

Model 2000

Web-enabled flow computer



Applications

- High accuracy gas and liquid flow computer *
- Station controller, liquid prover / grab sampler and valve & PID loop controller

Brief information

Scope: The Model 2000 web-enabled flow computer is designed for hydrocarbon liquid and gas measurement and control applications. The advanced features support flexible configurations for multi stream fiscal and custody transfer measurements based on volume, mass and energy calculations using the latest applicable AGA, ISO and API standards available.

Model 2000 can be configured for use either as stand-alone single or multiple stream flow computer supporting turbine, rotary, ultrasonic, orifice, density, venturi and coriolis flow meters or as a system component serving station controller, liquid prover / grab sampler or valve & PID loop control functionalities.

The top of the range Model 2000 flow computers provide remote control capabilities using web-based TCP/IP technologies for remote front panel operations, configuration set-up and pass-through communication ports enabling remote meter and transmitter diagnostics.

Model 2000 innovative digital technology: Elster-Instromet's involvement with flow computers started 30 years ago, but the last decade has shown a quantum leap through the use of digital technology. The flow computers have evolved from pure analogue stand-alone machines into the current state of the art digital web enabled system components ready to meet the challenge and requirements of the 21st century large scale liquid and gas metering.

Complete digital signal handling of SMART temperature, pressure and differential pressure transmitters through proven 32-bit high-speed microprocessor technology guarantees the full accuracy of the measurement is preserved. Ambient temperature dependence of signals is eliminated and the system performance is solely limited to the inherent accuracy of the transmitters. Digital communication is also used when connecting to turbine, rotary and ultrasonic flow meters, gas chromatographs and other energy measurement devices.

The Model 2000 digital flow computer features distributed processing and dual port memory access techniques to accomplish maximum system performance. All I/O cards have local processing capabilities to support on-board signal interfacing, control and alarming functionalities.

Main features

- High accuracy (error < 0.1%)
- 100/10 Mhz Ethernet ports
- Multiple P, T and ΔP transmitters
- Online density and relative density measurements
- Single or multiple stream(s)
- Compatible to a wide range of gas chromatographs
- Data, audit and alarm loggers
- Liquids & gas calculations to AGA / ISO / API
- Configurable display menu's, symbols, units
- Max. 5 multifunctional I/O boards
- Windows® configuration software
- USB programming interface
- Metrological approved: NMI, METAS, BEV, GOST, UKRAIN
- Pattern evaluation reports: EN12405

* For turbine, rotary, ultrasonic, orifice, venturi, and coriolis flow meters

Model 2000: Web-enabled flow computer

Configuration and programming

Accuracy and reliability

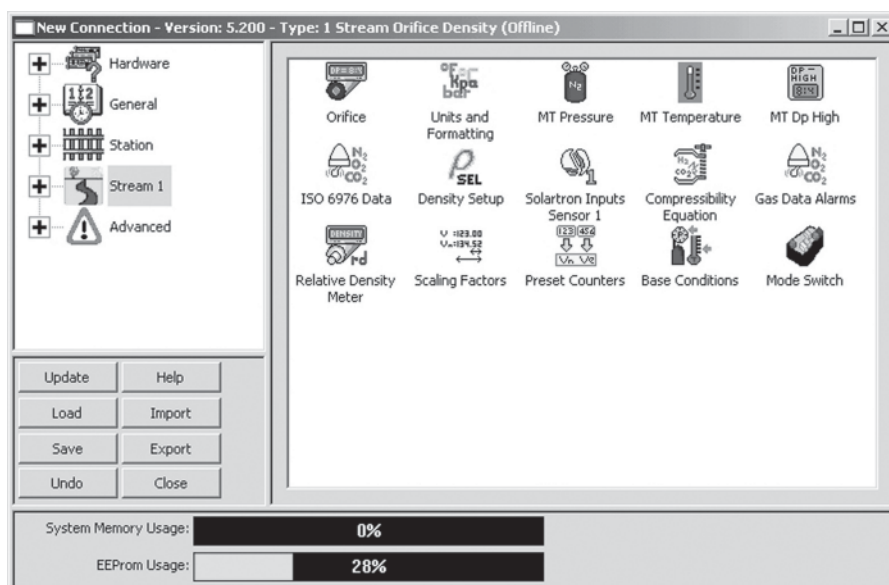
Both energy conservation and efficiency improvement in oil and gas utilisation call for more accurate metering. Open access for third parties to transmission lines or even distribution systems has been introduced in many countries and is gaining further support from regulatory bodies. Under such a regime where a pipeline owner only receives a fee for the transportation without the opportunity to profit from the gas sales, the financial risk of inaccuracies or malfunction of metering equipment may be very high, especially on short distance transmission. Reliability is at a premium for the Model 2000, both where it affects accuracy of metering and where it affects operation.

