

Thermo Scientific AutoPILOT PRO

One-to-Six Run Gas Flow Computer for Midstream and Transmission

The Thermo Scientific™ AutoPILOT™ PRO System is built on an innovative, field-proven technology platform for applications in transmission, processing, custody transfer and station control.

- Per second flow calculation on up to six meter runs simultaneously
- Customizable keypad and LCD screens to view specific parameters
- Interfaces with differential and linear signal devices
- Superior lightning protection built into each board
- Full USB support and high speed Ethernet connectivity
- Configurable screens in AutoCONFIG program



Thermo Scientific AutoPILOT PRO



Single Run or Expandable System

The next-generation Thermo Scientific AutoPILOT PRO gas flow computer is available as a single run measurement device, or as an expandable system capable of measuring up to six runs with full station control. Simply add input/output (I/O) as needed with no upgrades required to meet changing measurement and control requirements. With fewer instruments to monitor and maintain, staff consolidation and a reduction in spare parts inventory enable greater cost control.

Accurate and Powerful

Quantifying product with greater specificity during custody transfer ensures profits stay where they belong. The API 21.1 compliant AutoPILOT PRO system is engineered to enhance flow measurement and enables faster AGA calculations for rapid, accurate data capture. Built-in high-speed Ethernet connectivity and full USB support expedite and simplify data downloads to a PC or a memory stick. The AutoPILOT PRO system also easily integrates into corporate networks, facilitating data access by office-based staff.

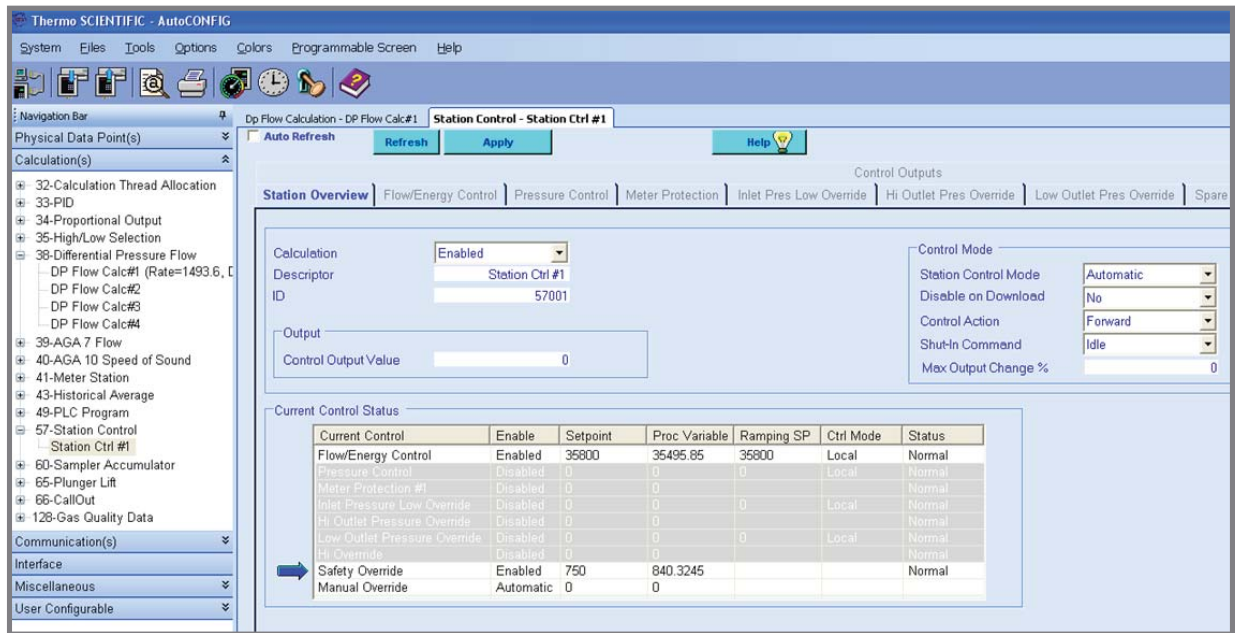
Easy to Configure and Use

An electronic flow computer and remote telemetry unit in one, the AutoPILOT PRO system is simple to configure and requires no programming. User-configurable screens in the Thermo Scientific™ AutoCONFIG Software simplify initial set-up, enabling staff to focus on other activities.

