
8021	External Point 6
8022	External Point 7
8023	External Point 8
8024	External Point 9
8025	External Point A
8026	External Point B
8027	External Point C

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8 COMPANION SOFTWARE

Chapter 8 COMPANION SOFTWARE

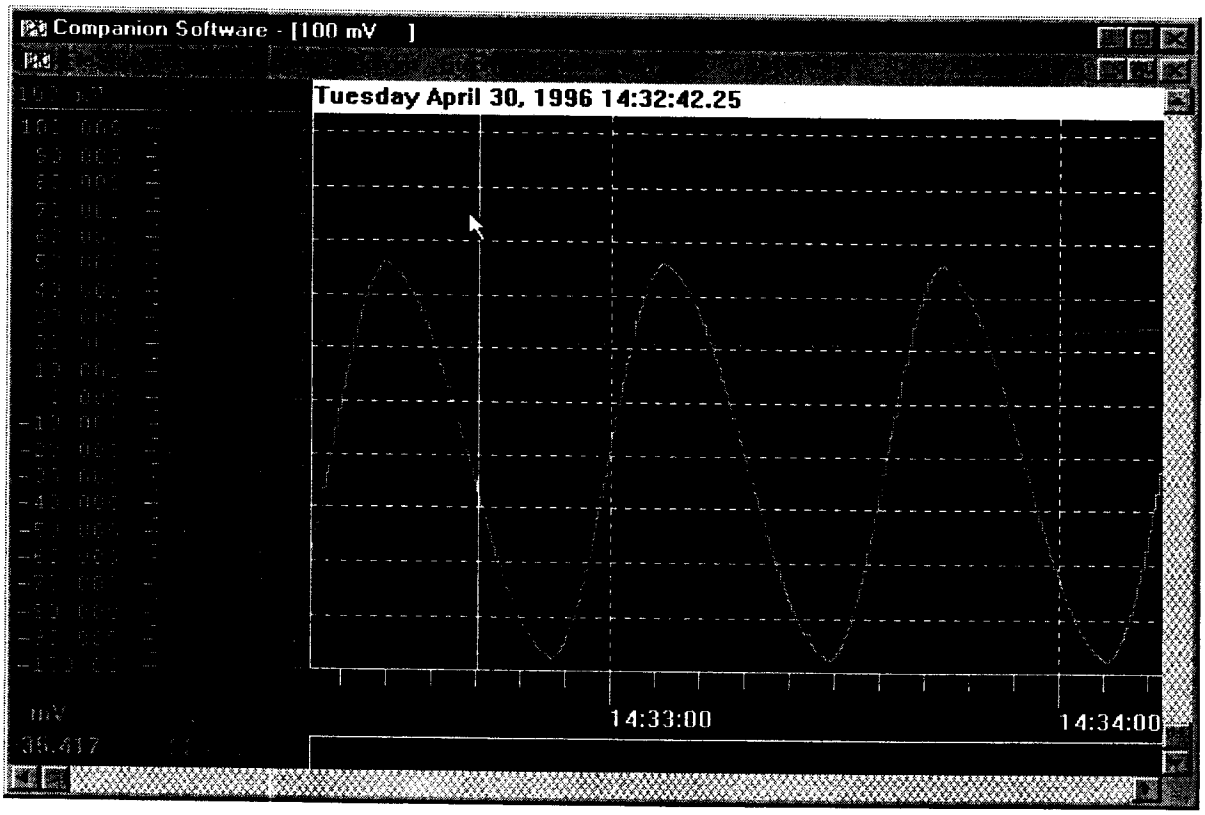
8.1 Overview

The Companion Software is an optional software package that runs under the Microsoft Windows or Windows 95 Operating Systems and enables the user to

- Read and analyze data files recorded on the recorder in graphical or tabular format, and browse Alarm Event files.
- Export files to spreadsheets such as Excel™ and Quattro™
- Download files from remote recorders via Modbus and modem.
- Link and examine files from different locations and dates, link events to trend data.
- Search data for specific events
- Fully configure and control up to 31 units at remote locations via the Modbus interface or via disk transfer.

The software can read Point and Event files. It can display the data (points) graphically and in tabular format. Multiple points can be shown in one graph. Data can also be exported in formats usable by spreadsheet programs, etc. It can also display Events and Information windows. Graph, Table, Event, and Information windows can be printed.

The files produced by the recorder are in MSDOS™ compatible format and the Windows™ File Manager can be used to copy, move, save and/or rename the files.



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8.2 Installation

Place the supplied 3½" disk into your floppy drive. Use the Windows Program Manager to select the File/Run menu item or in Windows 95 select Start/Run. Type in A:\SETUP or B:\SETUP depending on which drive you inserted the floppy disk into. Press the **OK** button. This will run the setup program which will automatically install your software. You will be asked to enter the destination drive and directory where you wish to have the software installed as shown below. If you do not wish to accept the default, type in the destination you want and press enter or click the "OK" button. Follow the instructions.

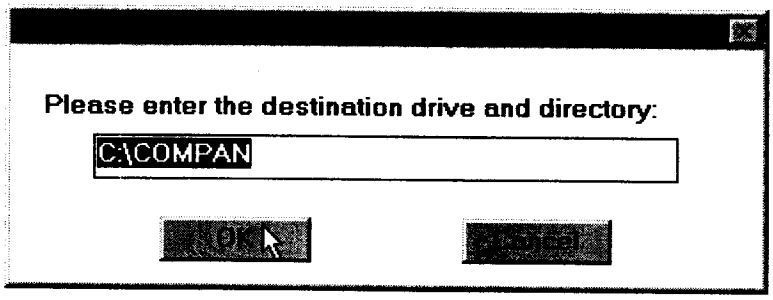


Figure 8-2 Installation Destination

To run the program click on the icon in the program manager or Start/Program manager.

8.3 Menu Options

The menu displays the primary selections available and each selection controls a specific portion of the program. Search, for example, has a sub menu that controls all the functions having to do with searching data. Some of the choices in a sub menu may in turn have a second level of sub menu, or may pop up a dialog box that enables data to be entered, or a selection to be made.



Figure 8-3 Menu Bar

The simplest method of accessing the menu is with the mouse. Simply position the mouse pointer on the menu selection required and press the left mouse button. Alternatively you can use the keyboard by pressing and holding the 'Alt' key and then pressing the highlighted (underlined) letter of the top menu option. To make selections from the sub menus, just type in the underlined letter of the desired selection. A third method is to press and release the 'Alt key. Now use the arrow keys to move around through the menus.

The menu items are as follows:

8.3.1 File

The File menu has the following sub menu options:

8.3.1.1 Use Disk / Use Recorder

A mutually exclusive selection to determine the source for file transaction. "Use Disk" will get files from the disk while "Use Recorder" will get files from a remote recorder over the Modbus. The serial port needs to be set up correctly for this option to work.

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Note: There is one condition that will prevent a file from being read over the Modbus. Any file that is cyclic and is currently being recorded to can NOT be read. If the user tries to read such a file will bring up an error message.

8.3.1.2 Open

Will bring up a file dialog box. Enter one or more filenames of the point file(s) to be graphed. This will create a new graph window with the selected point(s) in it. Alarm/Event files may also be opened with this dialog box. In the "Use Recorder" mode this will present a directory of files on the disk in the remote recorder.

8.3.1.3 Transfer

This enables the user to transfer files from a source to a destination. It's primary intent is to copy files from a remote recorder or card reader onto a local disk drive to facilitate browsing. The user will be presented with a file dialog box to select the files to copy, then a destination dialog box allows selection of where they go. The destination dialog box supports the use of wildcards so that a group of files can be copied to *.* on a local drive, and the naming will be automatic.

8.3.1.4 Erase

Will bring up a file dialog box. Enter the name of a file to be erased. On a card reader it will delete the last file on the card.

8.3.1.5 Hex Dump

This shows the first 1000 bytes of the selected file in hexadecimal format in a window and is for diagnostic purposes only.

8.3.1.6 Export

This feature creates a file that can be read by other programs such as spreadsheets. Files are exported in comma separated variables format (CSV). You must have a file loaded and the window active in order to export the file.

If a Config View or Report Window is active, this feature will allow the user to write the contents of these windows to a text file.

8.3.1.6.1 Exported File Format - Alarm/Events

The file has a header as follows: "Date", "Time", "Point/Event", "Type", "Value"

Each line afterwards has a line of data that corresponds to each line in the event window that is being exported. The data on each line follows the format indicated by the labels above. The format in which time and date are stored is as it appears in the event window, and may be changed by using the Options/Display menu. See section "8.3.5.1" on page 20.

Alarm Event Exported File Format Example:

"Date","Time","Point/Event","Type","Value"

30/4/1996 ,02:32:30 pm,3," High Peak:",51.970470

30/4/1996 ,02:33:01 pm,3,"Peak Reset:"

30/4/1996 ,02:32:52 pm,4,"Low Peak:",-95.335541

8.3.1.6.2 Exported File Format - Data

Graph data may be exported in various formats.

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Graph Data - The graph window must be active. Select the "File - Export option. The export dialog window will be presented as shown below.

The export dialog box allows the user to select the start and end times, the format for the time and date, and optionally break up into smaller files based on a time interval.

The data is stored in engineering units as setup on the recorder, i.e. degrees C, Volts, pressure, etc. These are the same values and range that you see on the axis of the graph. Temperature, for example, is exported in actual degrees.

8.3.1.6.3 Start Date and Time

Select the time to start exporting data, thus allowing part of the file to be exported.

8.3.1.6.4 End Date and Time

Select the time to stop exporting data.

