FlameIR-ME1 Product Sensor Details

FlameIR-ME1 Introduction

FlameIR®-ME1 is an ultra-low power NDIR CH $_4$ sensor using the most advanced ***solid state LED optical*** technology

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FlameIR®-ME1 calibration concentration up to 0-5% methane (100% LEL)

FlameIR®-ME1 average power consumption is ~ ***3.6mW*** (lower when sampling period is shortened), making it compatible with power supply or wearable applications

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The FlameIR®-ME1 typically has a reading accuracy of ***0.01% + 3%*** at full sensor range

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The FlameIR®-ME1 is ***built with zero point tracking*** and maintains CH_4 measurement accuracy throughout the life of the product

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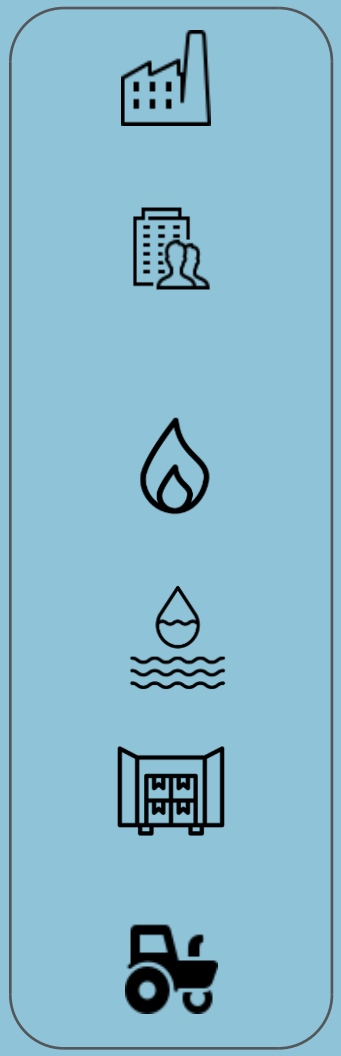
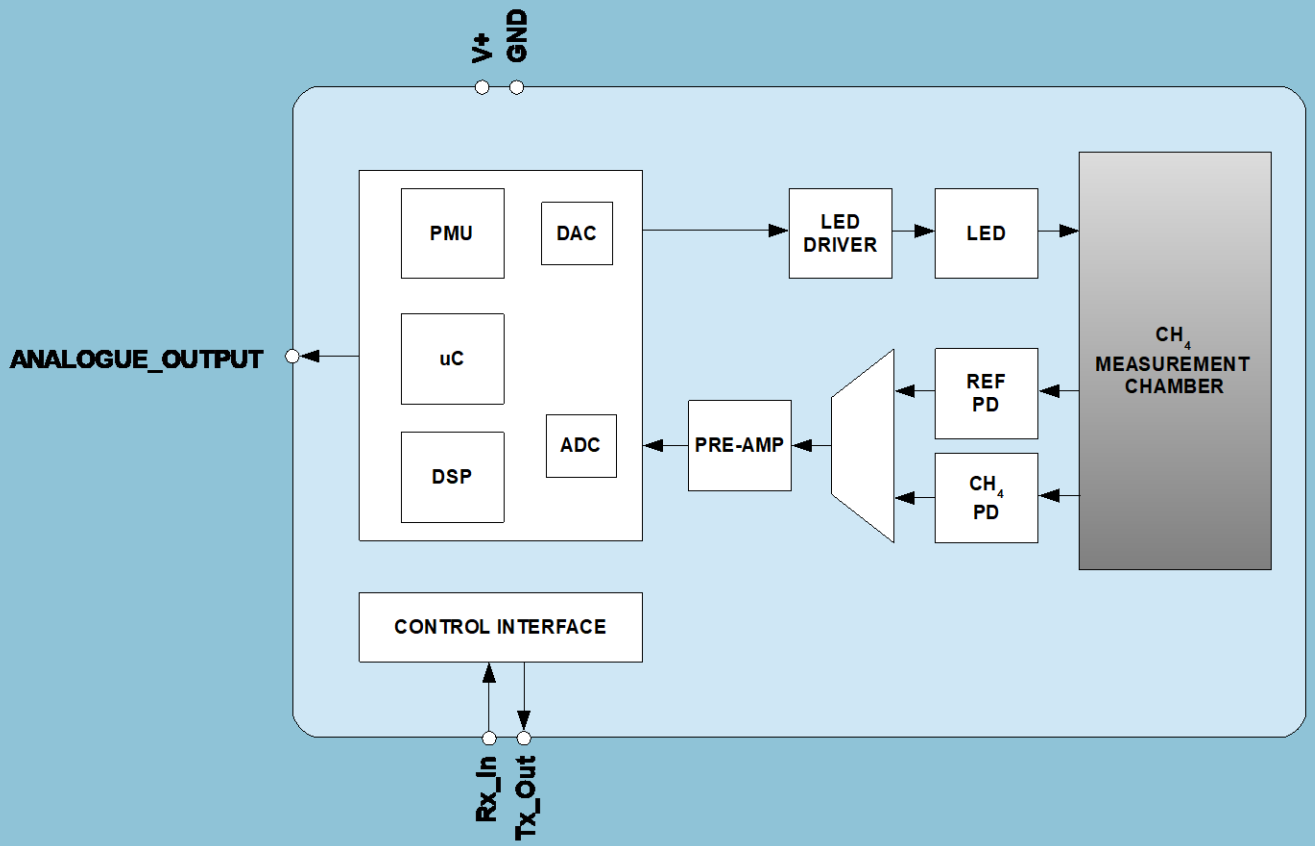
The FlameIR®-ME1 will be intrinsically safe certified and comply ***with ATEXII GD Ex ia IIC T4 Gb***

