Gas Measurement Manual

PART FIFTEEN

ELECTRONIC VOLUME CORRECTORS

Prepared by:

Transmission Measurement Committee and Customer Field Service and Measurement Committee

Catalog # XQ2406
September 2024

DISCLAIMER AND COPYRIGHT

The American Gas Association's (AGA) Operations and Engineering Section provides a forum for industry experts to bring their collective knowledge together to improve the state of the art in the areas of operating, engineering and technological aspects of producing, gathering, transporting, storing, distributing, measuring and utilizing natural gas.

Through its publications, of which this is one, AGA provides for the exchange of information within the natural gas industry and scientific, trade and governmental organizations. Many AGA publications are prepared or sponsored by an AGA Operations and Engineering Section technical committee. While AGA may administer the process, neither AGA nor the technical committee independently tests, evaluates or verifies the accuracy of any information or the soundness of any judgments contained therein.

AGA disclaims liability for any personal injury, property or other damages of any nature whatsoever, whether special, indirect, consequential or compensatory, directly or indirectly resulting from the publication, use of or reliance on AGA publications. AGA makes no guaranty or warranty as to the accuracy and completeness of any information published therein. The information contained therein is provided on an "as is" basis and AGA makes no representations or warranties including any expressed or implied warranty of merchantability or fitness for a particular purpose.

In issuing and making this document available, AGA is not undertaking to render professional or other services for or on behalf of any person or entity. Nor is AGA undertaking to perform any duty owed by any person or entity to someone else. Anyone using this document should rely on his or her own independent judgment or, as appropriate, seek the advice of a competent professional in determining the exercise of reasonable care in any given circumstances.

AGA has no power, nor does it undertake, to police or enforce compliance with the contents of this document. Nor does AGA list, certify, test or inspect products, designs or installations for compliance with this document. Any certification or other statement of compliance is solely the responsibility of the certifier or maker of the statement. Any reference to trade names or specific commercial products, methods, commodities or services in this document does not represent or constitute an endorsement, recommendation or favoring nor disapproval, disparagement, or disfavoring by AGA or any other person of the specific commercial product, commodity or service.

AGA does not take any position with respect to the validity of any patent rights asserted in connection with any items that are mentioned in or are the subject of AGA publications, and AGA disclaims liability for the infringement of any patent resulting from the use of or reliance on its publications. Users of these publications are expressly advised that determination of the validity of any such patent rights, and the risk of infringement of such rights, is entirely their own responsibility.

Users of this publication should consult applicable federal, state and local laws and regulations. AGA does not, through its publications intend to urge action that is not in compliance with applicable laws, and its publications may not be construed as doing so.

Changes to this document may become necessary from time to time. If changes are believed appropriate by any person or entity, such suggested changes should be communicated to AGA in writing and sent to: ***Operations & Engineering Section, American Gas Association, 400 North Capitol Street, NW, 4th Floor, Washington, DC 20001, U.S.A.*** *Suggested changes must include: contact information, including name, address and any corporate affiliation; full name of the document; suggested revisions to the text of the document; the rationale for the suggested revisions; and permission to use the suggested revisions in an amended publication of the document.*

FORWARD

This manual presents information on electronic volume correctors (EVCs) for installation, operation, calibration, and maintenance of EVCs. This is not a standard for electronic volume corrector (EVC) design. The information is intended to cover only instruments considered auxiliary devices mounted on the gas meter or receiving a direct pulse from a linear flow meter. *This does not include the primary flow measurement device (meter) but does include the integral temperature and pressure correcting devices that are incorporated now as part of the metering assembly.*

HISTORY AND BACKGROUND

Over the years, mechanical devices have been providing a means for correcting measured gas volume to base conditions of pressure and temperature. Their origin can be traced back to the 1920s when chart recorders were used to record line pressure at the gas meter. These charts would then be read to determine average line pressure so that the volume measured by the gas meter could be corrected to base pressure conditions. Today, very few mechanical chart recorders are still used for volume correction. They may record any metered volume, line pressure or line temperature combination. Another means of gas volume correction emerged during the 1950s. Mechanical instruments mounted on gas meters automatically corrected metered volume to base conditions. They mechanically measured and applied pressure and temperature correction factors to a gear-driven index through linkages and clutches.

Later, mechanical volume correctors were improved by adding an approximating cam for super compressibility correction and a switch contact output to allow connection to separate volume recorders or telemetering devices. The origin of electronic volume correction can be linked to the Supervisory Control And Data Acquisition (SCADA) systems that the gas and liquid transmission companies fielded in the early 1970s. Although electronic measurement and correction were much more accurate than that period's mechanical chart recorders or volume correctors, it was too costly for distribution.

However, this is no longer true. Advances in electronic technology have made it possible to provide cost- effective gas-volume correction in virtually all applications previously supported by mechanical correcting devices. Not only are the electronic volume correctors comparable in initial cost, but they also provide an increase in performance beyond the range of mechanical corrector technology. Performance improvements include increased measurement accuracy, data storage capacities, audit trail memory, better long-term stability, quicker calibration, and a decreased load on the instrument drive shaft.

