

Thermo Series 1600 is a technologically advanced 100mm programmable data recorder.

The Series 1600 combines the readability of an analog recorder with the flexibility, features and power of a microprocessor-based instrument.

From the most visible operator display to the most powerful post-data acquisition computation capability, the Series 1600 is more feature/benefit rich than any instrument of its type.

The Series 1600 will measure and process up to fifteen channels. These channels include four direct inputs consisting of millivolt, voltage and milliamp inputs, and a wide variety of thermocouples and RTDs. Inputs can be scaled linear, square root and/or logarithmic (with optional software). Up to eleven additional external, conditional or calculated points can be programmed.

The front panel of the recorder allows data to be simultaneously displayed on a large 12-character digital display and four color LCD bargraphs.



## Features

- Up to four direct inputs, fifteen total points
- Up to eight programmable contact outputs
- Standard front access RS232 serial port
- One or two optional serial ports RS232 and RS485/422
- MODBUS™ compatible communications
- 32 bit microprocessor provides advanced computation capabilities
- Four color LCD bargraph display indicates signal levels at a glance
- PC memory card supports historical data keeping
- Windows™ based PC configuration software

# Designed with the technician in mind . . .

## It will change your mind about recorders...

Traditionally, miniature recorders left a lot to be desired in the real world of industrial data gathering and recording applications.

In order to develop a recorder with unequaled reliability, Thermo drew upon its 50 years of industrial recording expertise to design a new generation of miniature recorders.

## Our design goals were simple...

- **32 bit microprocessor** - offers high speed operation, unequaled accuracy and programming flexibility
- **Reliable operation** - surface mount technology is used extensively in modular construction
- **Large displays** - four color LCD

bargraphs and 1/2" tall, 12 character LED alpha-numeric display

- **4 color trending** - for easy readability
- **Communications** - multipoint possibilities, RS232 front panel standard, RS422/485 optional on rear panel - MODBUS protocol

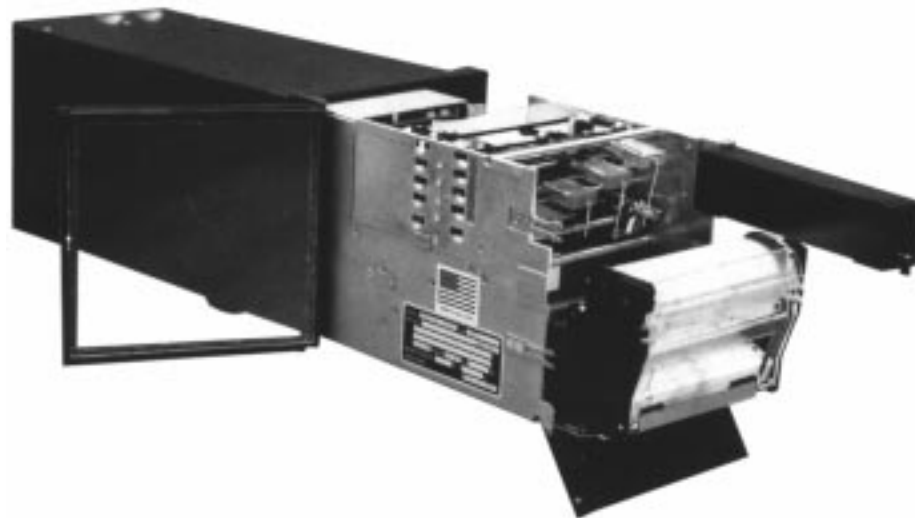
The 1600 series recorder measures 4 analog inputs (and 4 optional digital inputs) to drive one, two, three or four pens. Eleven calculated or conditional points and fifteen constants can be configured to perform peak monitoring, differentials, and averages. Gated timers, totalization, and conditional (Boolean logic) functions are available along with logarithmic calculations. A 40 operand equation is also possible by using only one calculated point. These

math capabilities allow you to pressure and temperature compensate flows, calculate total volume of vessels from level measurement, totalize the time an event is in alarm, determine flow through weirs and flumes, and many other applications.  $F_0$  computations are optional.