FlameIR-ME1 Target Market



industrial safety	• Any industry that uses hydrocarbons as part of the process • Safety inspection of entrance to confined space • mining industry
construction bu-siness	• Brownfield development often requires permanent gas monitoring • Garbage dump monitoring • Gas leak detectors for residential and high-rise buildings
gas delivery	• Permanent monitoring and personal safety • Leak detection in confined Spaces • Wearable safety monitor • Unattended pollution monitors
aquaculture	• Access to confined spaces • waste water treatment works
transport	• Access to confined spaces • Goods control
environ-ment	• contamination monitor • Agricultural security • Landfill monitoring

FlameIR-ME1 Block Diagram



- UART or I ² C digital interface, factory optional
- Digital or analog output (default only digital output, programmable analog output)

FlameIR-ME1 Function Setting

gas

- Plant calibration up to 5% (100% LEL) methane
- Other flammable gases (propane, butane, ethane) can be recalibrated
  - User programmable multi-point and slope recalibration
- No continuous calibration required (only zero reset annually)

Measurement rate and response

- Each measurement takes 1.28 seconds
- First read time ~16 seconds (assuming 12 measurements per read, which can be programmed by the user)

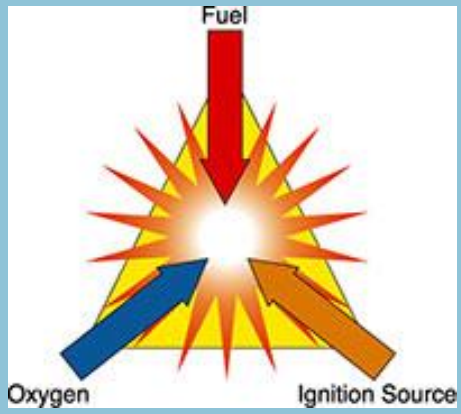
Environmental compensation

- Due to special technical design, the sensor is not affected by humidity
- Active real-time temperature compensation
- The ability to adjust readings according to environmental pressure levels

Sensor Area Classification

Category 1: (also known as 0 zone-FlameIR-ME1)

- Equipment used in high-risk areas where explosive gases are present for a long time.



Category 2: (also known as Zone 1)

- Equipment used in medium risk areas where explosive gases may occur under normal working conditions.

Category 3: (also known as Zone 2)

- Equipment used in areas where explosive gases may occur only under abnormal conditions.

