



FEDERAL AGENCY ON TECHNICAL REGULATION AND METROLOGY

CERTIFICATE

for pattern approval

RU.C.29.592.A No. 43237/1

Validity term to April 22, 2021

TYPE OF MEASURING INSTRUMENT
FLOWGAS gas volume correctors

MANUFACTURED BY
Engels Instrument Manufacturing Association Signal Limited Liability Company (Signal LLC);
Engels-19, Saratov Region

SERIAL NUMBER 47254-11

DOCUMENT FOR VERIFICATION
СЯМИ.408843 - 623 МИ with amendment 1

VERIFICATION TESTING INTERVAL 6 years

Certificate for pattern approval has been redrafted by order No. 677
of the Federal Agency on Technical Regulation and Metrology dd. April 3, 2017

Description of measuring instrument type is a normative annex hereto.

Deputy Head
of the Federal Agency



S.S. Golubev

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Series СИ

No 028861

Official seal: FEDERAL AGENCY ON TECHNICAL REGULATION AND METROLOGY* OGRN 1047706034232

DESCRIPTION OF THE MEASURING INSTRUMENT TYPE

(revised and approved by order No. 677 of the Federal Agency on Technical Regulation and Metrology dd. 03.04.2017)

FLOWGAS gas volume correctors

Application

FLOWGAS gas volume correctors (hereinafter - correctors) are designed to convert the operating volume of natural gas according to GOST 5542-2014, free oil gas according to GOST P 8.615-2005, other gases to standard conditions, depending on the measured pressure, temperature and gas compressibility factor.

Description of the measuring instruments

The principle of functioning of the corrector is based on measurement of the current values of pressure, temperature, gas volume at the operational conditions and calculation of the corrected volume and flow rate with the allowances made for gas components, converted to standard conditions.

The corrector provides for calculation methods of compressibility factor of:

- natural gas according to GOST 30319.2-2015, GOST 30319.3-2015, AGA-8 (international standard ISO 20765-1:2005);
- free oil gas, nitrogen, air, carbonic acid gas, inert gases using the national standard reference data service.

The corrector includes the following parts:

- microprocessor-based computer with a casing, microprocessor, communication module, optical port, screen, keyboard and independent power supply;
- integrated transducer of the absolute (gage) pressure;
- integrated pressure-differential transducer;
- integrated gas temperature transducer; and
- integrated ambient temperature transducer;
- installation kit for the corrector mounting on the gas meter.



Figure 1 - FLOWGAS gas volume correctors general drawing

The microprocessor-based computer is a microcomputer designed on the modern microprocessing technology allowing to measure the required parameters to high precision, to calculate, to store and to print data on the peripherals.

An LCD indicator is used as a screen providing a possibility for a user to display information in the form which is available to him/her.

The keyboard controls screen functioning, monitor information and program the corrector. Communication with the corrector and its programming can be provided using "Service Flowgas.exe" software included in the supplied package of the corrector.

The corrector is powered by:

- independent built-in battery-type power supply of max. 7,4 V voltage. Open-circuit voltage and short-circuit current shall not exceed 7,4 V and 0,07 A. Continuous work time of the corrector without replacement of the independent power supply is 6 years min.;

- external power supply (input ~ 220 V; 50 Hz, output = 9 B \pm 10 %, 100 mA).

Resistance temperature detectors are used as gas temperature transducers according to GOST 6651-2009. Circuit current of temperature transducers is 300-345 μ A, voltage 0,04 V, output - 10 mV.

Pressure transducers ensuring measurement of absolute pressure from 0,08 to 10 MPa, gage- from 0 to 10 MPa are applied on the correctors. Maximum pressure measurement working range is 1:11.

The transducers are integrated into the general electric circuit of the corrector, powered from the general diagram. Circuit current of the pressure transducers is 300-320 μ A, voltage - 1,2-1,5 V, output - 10 mV.

Exchange of the corrector with the peripherals is made via RS-232 interface and optical interface. The rate of information transfer via interface RS-232 is 19200 baud min., and via optical interface - up to 19200 baud. MODBUS-RTU protocol is used for exchange. A peripheral exchange (PC, printer, modem, monitoring system) is carried out without connectors switching.

The corrector creates the archives of the hour, daily, monthly archives settings for gas metering and the archives of abnormal situations, changes, etc. The depth of the hour archive is 20 months max., the depth of the daily archive is 60 months max., the depth of the monthly archive is 2000 months max., the depth of the archives of abnormal situations and changes is maximum 4000 and 2000 records accordingly.

LF output is provided for transfer of information about standard (operating) gas volume.

The correctors are manufactured in different modifications depending on the pressure and differential pressure measuring range, type of the transducers used and options of their installation.

The corrector is safely protected from the unauthorized tampering of the instrument which can result in measurements distortion. Programming of the corrector with the keyboard or service software can be carried out only after removing a seal on the lid of the computer casing and the seals of the programming switch. Additional condition here is entering an appropriate password. Any tampering with the corrector and operational changes should be recorded in the archives of the abnormal situations and changes specifying time and date. The seal is installed on the lid blocking access to the electronic board (connectors of pressure, temperature and pressure-differential transducers). All interferences with the corrector and modifications made are recorded in the archives of abnormal situations and modifications indicating time and date. Control sum of the verification factors of pressure - and temperature - sensing passages is recorded in the corrector datasheet when the primary verification has been conducted.

