DATASHEET

Enhanced Liquid & Gas Flow Computer for CompactLogix®

MVI69E-AFC

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ProSoft Technology's MVI69E-AFC in-chassis flow computer solution allows you to combine the power and scalability of a CompactLogix® automation system with the functionality typically only seen in a stand-alone flow computers or dedicated measurement RTU's. This provides you with the industry standard calculations, archiving, and reporting needed for custody transfer and allocation based measurement functions for Oil and Gas operations.

By combining automation and measurement functions into a single solution, this helps to reduce overall support and integration costs for Oil and Gas applications while also decreasing your overall capital spend. This simplified solution allows you to optimize your resources.

In addition, because our flow computer sits in a CompactLogix system, you can take advantage of Rockwell Automation's distributed I/O capability, wide range of communications protocols, and ProSoft's wireless radios to greatly reduce wiring to your transmitters and I/O devices.

Since the module operates as a co-processor for measurement related functions to the CompactLogix system, and as measurement requirements of the site grow, you can simply add an additional MVI69E-AFC module to increase your measurement capabilities to an individual site. A truly scalable automation and measurement solution.



Features

- **Meter Runs:** The module can calculate up to 12 meter runs simultaneously with four streams per run, making it cost-effective, since more meters can be connected to a single flow computer.
- **Modbus® Capabilities:** Remote configuration and diagnostics via Ethernet (Modbus TCP/IP) or Serial (Modbus) interfaces. Flexible serial port configurations allow for either two Modbus slave ports or one Modbus slave and one Modbus Master port. All data, including configuration, calculated results, and historical archives, are available using either the Modbus TCP/IP server or Modbus slave serial ports.
- **Customized Modbus Data Mapping:** Remapping to a virtual slave enables data concentration, reducing bandwidth load on the communication system.
- **Auditability:** Our configuration software provides the ability to download and view archives and events. Audit Scan captures process inputs and calculated results as "snapshots", allowing verification of calculations. The Log files record significant events and alarms. Hourly and daily archives are configurable historical records of user-selected data. The data can be viewed online, printed, or saved to a file in .txt or .csv format. Archive data can be exported to Flow-Cal .cfx format. Meter calibration and verification are stored on the module.
- **Meter Proving:** Allows for meter proving with 3 configurable prover types.
- **Security:** Password protection schemes are available to control user access and log meter calibration and verification activities. A built-in web server allows for remote network diagnostics and monitoring.

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Configuration

The EAFC Manager is a free Windows 7-based configuration, reporting, and monitoring tool provided with all MVIxxE-AFC modules. Project configurations may be uploaded, downloaded, and saved to the PC under user-selectable file names.

General Specifications

- The module is recognized by the processor as an Input/Output module.
- The provided Add-On Instruction (AOI) files are used for data transfers between the module and processor, reducing configuration time.
- Configuration is downloaded over Ethernet by way of the Modbus TCP/IP servers, or delivered by user-defined ladder.

Functional Specifications

The MVI69E-AFC operates as a powerful flow computer module, augmenting the operation of the CompactLogix® processor by providing a dedicated and accurate set of flow calculations.

- Calculates flow rates, accumulated volumes, accumulated mass, and (for gas product) accumulated energy.
- Calculation results are transferred to processor memory and may also be transferred to a SCADA host using Modbus serial or Modbus TCP/IP.
- User-configurable, allowing each of the meter runs to be individually set up to meet the specific requirements of an application.

Archiving

- Supports data archiving and event logging.
- Data archiving is available for each meter run, as two separately configurable files, one called “hourly” and the other called “daily”, whose records are intended to implement the Quantity Transaction Records (QTRs) required by applicable measurement standards. Under default configuration:
  (a) Records are written once each hour to the “hourly” file and once each day to the “daily” file, with additional records written to both files upon occurrence of an event that could affect measurement results (such as the change in value of a significant parameter).
  (b) Each record consists of 100 registers formatted with up to 50 data point values selected as being appropriate for the meter’s configuration (type, product, etc.) and compliant with QTR requirements.
  (c) Each file is formatted for a few of the most recent records to be kept in higher-speed local storage plus 1440 more records in larger-capacity, slower “extended” storage.
- Logging feature provides storage of up to 2,000 events and separately 2000 alarms.