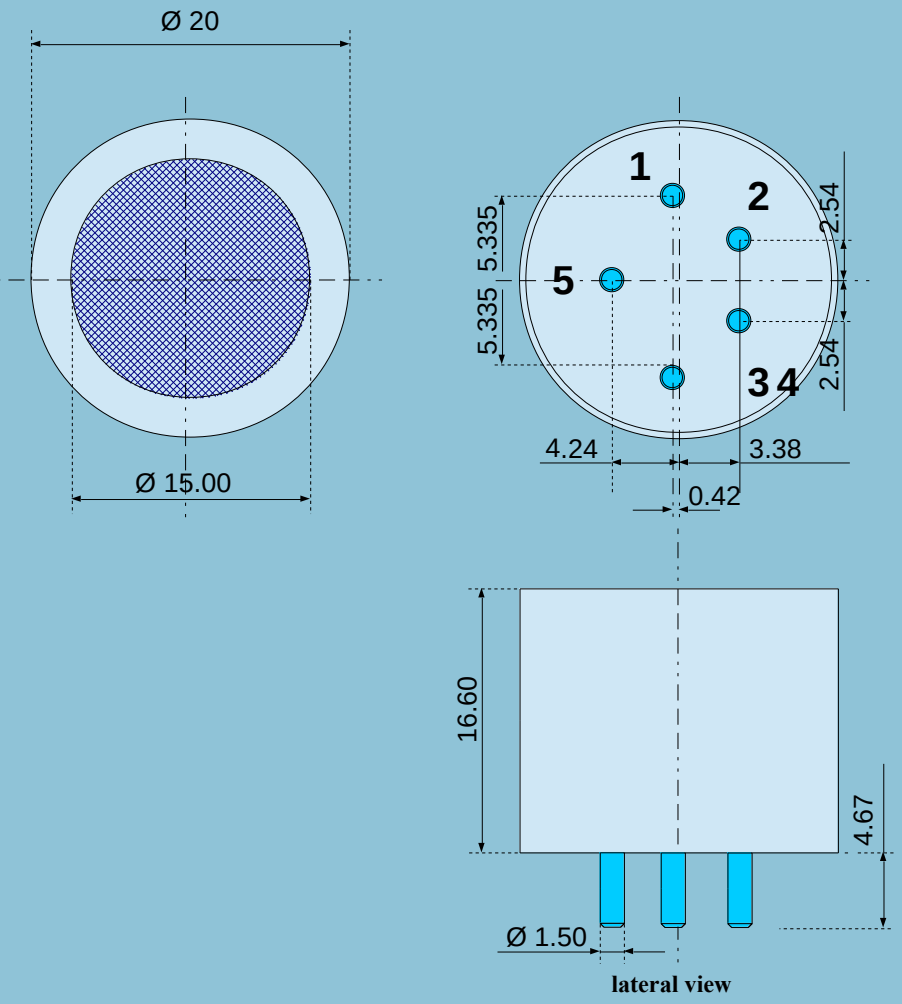
Security Certificate

- To verify that the Flame IR-ME1 sensor complies with ATEX II 1GD Ex ia IICT4 Gb requirements

only ATEX			Ex	ia	IIC	T4	Gb
II	1	GD					
device group	**device class**	**ambient air**	**explosion-proof**	**type of protection [of an electrical apparatus for explosive at mospheres]**	**Equipment groupings**	**temperature grade**	**Equipment protection level**
1: Equipment used in mines II: Equipment for areas where explosive gases, liquids or dust are present	M1: Mines that need to operate in an environment of explosive gas M2: Mines where power must be cut off in explosive gas environments gas 1:0 zone (gas) 2:1 zone (gas) Zone 3:2 (gas)	G: Gas D: Dust		gas d-Flameproof type e-Secure type n-Sparkless type p- Positive pressure type o-Oil-filled type q - Sand-filled type m-Flocculation type i-intrinsically safe	I– mine II-Explosive gases other than those in mines IIA= propane IIB = Ethylene or propane IIC = Hydrogen, ethylene, propane	Gas temperature class and maximum surface temperature T1 – 450°C T2 – 300°C T3 – 200°C T4 – 135℃ T5 – 100℃ T6 – 85°C	Ma-Very high level, even when energized (mine) Mb-High level, power failure (mine) Ga -Very high level (gas) Gb-High level (gas) Gc-Enhanced level (gas)
	stive Zone 20 (dust) Zone 21 (dust) Zone 22 (dust)			stive m – Pour-seal type t-Shell protection pD-Pressure increase	III-Explosive dusts other than in mines IIIA-Combustible dust IIIB-Non-conductive dust (and combustible gases) IIIC-Conductive dust (non-conductive and combustible)	stive Test the maximum surface temperature of the dust layer	Da-Very high level (dust) Db-High level (dust) DC-Enhancement level (dust)