Adaptability and flexibility

Today's oil and gas metering calls for adaptable solutions both in hard- and software design. The Model 2000 flow computer offers this flexibility in providing a large range of modular I/O interface boards supported by advanced user programmable software features. The menu (icon) driven Model 2000 Windows® interface is highly thought of by many of our worldwide customers.

Metering compatibility

The Model 2000 flow computer is designed to calculate the energy, mass and volume totals and instantaneous flow rates of gas and hydrocarbon liquids. Calculations are carried out using inputs from pulse generating turbine/rotary meters, ultrasonic meters, coriolis meters, venturi meters or from differential pressure measurements across orifice plates together with line temperature and line pressure transmitters. It uses preset or active input values of relative density, gas composition data and heating value. Active values can be received directly from gas chromatographs or can be written serially from supervisory systems.



Compressibility

The flow of gas is calculated using gas compressibility equations (Z) selected from a list of which includes AGA 8, ISO 12213, AGA 3 NX19 as well as fixed factors or table factors for non natural gases. Alternatively the flow of gas can be calculated using a transducer for line density. The flow of liquids is calculated using fixed or measured factors for density and relative density and correction based upon measured temperature and pressure of the liquid in accordance with the API standards chapter 11.2.1M, 11.2.2M and chapter 12.

Sensor select and alarming

Facilities of both high and low alarming on all active input signals are available. The alarms can be selected to enable a default value, a serial check value (from supervisory systems), an average value or a input value from an alternative sensor to be used in the flow calculation for the parameter in alarm. Indication is given of the time of occurrence and clearance of the alarm state. Solid state alarm output signals are also provided.

Digital process inputs

Digital communication (by HART protocol) is supported for differential pressure,

pressure, temperature and multi-variable (dP,P,T) transmitters eliminating the need for calibration of the Model 2000. This feature also eliminates the errors in flow measurement due to ambient temperature effects on the Model 2000, only the temperature coefficients of the transmitters contribute to the overall error. As an alternative the Model 2000 can be operated from transmitters that supply 4-20mA current output and also direct from a 100 ohm platinum resistance thermometer for temperature measurement. These types of input are measured using analogue inputs and a high resolution (24-Bits) A-D converter. All analogue inputs are calibrated using software.