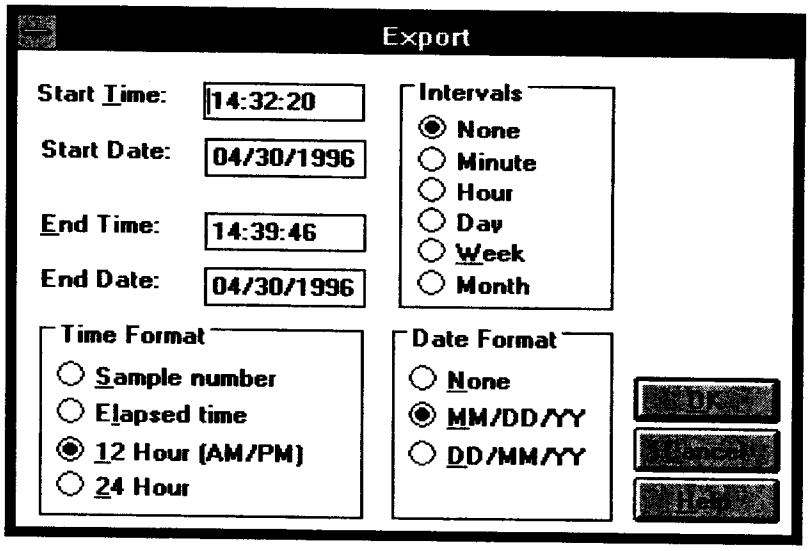


Figure 8-4 Export Dialog Box

8.3.1.6.4.1 Time Format

Select the time format either as sample number, where each value output will be numbered, elapsed time, where the first sample is time 0:00:00 and each sample is then time incremented, or select an absolute time format, 12 or 24 hour.

8.3.1.6.4.2 Date Format

Select either month day MM/DD/YYYY (American), or day month representation DD/MM/YYYY (European) or None to suppress the date.

8.3.1.6.4.3 Intervals

The Intervals option allows the user to export "Blocks" of data rather than the whole file which may be too large for certain spreadsheets. The block may be selected as intervals of one minute, one hour, one day, one week or one month. An interval of none exports the entire file. Select the option you want.

Once the export options have been selected click on the OK button or press [ENTER]. A dialog box will appear to select or enter the name and location of the

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export file. When a filename has been selected, click OK and the data will be exported into that file.

8.3.1.7 Print

In order to print a graph, table or event, the window must be active. To print, select File/Print from the menu. This will bring up a dialog box that allows you to select print options. The printout will go to the default system printer. To change the default printer, use the Window's control panel to set the printer you wish to use as the default.

The print options are as follows:

8.3.1.7.1 Start From

File Start - will cause the printout to start printing from the start of the file.

Current Position - will cause the printout to start from the left edge of the current graph or top edge of other windows.

8.3.1.7.2 Keep Going

Until End of File - will cause the printout to continue until the end of the file.

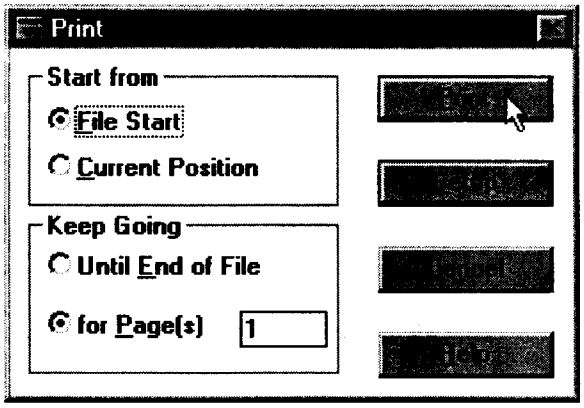


Figure 8-5 Print Dialog Box

for Pages - will cause the printer to print the number of pages in the edit box that is to the right of the radio button.

8.3.1.7.3 Setup

This button will bring up the dialog box for the default printer. This is where paper orientation, resolution, etc. can be set.

Press the "Print" button to start the printer or Cancel to exit.

8.3.2 Search

The Search menu allows the user to locate specific events in the open window. The following menu options are available. Note - First Setup the Find parameters.

8.3.2.1 Go to time

Enter in the Time (24 hour format) and Date to go to. Type in all four digits for the year. All windows that match the group number will move to the selected time. A group number of zero will update all open windows.

8.3.2.2 Find

Find the next data point that matches the search criteria. Can also be activated by pressing the "F2" key.

8.3.2.3 Search Setup

Select the pen, value, and directions for searching. Can also be activated by pressing the "Alt+F2" key. This brings up the Search setup dialog box shown in Figure 8-6 below.

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8.3.2.3.1 Sense

Select whether the data must be "Greater than", "Less than" or "Equal to" the selected "Value" to be considered a match.

8.3.2.3.2 Pen

Select which trace or pen the search will be performed on.

8.3.2.3.3 Direction

Determines if the search will go "Forward" or "Backward" from the current position.

8.3.2.3.4 Event Hopping

If this box is checked, the search criteria must be false first then come true again before the next search stops. This prevents the search finding every point above a value on a sine wave for example, but it will find each crossing of the compare point.

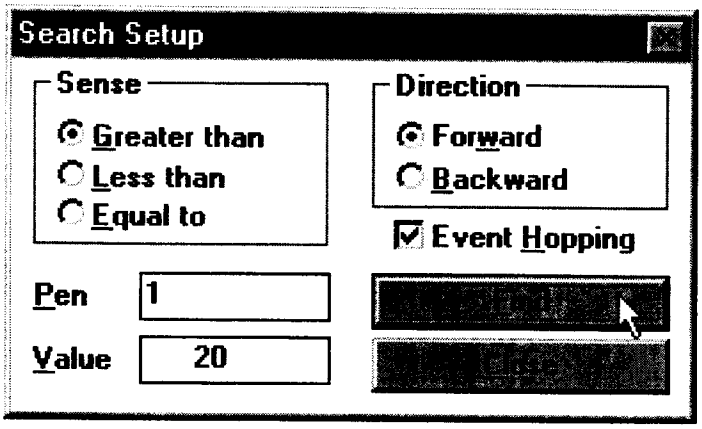


Figure 8-6 Search Setup

8.3.2.3.5 Value

Enter the actual compare value in the same engineering units as the pen being searched.

8.3.2.3.6 Find

The "Find" button will cause a search to occur immediately.

8.3.2.3.7 Close

The "Close" button will just close the dialog box.

8.3.3 Serial

This menu option enables data to be read from the recorder using an RS-232 or RS-485 interface. It also allows the user to dial up a remote recorder using a modem rather than using a direct connection. The recorder requires the Serial Comms hardware option. Before using these menu items ensure that the serial port has been set up correctly in the "Options - Com ports" menu. See Section "8.3.5.2" on page 20.

Note: Before the **point** or **alarm** windows display data, they automatically query the recorder for its current point setup information so that the information will be displayed correctly.

8.3.3.1 Point

This option provides a **real time display of point data** from the remote recorder. A serial link must have been successfully made for this option to work. A window will pop up as shown in Fig 8-7 below.

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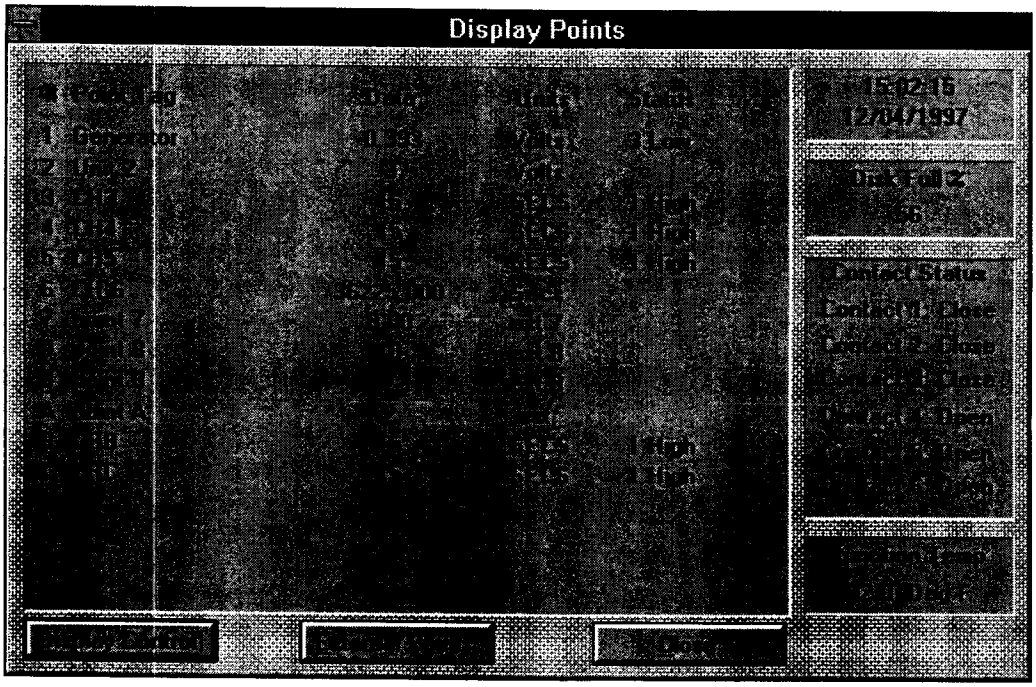


Figure 8-7 Display Points Window

Every selected points data will be displayed in the top left area. The current time and date set on the recorder is in the top right area. Below that is a display of the percentage of the disk that is already full. The next area shows what state each contact (relay) is in either open or closed. The bottom right area is the current junction temperature reading.

The display can be configured by clicking on the Display Control button or click the mouse pointer on the system button (the Square or "Windows" logo) in the top right corner of the Display Points Window. This will bring up a menu, select Display Control to bring up the setup dialog box. Click the points you wish to display, enter the display update rate in seconds, and click on Accept. External Points may be set by pressing the External Points button.

8.3.3.2 Alarm

This option provides a **real time display of point Alarm data** from the remote recorder. This is identical to the Points window except only points that are in alarm are displayed.

8.3.3.3 Dial Modem

This option allows communications to be established to a remote recorder and modem. It uses the internal (or external) PC modem. Use the "Option - Com Port" menu to select the PC modem. The modem at the recorder end as well as the recorder must be set up correctly. The baud rate must be set as the software disables the auto baud rate detect. The modem setup string at the PC end is in the Companion "Compan.ini" file. It is set for standard Hayes compatible modems and should not require editing. Note: Error compression and correction are disabled.

The options are:

8.3.3.3.1 Phone Number

Enter the phone number to be dialed. Include all digits. To enter a pause between digits use the ~ (Tilde). To have the modem pulse dial, precede the number with a P. The modem will ignore (,) and -.

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8.3.3.3.2 Command

This is NOT the modem initialization string and should be left blank if not used. It is a string of characters that will be sent to the remote site once modem connection has been made. It can be used to command remote switching systems to select a particular channel.