FlameIR-ME1 Encapsulation

Top View **Bottom View**



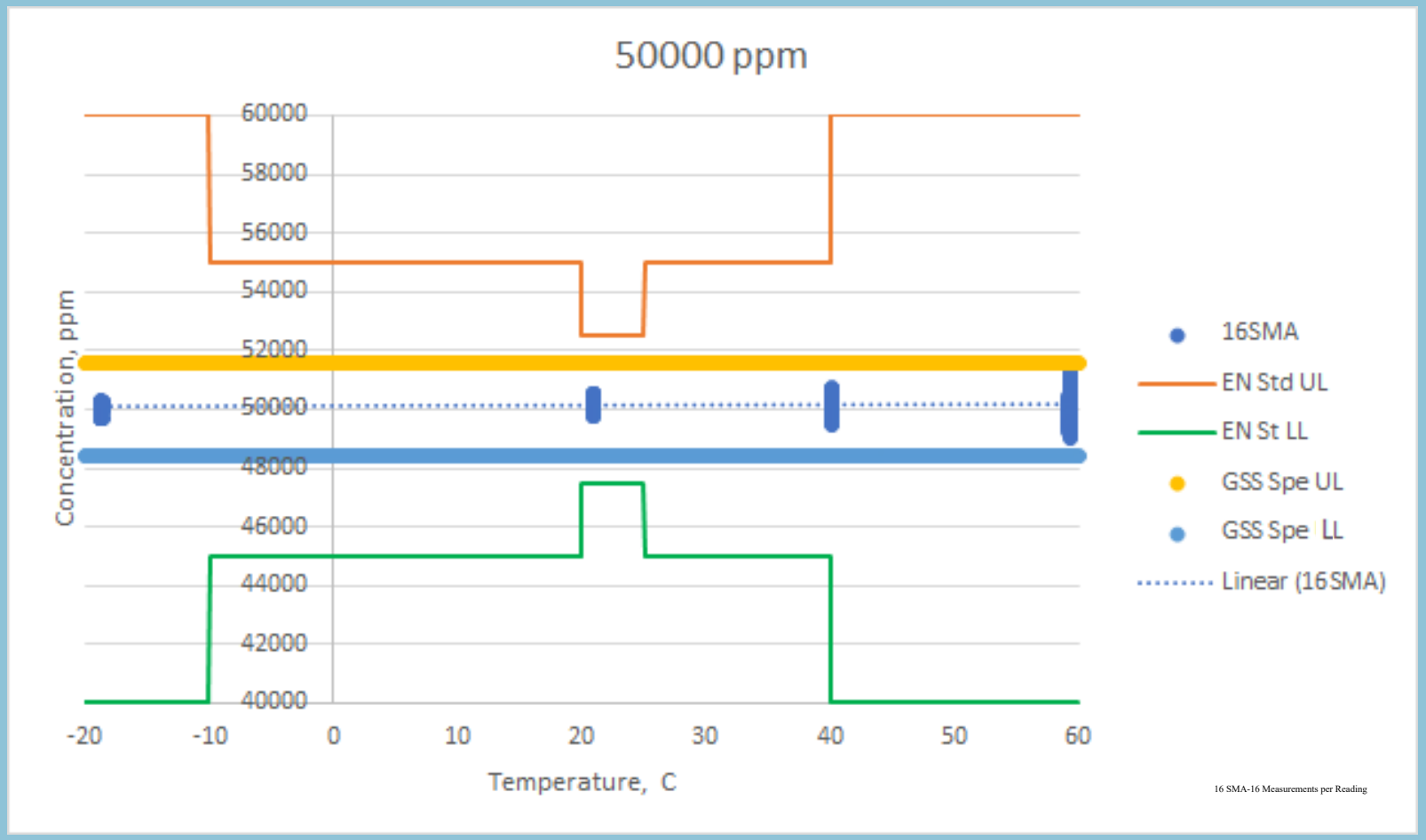
FlameIR-ME1 Parameter Performance*

parameter	symbol	test condition	MIN	TYP	MAX	unit
			0		5.0	%vol
accuracy		@25°C		± (0.01%, read the +3%)		%vol
Time of first reading after power on		Depending on the filter setting, usually 12 readings are taken per measurement		16		second