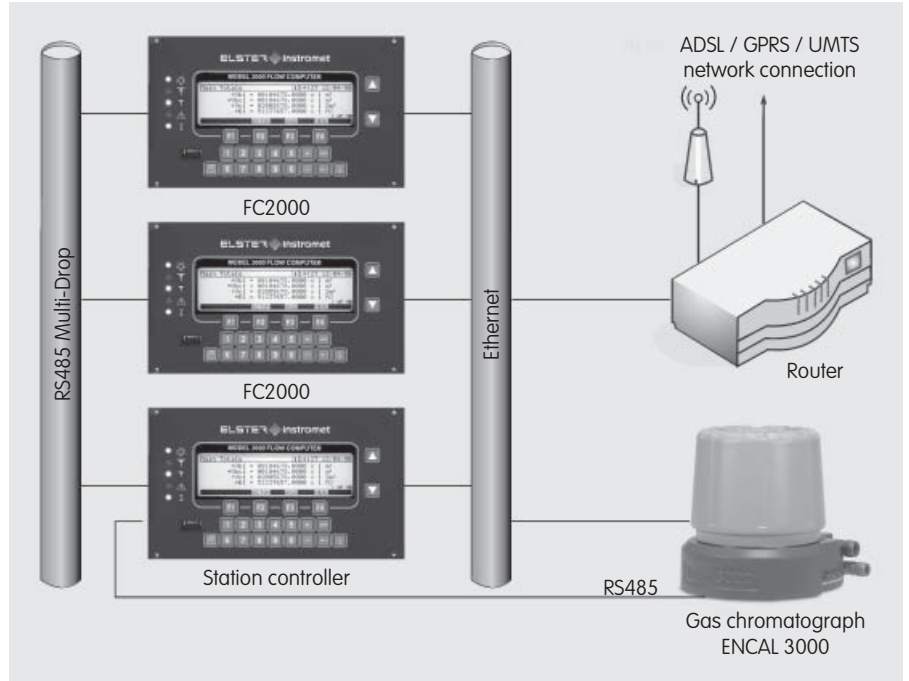


Serial communication features

Serial communication ports

Two high speed serial RS232/RS485 communication ports are provided as standard on the MPU module for data communication to a wide range of system devices or printers. Two or more extra serial ports can be used when fitting a COMMS module. All ports are programmable for the hardware mode of operation (RS232/ RS485), baudrate, parity, start and stop bits and handshaking protocols. A wide range of protocols and functions can be assigned to each port e.g.:

- Modbus ASCII or RTU
- Password Modbus ASCII / RTU
- E-I ultrasonic (uniform / RTU)
- E-I ultrasonic (thru-port)
- E-I ENCAL 3000
- Chromat ASCII or RTU
- Panametrics GM868
- Daniels senior sonic
- Sick Flowsic 600 (Modbus ASCII)
- Micro motion RFT9739 (ASCII)
- Serial printer
- Station controller
- Smart index / FI Encoder



PID analogue output control

An analogue output function is available that can be used to control process variables like flow rate, temperature, pressure, etc. via analogue output signals. The PID function uses the difference between a set point and a process value as input for its calculation. The analogue output value is controlled to be the sum of a proportional, integral and derivative action. It has a forward / reverse parameter to use the controller in the correct direction.

Gas chromatograph support

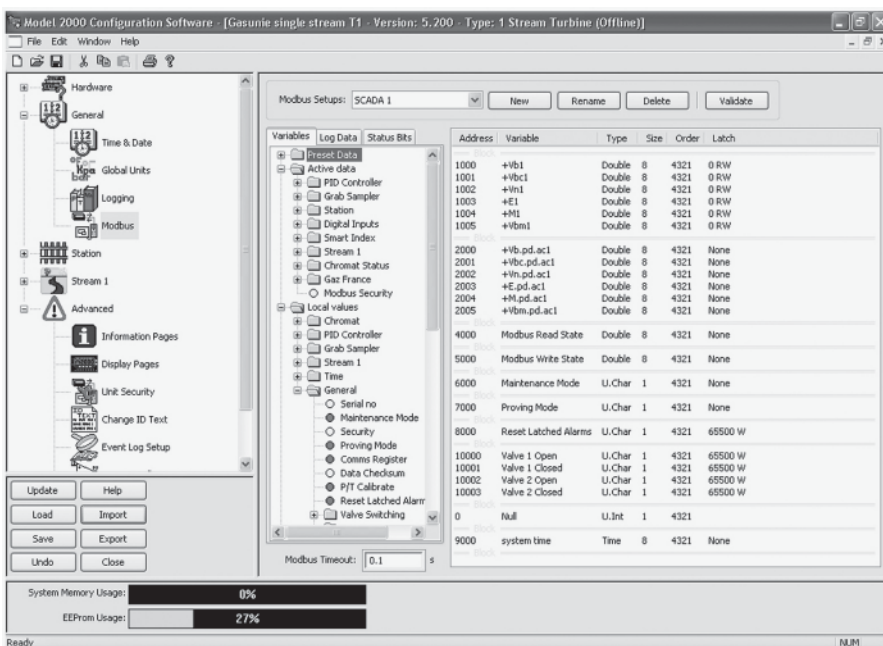
Since the Model 2000 can be used in a variety of gas measurement applications we have expanded our compatibility to a wide range of leading manufacturers of gas chromatographs e.g.:

- E-I ENCAL 2000/3000 (EU/USA)
- E-I ENSONIC
- Daniels 2251, 2551, 2350
- ABB 8000/8100
- ABB 3100
- Yamatake HGC303
- Siemens Optichrome
- Rosemount GCX
- OSC-01-E (Gasunie NL)

Multiple density transducers

The density inputs for the Model 2000 are high frequency periodic inputs. Two brands of density transducers are supported: Solartron and Sarasota. On alarm the FC2000 calculations can be programmed to continue with density keypad values, or alternative density values can be calculated from AGA8. Hourly and daily averages are available.

