



Optical Gas Analyzers

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Modular Gas Analyzer DX6100 Series



Advantages

- ✓ **high selectivity and stability**
- ✓ **wide range of measured concentrations**
- ✓ **Miniature gas sampling cell**
- ✓ **fast response**
- ✓ **long service life**

Features

- ✓ **no moving parts**
- ✓ **minimum dimensions and light weight**
- ✓ **low power consumption**

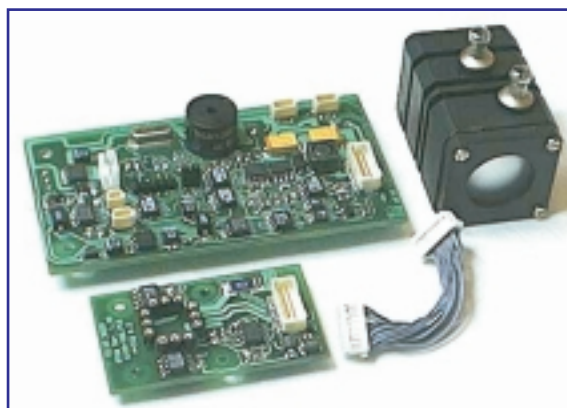
The company RMT Ltd introduces new DX6100 series of Modular Gas Analyzers. The principle of operation is based on selective absorption of IR radiation by gas molecules.

The differential double frequency optical scheme provides high accuracy in wide ranges of humidity and temperature due to the internal thermostabilization.

New type of middle infrared integrated pair (detector and light emitters) with built-in thermoelectric cooling is used. The used light sources are pulsed solid state MIR light emitters. The Lead Selenide photoresistor is used as photodetector.

There are several models suitable for the following gases: CO₂, CH₄, C_nH_m, water vapor. Another optional gas analyzers are available on request.

Both complete modular and OEM versions



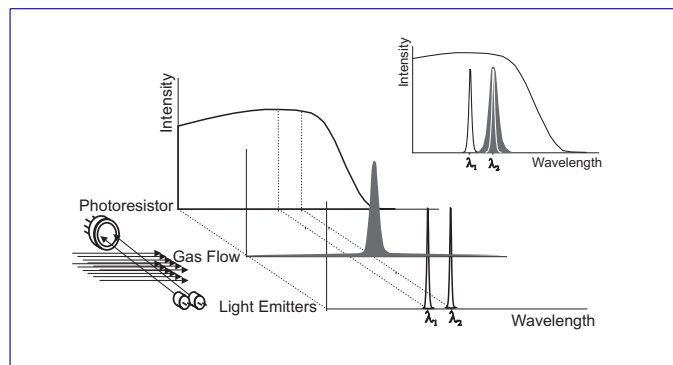
Principles of Operation

The NDIR (Non-Dispersive Infra-Red Spectroscopy) measurement method is implemented in the DX6100 Analyzer.

The analyzer provides gases concentration measurement based on the classical double channel optical scheme. One of the beams (measuring channel) has the wavelength which is tuned to the optical absorption line of the measured gas. The other beam (reference channel) has the wavelength which is out of the adsorption band of the measured gas.

Intensities of two light beams passed through the measured gas sampling cell are compared. Reference channel is used for indirect measuring of the initial

intensity of light, and allows to eliminate actual measurements conditions (total transparency of gas volume, optics imperfection and so on).



The principle of gas concentration measurement realized in DX6100 analyzer

Design Features

The DX6100 Gas Analyzer is specially designed for fast response, high sensitivity, low noise and low power consumption.

A number of design features contribute to the performance :

- The infrared sources are special narrow-band pulsed Light Emitters which operate in microsecond range. The light sources have long life (more then 10,000 hours).
- Radiation from Light Emitters passes through gas sampling cell, reflects from mirrors and is focused onto wide-band Photodetector.
- Both Light Emitters and Photodetector chips are integrated into a single housing and placed onto a miniature TE cooler for thermostabilization.
- Microcontroller provides temperature regulation with better then 0.1°C accuracy. The temperature is software selectable from ambient down to -20°C.
- Heat, dissipated from warm side of TE coolers, leads to few degrees of overheating of gas sampling cell above ambient. This factor plays the role of vapor anti-condensation at operation in wet conditions.
- All driving function of Light Emitters and Detector are operated by on-board microcontroller.
- Pre-amplified outputs are maintained by the microcontroller. The final result is the digital data of measured gas concentration and is available in realtime through RS-232C or analog port.
- For signal processing the calibrating data of Optical Unit is used. The data is stored in Optical Unit's EEPROM.
- The RS-232C port is also used for remote control from computer.