Disposable fibertip pens trend up to four variables in four colors while the thermal printer annotates the chart (see page 3). The optional 101 element bargraph displays pen position as well as alarm setpoints and alarm conditions. Point assignments to pens and bargraphs are programmable and calculated points can be trended. The front access RS232 port allows easy connection for downloading configuration information or collecting historical data. The two serial ports on the rear support RS422 or RS485 MODBUS communications.

The Remote Package provides four contact inputs for alarm acknowledge, changing scale sets, turning chart on/off or switching chart high/low speeds. Calculated points can be reset through these contacts or use them as event inputs. A 24 volt two-wire transmitter power supply is also available to power up to four 4 to 20 mA loops.

Four or eight alarm relay outputs are available. Points are programmed with up to 8 settings (Hi, Lo, rate, abnormal, open, close, true or false). Each setting can be programmed to activate a relay and multiple settings can activate a specific relay.



**Service and troubleshooting is quick and easy** - Removing the chart magazine is fast and simple. All printed circuit cards utilize high reliability surface mount components. Stepper motor servo drives position pens with geared tooth belts. Extensive diagnostic software is menu driven. Pens are disposable fibertip.

# Chart Printout - Comprehensive and easy to read . . .

Log of all points from the print menu provides header, point number, legend, data, engineering units and alarm status.

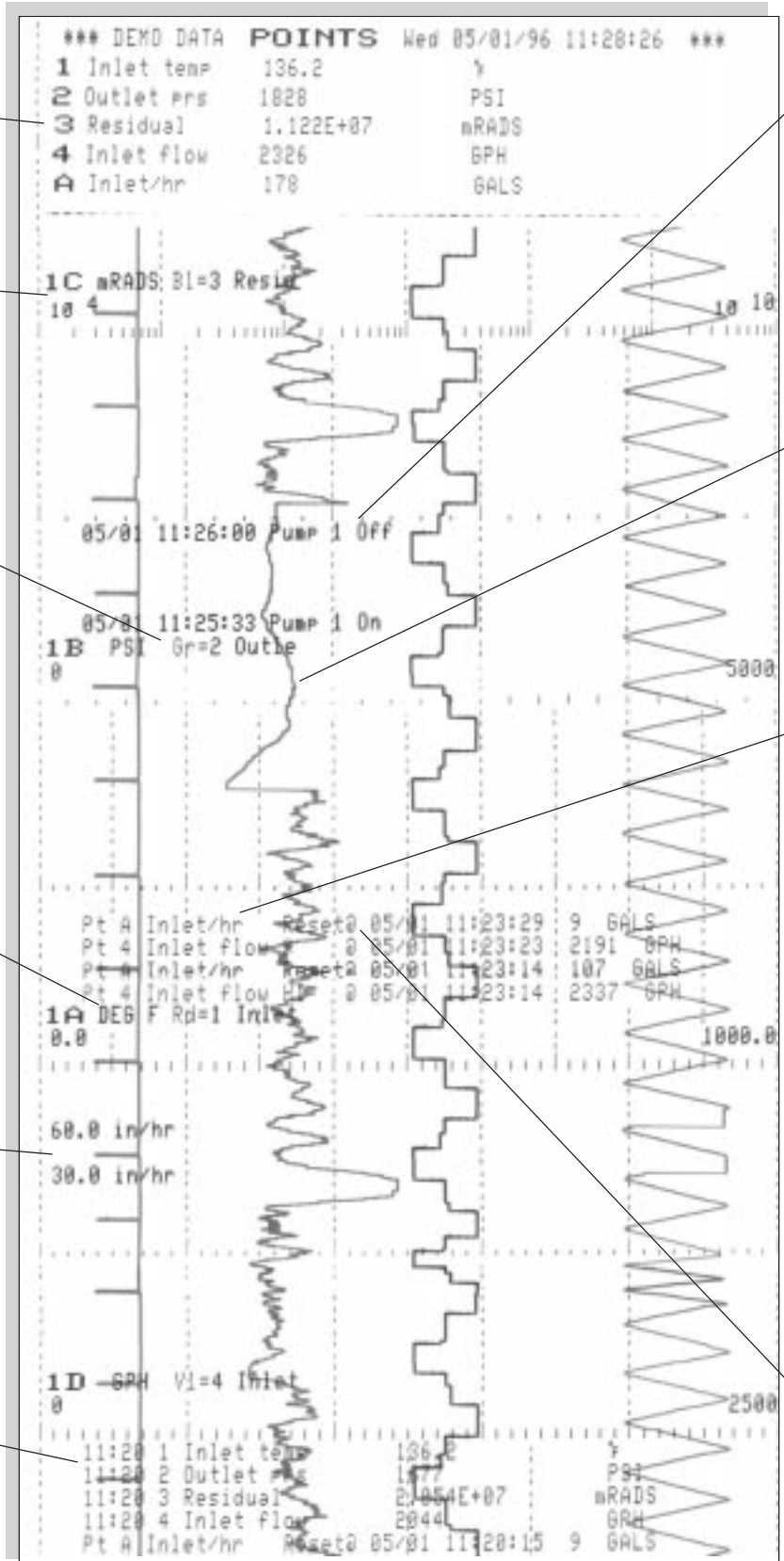
Two sets of eight fully programmable scales.