Optionally one density input can be configured as relative density input. When this type of input is selected this measurement will take priority over any value received for relative density from a gas chromatograph.



Model 2000: Web-enabled flow computer

Web-enabled Ethernet access

Networking module

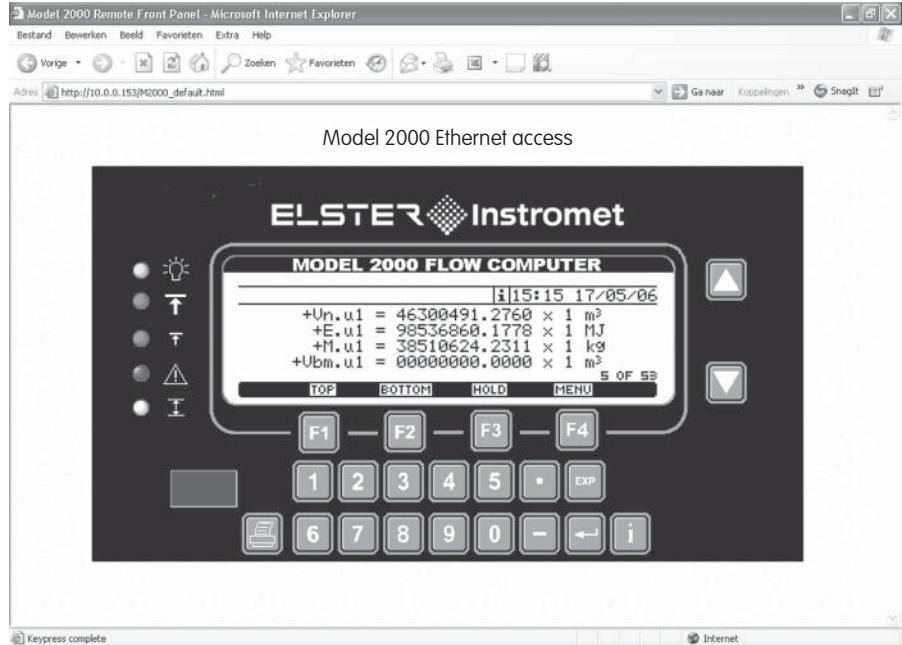
The Model 2000 can be equipped with one or more (independent) Network 2 modules. Each module provides a fast 10/100 MHz Ethernet port connection via a standard 8-pin RJ45 connector. Initial set-up and configuration of the Ethernet ports is done via the front panel USB programming port together with the Model 2000 Windows® programming tool. Correct connection to a network and communication is ensured by LED status indicators.

Model 2000 Ethernet features

The Ethernet port(s) allow full remote configuration as well as data collection of the Model 2000. Protocols like TCP/IP and Modbus over TCP/IP are supported as standard while others are under development. Multiple (PC) servers are allowed to access metering data from multiple flow computers in a web-based network system using standard available routers or switches. The Ethernet package data transfer is far more versatile than any other communication protocol. It allows data communication from any device to any other device (no dedicated master/slave) using unique IP address techniques and supports modern communication networks like GPRS, ADSL, Fibre-Optics, etc..

Remote front panel access

A unique feature of the Model 2000 Ethernet 2 module is the support for remote front panel operations. Access is provided using a standard web browser (Explorer) application selecting the IP-address of the device. On connection a JAVA applet will be started automatically and a virtual Model 2000 front panel will pop up. The PC mouse (or keyboard) is then used to activate any of Model 2000 keyboard buttons. All local keyboard and front panel functions are supported remotely (including alarm-log access and edit functions). The remote front



panel assists remote maintenance. Any local operator can be guided through the various menus from remote (and vice-versa).

Network pass through

Network pass through capabilities offer another unique aspect of the Model 2000 Ethernet functionalities. It allows any remote PC or supervisory system to access directly pressure or temperature transmitters, meters and/or gas chromatographs connected to the Model 2000 flow computer using any specific serial manufacturer's protocol. Remote serial diagnostics software can be used since the serial RS232 port is emulated in the PC or supervisory system.