8.3.3.3.3 Timeout

This is an additional time out to allow connection to a remote site. If you get a modem time out error you can add from 1 to 99 seconds additional time out here. Default is 0.

To dial, click on "OK". A pop up box will show "Modem Dialing". Once connection is made the display will show "Modem Connected". Click on "OK" and then proceed with remote communications as though the modem were not there. If connection is not made or the remote site does not answer, the display will show "Modem not connected". Check the phone number and com port setup and try again.

8.3.3.4 Hang up Modem

Once communication is completed, select Hang up modem to terminate the connection. The connection will automatically be terminated, and the modem will be reset, when you exit the program.

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8.3.4 Config

This menu option enables the recorder to be configured and controlled remotely using an RS-232 or RS-485 interface. The recorder requires the Serial Comms hardware option. Before using these menu items ensure that the serial port has been set up correctly in the "Options - Com ports" menu. Alternatively, the configuration information can be saved or loaded to disk which can be transported to a recorder where the configuration can be loaded or saved from the disk.

Most of the Config menu options affect a *local copy* of the configuration information. When changing a configuration in the Recorder over serial lines, it is usually best to load the current configuration from the recorder. Now the local copy of the configuration information is the same as what is in the Recorder. Any changes are then made locally and the configuration is then sent back down to the recorder where it is immediately written into the non-volatile memory.

Note that all communications with the recorder is according to the Modbus protocol. Refer to chapter 7 of the User's manual for details. It is not necessary to understand this protocol to use this program.

PROCEED WITH CAUTION - THESE OPTIONS WILL AFFECT THE OPERATION OF THE RECORDER. ENSURE THAT THE RECORDER SETTINGS MATCH THE SERIAL PORT SETUP IN THE OPTION/COM PORT MENU.

For more detail about the recorder configuration, refer to Chapters 4 and 5 of the User manual. The menu options are as follows.

8.3.4.1 Open

Read a previously saved configuration file from the disk. This is the standard windows load file dialog box. Configuration files saved at the recorder can be read in this way.

8.3.4.2 Save

Save the configuration information to a disk file. The filename defaults to the last file read, but may be changed by the user. This is the standard windows save file dialog box. Configuration files may be saved to disk for later upload at remote recorders.

8.3.4.3 Save As

Save the configuration information to a disk file and give it a new name. It will always ask you for the file's name. This is the standard windows save file dialog box.

8.3.4.4 View Config

Create a snapshot of the current configuration in the computer. Type in any text to describe this configuration in the User Text dialog box. This text will appear on the second line of the config window. If the configuration is changed after the window has been created, the window will **not** update. To view the new configuration open a new config window.

8.3.4.5 Load from Recorder

If a password is set, the user must enter it before continuing. This dialog box will allow the user to load the configuration from the recorder to the PC. Press the Start button to start the transfer. When the transfer is complete, press the Exit button to close the dialog box.

THE CONFIGURATION SHOULD BE LOADED BEFORE ANY EDITING TAKES PLACE TO ENSURE YOU ARE WORKING WITH CURRENT RECORDER DATA.

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8.3.4.6 Send to Recorder

If a password is set, the user must enter it before continuing. This dialog box will allow the user to send the configuration to the recorder from the PC. This configuration will be automatically "learned" into the non-volatile memory of the Recorder. Press the Start button to start the transfer. When the transfer is complete, press the Exit button to close the dialog box.

THIS PROCEDURE NEEDS TO BE EXECUTED BEFORE ANY EDITED DATA WILL BECOME EFFECTIVE IN THE RECORDER.

8.3.4.7 Displays

8.3.4.7.1 Time Format

Determines how time will be displayed on the recorder. It will be in either American (Month/Day/Year) or European (Day/Month/Year) format.

8.3.4.7.2 Language

Select either English or an alternate language to be used on the recorder. Note: an alternate language must have previously been loaded into the recorder.

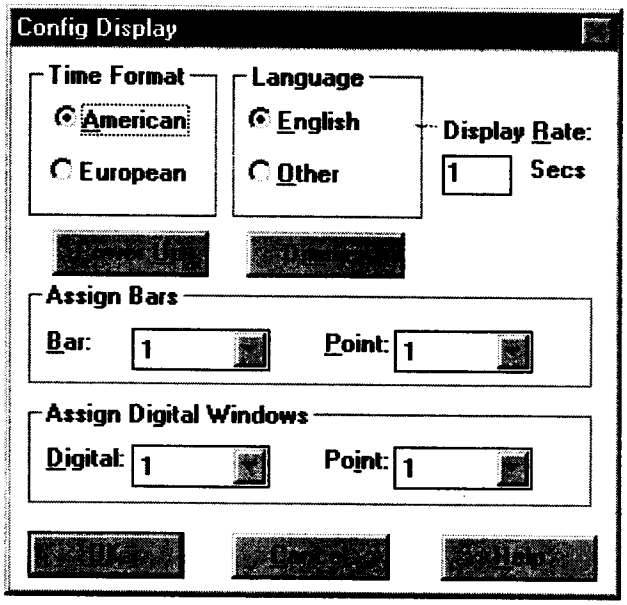


Figure 8-8 Config Display

8.3.4.7.3 Display rate

Determines how often the status window on top line of the display will update when point or alarm information is displayed there. It will also affect how fast the auto jog feature switches between pens. The range is from 1 to 60 seconds.

8.3.4.7.4 Screen Saver

Determines the number of minutes of keypad inactivity before the backlight turns off. Any modal message window will keep the backlight on so the user can see the message.

8.3.4.7.5 Assign Bars

There are two drop down boxes that work together to assign a point to each bar graph on the recorder. Click on the to drop down the pick list.

The first drop down box selects which Bar is to be assigned, the second drop down box will show what Point is assigned to it and allow you to change it.

8.3.4.7.6 Assign Digital Windows

There are two drop down boxes that work together to assign a point to each Digital Display on the recorder. Click on the to drop down the pick list

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The first drop down box selects which Digital window is to be assigned, the second drop down box will show what Point is assigned to it, and allow you to change it.

8.3.4.8 Power Up Display

Press the Power Up button to bring up a dialog box to set up the power up display. This is where the Unit Tag is set. See " Power Up Display" in section 5.4.3 of the User's Manual for more details. Click on "Power Up" display to set it. Refer to Section 5.4.3 for a detailed description.

8.3.4.8.1 Unit Tag

The Unit Tag String can be 20 characters and is used to identify a recorder.

8.3.4.8.2 Display

The "Display" radio buttons select what will be shown in the status window on power up. Autojog will display all the programmed points in sequence over and over. Point will select one point to be displayed. Alarms will cycle through all alarms that are valid at any given time. Make your selection.

8.3.4.8.3 Point Power Up

The radio buttons select which point will be displayed if the "Point" radio button is selected in the "Display" group above. Selection is mutually exclusive.

Once set up of displays is complete, click the "OK" button. Note that the recorder will not be updated until you send the configuration.

8.3.4.9 Dimmer

Pressing the Dimmer button brings up a dialog box to set the brightness of the backlight for the Display. The display will use the "bright" value until there is no activity on the touch screen for "timeout" minutes. The display will then use the "dim" value until the touch screen is pressed or an important message is displayed. The higher the "bright" and "dim" values are, the brighter the display will be.

8.3.4.10 Views

This is a list of all possible views. Only the views checked off here will be available for selection on the recorder. This eliminates the need to step through unused views to get to the desired views.

The "v" indicates vertical, the "h" indicates horizontal, and the "s" indicates small. Trends refer to the graphic screen. Thus "vTrends/vBars" is a display that is split between vertical trending and vertical Bar graphs. The Trend (chart) can only be horizontal or vertical at any time (set in the Chart/Pens dialog box) so only views with the active trend direction are selectable.

8.3.4.11 Chart / Pens

This menu item brings up a dialog box that allows the user to program the parameters directly affecting the charts or pens. Refer to Section 5.5.

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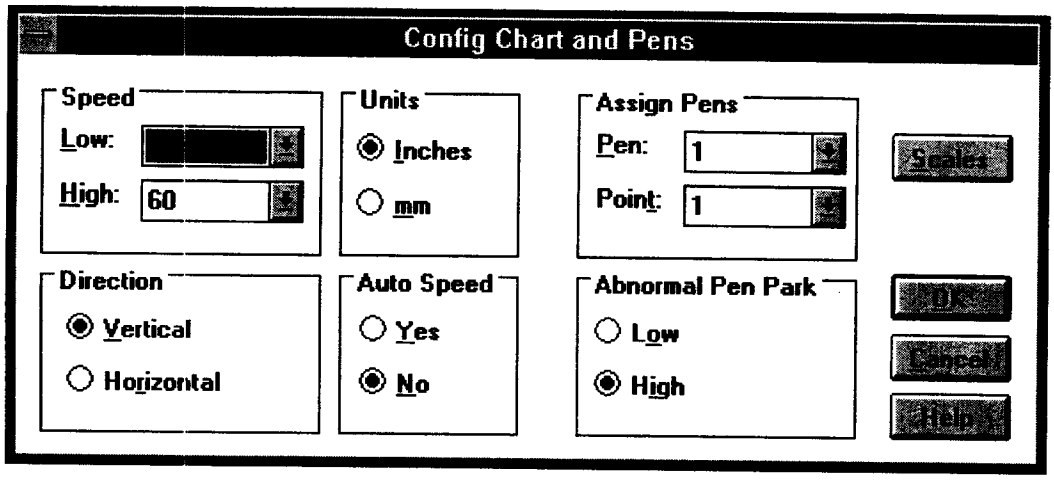


Figure 8-9 Config Chart and Pens

8.3.4.11.1 Speed

Low and High Chart Speeds are set using the drop down boxes to select a speed from the list. If the Autospeed setting if set to YES, the Low Speed setting is used when no Alarm is true and the High Speed setting is used if any alarm is true.

8.3.4.11.2 Units

Select between Millimeters and Inches units for chart speed.

8.3.4.11.3 Auto Speed

When Auto Speed is Yes the chart speed will change based on Alarms status. When Auto Speed is No, the chart speed will be set to High or Low Speed based on the "Chart Speed" radio buttons in the Function dialog box. Digital inputs can also be set to affect chart speed.

8.3.4.11.4 Chart Direction

Select the direction of the trend chart either horizontal, from right to left, or vertical, from top to bottom.