Rugged and Durable Design

Thermo Scientific gas flow computers are built to endure the most extreme environmental conditions. All boards are engineered and tested to withstand more than 120 consecutive, indirect lightning strikes, measuring up to 6,000 volts/3,000 amps each. In addition, temperature cycling from -40°C to +85°C (-40°F to +185°F) is conducted, ensuring reliable communication of valuable flow data from remote, unmanned locations.

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Thermo Scientific™ AutoCONFIG software, with built-in functions for transmission applications, helps streamline operations.

Advanced Station Control

The AutoPILOT PRO system encompasses much more than a simple collection of independent PID loops and offers the functionality to maintain flow, protect meter runs and provide safety overrides. It also optimizes flow conditions, when coupled with our meter staging algorithms, via a simplified user interface that indicates the exact condition of the meter station at-a-glance. This function is scalable from simple single run flow control to complete station control, including:

- Meter protection for up to 16 runs
- Flow/energy control with local and remote set points
- Pressure control
- Low inlet pressure & high/low outlet pressure override
- High safety override
- Split range outputs for up to four valves

Unique Run Switching

The unique and highly configurable run switching function works directly with the flow measurement function to ensure peak performance. Any combination of orifice and linear meters (i.e., coriolis and ultrasonic flowmeters) can be incorporated. Runs can be staged based on actual flow rates or flow velocities as read directly from a diagnostic port on an ultrasonic flowmeter. When tied directly to the measurement functions, the operator can specify levels for staging, or let the function decide based on actual flowing conditions.



Bi-Directional Detection & Control

The system detects flow direction and can change the direction by utilizing the valve sequencing function. Detection can be based on several methods, including differential pressure, single or dual discrete inputs, valve status and indication via UFM diagnostics. Up to eight valves and up to 16 user configurable steps can be controlled, virtually eliminating any additional equipment or manual operations.

Ultrasonic Diagnostics

Ultrasonic communications drivers for several third party natural gas ultrasonic flowmeters (UFM) are built-in to the system. This provides remote access of key diagnostics from UFM, which in turn can be used to very proper orientation and monitor key alarm points. Data includes vendor-specific alarm conditions, speed of sound (SoS) per path, and gains and gain limits per path. Full flow system diagnostics are achieved via the built-in AGA 10 SoS calculation that compares actual measured SoS as read directly from the UFM to a calculated AGA 10 SoS. If system is not within a user configurable deviation, the user is alerted via an alarm.

Pre-Wired AutoPILOT PRO XL Unit Simplifies Installation

The Thermo Scientific™ AutoPILOT PRO XL EFM/RTU is an ideal solution for high point-count systems. This comprehensive unit encompasses the same functionality and features as the AutoPILOT PRO EFM/RTU along with the following features and benefits:

- Built-in integrated wire management system simplifies setup
- No third party termination boxes helps reduce costs and facilitate installation
- Up to two safety interface barriers (SIB) can be added to connect up to six Thermo Scientific™ AutoMITTER PRO smart multi-variable transmitters

The XL unit is offered with two options, including a NEMA Type 4 metal enclosure and a case-less version that allows for it to be installed in an existing cabinet or larger enclosure.