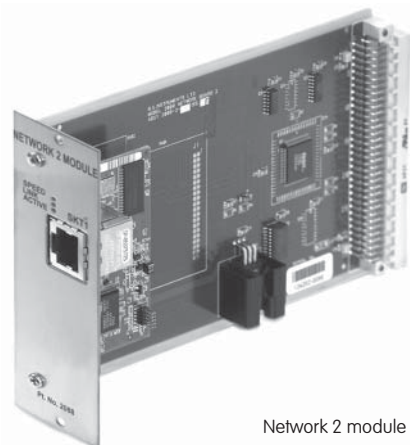
Pass through communication is suitable for many applications. For example to remotely read and configure HART transmitters using software packages provided by transmitter manufacturers or third parties e.g.: AMS or PACTware. Similarly uniform protocols can be used to read or diagnose ultrasonic meters remotely. Modbus packages over TCP/IP can be used to retrieve online and stored (logged) data from any Model 2000 flow computers for storage in supervisory systems.

Ethernet advantages

- Fast communication, worldwide
- Very good error recovery
- Multiple protocol support
- Modbus over TCP/IP
- Multiple PC - multiple FC's
- Up to 7 sessions per FC
- Remote front panel operation
- Network pass through
- Emulated RS232 port
- Easy set-up (using USB front panel)
- Remote diagnostics
- Remote Model 2000 configuration

(Currently under development)

- Remote firmware download
- Network printer support



Network 2 module

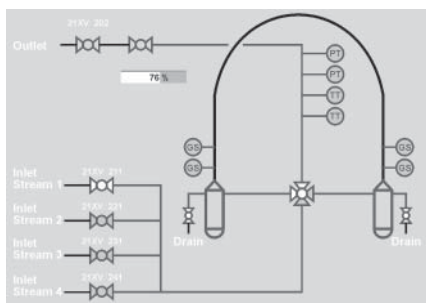
Supervisory and logging

ISS supervisory systems

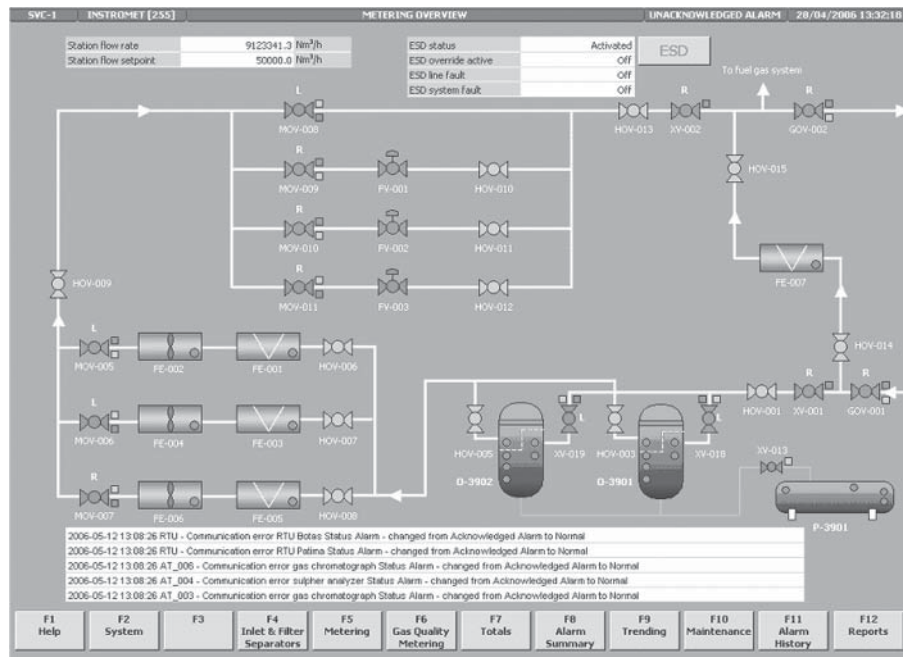
Elster-Instromet is specialised in gas measurement for more than 30 years. During this time we have not only proven to be a reliable manufacturer of the highest quality, but also a flexible solution provider of high accuracy measurement systems. The turn-key solutions are tailor made and range from small district metering and reduction stations to custody transfer border stations. Complete solutions include meters, skids, analyser houses, flow computers, station controllers, control cabinets and supervisory systems are widely used in many on- and offshore applications.