Pen assignment and point with tag legend is also included.

5-character programmable engineering units are printed for each scale.

Chart speed and time are printed whenever chart speed changes.

Interval logs can be programmed to start at a specified start time and at specified time intervals. They are printed at chart speed so as not to disturb time axis.



Event markers complete with 10-character message for beginning and ending of an event and time and date.

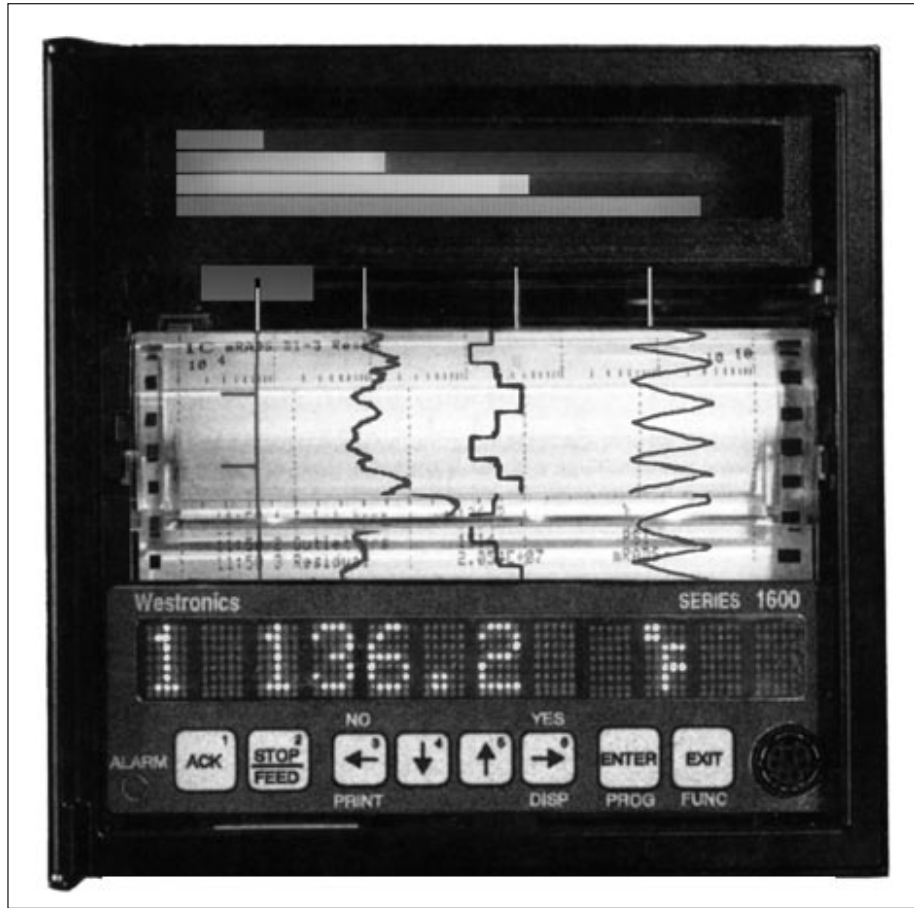
The programmable digital filter can smooth out noisy or erratic signals.