Configurable Options

- User-selectable units for totalizers and flow rates on a per channel basis.
- Roll-over value for resettable and non-resettable totalizers for every meter channel.
- Process analog input units and ranges (pressure, temperature, differential pressure, density) from analog input modules and pulse inputs from pulse/frequency input modules in a CompactLogix chassis.
- Fluid selection provides a choice of several liquid groups or gas measurement, using AGA, API, and/or ISO calculations.
- Event log reports for all security-sensitive configuration data (for example, orifice diameter) are date- and time-stamped. This data can be saved to disk for importing into any spreadsheet or printed as a hard copy.

Modbus Interface

- SCADA communication is provided by the Modbus TCP/IP server and Modbus slave serial ports.
- Modbus table may be re-mapped as a virtual Modbus slave for user-assigned contiguous register polling by a SCADA client/master (up to 20,000 registers).
- Poll remote devices (such as a Gas Chromatograph) by utilizing the Modbus Master serial port.
- Alarm, event, and meter archive log files may be downloaded in Enron Modbus format.

System Requirements - EAFC Manager

This configuration software is designed for Microsoft Windows 7. Minimum hardware requirements for a Windows 7 system are as listed below. More advanced operating systems have significantly higher minimum requirements regardless of EAFC Manager minimum requirements.

- 1 GHz or faster 32-bit (x86) or 64-bit (x64) processor
- 1 GB RAM (32-bit) or 2 GB RAM (64-bit)
- 16 GB available hard drive space (32-bit) or 20GB (64-bit)
- Assigned IP Address

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Hardware Specifications

Physical

Backplane Current Load	500 mA @ 5 Vdc (Power supply distance rating of 4)
Operating Temperature	32°F to 140°F (0°C to 60°C)
Storage Temperature	-40°F to 185°F (-40°C to 85°C)
Shock Vibration	♦ 30g operational ♦ 50g non-operational ♦ 5g from 10 to 150 Hz
Relative Humidity	5% to 95% RH, with no condensation
LED Indicators	Module Status, Backplane Transfer Status, Application Status, Serial Activity

Ethernet Port

1 Ethernet Application Port	♦ 10/100 Mbps, RJ45 ♦ Link and Activity LED ♦ Auto crossover (Auto MDIX)

Serial Ports (P1 & P2)

2 Serial Application Ports	♦ RJ45 (DB-9M with supplied cable) RS-232, RS-485, RS-422 jumper selectable ♦ RS-232 handshaking configurable ♦ 500V optical isolation from backplane ♦ Full hardware handshaking control, providing radio, modem and multi-drop support
Shipped with Unit	♦ (2) RJ45 to DB-9M cables ♦ (1) 6-foot DB-9F to DB-9F null modem cable

