

Micro Thermal Gas Metering

By:

Esmacil Soltani

Abolghasem Moradi

Hajar Azad

Islamic Azad University

Najafabad Branch

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Contents

Subject	page
Preface.....	XIII
Acknowledgment.....	XIV
Chapter 1: Principle of Operation and Theory	
1. Principles of Operation.....	1
1.1. Introduction	1
1.2. Market demand and smart gas meters	5
1.3. All-electronic gas meters for city natural gas metering.....	7
1.3.1. Ultrasonic gas meters	8
1.3.2. Differential pressure gas meters	10
1.4. Importance of Thermal Mass Flow Meter.....	12
1.5. Thermal Mass Flow Meter Application	13
1.6. Types of The Thermal Mass Flow meters.....	13
1.6.1 Insertion type Thermal Mass Flow meter.....	14
1.6.2. Capillary type Thermal Mass Flow Meters.....	14
1.6.3. Gas Flow and Heat Transfer between Gas and Capillary.....	17
1.7. Thermal Mass Flow meters	20
1.7.1. Principles of Thermal Mass Flow meters.....	20
1.8. Industrial Thermal Mass Flow Meter.....	21
1.8.1. Principles of Operation.....	22
1.8.2. Temperature Compensation	29
1.8.3. Application	29
1.8.4. Point Mass Velocity	30
1.8.5. Channel Flows.....	31
1.8.5.1. Single-point insertion meters	32
1.8.5.2. In-line Flow Conditioned Meters	34
1.8.5.3. Multi-Point Flow Averaging Arrays	35
1.8.6. Flow Calibration.....	35
1.8.7. Flow Generators	36
1.8.7.1. Open loop facility.....	36
1.8.7.2. Closed loop facility	37
1.9. Calibration technologies.....	38
1.9.1. Primary calibration volume standard	38
1.9.2. Secondary calibration volume standard	39
1.9.3. Calibration and metrological compatibility.....	40
1.9.4. Conclusions of Calibration	42

Chapter 2: Comparison and Review of Existing Gas Metering Technologies

2. MEMS gas meters	47
2.1. Introduction	47
2.2. Application	49
2.3. Thermal Flow Sensors	51
2.3.1. Material	51
2.3.2. Research Devices	53
2.3.2.1. Anemometers (Heat Loss).....	54
2.3.2.2. Calorimetric Flow Sensors (Thermo transfer)	57
2.3.2.3. Time of Flight Sensors	61
2.4. MEMS mass flow sensing technology	62
2.5. Current MEMS gas meters	64
2.6. MEMS gas meter design	66
2.6.1. MEMS gas meter mechanical design	69
2.6.2. MEMS sensor assembly	69
2.7. MEMS gas meter performance.....	70
2.7.1. Permissible errors	70
2.7.2. Pressure loss	72
2.7.3. Installation conditions	72
2.7.4. Calorific value assessment and compensation	74
2.7.5. MEMS gas meter field tests	79
2.7.5.1. Long term stability	79
2.7.5.2. Project for distribution and flow enhancement	80
2.8. CMOS Gas Flow Micro sensors.....	81
2.8.1. Design and Fabrication.....	82
2.8.2. Experimental	85

Chapter 3: Micro Thermal Natural Gas Metering Applications and Advantages

3.1. Introduction	87
3.2. Generating unique data by Micro Thermal gas meters.....	88
3.3. Sensor Module.....	88
3.3.1. Key Features of Sensirion's Micro thermal Gas Flow Sensing	88
3.3.1.1. Long-term Stability	89
3.3.1.2. Gas Quality Recognition	90
3.3.1.3. Pressure Independence and Temperature Compensation	90
3.3.1.4. Low Power Consumption.....	90
3.3.1.5. Bi-directional Gas Flow Measurement	91
3.3.1.6. Compact Size	91
3.3.2. Difference Between of Prototype and Final Connector	91
3.3.3. Flow Module Integration.....	92
3.3.4. Sensor Performance.....	93
3.3.4.1. Physical Specifications.....	93
3.3.4.2. Repeatability	93