8.3.4.11.5 Assign Pens

There are two drop down boxes that work together to assign a point to each pen on the chart on the recorder. Click on the to drop down the pick list. A maximum of six pens can be assigned.

The first drop down box selects which of the Pens is to be assigned, the second drop down box will show what Point is assigned to it and allow you to change it. Select "none" to turn the pen off.

8.3.4.11.6 Abnormal Pen Park

Select whether a pen goes to the high or low end of its scale when it is in an abnormal condition. e.g. TCBO, overrange, or overflow.

8.3.4.11.7 Scales

Click on the Scales button to edit any of the scales 1A through 2H. Select the scale to edit by clicking on the radio button and press OK. Refer to Section 5.5.2 for details. The edit options are:

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Origin	Select only Side
Decimal Fix	Select the number of decimal places to use
Divisions	Set the Major and Minor grid divisions
Range	Select the high, mid and low scale values
Scale Type	Select Linear or Logarithmic scale type
Scale Units	Enter a scale identifier to be shown on the chart.

The current settings are shown in the lower half of the dialog box. Press "OK" to enter the data and return.

8.3.4.12 Points

There are two program options, Points or Constants. Refer to Section 5.6 for details.

8.3.4.12.1 Program Points

Allows programming of the each point. Programming is very similar to the way it is done on the recorder. Select "Points..." and then "Program Points". Mark the radio button of the point to program and click on "Program". Select whether you want to "Modify" or "Delete" the point, or "Exit" back to the point selection dialog box. If you choose to Modify the point you will be presented with a point type menu. Select the point type by clicking the radio button and then click on "OK". This will bring up the Program Point dialog box shown below for Linear Point types.

The following options are available:

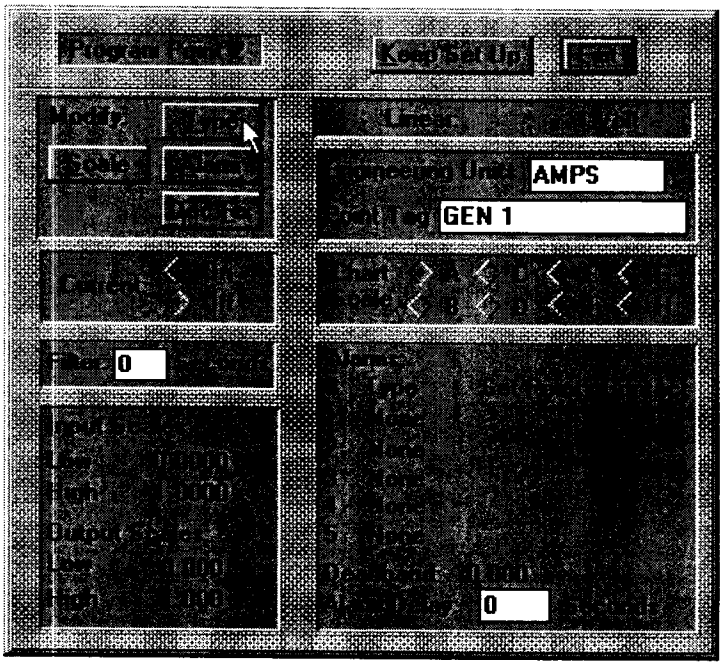


Figure 8-10 Program Linear Point Dialog Box

8.3.4.12.1.1 Type

Select Linear point type (may also show Thermocouple or RTD types depending on previous choices.

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8.3.4.12.1.2 Scale

Modify the input and output scaling if available.

8.3.4.12.1.3 Alarm

Set up the five available alarms, including setpoint, type, delay interval, contact out and deadband. Refer to User manual section 5.6.13 for details.

8.3.4.12.1.4 Decimal Fix

Select how many decimal places will be used to show digital values.

8.3.4.12.1.5 Current

Turn the optional current source (RTD option) on or off

8.3.4.12.1.6 Filter

Set the filter delay from 0 to 30 seconds

8.3.4.12.1.7 Engineering Units

Enter up to 5 characters to define the engineering units e.g. Volts

8.3.4.12.1.8 Point Tag

Enter up to 10 characters to define the point type e.g. PUMP 1 (not all characters will display on some windows)

8.3.4.12.1.9 Chart Scale

Click on the radio button of the Chart scale to be used for display and record purposes.

8.3.4.12.1.10 Alarm Delay

Enter the time period that an alarm must be active before it is registered to a maximum of 14400 seconds.

Once the point is setup, Click on "**Keep Set up**" to save or "Exit" to discard.

8.3.4.12.2 Constants

Up to 12 Constants may be entered. A constant should be set to 0 (zero) if it is not used. If a constant contains non numeric characters it will be shown as NAN for Not A Number. Up to 13 characters may be entered in as Decimal or Exponential numbers. When done click on "OK".

8.3.4.13 Record Set Up

The record set up menu allows the user to configure what and how to record. There are a number of check boxes to be selected.

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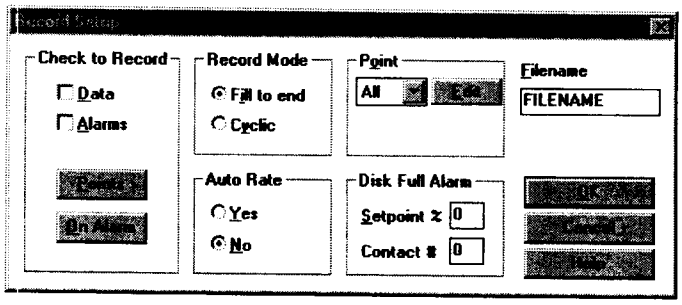


Figure 8-11 Record Setup Dialog Box

8.3.4.13.1 Check to Record

Use this box area to select what to record.

Data — Check to record any data (point) files. The Points must be selected below.

Alarms — Check to record an Alarm/Event file.

Points — Select this to bring up a point selection box. Check any point to be recorded. At least one point must be enabled (checked) to have Data checked.

On Alarm — Select this to bring up a trigger on alarm point. Check any point to act as alarm trigger.

8.3.4.13.2 Record Mode

Selects whether the data files should fill up the disk and stop (Fill to end), or once full, throw away the oldest data to make room for newer data (Cyclic).

8.3.4.13.3 Point

Sets up the point record modes. Select the point to Edit or "All" to make the settings apply to all points, then select "Edit". This brings up the point mode dialog box. Select the Low Sample Rate and High Sample Rate and whether the recording is to be Average or Instantaneous. Refer to the User manual section 5.7.3.

8.3.4.13.4 Filename

Enter the filename used to store all the point, alarm, and Config files. Each file type still has its own unique extension.

8.3.4.13.5 Disk Full Alarm

Set the point at which the disk is considered full and the alarm contact used to indicate this condition. Setpoint % is the percentage full from 1 to 99 and Contact # is the Relay output to use for the alarm from 1 to 6, or 0 if no contact is to be used.

8.3.4.14 Measurement

This dialog box affects the actual measurement of data signals. Refer to Section 5.8.

8.3.4.14.1 Span & Offset

When Span and Offset is Yes, the recorder will allow the user to set a span and offset for thermocouples and RTDs to compensate for long cable runs or inaccuracies.

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New range = (Full Scale x SPAN) + OFFSET

8.3.4.14.2 TCBO Interval

Sets the number of seconds between checks for Thermocouple Burn Out. Maximum is 600 seconds.

8.3.4.15 Digital I/O

8.3.4.15.1 Contact Outputs

This dialog box determines how the output relay contacts will behave if this option is fitted in the recorder.. Refer to Section 5.9.1 for detail.

Alarms clear	Opens the contact outs when the alarms are cleared.
ACK key	Opens the contact outs when the Acknowledge Key is pressed.
Fail-safe	Allows the contact outs to function as Fail-safe Contacts.
Reflash	Programs the contact outs to momentarily open and close each time an additional alarm is acquired.

8.3.4.15.2 Input Switches

This dialog box enables the function of each of the three digital inputs if this option is fitted in the recorder. The selections are mutually exclusive.

8.3.4.15.3 Event Messages

This option brings up a dialog box to enter the message text for each of the 3 digital inputs. There is an open contact message and a close contact message for each.

8.3.4.16 Com Port

Set up the serial communication port in the remote recorder. Note that changing these settings using the serial port may cause loss of connection. This information is not transmitted over the modbus, but is used in configuration files only.

Note that these settings do not affect the PC, local Serial Port options are set under Options - Com Port.

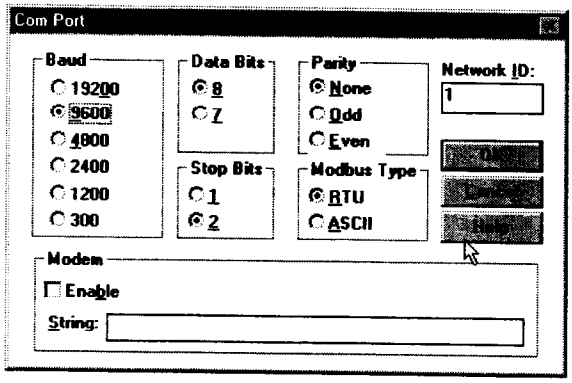


Figure 8-12 Com Port Setup

8.3.4.16.1 Baud Rate

Select the required baud rate to match the PC or modem.

8.3.4.16.2 Data Bits

The default is 8 but it may be changed to 7.

8.3.4.16.3 Stop Bits

The default is 2 but it may be changed to 1.

8.3.4.16.4 Parity

The default is None, but it may be set to Odd or Even.

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8.3.4.16.5 Modbus Type

The default is RTU (Remote Terminal Unit) bit it may be set to ASCII (much slower).

8.3.4.16.6 Network ID

This identifies the unit in a multidrop environment. Set a number between 1 and 255 which must agree with the local port setup. No two units on the same line can have the same network ID.

8.3.4.16.7 Modem

This option allows the use of an external modem with the recorder for dial up applications. Refer to the User manual section 5.10.3 for detail. Enable the modem here and enter the correct modem initialize String.

8.3.4.17 System

8.3.4.17.1 Beeper

Turn the system beeper on or off

8.3.4.17.2 Passcodes

These are the passcodes that have been set to protect the FUNCtion and PROGram menus. They cannot be set locally but are read from a remotely loaded configuration file. Any data entered into these fields is ignored by the recorder.