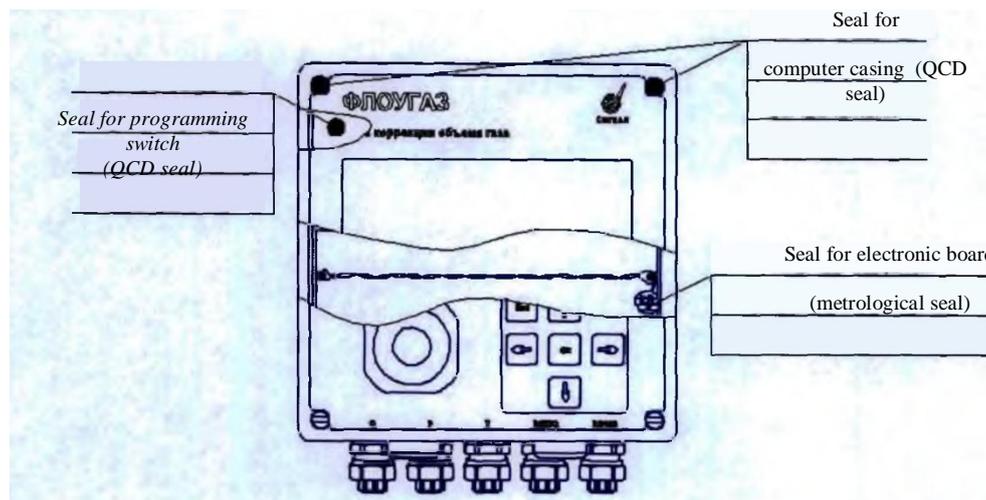


Figure 2 – Flowgas gas volume corrector sealing circuit

Software

Software is embedded. Conversion of the measured values and processing of measurements is carried out using internal hardware and software. FLOWGAS software is stored in the volatile memory.

The software of the FLOWGAS gas volume correctors is divided into the following parts:

- of metrological significance;
- of non-metrological non-significance;

The software is divided inside a software code at the programming language. A part of metrological significance includes the following:

- software modules involved in processing (estimation) of measurement results or effecting them;
- software modules displaying the measurement data, their storage, software and data security;
- software settings involved in calculation and effecting measurement results;
- components of the secured interface for data exchange between FLOWGAS and peripherals

The identification data of the part of metrological significance of the corrector software are specified in the Table 1

Table 1 – Identification data of the software

Identification data (characteristics)	Value
Identification software name	СЯМИ.00029- 01 12 01
Software version number (ID)	B.0.0.1.2
Software digital certificate (DC)	53F0
Algorithm for DC calculation	CRC-16

Protection level of the part of metrological significance of software is “high” according to P 50.2.077-2014.

Metrological and technical specifications

Table 2

Parameter	Value
Volume (flow rate) measuring range in operational conditions	Identified based on the size of gas meter
Measuring range of absolute (gage) pressure. MPa	from 0,08 to 10 (from 0 to 10)
The relative accuracy limits of the pressure sensing passage in the operational range of pressure measurement and at the ambient temperature ranging from minus 40°C to plus 60°C. %	±0,4
Gas temperature measuring range; °C	from -30 to +60
The relative accuracy limits of the gas temperature sensing passage at the ambient temperature ranging from minus 40°C to plus 60°C. %	±0,1
The relative accuracy limits of conversion of the measured gas operating volume to standard conditions in the operational range of pressure measurement and at the ambient temperature ranging from minus 40°C to plus 60°C. %	±0,5
The relative accuracy limits of conversion of the measured gas operating volume to standard conditions, %	±0,05
Measuring range of differential pressure, kPa	from 0 to 40
The limits of accuracy normalized to the differential pressure sensing passage in working range of differential pressure and at the ambient temperature ranging from minus 40°C to plus 60°C, %	±0,25
Ambient temperature measuring range, °C	from -40 to +60
The limits of the absolute accuracy of the ambient temperature sensing passage at ambient temperature ranging from minus 40°C to plus 60°C	±1
IP level ensured by enclosing according to GOST 14254-96	IP 66
EX marking in compliance with GOST P MЭК 600079-0-2011 and GOST P MЭК 600079-11 2010	Ex ib IIC T4 X
Supply voltage, V: - independent - external	7,4 9
Operating conditions. - ambient temperature, °C - relative air humidity, % at 35 °C ambient temperature, %	from -40 to +60 98
Overall dimensions, mm, max.:	200x100x160
Weight, kg, max.	3
Service life of independent power supply, years, at least	6
MTBF, hr, at least	60000
Average life, years, at least	12

Pattern approval mark is placed on the instrumentation panel of corrector by flat photoprinting and on the front pages of operational manual and datasheet- typographically.