3.3.4.3. Media Compatibility	93
3.3.4.4. Electrical Specifications	95
3.3.4.4.1. Operating Voltage	95
3.3.4.4.2. Interface	95
3.3.4.4.3. Electromagnetic Compatibility (EMC)	95
3.3.4.4.4. Preventions against electrostatic discharge (ESD)	95
3.3.4.5. Mechanical Specifications	95
3.3.4.5.1 Orientations Sensitivity	95
3.3.4.5.2. Assembly into Gas Meter	95
3.3.4.5.2.1. Mounting Place	96
3.3.4.5.2.2. Mounting Restrictions	96
3.3.4.5.2.3. Mounting Orientation	96
3.3.4.5.3. Housing Material	96
3.3.4.5.4. Wetted Materials	96
3.3.4.5.5. Weight	96
3.3.4.5.6. Gas Recognition and Compensation	96
3.3.5.1. Specifications	97
3.4. Gas Meter Housing	97
3.4.1. Flow Conditioner	97
3.4.2. Dimensions	99

Chapter 4: Standard for the Micro Thermal Gas Meters

4.1. Introduction	101
4.2. Scope	101
4.3. Normative references	102
4.4. Terminology	102
4.4.1. Definitions	102
4.4.1.1. Flow rate	102
4.4.1.2. Mass flow rate	102
4.4.1.3. Accuracy of measurement	102
4.4.1.4. Uncertainty of measurement	102
4.4.1.5. Repeatability	103
4.4.1.6. Flow profile	103
4.4.2. Specific terms	103
4.4.2.1. Sensor	103
4.4.2.2. Laminar flow element	103
4.4.2.3. Thermal mass flow meter TMF meter	103
4.4.2.4. Micro Thermal Mass Flow meter	104
4.4.2.5. Capillary thermal mass flow meter CTMF meter	104
4.4.2.6. Insertion and/or in-line thermal mass flow meter ITMF meter	104
4.4.2.7. Insertion-ITMF meter	104
4.4.2.8. In-line ITMF meter	104
4.4.2.9. Thermal mass flow controller	104
4.4.2.10. Transmitter	104

4.4.2.11. Retractor mechanism.....	105
4.4.2.12. Range ability	105
4.4.2.13. Turndown	105
4.4.2.14. k-factor	105
4.4.2.15. Normalized volumetric flow rate (GB)	105
4.4.2.16. Normalized velocity (GB).....	106
4.4.2.17. Actual flow rate	106
4.4.2.18. Working pressure	106
4.4.2.19. Maximum working pressure.....	106
4.4.2.20. Pressure absorption	107
4.4.2.21. External leak tightness	107
4.4.2.22. Error of indication	107
4.4.2.23. Normal conditions of use	107
4.4.2.24. Initial permissible errors	107
4.4.2.25. Endurance permissible errors	107
4.4.2.26. Base conditions	107
4.4.2.27. Distributed gas	108
4.4.2.28. Metering conditions	108
4.4.2.29. Meter error curve.....	108
4.4.2.30. Memory	108
4.4.2.31. Optical port.....	108
4.4.2.32. Register	108
4.4.2.33. Segment.....	108
4.4.2.34. Function	108
4.4.2.35. Additional functionality	108
4.4.2.36. Additional functionality device.....	108
4.4.2.37. Automatic meter reading.....	109
4.4.2.38. Connector	109
4.4.2.39. Universal time coordinated (UTC).....	109
4.4.2.40. Index.....	109
4.4.2.41. Methodological software	109
4.4.2.42. Tariff	109
4.4.3. Symbols.....	109
4.4.3.1. Pmax.....	109
4.4.3.2. MPE	109
4.4.3.3. Qmin.....	109
4.4.3.4. Qmax	109
4.4.3.5. Qr	110
4.4.3.6. Qdetectable.....	110
4.4.3.7. Qt.....	110
4.5. Capillary thermal mass flow meter (CTMF meter).....	110
4.5.1. Principles of measurement	110
4.5.2. Typical design	113
4.5.3. Applications and limitations of use	114