5 alarm set points per point. Time, point number, and type of alarm documented on chart. Also notes when points return to normal.

Resettable point types can be programmed to print on the chart a reset report. In case of Hi and Lo peak types, time and data printed correspond with the peak data latched.











# Designed with the operator in mind . . .



**Control/Information Panel** - Designed to provide convenient accessibility to all frequently used control keys required for operation and programming. An easy-to-read 12 character display provides complete point information, programming information, prompts, time and

date. The optional four color bargraph display provides fast and convenient monitoring of critical points. On the bottom left of the unit a red LED illuminates when there is an alarm or a unit fault. The standard RS232C communication connection is on the right side.

-  <sup>1</sup> Acknowledges alarms and de-activates the red alarm LED.
-  <sup>2</sup> Controls the chart and printing/recording functions.
-  <sup>3</sup> Provides a NO function when in a programming menu or left arrow to move a blinking cursor. This key will access the Print Menu from the Command Prompt.
-  <sup>4</sup> Used to scroll backwards through menus and menu items to select letters, symbols and numbers.
-  <sup>5</sup> Used to scroll forward through menus and menu items to select letters, symbols and numbers.
-  <sup>6</sup> Provides a YES function when in a Programming Menu or right arrow to move a blinking cursor. This key will access the Display Menu from the Command Prompt.
-  Will accept new programming, characters or values programmed. This key will access the Program Menu from the Command Prompt.
-  Will back the program up to the next higher menu when in a menu. This key will access the Function Menu from the Command Prompt.

**Select any one of four menu levels of operation . . .**

**Display Menu** — The Display Menu can display any programmed point or group of points, any current alarm or series of alarms, time and date, previous data before a reset, current chart speed, unit faults, and version of operating software.

**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 chart speed, turning alarm check on or off, and choosing scale set 1 or 2.

**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. Program Menu and Function Menu items may be passcode protected to prevent unauthorized entry.

**Print Menu** — The Print Menu allows printing of a complete list of current data and status of programmed point (Log points), a profile of system status parameters (Log profile), a listing of point program setup parameters for each point (Log program), one of sixteen preprogrammed messages (Trend Message), or the current time and date (Trend Time) can be printed on the chart.

# Specifications

## POINTS

<b>Capacity</b>	4 direct analog input channels, 15 total points (including analog inputs and calculated and external channels)
<b>Measurement Rate</b>	Selectable: all points every 250mS (4 analog inputs) or 125mS (2 analog inputs)

## ANALOG INPUT POINTS

<b>Standard Types</b>	DC Voltage: Linear and square root programmable to 10V (100mV, 1V, and 10V ranges) DC Current: Linear and square root programmable to 4 - 20 mA, 10 - 50 mA Dry Contact Thermocouple: J, K, T, E, R, S, B, C, Nicrosil Nisil, and Nickel/Nickel Moly
<b>Optional Types</b>	RTD: 10 ohm Cu, 100 ohm Pt 385, 100 ohm Pt 392, 200 ohm Pt 392, 120 ohm Ni and log programmable
<b>Accuracy</b>	Voltage: $\pm 0.05\%$ of programmed range Current: $\pm 0.1\%$ including shunt resistance Thermocouple: $\pm 1.5^\circ\text{C}$ for J, K, T, E, Nicrosil-Nisil and Nickel/Nickel Moly; $\pm 3^\circ\text{C}$ for R, S and C; $\pm 4^\circ\text{C}$ for B RTD: $\pm 0.5^\circ\text{C}$
<b>Resolution</b>	0.003% of full scale
<b>Impedance</b>	>10M ohms 100mV and 1V ranges, 30K ohms for 10V range
<b>Common Mode Voltage</b>	300 Vac p-p
<b>Common Mode Noise Rejection</b>	>120 dB at 50/60 Hz
<b>Normal Mode Noise Rejection</b>	>60 dB at 50/60 Hz