Completeness of measuring instrument

Table 3 - Completeness of measuring instrument

Item	Marking	Quantity	Note
FLOWGAS gas volume corrector	СЯМИ 408843-623 ТУ	1	
Operational Manual	СЯМИ 408843-623 РЭ	1	
Datasheet	СЯМИ 408843-623 ПС	1	
Verification method	СЯМИ 408843-623 МП	1	
Service software a (CD-R disk)	СЯМИ. 00030-01 12 01	1	
Operator Manual	СЯМИ. 00033-01 34 01	1	
Thermal transducer with harness	623-СБ9	1	Correctors with non-integrated temperature transducers
Datasheet on thermal transducer		1	
Optical interface		1	
RS-232 wire harness for exchange with PC	623-СБ15 СП	1	
Wire harness for modem connection	623-СБ11	1	On order
Wire harness for printer connection	623-СБ12	1	On order
Wire harness of flow transducer	623-СБ7	1	
Software for correction of the corrector metrological performance	СЯМИ.00031-01 12 01	1	On order
Operator Manual	СЯМИ.00034-01 34 01	1	
Software for data readout and storage from the peripherals	СЯМИ.00032-01 12 01	1	On order
Operator Manual	СЯМИ.00035-01 34 01	1	
Installation kit for mounting corrector on the gas meter		1	On order
Pressure-differential transducer with valve assembly		1	On order
Ambient temperature transducer		1	On order

Verification

is carried out according to the СЯМИ. 408843 - 670 МП Instruction. National Measurement Assurance System. FLOWGAS gas volume correctors. Verification method with amendment No. 1 approved by the State Center for Testing Measuring Instruments of Federal State Unitary Enterprise VNIIR dated December 12, 2016.

Basic verification instruments:

- digital pressure gauge (pressure generator), measuring range up to 10 MPa and relative accuracy maximum ± 0.05 %;;
- bank of resistors MCP-63 (registration No. 2042-65), precision class 0.05
- pulse generator, Г6-28 (registration No. 6181-77), error not more than ± 1 %;
- frequency counter ЧЗ-64/1 (registration No. 9135-83), intrinsic error not more than $\pm 1,5 \cdot 10^{-7}$;
- "Терморест-100" liquid thermostat (registration No. 25777-03), temperature control range from minus 30 to plus 100 °C, set temperature non-uniformity $\pm 0,01$ °C, temperature field nonuniformity in thermostat working volume $\pm 0,01$ °C.

- master resistive thermometer ETC-100 (ЭТС-100) (registration No. 19916-10), third class according to GOST 8.558-2009 (temperature range from minus 50 to plus 419°C, error not more than ± 0.015 °C).
- aneroid barometer M 67 (registration No. 3744-73), measuring range from 81130 to 105320 Pa and error not more than ± 106 Pa;
- psychometric hygrometer of VIT-1 (registration No. 42453-09), measuring range of relative humidity from 20 to 90 %, measuring range of temperature from 15 to 40 °C to plus 40 °C, scale division value - 0.1 °C;
- signal transducer Terkon (registration No. 23245-08), limits of intrinsic error of resistance measuring $\pm [0.0002 + 1 \times 10^{-5} \times R_{\text{meas}}]$ Ohm., voltage measuring $\pm [0.0005 + 5 \times 10^{-5} \times U_{\text{meas}}]$ mV.

Similar verification instruments enabling determination of metrological characteristics of the measuring instruments to be calibrated with the required accuracy are acceptable.

Verification mark is placed in the certificate of verification and/or datasheet

Measurement methods

are listed in the Operational Manual.

Regulatory and technical documents specifying the requirements to FLOWGAS gas volume correctors

- TP CU 012/2011 On Safety of Equipment Intended for Use in Explosive Atmospheres
- GOST 30319.2-2015 Natural gas. Methods of physical properties calculation. Calculation of physical properties based upon density, nitrogen and carbon dioxide content
- GOST 30319.3-2015 Natural gas. Methods of physical properties calculation. Calculation of physical properties based upon composition
- СЯМИ.408843 - 623 TY FLOWGAS gas volume correctors. Specifications.

Manufacturer

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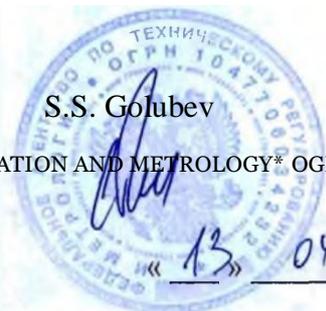
Testing Center

Federal State Unitary Enterprise “All-Russian Research Institute for Flow Metering” (FSUI VNIIR);
 Address: 2nd Azinskaya Street-7A, Kazan, RT, 420088
 phone: +7 (843) 272-70-62. fax: +7 (843) 272-00-32.
 website: www.vniir.org
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 Accreditation certificate FSUI VNIIR for testing of measurement instruments for Pattern Approval No. RA.RU.310592 dated 24.02.2015.

Deputy Head
 of the Federal Agency
 on Technical Regulation
 and Metrology

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