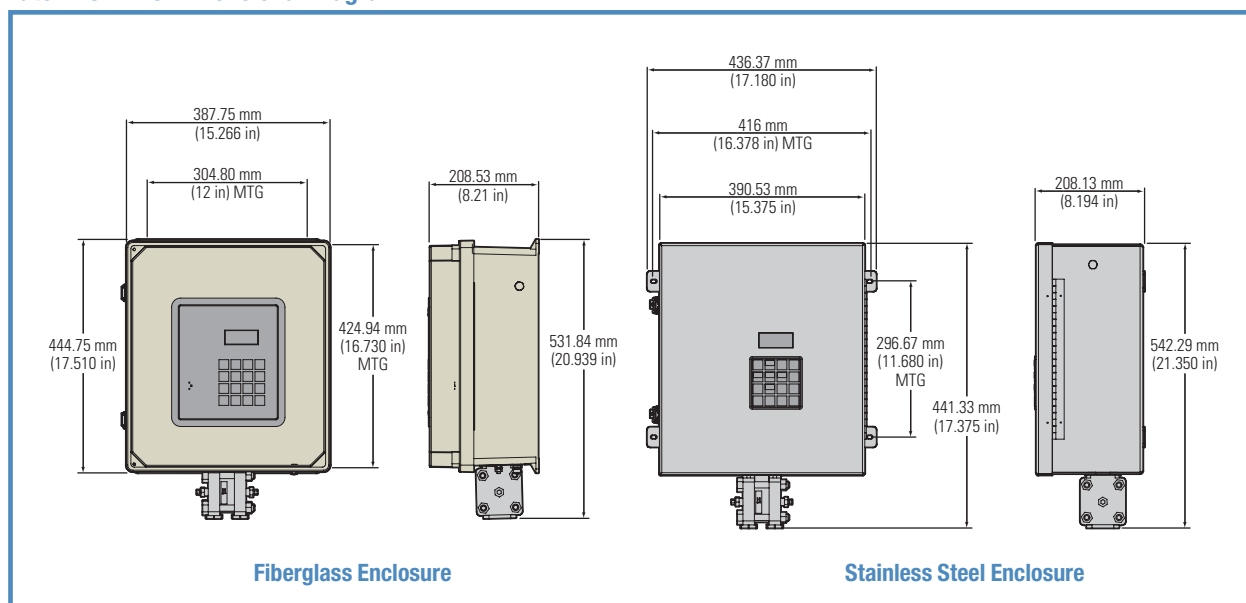
Thermo Scientific™ AutoPILOT PRO XL Unit

AutoPILOT PRO Input/Output (I/O) Boards: Built-In and Optional

	Board	Discrete Inputs (DI)	Discrete Outputs (DO)	Pulse Inputs	Analog Inputs (AI)	Analog Outputs (AO)	Communication Ports
Built-In*	Motherboard	2 contact inputs, internal +5 VDC wetting voltage	2 open-drain MOSFETs, externally powered, Rate: +30 VDC max, 250 mA max	2 pulse inputs configurable for slot sensor, magnetic pick-up or dry contact inputs, 10 KHz max	3, 1-5 VDC AI plus one 100 ohm RTD input		1 local RS232 port; 1 selectable RS232/RS485 port
Optional**	Analog Input <i>(up to 4 boards)</i>				4 1-5 VDC AI		
	Serial Expansion <i>(up to 4 boards)</i>						2 ports (both selectable RS232/RS485, synchronous/asynchronous)
	MEB-2-DI/DO <i>(up to 4 boards)</i>	2 contact inputs, internal +5 VDC wetting voltage	2 open-drain MOSFETs, externally powered. Rated: +30 VDC max, 250 mA max				
	MEB-2-Pulse Input <i>(up to 2 boards)</i>			2 pulse inputs configurable for slot sensor, magnetic -up or dry contact inputs, 5 KHz max			
	MEB-2-D/A <i>(up to 2 boards)</i>					2 outputs, 1-5 VDC or 4-20 mA, powered by battery or external +24 VDC	
	MEB-4-DI <i>(up to 4 boards)</i>	4 contact inputs, internal +5VDC wetting voltage					
	MEB-4-DO <i>(up to 4 boards)</i>		4 open-drain MOSFETs, externally powered. Rated: +30 VDC max, 250 mA max				