4.5.3.1. Gas property effects	114
4.5.3.2. Application and fluid properties.....	114
4.5.3.3. Temperature effects.....	115
4.5.3.4. Pressure effects.....	115
4.5.3.5. Pulsation effects	115
4.5.3.6. Pressure loss	115
4.5.3.7. Cleanness of the gas	116
4.5.3.8. Mounting orientation effects	116
4.5.3.9. Installation effects for flow profile.....	116
4.5.3.10. Vibrations -hydraulic and mechanical.....	116
4.5.3.11. Valves.....	116
4.5.4. Meter selection	116
4.5.4.1. Principal requirement	116
4.5.4.2. Performance specifications	117
4.5.4.3. Physical specifications	117
4.5.4.4. Meter ratings	117
4.5.4.5. Application and fluid properties.....	117
4.5.4.6. Corrosion.....	118
4.5.4.7. Transmitter specifications	118
4.5.5. Installation and commissioning.....	118
4.5.5.1. General considerations	118
4.5.5.2. Safety	119
4.5.5.3. Mechanical stress	119
4.5.5.4. Process adjustment	119
4.5.5.4.1. General.....	119
4.5.5.4.2. Zero adjustment.....	119
4.5.5.4.3. Span adjustment	119
4.6. Working conditions	120
4.6.1. Flow range	120
4.6.2. Temperature range.....	120
4.6.3. Range of gases.....	121
4.6.3.1. Wet gases	121
4.6.4. Orientation.....	121
4.6.5. Permissible errors.....	122
4.6.5.1. Requirements.....	122
4.6.5.2. Test.....	123
4.7. Metrological performance.....	124
4.7.1. Errors of indication.....	124
4.7.1.1. Requirements.....	124
4.7.1.2. Test.....	124
4.7.2. Pressure absorption	125
4.7.2.1. Requirements.....	125
4.7.2.2. Test.....	126
4.7.3. Metrological stability	126

4.7.3.1. Requirements.....	126
4.7.3.2. Test.....	126
4.7.4. Immunity to contaminants in gas stream.....	126
4.7.4.1. Requirements.....	126
4.7.4.2. Test.....	127
4.7.4.3 Specification of contamination dust.....	128
4.7.5. Installation effects.....	128
4.7.5.1. Requirements.....	128
4.7.5.2. Test.....	129
4.7.6. Zero flow.....	129
4.7.6.1. Requirements.....	129
4.7.6.2. Test.....	129
4.7.7. Reverse flow.....	129
4.7.7.1. Requirements.....	129
4.7.7.2. Test.....	130
4.7.8. Low flow registration.....	130
4.7.8.1. Requirement.....	130
4.7.8.2. Test.....	130
4.7.9. High flow registration.....	130
4.7.9.1. Requirement.....	130
4.7.9.2. Test.....	130
4.8. Construction and materials.....	130
4.8.1. General.....	130
4.8.2. Robustness of meter case.....	131
4.8.2.1. General.....	131
4.8.2.2. Protection against penetration of dust and water.....	131
4.8.2.2.1. Requirements.....	131
4.8.2.2.2. Test.....	131
4.8.2.3. Resistance to internal pressure.....	131
4.8.2.3.1. Requirements.....	131
4.8.2.3.2. Test.....	131
4.8.2.4. External leak tightness.....	132
4.8.2.4.1. Requirements.....	132
4.8.2.4.2. Test.....	132
4.8.2.5. Heat resistance.....	132
4.8.2.5.1. Requirement.....	132
4.8.2.5.2. Test.....	132
4.8.2.6. Connections.....	132
4.8.2.6.1. Orientation.....	132
4.8.2.6.1.1. Requirements.....	132
4.8.2.6.1.2. Test.....	133
4.8.2.6.2. Nominal connection diameters for single and two pipe.....	133
4.8.2.6.2.1. Requirements.....	133
4.8.2.6.2.2. Test.....	133