Operation Overview

The order of measurements with DX6100 device is as follows:

1. Firstly, the individual calibration of device is required with using of standard gas mixtures.

The Detector output signal is non-linear with respect to measured gas concentration. The intensity of light which passed through gas sampling cell is the integral of various optical rays from Light Emitter. Also sensitivity of Detector and performance of Light Emitter depend very much on its operating temperatures.

Detector's output signals (both measuring and reference channels) are measured while calibration gases with known concentration are passed through the gas sampling cell. The data obtained are used for polynomial extrapolation of calibration results.

The polynomial coefficients and the "zero" ratio are stored into the device internal on-board EEPROM memory.

The first calibration is made by Manufacturer.

The factory standard calibration uses not fewer than 5 standard gas mixtures.

Several calibrations are made at different ambient temperatures (in specified operating range) and at corresponding optimal operating temperatures of the integrated detector-emitter pair.

It is possible to store up to 15 such calibrations for further application.

2. During a routine operation the detector's output signals are measured. Using known "zero" value and polynomial coefficients the gas concentration is calculated with a high accuracy as a function of measuring and reference channels signals ratio.

Resulted concentration is calculated in absolute mmol/m^3 units.

The device provides (if required) recalculation of the concentration into relative ppm units. But to convert absolute

units (mmol/m^3) into relative (ppm) ones it is necessary to use ambient temperature and pressure.

The values of ambient temperature and pressure can be input by a user manually into the device memory at the beginning of the experiment.

Default values are extracted by the device microcontroller from the memory and correspond to ambient conditions at calibration procedure.

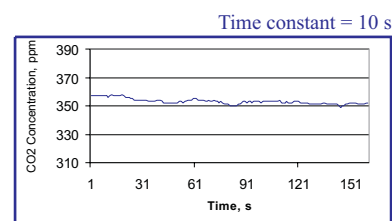
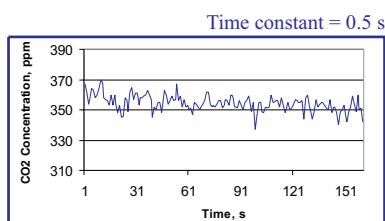
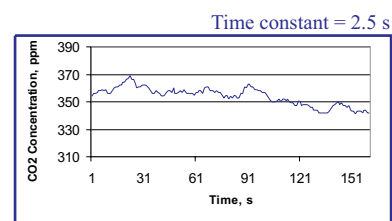
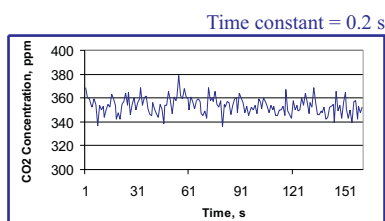
Also it is possible to use the value of measured ambient temperature provided by an on-board digital thermo-sensor.

3. To preserve high accuracy of the device it is necessary to make "zero" adjustments periodically as recommended in Chapter "Maintenance" of the Manual.

4. Periodicity of device recalibration is 1 year. It could be done at the factory of Manufacturer, or by a user with the help of corresponding DX6100 Vision software.

Noise Level

Adjustable noise level is realized due to application of algorithm of digital filtration. Main parameter of digital filter is a Time constant. It is adjustable in a range 0.1...60 s.



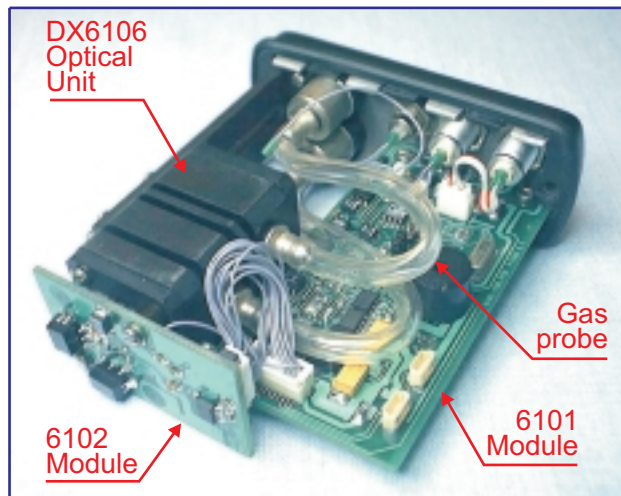
Inside the Analyzer

The DX6100 Analyzer consists of three main parts:

- DX6106 Optical Unit,
- 6101 Controller Module,
- 6102 Optocomponent Mating Module.

Those parts combined together and housed into a body form a completed version of DX6100 analyzer.