8.3.4.17.3 Clear Points

Set all points to off. This option enables the user to clear the local database.

USE WITH CARE. REFER TO THE USER MANUAL SECTION 4.1.3 FOR DETAIL

8.3.4.17.4 Init Profile

Sets all the local profile parameters to default values.

8.3.4.18 Function

There are two Function options, one affects the local database (this option) the other is live connection to a remote recorder. This window enables the settings of options found in the recorder FUNCtion menu. Note that the "Reset Now" options are not shown as they are not applicable.

8.3.4.18.1 Active

Select which points are to be active (operational). Deselect any points not being used.

8.3.4.18.2 Chart Speed

Select the Low or High chart speed.

8.3.4.18.3 Check Alarms

Determines whether the alarms will be checked, be activated, or ignored. Select Yes to check them or No to ignore them.

8.3.4.18.4 Scale Set

Select either scale set 1 or scale set 2.

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8.3.4.18.5 Record Speed

Select the Low or High record speed.

8.3.4.18.6 Recording

There are three options - Record On, Record Off and Triggered. This will set the default record condition on the recorder. Ideally Record Off should be selected for a newly configured recorder.

8.3.4.18.7 Views

There is a drop down menu that lists the various display view combinations. Click on the ▪ to drop down the pick list and select the default (startup) view for the recorder. The "v" indicates vertical and the "h" indicates horizontal. Trends refer to the graphic screen. Thus "vTrends/vBars" is a display that is split between vertical trending and vertical Bar graphs.

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8.3.4.19 Function (Live)

If a password is set, the user must enter it before continuing. When the Function dialog box is opened (figure 8-13), the recorder is queried for its current status. If no recorder is attached to the serial port you will get an error message. Each point that is active will have its check box checked.

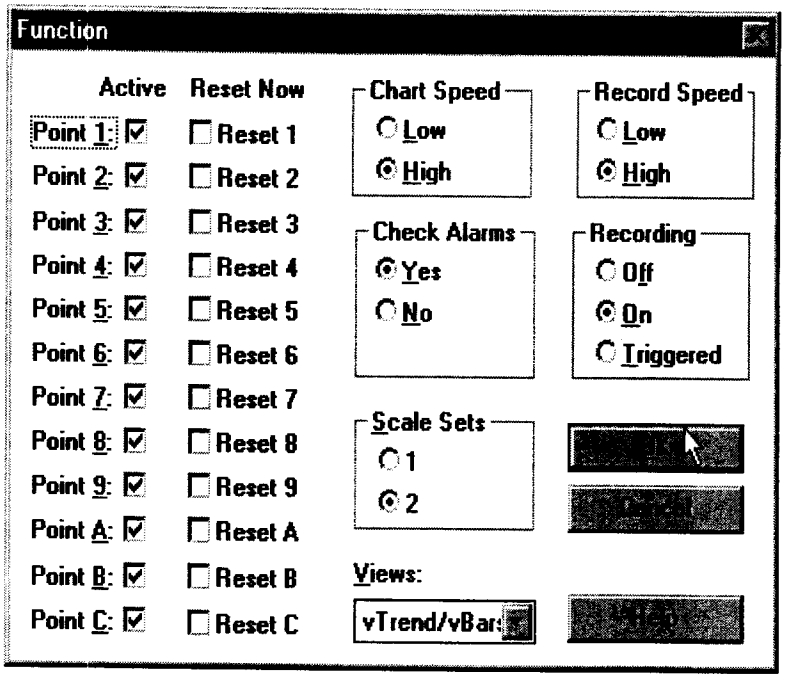


Figure 8-13 Live Functions

8.3.4.19.1 Active Points

To deactivate (bypass) or activate a point, check or uncheck the box alongside each Point n .

8.3.4.19.2 Reset Point

To reset a point, check that point's Reset Now check box. (Reset is only meaningful for resettable point types, Peaks, averages, totalizing.) When OK is clicked, the points will be reset.

8.3.4.19.3 Chart Speed

Select the Low or High chart speed. Chart speeds are set in "Config - Charts/Pens".

8.3.4.19.4 Check Alarms

Determines whether Alarms are checked - Yes, or not - No.

8.3.4.19.5 Scale Sets

Selects which scale set is currently to be used, 1 or 2.

8.3.4.19.6 Recording

There are three option - Record On, Record Off and Triggered. This will set the default record condition on the recorder. Ideally Record Off should be selected for a newly configured recorder.

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8.3.4.19.7 Views

There is a drop down menu that lists the various display view combinations. Click on the to drop down the pick list and select the default (startup) view for the recorder. The "v" indicates vertical and the "h" indicates horizontal. Trends refer to the graphic screen. Thus "vTrends/vBars" is a display that is split between vertical trending and vertical Bar graphs.

When the OK button is pressed, the results of this dialog box will be sent to the recorder. Any point that has its reset check box set will be reset at this time.

If the Cancel button is pressed, the dialog box will close without updating the recorder.

8.3.4.20 Time / Date

When this dialog box opens, it puts the current PC time and date into the edit boxes. If the user presses the "Get time" button, the current time will transmitted from the recorder, or if the "Use PC time" check box is checked, it will get the time from the PC's clock.

When the OK button is pressed, the time in the edit box will be sent to the recorder unless the "Use PC time" check box is checked. In that case, the current PC time will be sent to the recorder.

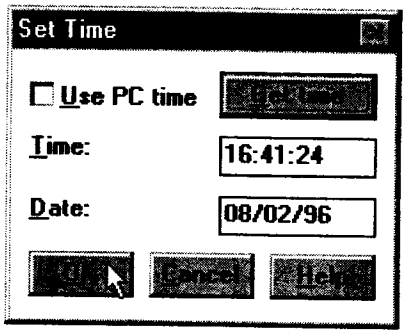


Figure 8-14 Set Time

8.3.5 Options

8.3.5.1 Display

Controls how data is shown in the windows on the screen.

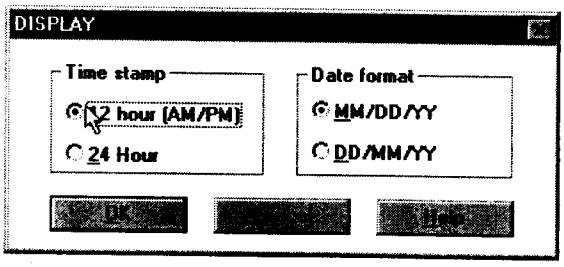


Figure 8-15 Display Dialog Box

8.3.5.1.1 Time Stamp

Select whether time is shown in 12 hour or 24 hour format.

8.3.5.1.2 Date Format

Select whether dates are shown in month/day/year MM/DD/YYYY or day/month/year DD/MM/YYYY format.

This affects how time and date is shown throughout the program. It also affects how time and date are exported when exporting an Event window. Time and date formats are for Graph and Table window Exports is defined in the Export dialog box.

8.3.5.2 Com ports

Set up the serial port for communication with the recorder. Refer to Section 5.10.

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8.3.5.2.1 Baud

Select the speed (Baud rate) of communication with the recorder. Must match the recorder and modem.

8.3.5.2.2 Data Bits

Select 8 bits only.

8.3.5.2.3 Parity

Select None, Odd or Even. Must match the recorder.

8.3.5.2.4 Stop Bits

Select 1 or 2. Must match the recorder.

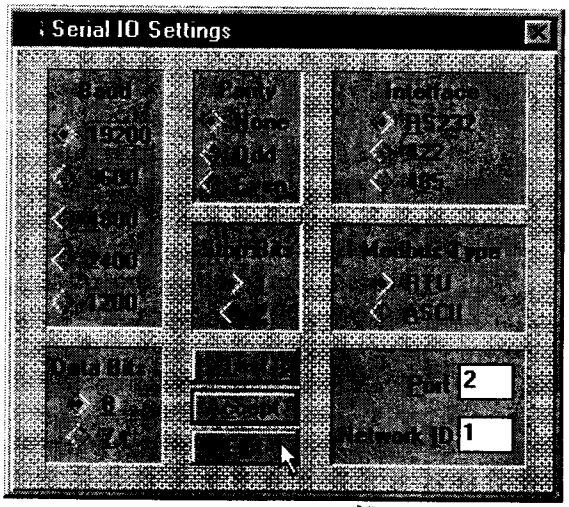


Figure 8-16 Serial IO Setting Dialog Box

8.3.5.2.5 Interface

Select the type of interface you are using. The modem is an RS232 interface. Must match the recorder.

8.3.5.2.6 Modbus Type

Select Modbus Protocol. Must match the recorder.

8.3.5.2.7 Port

Select the Com port your serial card is on, or the Com port your modem is on.

8.3.5.2.8 Network ID

This is the network address of the recorder. It needs to be set even if you have only one device on the line and are using the RS232 interface. The default is 1. The maximum value is 255. It must match the Network ID in the recorder.

8.3.5.2.9 Test

This will only work if all the above setups are correct. Start the test and the Receive Number should track the Transmit number. If the numbers start to drift apart the system is losing Modbus packets due to noise on the line. If the test fails you will receive an error message. Err 5 = no communication, Err 7 = incomplete data.

Once all setup is complete and the test is successful, press "Accept" to save and exit.

8.3.5.3 Set Password

This sets the password to prevent unauthorized access to change recorder settings over the Modbus. If a password already exists, type it in. Now you can change the password. Type in the new password and repeat it to ensure you typed it correctly. To create "no password", type a password that has not characters in it.

8.3.6 Graph

This is only shown if a graph is the currently selected window.

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8.3.6.1 Raw Graph

This sets many of the graph attributes to their default values.

8.3.6.2 Cursor Toggle

This turns the cursor on or off. (Also the T key). The cursor appears as a movable vertical line on the graphic screen and is used to identify individual samples. The cursor has a readout associated with it. By default the readout of amplitude and time / date is that of the extreme left hand sample (against the vertical axis). The cursor may be dragged with the mouse or moved with the left and right arrow (←,→) keys. The readout always refers to the samples directly beneath the cursor.

8.3.6.3 Zoom In

Zoom in will amplify the vertical axis by a factor of 2 each time it is pressed. It also may be activated by using the "+" button on the numeric keypad.

Maximum Zoom is 32 times (5 Zooms).