set up	symbol	test condition	service voltage		mean power
			V	I (mA)	mW
Sensor activated, measuring speed at 1.28 times per second		Default Settings (unoptimized)	3.3	1.1	3.6

* All parameters are measured in actual performance

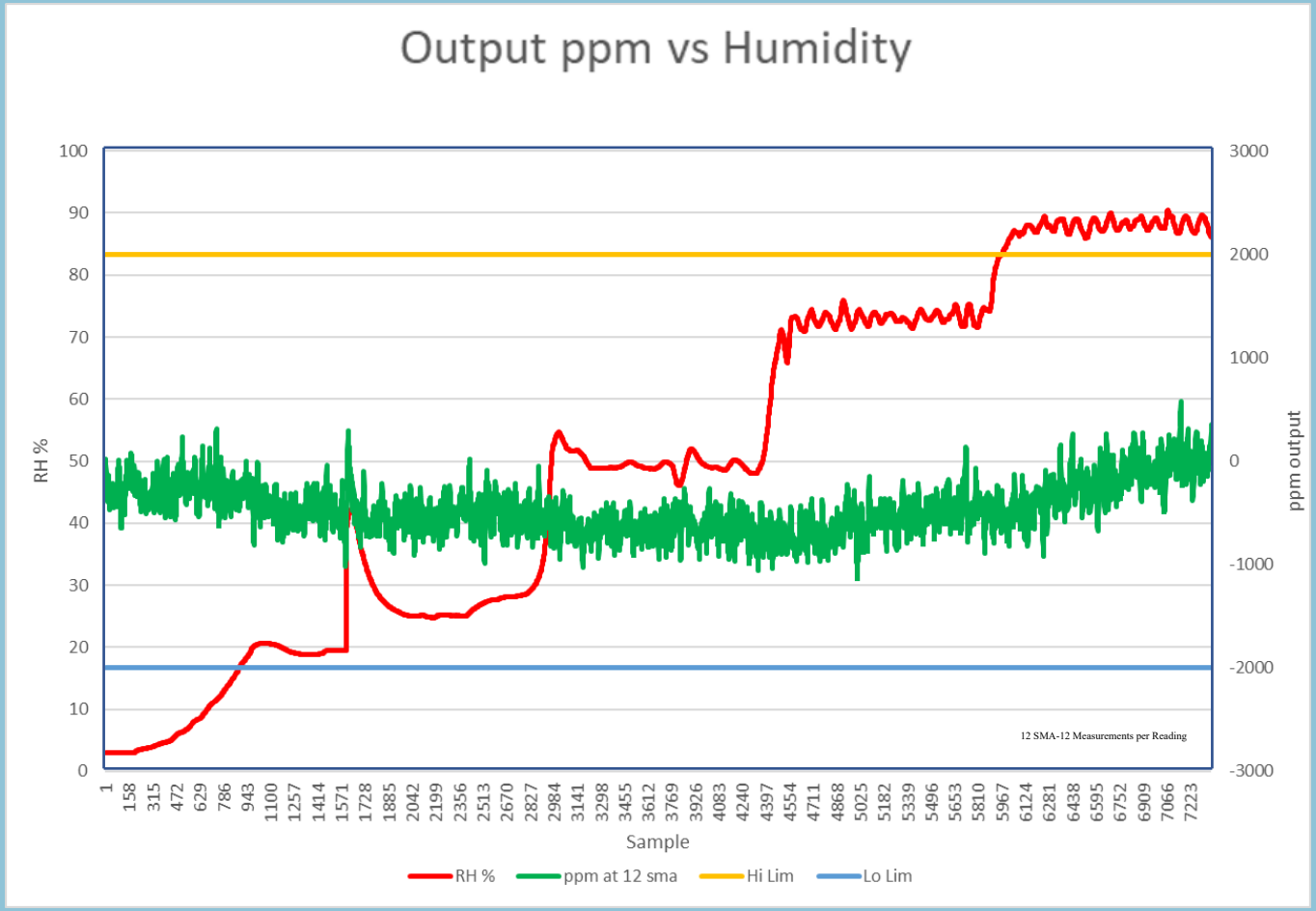
FlameIR-ME1 methane sensor-Thermal performance