4.8.2.6.3. Torque	133
4.8.2.6.3.1. Requirements.....	133
4.8.2.6.3.2. Test.....	133
4.8.2.6.4. Bending moment	133
4.8.2.6.4.1. Requirements.....	133
4.8.2.6.4.2. Test.....	134
4.8.2.7. Resistance to vibration	136
4.8.2.7.1. Requirements.....	136
4.8.2.7.2. Test.....	137
4.8.2.8. Ageing of external surfaces of the meter, including index windows and adhesion of the index window	138
4.8.2.8.1. Requirements.....	138
4.8.2.8.2. Test.....	138
4.8.2.9. Protection against solar radiation	139
4.8.2.9.1. Requirements.....	139
4.8.2.9.2. Test.....	139
4.8.2.10. Resistance to external humidity	139
4.8.2.10.1. Requirements.....	139
4.8.2.10.2. Test.....	139
4.8.2.11. Flame retardance of external surfaces	140
4.8.2.11.1. Requirements.....	140
4.8.2.11.2. Test.....	140
4.8.2.12. Resistance to the effects of toluene/iso-octane vapour	140
4.8.2.12.1. Requirements.....	140
4.8.2.12.2. Test.....	140
4.8.2.13. Resistance to water vapour.....	143
4.8.2.13.1. Requirements.....	143
4.8.2.13.2. Test.....	143
4.8.2.14. Resistance to impact.....	145
4.8.2.14.1. Requirements.....	145
4.8.2.14.2. Test.....	145
4.8.2.15. Resistance to mishandling.....	147
4.8.2.15.1. Requirements.....	147
4.8.2.15.2. Test.....	148
4.8.3. Corrosion protection.....	148
4.8.3.1. General	148
4.8.3.2. Resistance to external corrosion.....	149
4.8.3.2.1. Protection against external corrosion for material which.....	149
4.8.3.2.2. Protection against external corrosion for corrosion resistant	151
4.8.3.3. Resistance to internal corrosion	152
4.8.3.3.1. Protection against internal corrosion for material which	152
4.8.3.3.2. Protection against internal corrosion for corrosion resistant	154
4.8.4. Resistance to storage temperature range	154
4.8.4.1. Requirements.....	154

4.8.4.2. Test.....	155
4.8.5. Resistance to high ambient temperatures.....	155
4.8.5.1. Requirements.....	155
4.8.5.2. Test.....	155
4.8.5.2.1. Apparatus.....	155
4.8.5.2.2. Test.....	156
4.9. performance.....	157
4.9.1. Meter assembly.....	157
4.9.1.1. General.....	157
4.9.1.2. Durability.....	157
4.9.1.2.1. Requirements.....	157
4.9.1.2.2. Endurance test.....	157
4.9.1.3. Meter error of indication at declared ambient and gas.....	159
4.9.1.3.1. Requirements.....	159
4.9.1.3.2. Test.....	160
4.9.2. Ageing test.....	162
4.10. Calibration.....	163
4.10.1. General considerations.....	163
4.10.2. Use of the desired gas under process conditions.....	163
4.10.3. Use of a surrogate gas.....	163
4.10.4. In-situ calibration.....	164
4.10.5. Insertion-ITMF meter.....	164
4.10.6. Calibration frequency.....	164
4.10.7. Calibration certificate.....	164
4.11. Pre-installation inspection and testing.....	165
4.12. Maintenance.....	166
4.12.1. General.....	166
4.12.2. Visual inspection.....	166
4.12.3. Functional test.....	166
4.12.4. Record keeping (maintenance audit trail).....	166
4.13. Index.....	167
4.13.1. Recording and storage.....	167
4.13.1.1. Requirement.....	167
4.13.1.2. Test.....	167
4.13.2. Display.....	167
4.13.2.1. Requirement.....	167
4.13.2.2. Test.....	168
4.13.3. Segmental display.....	168
4.13.3.1. Requirements.....	168
4.13.3.2. Test.....	168
4.13.4. Display reset.....	168
4.13.4.1. Requirements.....	168
4.13.4.2. Test.....	168
4.13.5. Index windows and surround.....	169

4.13.5.1. Requirements.....	169
4.13.5.2. Test.....	169
4.14. Memory.....	169
4.14.1. Memory.....	169
4.14.1.1. Requirement.....	169
4.14.1.2. Test.....	169
4.14.2. Updating.....	169
4.14.2.1. Requirement.....	169
4.14.2.2. Test.....	170
4.14.3. Data.....	170
4.14.3.1. General.....	170
4.15. Battery.....	170
4.15.1. General.....	170
4.15.1.1. Requirements.....	170
4.15.1.2. Test.....	171
4.15.2. Battery life.....	171
4.15.2.1. Requirements.....	171
4.15.2.2. Tests.....	171
4.15.3. Battery compartment.....	171
4.15.3.1. Requirements.....	171
4.15.3.2. Test.....	172
4.15.4. Battery replacement.....	172
4.15.4.1. Requirements.....	172
4.15.4.2. Tests.....	172
4.15.5. Battery lifetime total.....	173
4.15.5.1. Requirements.....	173
4.15.5.2. Test.....	173
4.15.6. Voltage interruptions.....	173
4.15.6.1. Requirements.....	173
4.15.6.2. Test.....	174
4.15.7. Operating voltage.....	174
4.15.7.1. Requirements.....	174
4.15.7.2. Test.....	174
4.16. Marking.....	174
4.16.1. All meters.....	174
4.16.2. Battery.....	175
4.16.2.1. Requirements.....	175
4.16.2.2. Test.....	175
4.16.3. Two-pipe meters.....	176
4.16.4. Durability and legibility of marking.....	176
4.16.4.1. Requirements.....	176
4.16.4.2. Indelibility test.....	176
4.16.4.3. Ultraviolet exposure test.....	176
4.16.4.4. Weathering.....	176