This expertise has led to one of the most advanced custody transfer supervisory systems available on the market at present. The core of the system is the Elster-Instromet Supervisory Suite (ISS) software being more than a SCADA package. ISS is developed specifically for gas and liquid applications where accurate calculations, data processing and reporting are of the utmost importance. Such applications include gas & liquid metering stations, calibration installations, telemetry, remote metering, billing and pipeline monitoring systems.

As a system component this is where the Model 2000 web-enabled flow computer / station controller fits best.



Liquid prover application



Data loggers

Model 2000 can be configured to log up to 16 different tables of data. Each table can be configured to log any parameter either at a programmable time interval (1 min. to 1 month) or at the occurrence of an event. The number of logs for each table can be set. The maximum number of items is defined as the sum of all active tables up to a maximum of 150,000 items for a Model 2000 with a large memory MPU board fitted.

Alarm logging

Alarm logging is provided at the occurrence and clearance of each alarm, fault and warning. Up to 160 separate alarms can be stored and indicated with date and time of the occurrence.

Audit / event log

An audit / event log is available to record up to 500 events with date and time of occurrence. To and from values for data changes are stored to support audit trail facilities.

Logs retrieval

All data, alarm and audit/event logs can be retrieved from Model 2000 using the:

- Front panel USB port
- Network ports

- Modbus serial ports
- Optional serial printer port (for direct paper reporting)

The logs can be stored on a PC or supervisory system or be exported directly into spread-sheets for additional processing by mainframes.

User configurable display

Not only the language of all display parameters and their names can be configured also the items which are required to display are user defined.

Report printing

Report printing is supported in a very user friendly and flexible manner. Multiple free-programmable user defined reports can be generated using the Model 2000 configuration software. Available print options are:

- Alarm print, automatic data mode or in maintenance mode print
- Front panel print button
- History type reports
- Daily, weekly or monthly reports
- Multiple contract times
- Data in any format or decimal places
- Print logged data
- Print maximum, minimum or average columns

Model 2000: Web-enabled flow computer



Technical data	
Hardware architecture	Motorola Coldfire microprocessor 32 bits, 40 MHz - RAM data memory 16 MBit, flash program memory 8 or 16 MBit, EEPROM preset memory 1 MBit
Calculation gases	Compressibility: AGA3-NX19, GOST, AGA 8 (full composition), ISO 12213, Fixed Z, Table Z Flow calculations: ISO 5167 (2003), AGA 3; STACA / CATS (North Sea) Equation Support Heating Value & Relative density: ISO 6976 (mass or volume based) (molar percent or mass fraction) AGA Report No. 9 - US Meter; AGA Report No. 7 - turbine Meter
Density	Density and relative density periodic type transmitter support. - Solartron or Sarasota equations - Upstream or downstream calculation - Temperature and/or VOS compensation
Calculation liquids	Simple fixed density: - Water or fuel oil (fixed K-factor) Condensate based measured density: - Oils - API Chapter 11.1 Tables 53A and 54A - NORSOK I-105 - API Chapter 11.2.1 and 11.2.2 - ASTM-D-1250 - API MPMS 12.2.5.3 & 4
Prover functions	API MPMS12.2.5.1 to 4
Pulse integrity	API 5.5 level A, ISO6551 level A, pulse interpolation, dual pulse chronometry
Steam	ISO 5167 Venturi Equations
Wet gas	ISO 5167 Orifice and Venturi equations - De Leeuw correlation - Dickinson Jamieson correlation - Steven correlation - Chisholm correlation - Homogenous correlation (measured line density)
Station controller	Up to 5 (optional 8) flow computer can be served - Station pressure and temperature measurement - Distribution of gas data to all connected flow computers - Station totals and flow calculations, display and reporting - Average gas data calculation - Stream flow comparison (mixed types e.g. turbine and ultrasonic)
Ethernet	One or more independent Ethernet ports (10/100 MHz) - Multiple protocol support, Modbus over TCP/IP, remote front panel operation - Remote diagnostics, configuration and set-up, max. 7 sessions per Ethernet port - Pass through communication support
Serial ports	Two or more isolated serial ports (RS232/RS485) programmable baudrate up to 115kB - Station totals and flow calculations, display and reporting
Analogue / pulse outputs	4 analogue 4-20 mA current loops (16 bit D/A conversion max error 0.15%) per output module 12 pulse / alarm or status opto-coupler outputs per output module
Inputs (per module)	2 pulse counting / frequency inputs (5kHz) for turbine (pulse) or density input signals 2 HART transmitter loops (max. 3 transmitters per loop) 4 analogue inputs 4-20mA (24 bit A/D conversion) 1 (optional 2) direct PRT input(s) (3 or 4 wire) 3 digital status inputs
Power supply	21 to 28 V DC maximum 25 VA
Display	Liquid crystal with backlight, large viewing area 130 x 34 mm with 240 x 64 pixels
Dimensions / mounting	Custom designed and manufactured construction, Dimensions 128 x 213 x 235 mm (H x W x D) Half 19" (3U) rack mounted or panel mounted
Temperature range	Operating 0 to +60 °C, storage 0 to +70 °C
Accessories	- Rack mounted counter module (max. 4 electromechanical counters) - Printer unit using ink ribbon with integral paper rewind - 19" rack for cabinet mounting, will hold two M2000 with a printer and counter module USB programming cable and Windows configuration software