Temperature performance (@ 5% methane)

- As the temperature changes, the engineering sample is stable and accurate, <± (0.01% + read number 3%)
- Fully meet the requirements of IEC standards, more competitive advantage over competitors

FlameIR-ME1 methane sensor- RH performance



Relative humidity performance (green line)

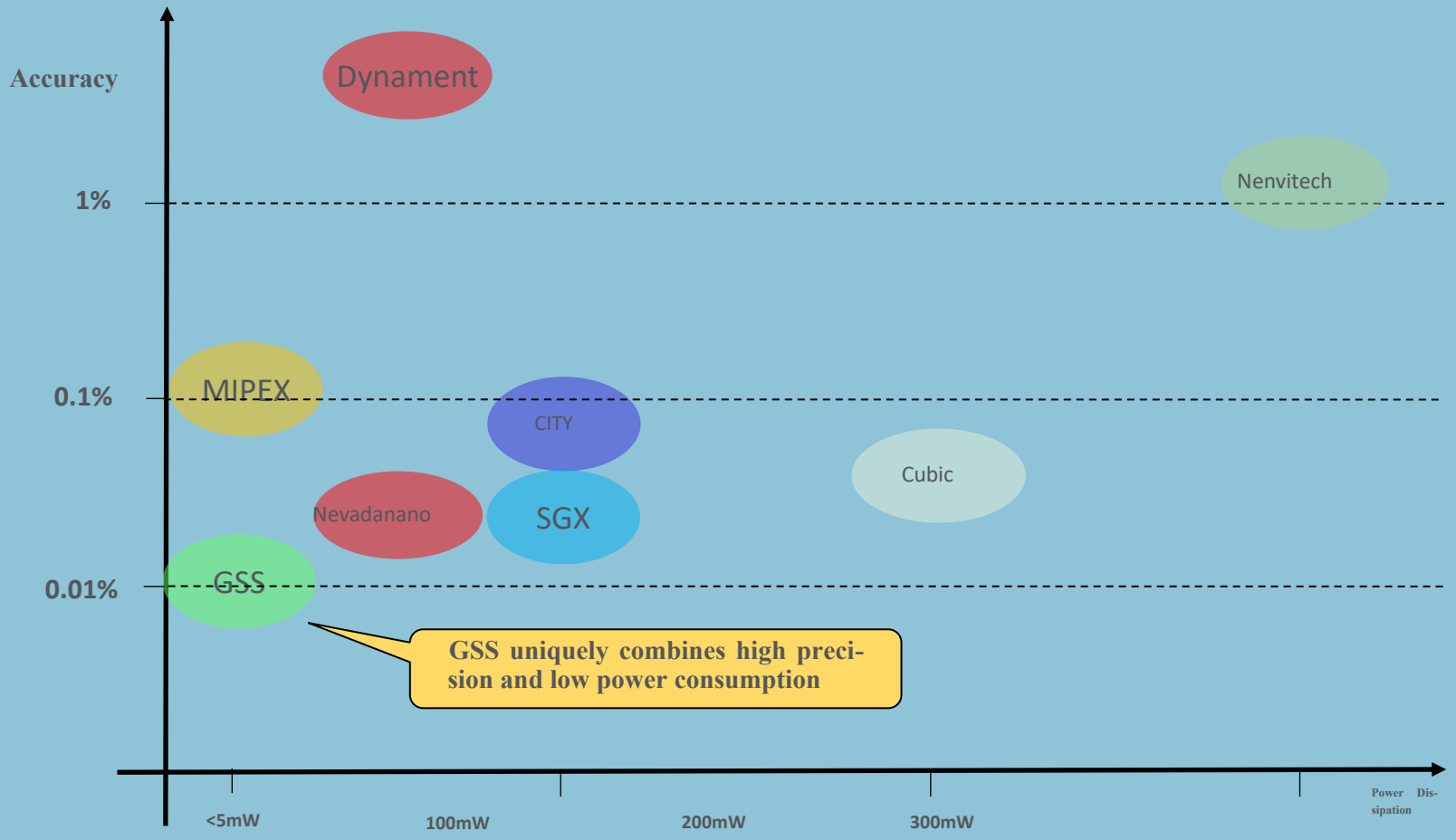
- The humidity of the engineering sample is stable and accurate, and the performance impact caused by RH change is minimized. It fully complies with IEC standards (upper and lower limits in the figure)