The same components taken separately, supplemented by a set of special cables, form a Kit for OEM applications (DX6100 OEM) analyzer.



DX6100 Analyzer with the Cover Removed

DX6106 Optical Unit



DX6106 Optical Unit with Optopair Detached

The DX6106 Optical Unit is the head part of the Gas Analyzer. It consists of an isolated gas sampling cell (the spherical mirror and the sapphire window are placed at the end sides) and a new generation integrated optopair with 6102 electronic module.

The internal volume of the gas cell depends on Optical Unit version. The gas sampling cell has two gas inlets with 5.0 mm internal diameter.

The gas sampling cell can be easily disassembled for service

of internal optics (mirror and window). For this purpose both the top and bottom covers can be removed and the optical components extracted out.

The mirror has special SiO₂ safety layer.

DX6106 Optical Units are manufactured in two versions:

with DX6106.C2 and DX6106.C4 gas sampling cells (See Table).

Depending on what gas and what limiting concentration value must be measured by the Analyzer, it is furnished with one or the other sampling cells.

Gas sampling cell	No. of passes	Total path length [mm]	Internal volume [ml]
DX6106.C2	2	55	4.7
DX6106.C4	4	100	10.4

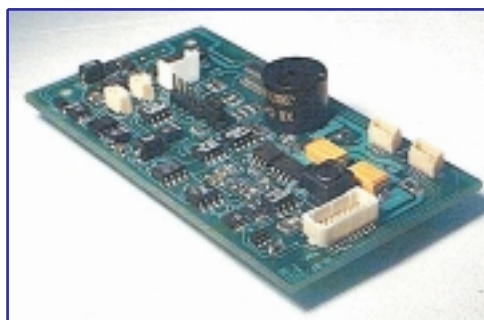


DX6106.C2 Gas Sampling Cell



DX6106.C4 Gas Sampling Cell

6101 Controller Module



6101 Controller Module

The 6101 Controller Module provides the following functions:

- amplification and processing of detector's output signals,
- storage of identifier and individual calibration parameters.
- thermostabilization of optocomponent using built-in PID algorithm of TE cooler regulation with thermosensor,
- signals forming for light emitters driving
- filtering and digitizing of Detector's pre-amplified output,
- conversion of amplified output signals into gas concentration using stored calibration data,
- driving by the gas analyzer through RS-232 port,
- light and sound alarm.

6102 Optocomponent Mating Module



6102 Optocomponent Mating Module

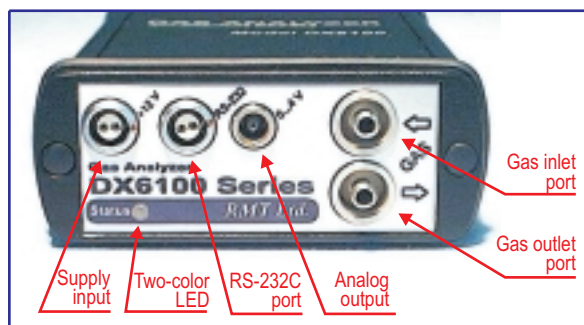
The 6102 Optocomponent Mating Module provides:

- pre-amplification of photodetector's signals,
- light emitters driving,
- power supply of photodetector and thermistors with precise voltage.

Output Connectors

There are the following units on the front panel of the DX6100 Analyzer:

- Power supply input connector,
- RS-232 connector,
- Analog output connector,
- Two-color LED indicator,
- Inlet gas port,
- Outlet gas port.