4.16.4.4.1. Closed locations	176
4.16.5. Accompanying information.....	177
4.17. Software.....	178
4.17.1. Requirements.....	178
4.17.2. Test.....	178
4.18. Communications.....	178
4.18.1. General	178
4.18.2. Character transmission	179
4.18.3. Communications protocol	179
4.18.3.1. General	179
4.18.3.2. Wakeup	179
4.18.3.3. Sign-off	179
4.18.3.4. Security	179
4.18.3.5. Time-outs	179
4.18.3.5.1. General	179
4.18.3.5.2. Inactivity time-out.....	179
4.19. Production requirements for gas meters	179
4.19.1. Specification.....	179
4.19.2. Technical requirements	180
4.19.3. Certificates of conformity	181
References	183

Preface

Like other thermodynamic parameters measured, measurement of fluid flow rate, in order to calculate the amount of fluid flowing through a conduit, particularly measured natural gas per unit of time, has always been very important in the industry. Different techniques and instrumentation is used to measure these parameters depending on the type, flow, precision measuring flow rate range that regardless of how the act of measurement, the most famous ones are: turbine, ultrasonic, magnetic, pressure differential and thermal mass flow meters. Such flow meters are divided in three groups sensitive to the size, mass and velocity of fluid flow in terms of structure and function.

Among these meters, thermal mass flow meters are more sensitive to low flows. Due to the lack of mechanical moving components, a very little pressure drop is provide in the flow passage path.

The measurement technology is based on a MEMS “Micro Thermal Flow Sensing” principle. A micro heating element heats two temperature sensors placed symmetrically to the heater in bypass. In presence of gas flow the two sensors measure a temperature differential which is related to the flow on the basis of known physics principles. Measurement accuracy is high and suitable for gas meters which are in accordance with the measuring instrumentation directive. Such micro-thermal measuring principle is also used in the laboratory instrumentation.

Gas enters the meter and is divided into two flow paths; in both, laminar flow is ensured, in the bypass capillary tube by the very small diameter of the capillary, and in the main tube by the pressure dropper/laminar flow element. Most of the flow goes through the main pipe with pressure dropper: the pressure drop forces a small fraction of flow through the bypass capillary tube.

At the maximum flow rate, the pressure dropper placed in the main gas flow generates a pressure drop. Less than 1 % of the gas stream, i.e. the mass flow rate in the capillary circuit is thereby forced to flow through the bypass capillary tube and over the sensor.

In the micro-thermal mass flow sensor, the temperature difference between two temperature sensors placed symmetrically upstream and downstream of the micro heater detects the passage of gas flow.

In this book, in the first chapter, the authors sought with regard to their many years of experience in the design, manufacture and optimization of equipment for measuring and controlling fluids, especially in the gas industry, in order to learn and use more and more artisans, academics, researchers and consumers in related fields, to explain the basic principles and practice their thermal mass gas flow meters. In the second chapter of this book, application and performance of MEMS is expressed and it is summarized a compare and review of existing technologies for measuring the gas. In the third chapter, the physical and technical characteristics of sensor and metering of Gas-Souzan company have been investigated and finally in the fourth chapter, it has been provided recommended standards such as EN 1359, EN 16234 and ISO 14511:2001 in order to selection, installation, operation and calibration of the thermal mass flow meters.

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Es_soltani@iaun.ac.ir

moradi@gas-souzan.com

h.azad@grad.kashanu.ac.ir

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