*Built-In: Standard for LCS & Expandable Models. **Optional: Expandable Models Only

AutoPILOT PRO Dimensional Diagram



Thermo Scientific AutoPILOT PRO EFM/RTU for Transmission

General Specifications

Processor	32-bit, 60 MHz MCU
Program Memory	4 MB of flash memory
Data Storage Memory	SRAM, 2 MB, battery-backed
CPU Board Communication Port	1 RS232, 1 RS232/RS485, 1 10Base-T Ethernet port, 1 USB slave port
Input Power	10 VDC to 30 VDC
Output Power	9 VDC/80 mA
Historical Data Storage	User configurable, defaulting to 65 days of daily, 35 days of hourly per meter run
Audit Trails	200 audit events, 60 different types of audits
Alarm Log Storage	200 alarm events, 15 different types of alarms

Environmental Specifications

Operating Temperature	-40°C to +85°C (-40°F to +185°F)
Operating Humidity	0-95% RH, non-condensing
Enclosure Rating	NEMA 4X/IP65
Certifications	CSA/C-US Class I, Div 2, Groups C and D (provides intrinsically safe circuits to AutoMITTER PRO for use in Class I, Div 1, Groups C and D hazardous locations); ambient temperature range of -40°C to +85°C (-40°F to +185°F), temperature code T3C; type 4X enclosure CE – Electromagnetic compatibility (EMC); CE – II 3 G Ex nL nA IIB T4; -40°C to +85°C (-40°F to +185°F); ATEX Zone 2 (Cat 3) FCC Compliant – FCC 47CFR Part 15, Class A; Measurement Canada – AG-0564C

Physical Specifications

Keypad	4 x 4 (16-key) input
Display	4 x 16 character LCD; User programmable scroll list and menus

Natural Gas Calculations

Supercompressibility	(Fpv) AGA 8 Gross-1992; AGA 8 Detail-1992; AGA 8 Short-1988; NX-19; NX-19 Analysis; GERG
Differential Meters	(DP, Orifice) AGA 3/ANSI/API 2530-1992 Method 2; AGA 3/ANSI/API 2530-1985; ISO 5167; Cone meters; Annubar; GOST
Linear Meters	(Turbine) AGA 7; AGA 9; AGA 11
Energy	AGA 5; GPA 2172; ISO 6976
Diagnostic	AGA 10 SoS
Additional Factors/Equations	Fwv (manual, partial or full); Fws
Turbine Meter Linearization	10 Point Frequency/K-factor Table

Liquid Calculations

API Tables	Table A (generalized crude oils); Table B (generalized products); Table C (thermal expansion properties); Old Table (NGL, LPG SG range 0.425 to 0.650); Table 23/24 E (NGL, LPG); VCF (CH 11.1 2004); Propylene (CH 11.3.3.2); Ethylene (API 2565/CH 11.3.2.1); Ethylene (NBS 1045)
Volume Correction Factor (VCF)	Consistent with API 2540/ASTM D1250-80/IP 200; 5/6 A/B; 23/24 A/B; 53/54 A/B; 6/24/54 C; CH 11.1 2004; Note: natural gas liquids (NGL) and liquefied petroleum gases (LPG): OLD 23/24, OLD 53/54; Table E is new standard to replace OLD 23/24.
Correction for Effect of Pressure on Liquid	Ch 11.2.1/Ch 11.2.2; Ch 11.2.1M/Ch 11.2.2M (compressibility factors for hydrocarbons), equilibrium pressure
Propylene Density	API Ch 11.3.3.2
Ethylene Density	API 2565 (Ch 11.3.2.1); Ethylene NBS 1045
Live Density Input	Thermo Scientific Sarasota liquid density meter, Solartron, UGC, 4-20 mA

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