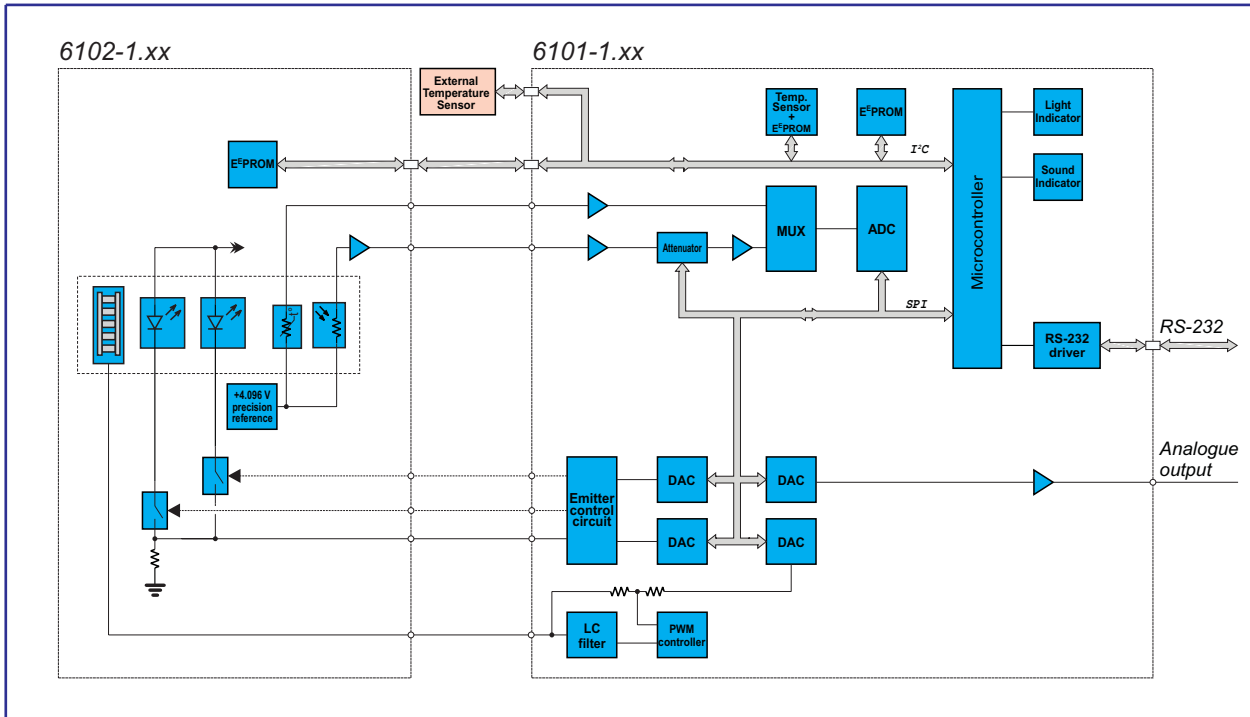
Output Connectors of DX6100 Gas Analyzer

Functional Diagram

6102 Optocomponent Mating Module is connected with 6101 Controller Module with special cable via miniature 20 pin

System Interface connectors. Digital Thermometer is an optional module for the measurement of an absolute

value of ambient temperature with 0.5°C accuracy.



Functional Diagram of DX6100 Gas Analyzer

DX6100 Vision Software

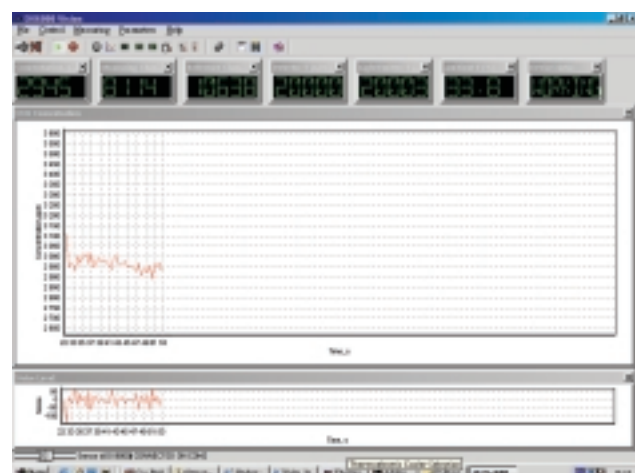
In general it is not required anything for the Analyzer operation except the external power source.

But for many purposes, such as the change of tunings of the analyzer, zero adjustment, calibration and so on, the control computer is necessary.

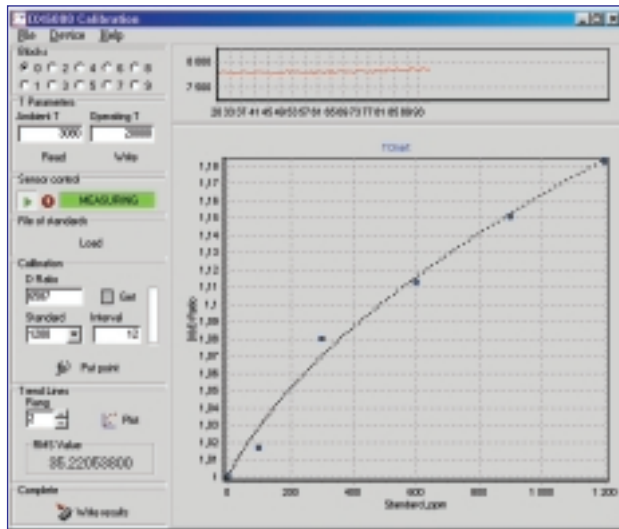
The RMT Ltd has developed the DX6100 Vision program grup specially for working with the DX6100 Gas Analyzer.