FlameIR-ME1 Features and Advantages

market demands	GSS product features	superiority
Battery long life	~3.6mW sensor power consumption (at declared accuracy)	**Battery-powered operation without long-term supervision**
certainty of measurement	± (0.01% + 3% of the reading) Test accuracy unpacked	**The specified and test accuracy guaranteed by GSS**
simple to use	Zero adjustment can be made automatically without user interference	**Easy to set up on site**
Polygases	Can be reprogrammed to measure other flammable gases or mixtures	**Other flammable gases can be measured at the site**
Low maintenance	Low drift, reducing the need for continuous range calibration	**For the purpose of statement accuracy, calibration should not be done more than once a year**
sturdy and durable	Designed for stable and precise operation, insensitive to vibration and shock	**Suitable for portable applications**
Multi-port mode	UART, I ² C or analog output	**Suitable for multi-sensor applications**

FlameIR-ME1 Methane Gas Sensor Competition Comparison

Methane Sensor Power and Accuracy contrast



Competition Review for Methane NDIR Sensors

Products/sensors	Environmental precision (%) vol)	Temperature range (° C)	External temperature accuracy	Pressure range (mbar)	Pressure accuracy	service voltage Nominal value (range) V	power
GSS	± 0.01% + 3% of the reading)	-20 ~ +50 or -40 ~ +60	± (0.015%, + read the 6%)	800 - 1200	tbd	2.97-3.5	~3.6mW @3.3V
SGX INIR-ME	± 0.06% or ± 6%rdg	-20 ~ +55	±0.01% < 2% ±0.02% < 4% ±0.05% < 5%	800 - 1200	Not in the DS	3.3 (3.2 – 5.25)	115mW @ 3.3V
MIPEX-02-X-X-X.1 X (RX)	± 0.1 or ± 5%rdg	-40 ~ +60	± 0.4% or ± 20%rdg	800 - 1200	± 0.2% or ± 30%rdg	(3 – 5)	5mW @3.3V
Dynament MSH2ia	±10% rdg	-20 ~ +50	±0.1% or ±10% rdg <50%FS, ± 10%rdg> 50%FS, or 2%FS if larger	Calibration pressure of ±5%		(3 – 5)	45mW @3V
Cubic NDIR CH4 Sensor SJH	±(0.05% + 5%rdg)	-40 ~ +70	Not in the DS	Not in the DS	Not in the DS	(3.3 – 6)	200mW @3.3V
Nenvitech IRNET-P	±1%FS < 25%FS ±2%FS <50%FS ±5%FS >50%FS	-40 ~ +60	±3%FS < 50%FS ±5%FS > 50%FS	800 - 1200	0.1 ~ 0.2% / mbar	(3 – 5.5)	275mW @3.3
Citytech IRcelCH4	±(0.1% + 4%rdg)	-20 ~ +50	Such as ambient temperature accuracy	700 - 1300	Not in the DS	3.3	100mW @3.3V
Nevadanano MPS Methane	±0.025%	Limited, but undefined -40 ~ +75	±0.13%	800 - 1200	undefinition	3.3 – 5.0 ±5%	29mW

