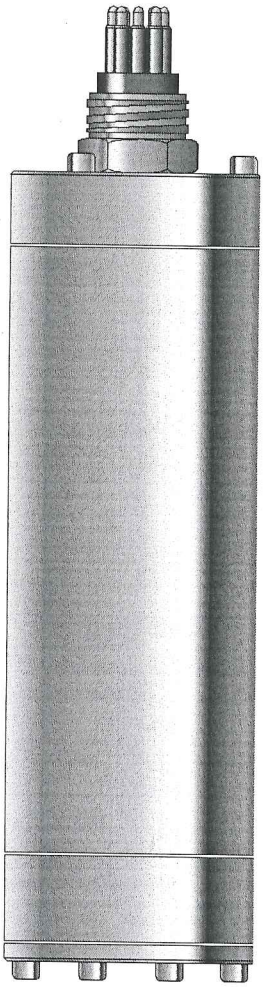
METS methane sensor

S/N GT184-F32

MANUAL



FRANATECH

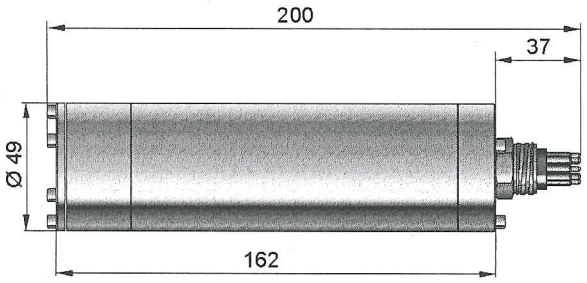
UNDERWATER SENSORS FOR DISSOLVED GASES

2 Mechanical Specifications

Dimensions

Housing diameter: 49 mm
Length overall: 200 mm

Weight approx.: in air 0,8 kg
in water 0,5 kg



Materials

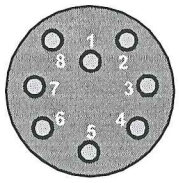
Titan Housing and Connector

Connector

Subconn © microcircular MCBH8M

3 Input / Output Specifications

3.1 Pin configuration

pin #	configuration	description
1	positive supply 9 – 36 VDC	 male face view
2	GND	
3	signal methane 0-5 V	
4	NC	
5	signal temperature 0-5V	
6	GND	
7	TxD(RS232)	
8	RxD(RS232)	

Note:

- both GND (pins 2 and 6) are connected together on the electronic board
- temperature is measured inside the detector room

3.2 Consumption:

115 mA @ 12 VDC (switch-on peak max. 250 mA)

3.3 Communication protocol for digital output

RS232
9600 Baud rate, 8 Data Bits, 1 Stop Bit, no Parity Bit

symbols used
Carriage Return: <CR>
Space: <SP>
Command/Query: #
Sensor reply: >

The sensor has a PIC-address set at A0

To read data, send the command: #A0<CR>
Sensor reply:
>1:Methane<SP>2:Temperature<SP>3:Reserve<SP>4:Reserve<SP>5:Reserve<SP>6:Reserve<SP>
7:Reserve<SP>8:Reserve<CR>

The output is ASCII - Hex as raw data, corresponding to voltage.
To convert to voltage value, first convert from Hex to Decimal, then multiply by 5 / 4096:

Example:
Query: #A0
Reply: >1:0AF2 2:07FB 3:0714 4:0000 5:0000 6:0000 7:0000 8:0000

The first value would then be: 0AF2(h) = 2802(d) → 2802 * 5V / 4096 = 3,42 V

3.4 Calibration formula

Basically the calibration aims at providing a relation between the sensor signal output and the concentration of dissolved methane.
It is carried out in a dedicated apparatus, which allows to prepare water with a known concentration of dissolved methane.
Gas mixtures of methane in air at different concentrations are bubbled in a reasonably air-tight tank filled with water. Calibration is started at lowest concentration in order to avoid having to change the water after each measure. The water is circulated into a small chamber, to which the sensor-head is attached by means of a flange.
It is possible to have the sensor directly in the mixing tank, however the water must be circulated or stirred by some means. Otherwise a dead layer could build itself right before the membrane, hampering methane diffusion. This can induce an important delay before equilibrium is reached.
The different concentrations are obtained from commercial certified gas mixtures (methane in synthetic air). The water temperature is set at a definite value and maintained thermostatically.
For each concentration the measurement is made first when relative humidity has set around 100% and when equilibrium is reached between the partial pressures of methane in the gas mixture and in the water. The signal output stays then level. The time needed to attain this is conditioned to the size of the tank. A water sample is taken, and analyzed with a gas-chromatograph using the Head-Space method. The concentration is calculated equivalent under standard (25 °C, 1 atm).
The calibration is carried out at different concentrations (generally 5) and temperatures (generally 3).
The conversion formula is obtained by a 3dimensional fitting between output voltage, concentration and temperature. The concentrations and temperatures are chosen first according to the ranges expected at the deployment location, second according to the degree of resolution which is needed. As a rule, the wider the range the poorer the resolution. Typical range limits are concentrations between 50 nmol/l and 10 µmol/l, and temperatures between 2 and 20°C.