8.3.6.4 Zoom Out

Zoom out reduces the amplitude of the vertical axis by a factor of 2. It also may be activated by the "-" button on the numeric keypad.

8.3.6.5 Compress

Compress will compress more time onto the graph in the horizontal plane. Graphs have a range of 1/100th second per pixel to over 10 minutes per pixel. When scrolling in compressed mode, the system needs to retrieve more data from the disk. This may take some time. Compress also may be activated from the current graph window with the Numeric "/" button or by pressing "Alt" + "←".

8.3.6.6 Expand

Expand will spread the graph out in the horizontal direction. This feature also may be activated from the active graph window using the Numeric "*" button or by pressing "Alt" + "→".

8.3.6.7 Setup

Brings up the Edit Graph Dialog box. It may also be activated by double clicking on the graph window. Refer to "Using the Edit Graph Dialog Box" on page 28 for details.

8.3.7 Table

This menu option is only shown if a table is the currently selected window. It brings up a Table Options dialog box.

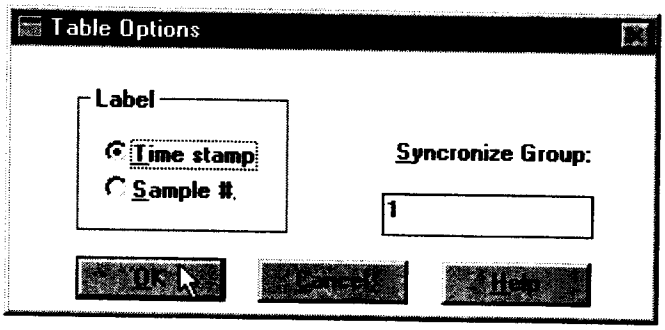


Figure 8-17 Table Options Dialog Box

8.3.7.1 Label

Select whether Time stamp or Sample # (number) is displayed as the lead in for the table data. Sample numbers start from one and are numbered sequentially through the end of each block of data.

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8.3.7.2 Synchronize Group

The Synchronize Group option allows various windows, graphs, events and tables, to track one another in time. All windows assigned to the same group will move to the same point in time when any one of them is moved or the "S" key is pressed. This assumes they all cover the same time span. Event windows will synchronize to the closest time related event. There can be multiple groups, each distinguished by the group number.

8.3.8 Event

This menu option will only shown if an Event (alarm) window is the currently selected window. A dialog box allows selection of a Synchronize Group. Refer above for details.

8.3.9 Window

All the windows listed below may be printed by selecting the **File/Print** menu item.

8.3.9.1 Graph

The Graph item will do one of two different things. If the currently active window is a graph window, selecting this menu item will create a second graph window of the same graph. This allows two windows on the same graph in different positions or different zoom levels. If the currently active window is not a graph, this option allows you to create a new graph by bringing up the Read File dialog box. The new file will be read into a new window. To add a file to an existing graph window use the Edit Graph dialog box.

8.3.9.2 Table

Create a table based on one of the pens in a graph. Use the Select Pen dialog box to choose which pen to use to create a table.

8.3.9.3 Info

Create an information window that tells about each pen in a graph.

8.3.9.4 Report

Create a report based on the data in a graph. Select the start and end times for the report. The report will print out the maximum, minimum, and average values of the data for each Interval selected.

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8.3.9.5 Cascade

Select "Windows - Cascade" to arrange all open windows one behind the other as shown in Figure 8-18. Alternatively Press and hold the Shift key and press "F5".

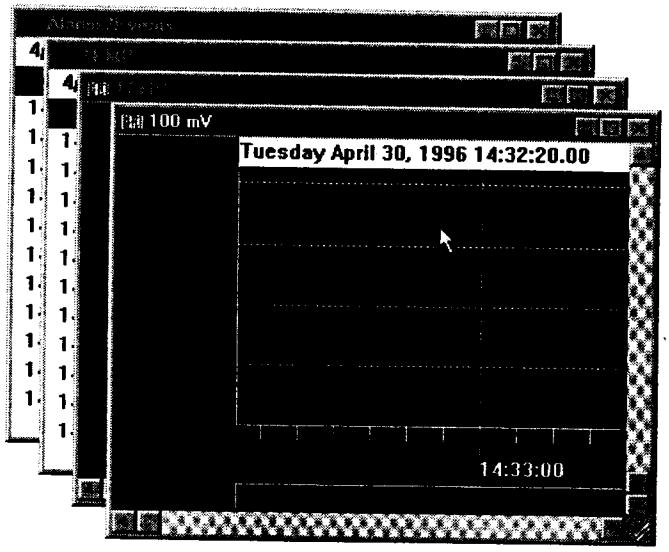


Figure 8-18 Cascaded Windows

8.3.9.6 Tile

Select "Windows - Tile" to arrange all open windows in the available space as shown in Figure 8-19. Alternatively Press and hold the Shift key and press "F4".

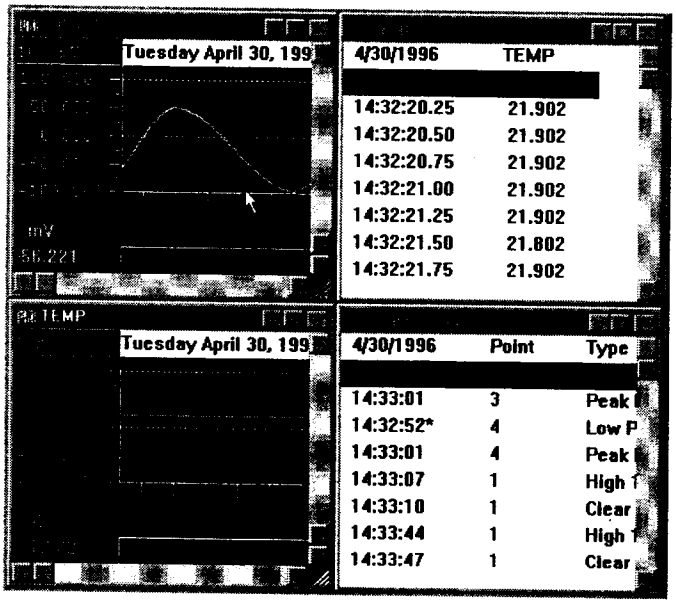


Figure 8-19 Tiled Windows

8.3.9.7 Arrange Icons

If any window is minimized, selecting "Windows - Arrange Icons" will arrange the window icons along the bottom of the main window area.

8.3.10 Help

8.3.10.1 About

Opens a window that gives the Title of the program, version number, and company information.

8.3.10.2 Contents

Shows the "Contents" page of the help file.

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8.4 Tutorial

8.4.1 Copy Files from Floppy Disk to Hard Disk

Use the Window's File Manager program to copy the files. See the Window's documentation for details. Any other program that can copy DOS files (including the COPY command at the DOS prompt) can be used to copy these files.

8.4.2 Scroll bars

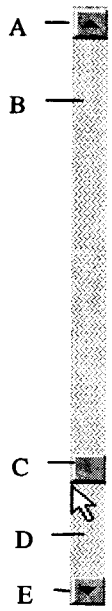


Figure 8-20

A scroll bar is used to move the object in the associated window (lists, graphs, tables).

There are two types of scroll bars, vertical and horizontal. The vertical scroll bar will be described, (Figure 8-20) but the horizontal scroll bar is analogous.

The scroll bar has five parts to it. An up arrow A, a top region B, a thumb button C, a bottom region D, and a down arrow E. The up arrow moves the associated object in the windows up one unit. The down arrow moves the object down one unit. The 'unit' may be a single line of text or a segment of the graph. To move the object by this single increment, place the mouse cursor (using the mouse) over either button and press the *left* button once.

The thumb button shows where the visible part of the object is relative to the beginning and end. Every time the object is moved, the thumb button reflects its new position. The thumb button may be held and dragged by pointing to it with the mouse cursor (using the mouse) then pressing and holding the *left* mouse button while dragging the mouse and consequently the thumb button up or down. The object will be moved accordingly.

Pressing the left mouse button when the mouse cursor is pointing to the top region (the area on the scroll bar between the up arrow and the thumb button), the object will move up by one "page". The object will move down one "page" when this is done on the bottom region.

8.4.3 Using Dialog Boxes

A dialog box is a special window where several selections can be made, or different types of data can be displayed or entered. Although dialog boxes may all appear very different, they all have some common functions.

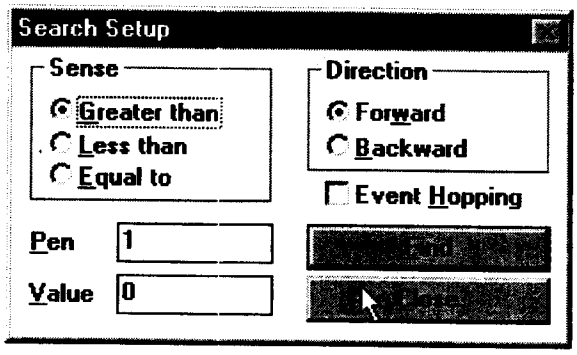


Figure 8-21 A Typical Dialog Box

To edit any selection in an area of a dialog box, that area must be made current. This can be done by pointing to that area of the dialog box (e.g. a list of radio buttons) with the mouse cursor and pressing the left mouse button, or keep pressing the [TAB] key until that part is current (highlighted), or Press and hold [ALT] and the underlined letter in the label for that part. All keyboard entries are directed to the current object (part) of the current window.

Therefore, what a key does depends on Which area is currently active.

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8.4.4 Open a Graph

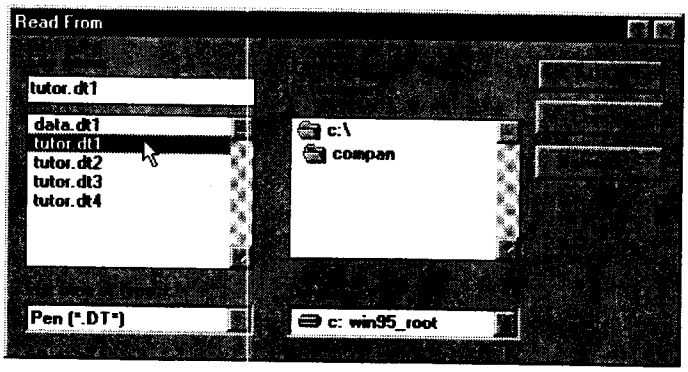


Figure 8-22 Read File Dialog Box

To open a graph select the "File" menu, then select "Read File". The standard filename dialog box opposite will appear. There are various ways to select a file. Firstly, graph data files have the extension ".DT*", shown in the List files of type drop down box. Select the Drive (e.g. A:) and Folder (sub-directory) where the data files reside. A list of the available files will be shown in the File name list box.