ACKNOWLEDGMENTS

This Electronic Corrector manual represents many hours of work by the members of the Transmission Measurement Committee, and Customer Field Service and Measurement Committee of the AGA Operating and Engineering Section. Those who made significant contributions and deserve special recognition are:

Tushar Shah (Co-Chair)	Eagle Research Corporation
Robb Albers (Co-Chair)	National Fuel
Mary Abens	Emersons (AUTOSOL/PSS/MTWN)
Rex Allen	Southern California Gas
Madeline Corb	Dresser
Shane Dolar	Dominion Energy
Pierre Dufour	Honeywell
Luis Escobar	AGA
Jim Eubanks	Retired – Southern California Gas
Melissa Fearing	Xcel Energy
John Hand	TC Energy
Matt Holsten	Black Hills Energy
Kasey Howe	Honeywell
Mady Killfoil	Atmos
Craig Lam	Sick
John Lansing	Lansing Measurement Service, LLC
Matthew McConnell	Southern Star Central Gas Pipeline
Austin McWilliams	Horizon Technologies
Winston Meyer	Retired - Center Point Energy
Sam Patel	Consumers Energy
Rick Spann	Dominion Energy
John Valdez	Center Point Energy
Kiran Vijayakumar	RMG

AGA Staff Executive

Ken Buys

CONTENTS

DEFINITIONS

Base condition

Defined pressure and temperature used in the custody transfer measurement of fluid volume and other calculations. Base conditions may be defined by regulation, contract, local conditions or organizational needs. Base conditions may vary within regions such as: 1) USA, pressure 14.73 psi absolute, temperature 60 °F, as defined by NAESB. 2) Canada, pressure 101.325 kPa absolute, temperature 15 °C. 3) Mexico, pressure 1 kgf/cm² (equivalent to 98.1 kPa absolute), temperature 20 °C.

Baud rate

The baud rate is the rate at which information is transferred in a communication channel. Baud rate is commonly used when discussing electronics that use serial communication. In the serial port context, "115,200 baud" means that the serial port can transfer a maximum of 115,200 bits per second

Data log

It is data collection and storage over a period. Sometime in industry refers to as histories, audit trail, event logs etc.

Form A

A “Form A” would mean the contacts are normally open when the coil of the relay is not energized or the there is no magnetic field nearby in a reed switch.

Form B

A “Form B” would mean the contacts are normally Closed when the coil of the relay is not energized or the there is no magnetic field nearby in a reed switch.

Form C

A “Form C” would have three leads and would have one normally open contact and one normally closed contact. This is also called a “changeover” device because the common contact changes from the normally closed position to the normally open position when the coil is energized in a relay, or a magnetic field is nearby in a reed switch.

Standard Condition

A standard cubic foot of gas is the amount of gas that occupies one cubic foot at base conditions.

Wiegand Sensor

Wiegand sensors are magnetic sensors that make use of the Wiegand effect to generate a consistent pulse every time magnetic field polarity reverses and therefore do not rely on any external voltage or current.

ABBREVIATIONS

ACFH	Actual Cubic Feet Per Hour (Uncorrected)
AMI	Advanced Metering Infrastructure
AMR	Automatic Meter Reading
CF	Cubic Feet
EVC	Electronic Volume Corrector
I/O	Input and/or Output
IrDA	Infrared Data Association
REV	Revolution (Rotation)
SCADA	Supervisory Control And Data Acquisition
SCFH	Standard Cubic Feet Per hour (Corrected)
TCP/IP	Transmission Control Protocol/Internet Protocol
TEG	Thermoelectric Generator

1 GENERAL

1.1 Overview of Electronic Volume Corrector (EVC)

Most meters measure actual (uncorrected) flowing volume. The actual flowing volume varies with pressure/temperature and needs to be corrected to reflect standard conditions (corrected). The value the flowing volume would assume at standard conditions is calculated per the gas laws, as covered in section 1.6 of this document. The corrected volume calculation can be performed by an electronic volume corrector (EVC) using one or more methods specified in reports AGA-7, AGA-5, AGA-8, and NX-19.

In addition to the live volume correction function, an EVC can provide benefits that older mechanical technologies could not, such as increased accuracy, easy calibration, configuration flexibility, simplified maintenance, data storage, and local/remote data communication.

The installation of an EVC vs a flow computer may depend on meter type, customer type (residential/ commercial /industrial), power availability, and cost.

1.2 Basic Components

An EVC typically consists of an enclosure, a pulse-input device (for volumetric input), a line pressure transducer, a temperature transducer, a display, electronic circuit boards, communication port(s), and a power supply. An EVC may contain other optional components such as a secondary pressure transducer, status/alarm inputs from other devices, keypad, pulse outputs, communication devices (phone modem, cell modem, etc.), The EVC may be mounted directly to the gas meter (integral mount), directly mounted on the instrument drive of a gas meter, pipe-mounted, pole-mounted, or wall-mounted. Figure 1 shows a typical EVC installation on the instrument drive of the turbine meter and Figure 2 shows a typical installation of integral mount EVC on the rotary.