## CALCULATED POINTS

<b>Standard Types</b>	Equation: parenthetical algebraic entry (addition, subtraction, multiplication, division, square root, powers, Ln, L <sub>10</sub> ), unlimited nesting, 40 operators max Hi Peak, Lo Peak, HILo difference, Moving Average, Gated Timer
<b>Optional Types</b>	Logarithmic, Flow Totalization, Sterilization (F <sub>0</sub> , F <sub>h</sub> )

## PRINTING

<b>Method</b>	9 dot moving thermal printhead
<b>Chart Annotation</b>	Chart grids, alarm annotation, channel ID, logs, chart scales and engineering units
<b>Chart Scales</b>	2 sets of 8 scales, left, right or center origin, scale compression/expansion

## TRENDING

<b>Medium</b>	Disposable fibertip pens; writing length 3500' Pen 1 Red, Pen 2 Green, Pen 3 Blue, Pen 4 Violet
<b>Trended Accuracy</b>	$\pm 0.3\%$ of chart scale, pen positioning by optical sensor feedback Pen Offset Compensation for time axis alignment of pens on the chart (selectable)
<b>Pen Response</b>	1 second (10% to 90% of scale)
<b>Chart Paper</b>	Thermal fanfold, 4" (100mm) x 52" (16M)

## CHART SPEEDS

<b>Standard</b>	Programmable: 0.5 in/hr min; 600 in/hr max
<b>Metric</b>	Programmable: 10 mm/hr min; 15000 mm/hr max

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Windows™ is a trademark of Microsoft Corporation

## DISPLAY

<b>Alpha-numeric</b>	12 character, 5 x 7 LED display, update rate programmable 1 to 60 seconds
<b>Bargraphs (opt)</b>	Four, 101 element, red, green, blue, violet

## FRONT PANEL

<b>Keyboard</b>	Tactile-feedback keys support unit set-up, alarm acknowledge, start-stop chart, and paper feed
<b>Alarm/Fault Indicator</b>	Red LED display indicates point-in-alarm conditions & unit faults
<b>Serial Port</b>	Front panel RS232 standard

## INPUT/OUTPUT

<b>Serial Channel (opt)</b>	Up to two RS422/485, selectable MODBUS ASCII or RTU protocol, selectable from 300 to 19200 baud Support for up to 31 instruments in a multi-drop environment
<b>Alarm Contact Outputs (opt)</b>	4 or 8 dry Form "C" contacts, rated 1A at 117 Vac and 26 Vdc, 0.5A at 230 Vac (resistive) Assignable to any point(s) alarm and/or abnormal conditions
<b>External Digital Inputs (opt)</b>	4 inputs assignable as Chart On/Off, Alarm Acknowledge, Event Marker, or Active Chart Scale Set Select
<b>PC Memory Card (opt)</b>	.25, .5, 1 or 2 meg available

## POWER

<b>Mains Requirements</b>	90 to 264 Vac, 47 to 63 Hz or 24 Vdc at <30 VA
<b>Failure Protection</b>	Programmed parameters stored in EEPROM memory. Clock circuit sustained for minimum of 72 hours with AC power removed.
<b>Sensor Power (opt)</b>	24 Vdc at 150 mA, Two-wire transmitter power

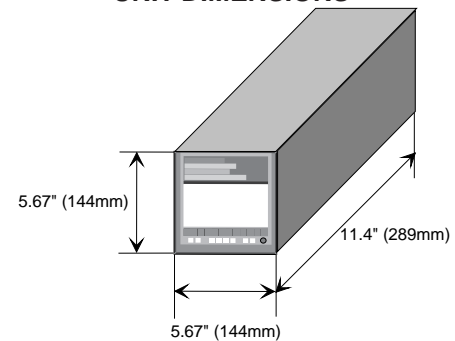
## WEIGHT

4 pen model, 12.2 lbs.

## ENVIRONMENTAL

<b>Operating Temperature</b>	0° to 45°C
<b>Operating Humidity</b>	30% to 85% RH non-condensing
<b>Electromagnetic Compatibility (opt)</b>	Compliance with European Union EMC Directive 89/336/EWG (CE Mark); Compliance with EPRI Report TR-102323
<b>Seismic</b>	IEEE 344-1987

## UNIT DIMENSIONS



Thermo Electron implementation of new developments and product improvements may result in specification changes in this document

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