Place the cursor over the file you want and click the *left* mouse button. The file name will be highlighted and will appear in the File name box. To select more than one graph to appear in a single graph window, hold the Ctrl (Control) key down while simultaneously clicking on the files you want in the graph. Each file will be highlighted. It is also possible to type the name of the file into the File name box. Click on the "OK" button. This will bring up a graph with the files you selected.

8.4.5 The Graph Window

The graph window is that part of the screen which display the graph. There can be more than one graph window on the screen at the same time.

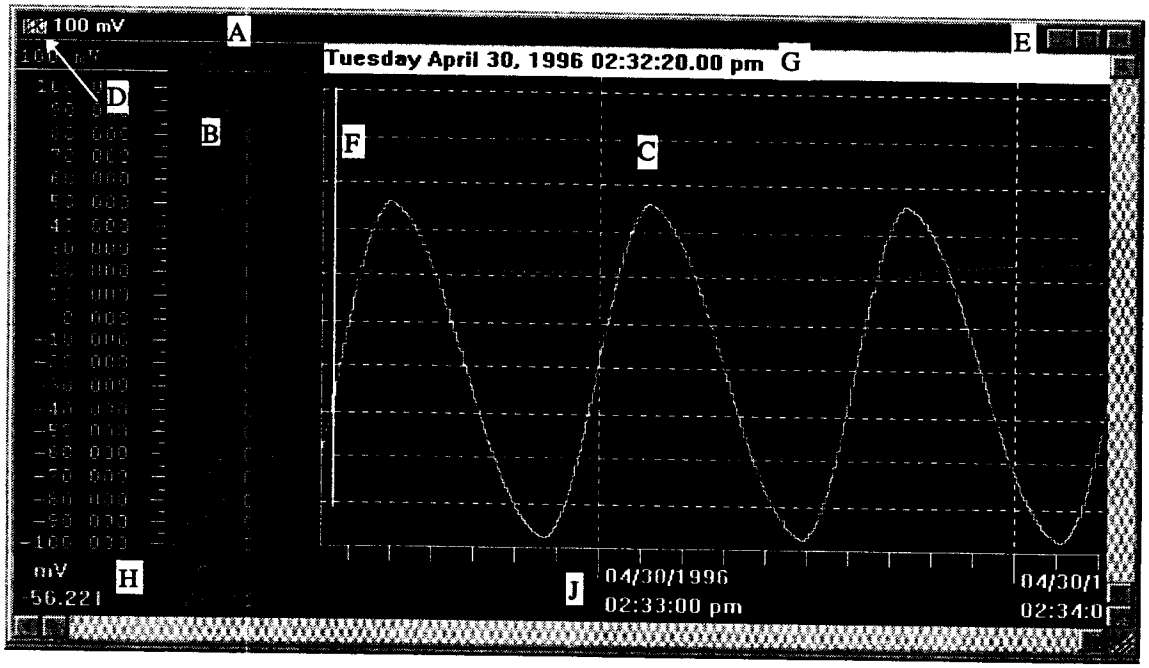


Figure 8-23 The Graph Window

The Graph Window has a **title bar (A)** which defaults to the point name of the first point in the graph. A window is made active by placing the mouse cursor in the window and pressing the

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left mouse button. The title bar changes color when it is active. The Ctrl +Tab or Ctrl + F6 button can be used to move among windows.

To the extreme left of the title bar is the **System Button (D)** box. This is like any other System button in a Windows environment. It enables you to move or size the window using the arrow keys. You can of course move the window with the mouse by moving the cursor into the title bar and pressing and holding the left mouse button. Drag the mouse and the window will move. Release the button to place the window. Similarly you can size the window by placing the cursor over the border edge of the window. The cursor will change shape indicating the direction in which you can drag the border. Press and hold the left mouse button and drag the border to the size you want. The system button also allows you to Size, Move or maximize (fill the screen) the graphics window. Finally you can close the window. To activate the System Button from the keyboard press ALT and the minus "-" key. To exit press "Esc" twice.

On the extreme right of the title bar are the **size buttons (E)** which will make the graph fill the screen, or reduce the screen to an icon. The function of the buttons depend on which version of Windows is being used, and follows standard Windows protocol. Check your Windows manual.

Along the right edge of the window is the Vertical Scroll bar. It has a button in the middle and an arrow button at either end. When the graph is zoomed, you can use these buttons to scroll the graph up and down. Note that the values on the left side of the window change accordingly. The button in the center of the scroll bar indicates the relative position of the current view in the window to the available scroll area. You can use the UP and DOWN Arrow keys, and Page Up and Page Down Keys to scroll , or you can click the arrow buttons with the mouse. You can also click and hold on the scroll bar button and drag it to the desired position with the mouse. (Refer to "Scroll bars" on page 25)

Along the bottom of the window is the Horizontal Scroll bar. It also has two arrow buttons at the ends and the position indicator button. These buttons work the same as the vertical scroll buttons. The left and right arrow buttons move you back or forwards through the file, and the position button indicates relative position. As you scroll, the system may need to read more data from a file. This may cause a slight delay in updating the screen. You can use the Left and Right arrow keys to scroll through the data but it is slow.

If the **cursor** is turned on it is shown as a vertical line on the **graph (F)**. The **Date (G)** and **absolute values (H)** are of the samples directly under the cursor. The cursor can be moved by placing the mouse pointer over it. The mouse pointer will change shape. Press and hold the left mouse button and drag the cursor to where you want it. You can fine move the cursor with the left and right arrow keys. If the cursor is turned off, the date (G) and amplitude values (H) refer to the samples against the left vertical axis.

The **X Axis** shows the **time stamp (J)** which is updated as you scroll.

The **Y Axis** has the scales along the left side of the **window (B)**. There can be one column for each pen (point). The values below each scale is the current data (H) for the sample against the left vertical axis if no cursor is present, or the value of the sample under the data cursor if it is present. These values have the engineering units associated with them as set in the recorder. On color screens the **traces (N)** are color matched to the channel data.

To bring up the Graph Editor, double click in the graph area (C). To edit a pen (or trace) directly, double click on its Y scale (B).

8.4.6 Add a Point to the Graph

To add another trace (point) to the graph, double click the mouse over the graph area (C) or select "Graph - Setup" from the menu. The Edit Graph dialog box will appear. Press the Add button. This will bring up the Edit Pen dialog box shown below (Figure 8-24).

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Press the filename button. The read file dialog box will appear. Select a file and press the OK button. This will return you to the Edit Pen Dialog Box. Click on the "OK" button to return to the Graphics Window.

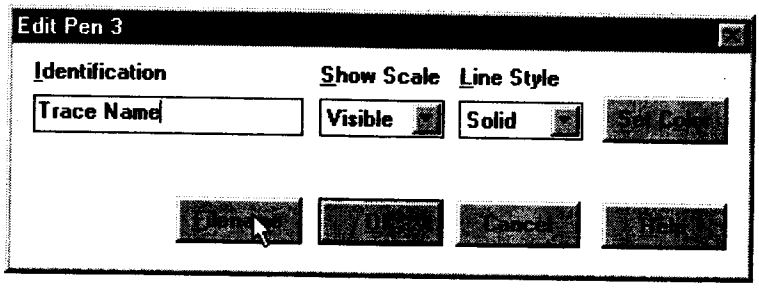


Figure 8-24 Edit Pen Dialog Box

8.4.7 Using the Edit Graph Dialog Box

Double click the mouse over the graph area or select "Graph - Setup" from the menu to bring up this dialog box. Here the graph's title and colors can be changed. Pens (points) can be added to, edited, or deleted from the graph.

Title will change the graph's title that appears in the Title Bar and printouts.

Synchronize Group determines which other windows this window will track. All windows with the same Synchronize Group number will track in time. As one window moves horizontally, so will those with the same group number.

If the **Iterpolate between samples** check box is checked, a straight line from one sample to the next will be drawn on the graph instead of using a "stair step". This only affects a graph that has been expanded so there are more than one pixel per sample. The interpolation will make the graph appear smoother. Only the graphics are interpolated. All digital displays are **not** interpolated.

Foreground Color and **Background Color** enable the user to customize the graph colors.

Make Default - Select this to save the setup into the "Compan.ini" file. These settings will be used in future.

To edit a pen, select a pen from the list using the mouse or arrow keys then press the **Edit** button or just double click on the desired pen.

To add a pen, press the **Add** button.

To delete a pen, select the pen using the mouse or arrow keys. Next press the **Delete** button.

If you are editing or adding a pen a Edit Pen dialog will pop up.

8.4.8 Edit a Pen

A pen or trace can be edited as it is being loaded above, or you can double click on the graphics area and then select the pen to edit from the Edit Graph Dialog box, or you can double click on the Y Axis of the pen.

The Edit Pen dialog box (Figure 8-24 above) can be used to add a name to the trace with the **Identification** box, simply type in the name you want. Use the **Show Scale** drop down list to select whether the Y Axis scale is visible or not (off). If all traces have the same axis it is not necessary to show them all.

The **Line Style** drop down list allows differing line types to be applied to the pens. This allows the different traces to be identified on monochrome monitors, but more importantly, it allows differentiation on print outs, since most printers cannot print color.

Finally the **Set Color** option allows the user to select any color for the trace. Click OK to return to the Graph..

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8.4.9 Open a Table

When a graph is the currently selected window, select "Window - Table" from the menu. This will bring up a Select Pen dialog box. Highlight the desired pen and press the OK button. A window that contains a scrollable list of the point data will appear. The table contains sets of two columns, the exact number of these depends on the window size. The top line of the columns is the date (Or Sample # header) and description, below this is the time stamp (or sample number) and data as shown below.

Time Stamp Format:

4/30/96	POINT TAG
14:31:20.50	-32.951
14:31:20.75	-32.980
etc.	

Sample Number Format:

Sample #	POINT TAG
6	-32.951
7	-32.980
etc.	