Agency Approvals & Certifications

Please visit our website: www.prosoft-technology.com

Measurement Compliance Standards

Document	Title	Published
AGA Report No. 3	Orifice Metering of Natural Gas	
AGA Report No. 3, Part 1 (API MPMS Chapter 14.3.1)	General Equations and Uncertainty Guidelines	Errata (2013) 4th Edition (Sep 2012) 3rd Edition (Oct 1990)
AGA Report No. 3, Part 2 (API MPMS Chapter 14.3.2)	Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids – Concentric Square-edged Orifice Meters, Specifications and Installation Requirements	Errata (2017) 5th Edition (Mar 2016) Reaffirmed (Mar 2006 2nd Printing (Jun 2003) 4th Edition (Apr 2000)
AGA Report No. 3, Part 3 (ANSI/API MPMS Chapter 14.3.3)	Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids – Concentric Square-edged Orifice Meters, Natural Gas Applications	4th Edition (Nov 2013) Reaffirmed (Feb 2009) 2nd Printing (Jun 2003) 3rd Edition (Aug 1992)
AGA Report No 3, Part 4 (API MPMS Chapter 14.3.4) (GPA 8185-92, Part 4)	Natural Gas Fluids Measurement – Concentric Square-Edged Orifice Meters. Part 4: Background, Development, Implementation Procedures and Subroutine Documentation	Reaffirmed (Mar 2006) 3rd Printing (Jun 2003) 2nd Printing (Aug 1995) 3rd Edition (Oct 1992)
AGA Report No. 7	Measurement of Natural Gas by Turbine Meters	Revised (Feb 2006)
AGA Report No. 8, Part 1	Thermodynamic Properties of Natural Gas and Related Gases. DETAIL and GROSS Equations of State	3rd Edition (Apr 2017) 2nd Edition (Nov 1994)
AGA Report No. 9	Measurement of Gas by Multipath Ultrasonic Meters	3rd Edition (Jul 2017) 2nd Edition (Apr 2007)

Document	Title	Published
API MPMS Chapter 11	Physical Properties Data (Volume Correction Factors)	
API MPMS Chapter 11.1 (ASTM D 1250-04) (IP 200/04)	Standard Document and API 11.1 VCF Application Temperature and Pressure Volume Correction Factors for Generalized Crude Oils, Refined Products, and Lubricating Oils	Reaffirmed (Aug 2012) (May 2004)
API MPMS Chapter 11.2	Data File of Chapters 11.2.2 and 11.2.2M	1st Edition (Aug 1984)
API MPMS Chapter 11.2.2	Compressibility Factors for Hydrocarbons: 0.350-0.637 Relative Density (60 °F/60 °F) and -50°F to 140°F Metering Temperature	Reaffirmed (Sep 2017) 2nd Edition (Oct 1986)
API MPMS Chapter 11.2.2M	Compressibility Factors for Hydrocarbons: 350-637 Kilograms per Cubic Meter Density (15°C) and -46°C to 60°C Metering Temperature	Reaffirmed (Sep 2017) 1st Edition (Oct 1986)
API MPMS Chapter 11.2.4 (GPA Technical Paper 27)	Temperature Correction for the Volume of NGL and LPG Tables 23E, 24E, 53E, 54E, 59E, 60E	Reaffirmed (Oct 2012) 1st Edition (Sep 2007)
API MPMS Chapter 11.2.5 (GPA Technical Paper 15)	A Simplified Vapor Pressure Correlation for Commercial NGLs	Reaffirmed (Sep 2017) 1st Edition (Sep 2007)
API MPMS Chapter 12	Calculation of Petroleum Quantities	
API MPMS Chapter 12.2.1	Calculation of Petroleum Quantities Using Dynamic Measurement Methods and Volumetric Correction Factors. Part 1: Introduction	Reaffirmed (Mar 2014) Errata 1 (Jul 2009) 2nd Edition (May 1995)
API MPMS Chapter 12.2.2	Calculation of Petroleum Quantities Using Dynamic Measurement Methods and Volumetric Correction Factors. Part 2: Measurement Tickets	Reaffirmed (Feb 2016) 3rd Edition (Jun 2003)
API MPMS Chapter 12.2.3	Calculation of Petroleum Quantities Using Dynamic Measurement Methods and Volumetric Correction Factors. Part 3: Proving Reports	Reaffirmed (May 2014) 1st Edition (Oct 1998)
API MPMS Chapter 14	Natural Gas Fluids Measurement	
API MPMS Chapter 14.2 (AGA Report No. 8)	Compressibility Factors of Natural Gas and Other Related Hydrocarbon Gases	3rd Printing (Nov 2003) 2nd Printing (Jul 1994) 2nd Edition (Nov 1992)
API MPMS Chapter 14.3.1 (AGA Report No. 3, Part 1)	Orifice Metering of Natural Gas and Other Related Hydrocarbon Fluids – Concentric, Square-edged Orifice Meters. Part 1: General Equations and Uncertainty Guidelines	Errata (Jul 2013) 4th Edition (Sep 2012) 3rd Edition (Oct 1990)
API MPMS Chapter 14.3.2 (AGA Report No. 3, Part 2) (GPA 8185-00, Part 2)	Natural Gas Fluids Measurement – Concentric, Square-edged Orifice Meters. Part 2: Specification and Installation Requirements	Errata (2017) 5th Edition (Mar 2016) Reaffirmed (Mar 2006 2nd Printing (Jun 2003) 4th Edition (Apr 2000)
API MPMS Chapter 14.3.3 (AGA Report No. 3, Part 3) (GPA 8185, Part 3) (ANSI/API 2590-1991, Part 3)	Natural Gas Fluids Measurement – Concentric, Square-Edged Orifice Meters. Part 3: Natural Gas Applications	4th Edition (Nov 2013) Reaffirmed (Feb 2009) 2nd Printing (Jun 2003) 3rd Edition (Aug 1992)
API MPMS Chapter 14.3.4 (AGA Report No 3, Part 3) (GPA 8185-92, Part 4)	Natural Gas Fluids Measurement – Concentric Square-Edged Orifice Meters. Part 4: Background, Development, Implementation Procedures and Subroutine Documentation	Reaffirmed (Mar 2006) 3rd Edition (Nov 1992)
API MPMS Chapter 14.5 (GPA Standard 2172-09)	Calculation of Gross Heating Value, Relative Density, Compressibility and Theoretical Hydrocarbon Liquid Content for Natural Gas Mixtures for Custody Transfer	Reaffirmed:(Feb 2014) 3rd Edition (Jan 2009)
API MPMS Chapter 14.9 (AGA Report No. 11)	Measurement of Natural Gas by Coriolis Meter	2nd Edition (Feb 2013)
API MPMS Chapter 20	Allocation Measurement of Oil and Natural Gases	
API MPMS Chapter 20.1	Allocation Measurement	Reaffirmed (Oct 2016) 1st Edition (Sep 1993)

