

## FSM-G-11E Pre-calibrated Module for Methane Gas

### Features:

- \* Factory calibrated
- \* Temperature compensated
- \* Interference resistance sensor TGS2611 applied
- \* Compact
- \* RoHS compliant

FSM-G-11E is a pre-calibrated module for natural gas alarm with its accurate calibration function coming from Figaro's temperature and humidity control device. The sensor chosen for this module is TGS2611-E00 containing a filter to eliminate interfering gases such as alcohol ; as a result, it is more selective and responds faster to methane gas.

The most important process in the manufacture of a reliable civil gas alarm is the calibration of the alarming point, which is complex and time-consuming, and also lots of money needed to purchase the calibration equipment. By simply using this module, this costly calibration process can be left out, making it easier and simpler for users to manufacture civil grade natural gas alarms. What Figaro offers to the users is a gas detector circuit with a sophisticated design, which includes a temperature compensated circuit combined with an in-built thermistor and a low power methane sensor adjusting the load resistance separately.

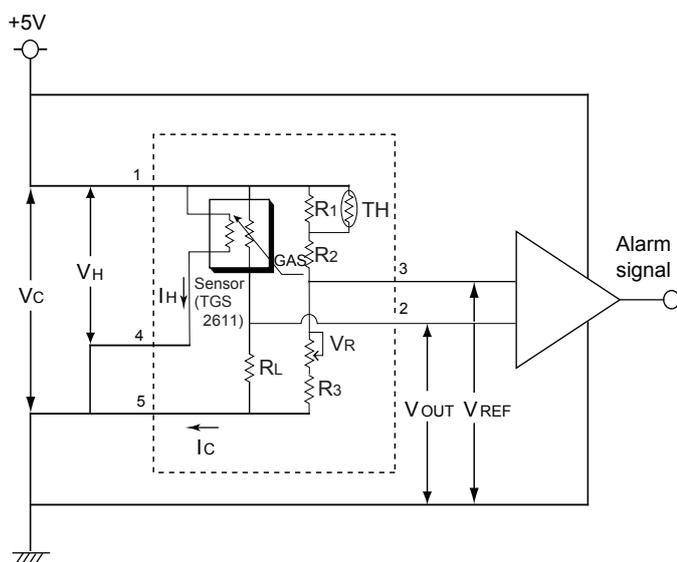
Socket type connection facilitates regular replacement of the sensors. This input/output socket makes it easier for connecting with the main board, which can be used for methane and LP gas detectors by simply replacing the module. The design of the module meets the performance requirements of both EN50194 and UL1484. Please refer to *Technical Information for TGS2611* for details regarding sensor's sensitivity features and refer to *Application Notes for TGS2611* for further information on circuit design.

### Application:

- \* Control of civil grade natural gas alarm



### Circuit Diagram :



- Vc: Loop voltage
- Ic: Loop current
- VH: Heater voltage
- I<sub>H</sub>: Heater current
- V<sub>OUT</sub>: Output voltage
- V<sub>REF</sub>: Reference voltage

### Pin connections:

5V DC supply connects to Pin #1, and the voltage comparator should be connected to Pins #2 and #3. The circuit used to detect heater failure can be connected to Pin #4 (in this case, Pins #4 and #5 should connect GND). When gas sensor module is exposed to the alarming point of the expected target gas, V<sub>OUT</sub> will reach or exceed V<sub>REF</sub>, and the module will alarm.

Note: As it is described in Part 2-6 in *Technical Information for TGS2611*, in the first few seconds after powering up the sensor which has been switched off for a long time, the sensor resistance (R<sub>s</sub>) will decline dramatically before recovering to a stable state regardless the presence and absence of the target gas. In the first few seconds after powering up as V<sub>RL</sub> could be bigger than V<sub>REF</sub>, alarm can be triggered for this reason. To prevent undesired alarms during sensor warming-up, it is necessary to refer to Part 1-7 in *Application Notes for TGS2611* to make appropriate modification on the circuit.

### Components details:

Symbols	Components	Spec.	Qty.
R1	Carbon resistor	22kΩ	1
R2	Carbon resistor	6.8kΩ	1
R3	Carbon resistor	6.8kΩ	1
RL	Carbon resistor	1.1~4.7kΩ	1
VR	Potentiometer	20kΩ	1
TH	Thermistor	10kΩ@25° C B value=3370±1%	1
Sensor	Gas sensor	Figaro TGS2611-E00	1
CN	Connector	Nichiatsu MB5P-90S	1

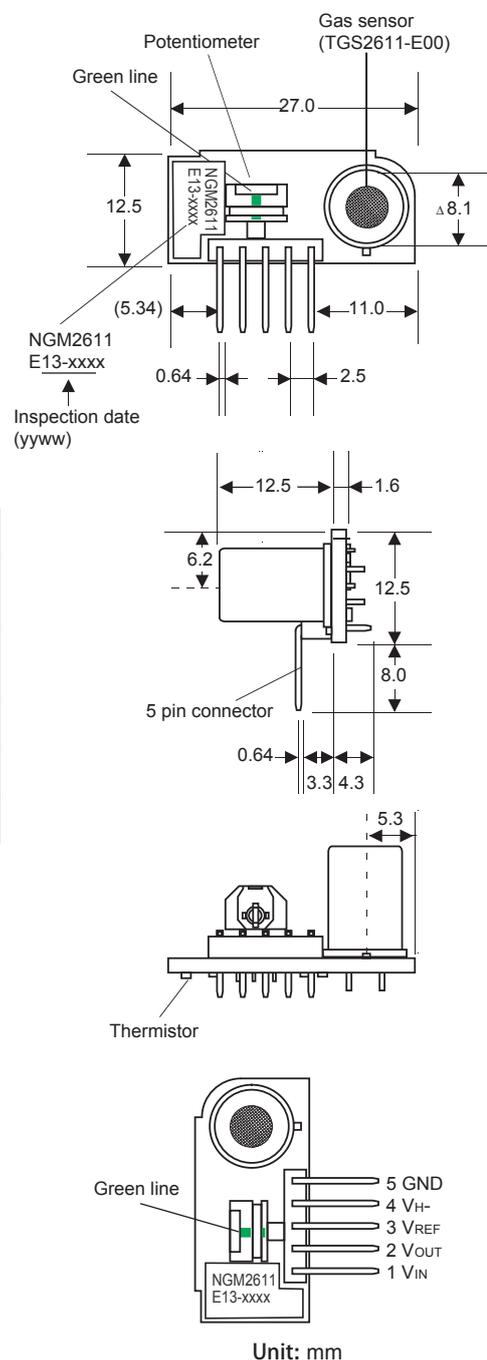
### Specifications:

Model No.		FSM-G-11E	
Standard test conditions	Test gas condition	5000±100ppm methane in air, 20° C±2° C, 65±5%RH	
	Circuit condition	V <sub>H</sub> =5.0±0.05V DC V <sub>C</sub> =5.0±0.05V DC	
	Test warming-up time	48 hours	
Electrical features under standard test conditions	Reference voltage	V <sub>REF</sub> (STD)	V <sub>OUT</sub> (STD)±0.5V DC
	Output voltage	V <sub>OUT</sub> (STD)	2.5±0.5V DC

### Specifications:

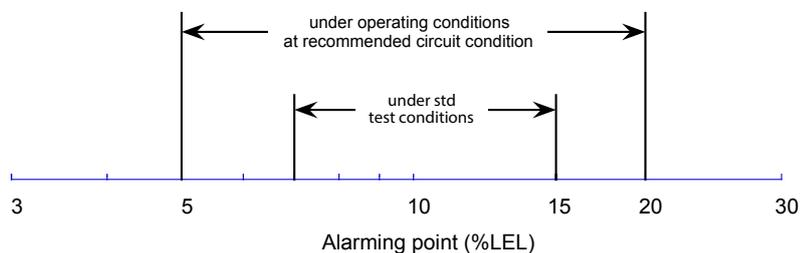
Suggested working conditions	Heater voltage	V <sub>H</sub>	5.0±0.2V DC
	Loop voltage	V <sub>C</sub>	5.0±0.2V DC
	Minimum resistance between pin#2 and GND	2.5MΩ	
	Minimum resistance between pin#3 and GND		
	Working condition	0° C~40° C, 30~95%RH	
	Temperature difference between the inside and outside of the detector	≤ 10° C max. (see note 1)	
Electrical features under working conditions	Heater current (current between pin #1 and pin #4)	I <sub>H</sub>	56±5mA
	Loop current (current between pin #1 and pin #5)	I <sub>C</sub>	10mA (max)
	Reference voltage	V <sub>REF</sub>	1.0~4.0V DC (see note 2)
	Output voltage	V <sub>OUT</sub>	0.05-(V <sub>C</sub> -0.05)V DC (see note 3)

### Structure and dimensions:



**Important notice:** When initially setting up the potentiometer before using the module, user should check and confirm that the potentiometer has already been located in the correct position. There is a green line on the FSM-G-11E for alignment, which must be aligned with the other green line on the potentiometer.

## Performance assurance:



The performance assurance of methane gas detector using FSM-G-11 when alarming point is 10%LEL

Notice: The predictable and typical error using FSM-G-11 when methane is 10%LEL is as the figure above. While in actual application, things can be different as the alarming threshold may also be affected by factors such as variations in test conditions, excess heat inside the housing of the gas detector. In a word, Figaro will neither specify nor acquiesce in the performance in this figure. Please consult Figaro if a big difference is found between the actual and the expected performances of the detector.

## Basic test circuit:

Absolute maximum ratings (see Note 4)	Loop voltage	$V_C$	-0.3~+5.5V DC
	Heater voltage	$V_H$	-0.3~+5.5V DC (5.5V max for 2min)
	Operating temperature		-15° C~+55° C (max 95%RH)
	Storage temperature		-20° C~+60° C (non-condensing)
	Soldering temperature		260° C (max for 10s)

Note 1: If the heat produced by circuit components causes the temperature inside the detector to exceed the ambient temperature outside the detector housing by 10°C or more, the calibrated alarming concentration value may drift due to the drift in reference voltage  $V_{REF}$ . Please consult Figaro if user cannot guarantee the temperature difference between the inside and outside of the detector housing is kept below 10°C by design.

Note 2: Reference voltage may exceed rated range if operating temperature is beyond the suggested working conditions.

Note 3: Output voltage may exceed nominal range if the following conditions occur:

- \*Methane concentration exceeds 20,000ppm
- \*During warming-up ((Due to initial action, please refer to Part 2-6 *Initial Action* in *Technical Information for TGS2611* on page ), setting up failure thresholds is highly recommended when using NGM2611-E13.
- \*\*The recommended failure thresholds are: :
  - 1.0V DC >  $V_{ref}$  > 4.0V DC
  - 0.05V DC >  $V_{out}$  >  $(V_C - 0.05)V$  DC

Note 4: The design of the detector should conform to the “suggested working conditions” described above. However, the design of the detection circuit should in no case exceed the “Absolute maximum ratings”, otherwise, damage or performance degradation may happen to the sensor.