To switch between time and sample number, the table window must be active. Click anywhere in the table to make it active. Then select "Table" from the menu. The Table dialog box pops up. You can select the label type and Synchronize group. Click "OK" when done.

A single entry in the table is highlighted. This is the current sample. You can scroll up or down through the table using the up and down arrow keys, or you can use the vertical scroll bars and the mouse cursor.

To synchronize other windows, graph, table or event, make sure that this table belongs to the same synchronize group as the other windows. Select the sample you are interested in then press the "S" key to Synchronize. All other open windows will jump to the same date and time location (or as close as they can get).

8.4.10 Open an Event Window

When a graph or table is the currently selected window, select "Window - Event" from the menu. This will bring up the Read File dialog box with "*.alm" (event) files shown. Highlight the desired file and press the "OK" button. A window that contains a scrollable list of the event data will appear.

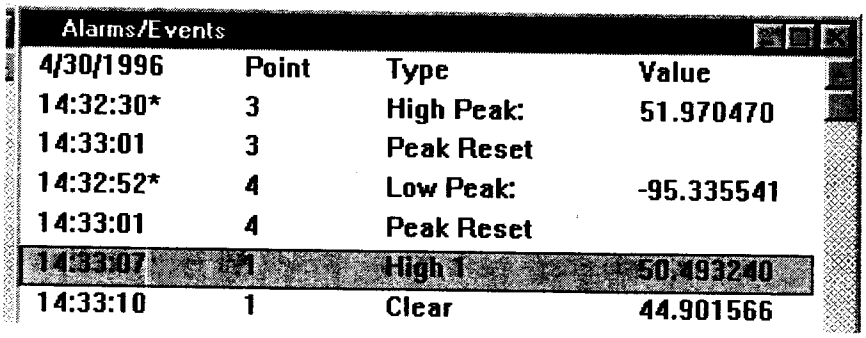


Figure 8-25 The Event Window.

The table contains the time stamp, Point Number, Event Type and the Value as shown above. Time stamps followed by a "*" are out of time sequence and are typically reset points which have two entries, the first is the time of the reset, the second is the time the actual peak was detected and its value.

A single entry in the event table is highlighted. This is the current sample. You can scroll up or down through the table using the up and down arrow keys, or you can use the vertical scroll bars and the mouse cursor.

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To synchronize other windows, graph, table or event, make sure that this table belongs to the same synchronize group as the other windows. Select "Event" from the menu to bring up the Event Option dialog box and enter the Synchronize group number. Press "OK" to return. Select the sample you are interested in then press the "S" key to Synchronize. All other open windows will jump to the same date and time location (or as close as they can get).

8.4.11 Print a Graph, Table, etc

With a Graph, Table, Event, Info, Report, or Config window as the selected window, select "File - Print" from the menu. This will bring up the Print dialog box. Refer to Section 8.3.1.7.

The radio buttons "From Start" and "From Current Position" determine where the printing will start. "From Start" will cause printing to start from the very beginning of the graph. "From Current" will cause printing to start where the graph is positioned in the window on the screen. The "To End of File" and "Page(s)" radio buttons select whether the printing will continue until the end of the graph or for the selected number of pages in the edit box beside the "Page(s)" radio button.

Select what pages you want to be printed. Press the Setup button if the printer needs to be setup. It is advisable to print in the landscape mode. If you are using a monochrome printer and there is more than one trace on the graph, use the Edit Pen option to set the line styles to make the traces more visible. Press the Print button to print.

Print will always use the default system printer. The default printer can be changed in the "Control Panel" using the Printers icon. In some versions of Windows, it can also be changed in the Print Manager. See the Window's manuals for details.

8.4.12 Exporting Data

Highlight the Graph or Table window you wish to export. Choose "File - Export" from the menu. If you were in a graph window all the pens will be exported together. The Export dialog box will be presented. The options are described in "Export" on page 8-3. Select "OK" and choose the file name from the File Save dialog box. Press "OK" to export.

Highlight a Config or Report window you wish to export. Choose "File - Export" from the menu. A File save dialog box will appear. Type the name of the file into which the text will be written. This allows the user to have the text of a configuration or Report into a text file that can be edited by the user to add notes, etc.

8.4.13 Using the Search Setup Dialog box

You must be in an active graphic window to search. Select "Search - Search Setup" from the menu or press Alt-F2 from the keyboard to bring up the search setup dialog box. Refer to section "8.3.2.3" on page 5.

Select to search for the next occurrence when the data for a given "Pen" is "Greater than", "Less than", or "Equal to" the "Value". Search will start at the current position and search either "Forward" or "Backwards" though the file. When the "Event Hopping" check box is checked, search will first search for the search condition to NOT be true then find the next occurrence when it is true. This allows the user to quickly go from one "event" to the next. The "Find" button will cause the search to occur right now. the dialog box will stay up until the "Close" button or the "Close" system button menu item is selected.

8.4.14 Synchronizing Windows

Synchronizing windows allows two or more windows to track one another with respect to time. Thus if you have a window with a table and a window with a graph synchronized as a single group, as the cursor bar is moved in the graphic window, so the table will be automatically

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updated. Similarly if you scroll through a table, any time you press the "S" key, the graph will synchronize with the table entry. If you do not want two windows to synchronize, assign them to different synchronize groups.

8.4.14.1 Assigning Synchronize Groups

8.4.14.1.1 Graphics

From a Graphics Window double click on the graph area. This will bring up the Edit Graph dialog box, or if the graphic window is active, you can select "Graph - Setup" from the menu. Use the Synchronize Group Edit line to enter the group number. Click on "OK" to return.

8.4.14.1.2 Tables

From a Table Window select "Table" from the menu to bring up the Table Option dialog box. Use the Synchronize Group Edit line to enter the group number. Click on "OK" to return.

8.4.14.1.3 Events

From an active Event Window select "Event" from the menu to bring up the Event Window Options dialog box. Use the Synchronize Group Edit line to enter the group number. Click on "OK" to return.

8.4.14.2 Synchronize Tips

For Graphic windows, turn the Graphic Cursor on by pressing the "T" key. This focuses the synchronize point at the cursor, otherwise the synchronize point is the Y Axis edge of the graph.

Tile the windows so that you can see what is going on between them. Maximize the main window to give yourself as much room as possible.

With tables and Events, you must press the "S" key to get them to synchronize.

If you are comparing graphs of last weeks data with this weeks by way of example, make sure the two graphs are assigned to different synchronize groups, else they will try to track one another by absolute date and time, and you will not be able to see two different periods.

8.4.15 Time Discontinuities

It is possible to add a trace to a graph by double clicking on the graph area to bring up the Edit Graph dialog box and selecting "Add". This added trace may represent data recorded at a totally different date to the trace already on the graph. The difference could be years. The two traces will obviously not overlap if they do not share a common time period, however the difference in time between the end of one graph and the start of the next is compressed where there is no data, and a band is placed on the chart with two vertical time stamps, the left hand time stamp is the end time of the older graph and the right hand time stamp is the start time of the newer graph. The time stamps may be separated by days or years. If you drag the cursor across this band you will get the actual time and date in the date window. Thus the time band separates traces that are not contiguous in time. Refer to Figure 8-26 below.

This time discontinuity band may also be seen in a single trace. If you are recording data at a rate of one sample per minute, then you stop for an hour and then continue, you will see the time discontinuity band in the graphic window at the point in the trace where you stopped for the hour. In fact, at any point in a trace at which the program determines there is a time continuity, be it seconds, minutes or days, it will insert the time discontinuity band.

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This feature allows the user to load totally unrelated files onto the same graph. For example you may have two recorders at different parts of the plant, one recording air pressure and one recording a process elsewhere. If the air pressure dropped, it may have affected the process. It is now possible to load the files from the two different recorders onto one graph and compare the dip in air pressure to the actual process. This may also be done in two separate graph windows that are synchronized.

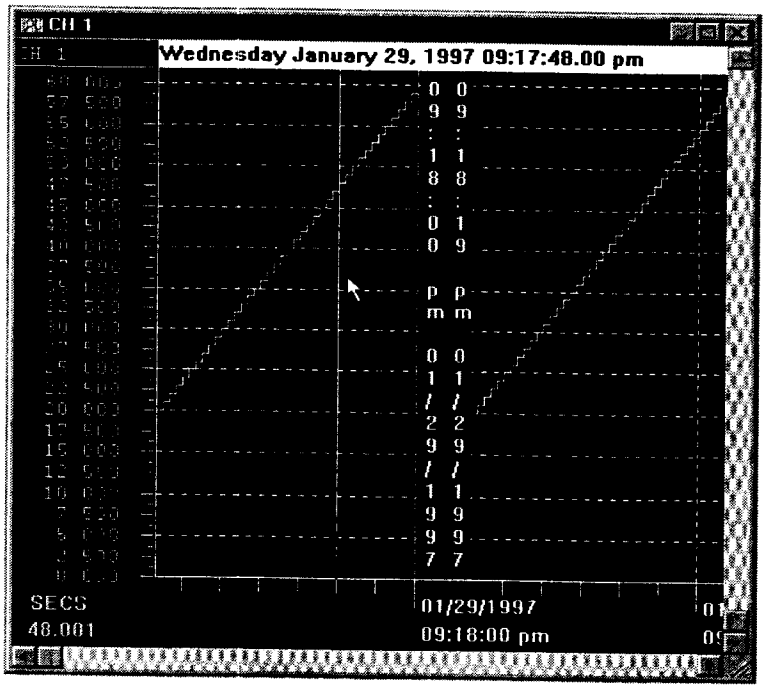


Figure 8-26 Time Discontinuity.

Note that the drag button in the horizontal scroll bar will affix itself to one or other ends as it generally cannot compute position across discontinuities. You can however use the left and right arrow buttons to move the window time frame.

8.5 Get Data

Get Data is a utility program supplied with every recorder. It is a very limited capability version of the Companion Software, allowing the user to export data from disk to spreadsheets. Installation is the same as for the Companion. Refer to "Installation" on page 2.

When you run the program, the only menu options are "Export" and "Exit"

To Export a file from the disk, select this menu option. You will get the "Read From" dialog box which is a file selection menu. Select the file type, source and the file name and press "OK". This takes you to the Export dialog box. Refer to "Export" on page 3 as the functions are identical.

To exit the program select the "Exit" menu option.

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Glossary of Terms

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