Security Certification Co-mparison

	ATEX	IECEx	UL	SIL	condition
GSS	✓ Ex ia IIC T4 Gb	✓			Due to the use of LED, intrinsically safe, no fireproof housing required
SGX INIR-ME	✓ Ex db IIC Gb	✓			Maximum power th-ermal resistance of 1.5 W lash water
MIPEX-02-X-X-X.1 X (RX)	✓ Ex ia IIC Ga	✓	✓ Class 1, Div 1 Group A,B,C,D		
Dynament MSH2ia	✓ Ex db IIC Gb		✓ Class 1, Div 1		Ui = 6V Pi = 0.8W Ci = 4.105μF Li = 0 mH
Cubic NDIR CH4 Sensor SJH		✓ Ex ia IIC T4 Ga			
Nenvitech IRNET-P				✓	
Citytech IRcelCH4	✓ Ex d IIC T4				-20 ~ +55° C Pmax = 1.4W
Nevadanano MPS Methane					

ATEX (EX)

db = fireproof enclosure ia = intrinsically safe

IIC = Explosive (almost all gases)

Ga = 设备保护级别 1,2,3区

Gb = Equipment protection class 1,2 zones

maximum surface temperat-ure

T6 = 85℃ T

5 = 100℃

T4 = 135℃ T

3 = 200℃

region

0 = High risk, always explosive gas environment

1 = There may be explosive gas environment

2 = Not likely to have an explosive gas environment

Advantages of GSS Methane Sensor

market demands	Best contender	GSS superiority
Long battery life, small size	✓✓	✓ ✓ ✓ **Minimum power**
certainty of measurement	✓✓	✓ ✓ ✓ **Best accuracy**
simple to use	✓	✓ ✓✓ **No zero adjustment is required during use**
Low maintenance	✓	✓ ✓ ✓ **Simple calibration, annual calibration**
sturdy and durable	✓✓✓	✓ ✓✓ **Not sensitive to shock and vibration feel**
Multi-port mode	✓	✓ ✓ ✓ **UART, I ² C, analog options**

Sample Schedule

pre-production sample

- **Mass production**

will end in Q22022

- 2022 Q3 ended

Summary of CO_2 and CH_4 Product Lines

option	CozIR®	ExplorIR®	SprintIR®	FlameIR®
gas	CO_2	CO_2	CO_2	CH_4
range	Up to 1%	As high as 100%	As high as 100%	Up to 5% (100% LEL)
accuracy (Typ.@25。C)	±(30ppm + 3% RDG)	±(70ppm + 5% RDG)	±(70ppm + 5% RDG)	±(0.01% + 3% RDG)
sampling rate	2 times per second	2 times per second	Up to 50 times per second	1.28 times per second
consistency	±10ppm	±10ppm	±10ppm	-
temperature stabilization	2.5ppm/°C	2.5ppm/°C	2.5ppm/°C	-
Response time (T_{50})	Approximately 30 seconds (dispersion)	Approximately 30 seconds (dispersion)	3.6 Second @ 0.1 l/min	Approximately 30 seconds (dispersion)
digital interface	UART or I ² C	UART	UART	UART or I ² C
Analog voltage output	Yes (option)	Yes (option)	deny	yes
operating temperature range	0. C~+ 50. C or -25. C~+55. C	0. C~+ 50. C or -25. C~+55. C	0°C ~ +50°C	-20. C ~ +50. C or -40°C ~ +60°C
working voltage	3.25V ~ 5.5V	3.25V ~ 5.5V	3.25V ~ 5.5V	3.3V
Power consumption (active)	<110uW each reading (Blink)	<3.5mW	<100mW	<3.6mW
Product options	T and RH (optional)	T and RH (optional)	not have	UART or I ² C, gas type

深圳市杰晟兴电子有限公司 JM Components Limited

地址：深圳市福田区中航路7号鼎诚国际大厦南座2007室 邮编：518031
手机：13662266995 马少良 电话：0755-83951311 传真：0755-83952401
官网：cn-sensor.com 电邮：jackson@jmcomponents.com