I/O interface modules



Module type	MPU	MPU ext. memory
Part number FC2000-SP....	2134	2024
32 bit high speed MPU (40MHz)	x	x
16 Mbit data memory (RAM + battery backup)	x	x
8 Mbit program memory (FLASH)		x
16 Mbit program memory (FLASH)	x	
1M preset memory (EEPROM)	x	x
2 isolated RS232/RS485 serial ports	x	x

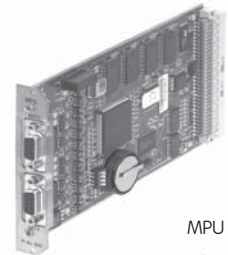
Module type	Comms	Comms 2
Part number FC2000-SP....	2032	2087
2 isolated RS232/RS485 serial ports (up to 115 kbaud)	x	x
Dual port memory access (multiple serial boards possible)		x

Module type	Input	Input 2	PRT	PRT 2
Part number FC2000-SP....	2037	2080	2030	2085
2 HART inputs (each 3 transmitters)	x	x	x	x
4 current inputs 4-20 mA (24 Bit)	x	x		
1 PRT input (PT-100 3 wire)	x	x		
2 PRT inputs (PT-100 4 wire)			x	x
3 digital status inputs	x	x	x	x
2 HF inputs	x	x	x	x
1 prover pulse output		x		x
Pulse integrity check		x		x

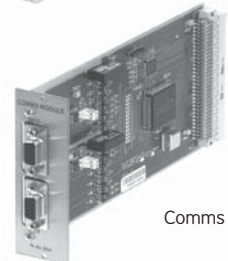
Module type	Output	Output 2
Part number FC2000-SP....	2033	2083
4 isolated current loop outputs 4-20 mA (16 bit)	x	x
12 isolated switching outputs (opto-coupler)	x	x
Analogue output calibration switch		x

Module type	Network 2
Part number FC2000-SP....	2088
1 Ethernet connection (10/100MHz) RJ-45 - 8 pin	x
Remote front panel operation	x
Modbus TCP/IP support	x
Pass through communication enabling transmitter diagnosis	x
Configuration set-up	x

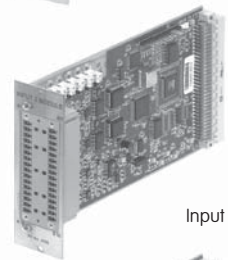
Module type	Power supply
Part number FC2000-SP....	2038
1 power supply input nominal +24VDC (21 to 28 VDC, 25 VA)	x
1 auxiliary output supply +24VDC (fused)	x