Document	Title	Published
API MPMS Chapter 21	Flow Measurement Using Electronic Metering Systems	
API MPMS Chapter 21.1 (ANSI/API MPMS Ch. 21.1-2011) (AGA Report No. 3)	Electronic Gas Measurement	2nd Edition (Feb 2013)
API MPMS Chapter 21.2	Electronic Liquid Volume Measurement Using Positive Displacement and Turbine Meters	Reaffirmed (Oct 2016) 1st Edition (Jan 1998)
GPA 2145-16	Table of Physical Properties for Hydrocarbons and Other Compounds of Interest to the Natural Gas and Natural Gas Liquid Industries	Revised (2016) Adopted (1942)
GPA Technical Paper 15 (API MPMS Chapter 11.2.5)	A Simplified Vapor Pressure Correlation for Commercial NGLs	Reaffirmed (Sep 2017) 1st Edition (Sep 2007)
GPA Technical Paper 27 (API MPMS Chapter 11.2.4)	Temperature Correction for the Volume of NGL and LPG Tables 23E, 24E, 53E, 54E, 59E, 60E	Reaffirmed (Oct 2012) 1st Edition (Sep 2007)
GPSA Engineering Data Book	SI	14th Edition (2017)
GPSA Engineering Data Book	FPS	13th Edition (2017)

ISO 5167	Measurement of fluid flow by means of pressure differential devices inserted in circular cross-section conduits running full	
ISO 5167-1	General principles and requirements	(2003)
ISO 5167-2	Orifice plates	(2003)
ISO 5167-3	Nozzles and Venturi nozzles	(2003)
ISO 5167-4	Venturi tubes	(2003)
ISO 5167-5	Cone meters	(2016)
ISO 6976	Natural Gas – Calculation of calorific values, density, relative density and Wobbe indices from composition	(2016)

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