The certificate with the calibration formula is provided on the next page.

Formula digital

Type: **METS Methane Sensor**

Serial number: **GT184-F32**

$$R = 8{,}102 + 403{,}167 * \exp\left(\frac{-f}{19021{,}824}\right) + 4270{,}623 * \exp\left(\frac{-f}{3715{,}891}\right)$$

$$c = \exp\left[1{,}658 * \ln\left\{\left(7{,}631 + 53{,}962 * \exp\frac{-V_t}{0{,}681}\right) * \left(\frac{1}{R} - \frac{1}{-198{,}385 + 645{,}644 * \exp\frac{-V_t}{2{,}055}}\right)\right\}\right]$$

$$t = 22{,}01 * V_t - 5{,}25$$

R = methane detector resistance [kΩ]
c = methane concentration [µmol/l]
t = gas temperature [°C]
f = frequency [Hz]
V_t = temperature voltage [V]

Methane range: 1 nmol/l – 500 nmol/l

Temperature range: 2 –20 °C

Calibrator : J.G. ..... Date : June 13, 2013

Formula analogue

Type: **Methane Sensor METS**

Serial number: **GT184-F32**

$$c = \exp\left[1{,}621 * \ln\left\{\left(0{,}084 + 0{,}630 * \exp\frac{-V_t}{0{,}678}\right) * \left(\frac{1}{V_{CH4}} - \frac{1}{-2{,}302 + 7{,}590 * \exp\frac{-V_t}{2{,}038}}\right)\right\}\right]$$

$$t = (V_t * 22{,}01) - 5{,}25$$

c = methane concentration [µmol/l]

t = water temperature [°C]

V_{CH4} = methane voltage [V]

V_t = temperature voltage [V]

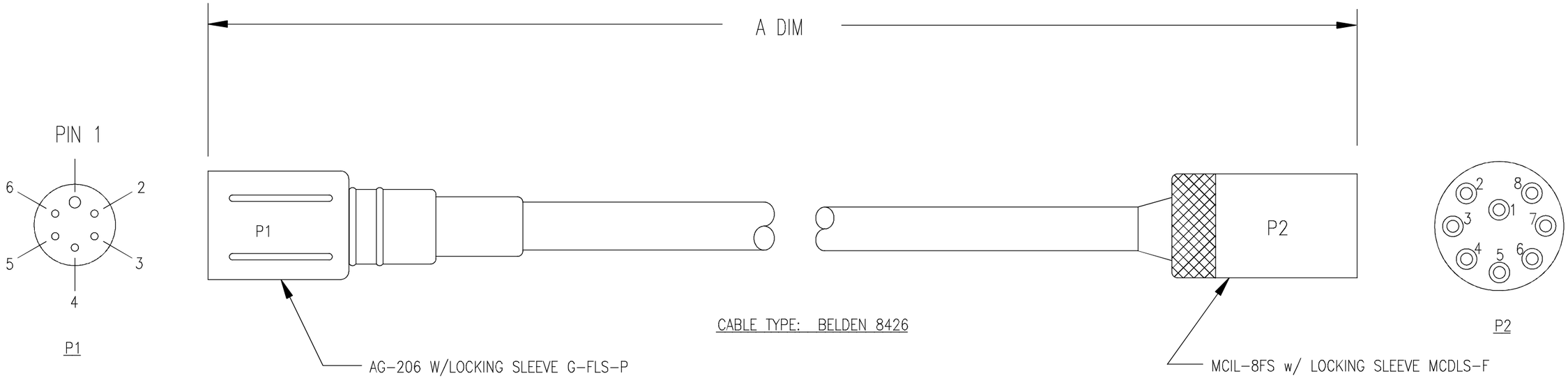
Methane range: 1 nmol/l - 500 nmol/l

Temperature range: 2°C – 20°C

Calibrator : J.G. .....

Date : June 13, 2013

DATE	SYM	REVISION RECORD	AUTH.	DR.	CK.
1/21/13	A	UPDATE MFG NAME	CL	CB	CB



P1

SBE PART NUMBER	A DIM
171747	60 INCHES

P1 (AG-206)	P2 (MCIL-8FS)	SIGNAL
PIN 1	PIN 2	POWER COMMON
PIN 2	PIN 3	METHANE SIGNAL
PIN 3	PIN 2	METHANE RETURN
PIN 4	PIN 5	TEMPERATURE SIGNAL
PIN 5	PIN 2	TEMPERATURE RETURN
PIN 6	PIN 1	+15 VDC

SEA-BIRD ELECTRONICS, INC

P/N	SCALE	DRAWN BY	KLP
SEE TABLE	NTS	APPROVED BY	

CABLE: AG-206 TO MCIL-8FS
FRANATECH METS I/F

DATE	DWG NO.	SHEET	REV
1-9-03	32765	1 of 1	A