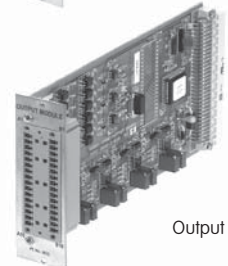
MPU



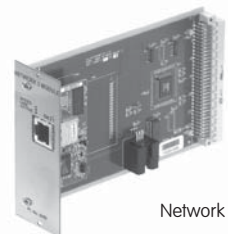
Comms



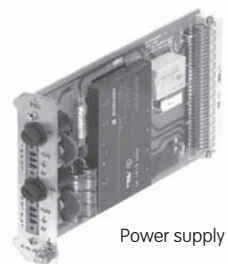
Input



Output




Network

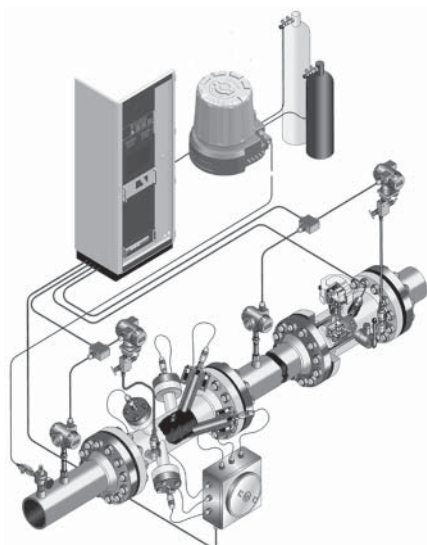


Power supply

Model 2000: Web-enabled flow computer

Model 2000 Type selection guide																	
Application	Features 	Streams		Flow meter type						Flow correction				Primary flow measurement			
		Minimum	Maximum	Turbine / rotary (various brands)	Ultrasonic (various brands)	Orifice plate	Coriolis (micro motion RF19739)	Venturi	Venturi 2 (Flow line stream)	Density (ρ)	Pressure (P)	Temperature (T)	Compressibility (Z)	Gas chromatograph (Hs, gas data)	□	HART	Serial
															Pulse type meter	Differential pressure (dP)	Multi variable mass flow (dP, P, T)
Gas	T1, T2, T3	1	3	x						x	x	x	opt.	x			
	U1	1	1		x					x	x	x	opt.				x
	U2, U3, U4	2	4		x					x	x	x	opt.				x
	O1, O2	1	2			x				x	x	x	opt.		x		
	TD1, TD2, TD3,	1	3	x					x				opt.	x			
	UD1	1	1						x				opt.				x
	UD2, UD3, UD4	2	4						x				opt.				x
	OD1, OD2	1	2			x			x	x	x		opt.		x		
Liquid	LT1	1	1	x					x					x			
	LTD1	1	1	x					x					x			
	LC1, LC2	1	2				x		x	opt.	opt.			x			x
Steam	VT1, VT2	1	2				x		x	x	x				x		
Wet gas	WGV1	1	1				x		x	x	x				x		
	WGV21, WGV22, WGV23	1	3					x				x				x	
Station controller	STN5	1	5	Controller applications (non measurement)													
	STN8	1	8														
Prover	Liquid prover	1	4														

Other Model 2000 advanced features



- Cost effective for all configurations
- Reliable reputation both hardware and software
- Flexible configuration for all applications
- Windows® 2K, NT and XP compatible configuration software
- Software can be configured at office PC before downloading in Model 2000
- Software updates and configuration can be sent immediately via e-mail
- Fully secure using password and security switch protection
- Integrated firmware downloader in Windows® configuration software
- Self checking of data and memory for correct internal operations
- 15 minute totalizers
- Maintenance mode and hold totals mode
- Metric and imperial units
- Valve control outputs (selectable pulse on-time, use in odorization)
- Turbine meter lubrication support
- Pollution measurement for power stations (emission factor calculations)
- Liquid grab sampler system support

Your contacts

Germany
 Elster-Instromet GmbH
 Steinern Str. 19 - 21
 55252 Mainz-Kastel
 T +49 6134 605 0
 F +49 6134 605 223
 www.elster-instromet.com
 info@elster-instromet.com

Belgium
 Elster-Instromet N.V.
 Rijkmakerlaan 9
 2910 Essen
 T +32 3 670 0700
 F +32 3 667 6940
 www.elster-instromet.com
 info@elster-instromet.com

Singapore
 Elster-Instromet
 Singapore Representative Office
 80 Marine Parade Road
 09-04 Parkway Parade
 Singapore 449269
 T +65 6247 7728
 F +65 6247 7729

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