The DX6100 Vision software provides all possible operational modes of the DX6100 Gas Analyzer. The DX6100 Vision has the simple interface and does not demand the User's special knowledge.

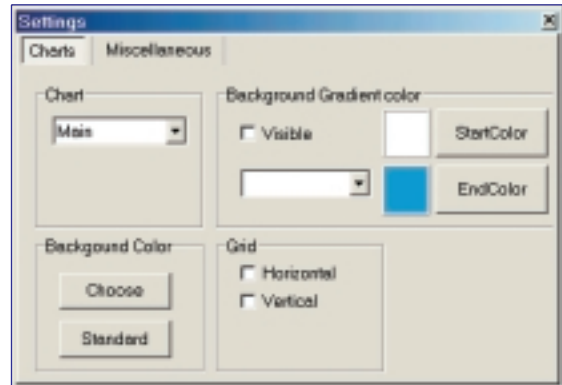
The DX6100 Vision software CD is delivered with the DX6100 Gas Analyzer.



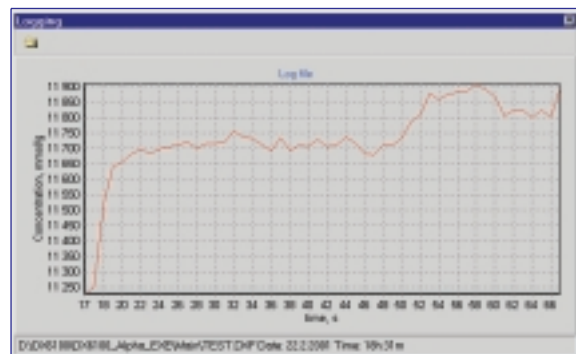
DX6100 Vision Main Window



Calibration Window



Settings Window



Data logging Window



Indicator Windows



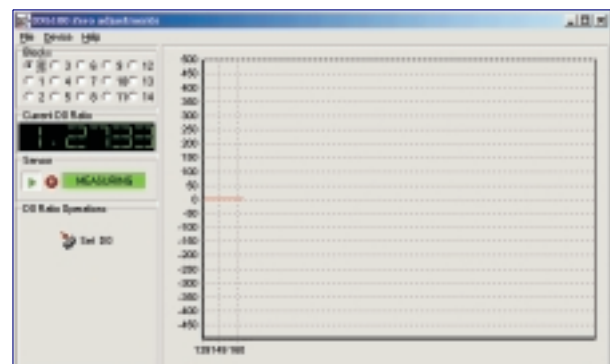
DX6100 Vision Program Toolbar

Zero Adjustments

To ensure the high accuracy, simple adjustment can be made during operation to adjust “zero” ratio.

The procedure requires to start the sensor in Calibration mode and to flow up any "zero" gas through the gas sampling cell.

The new “zero” coefficient will be stored into EEPROM in place of old value after the adjustment procedure complete.

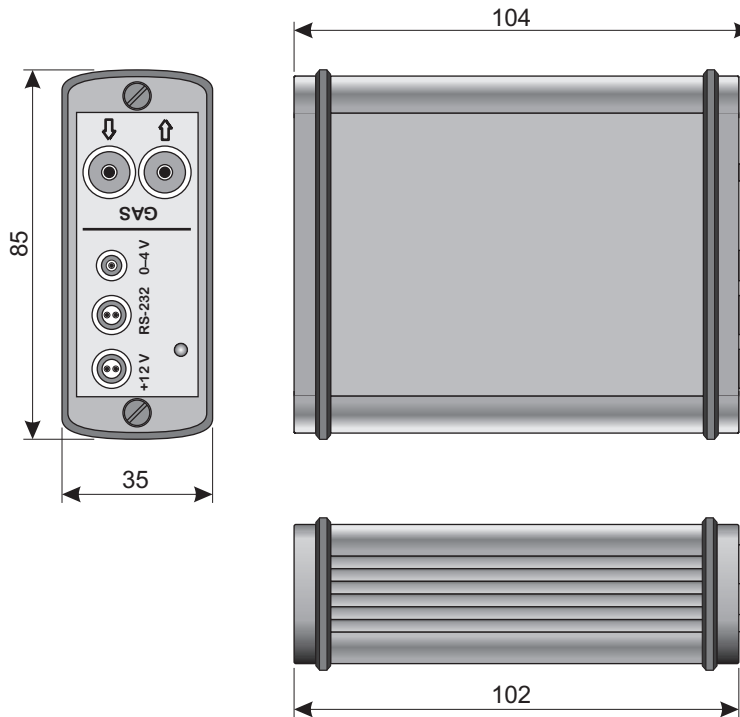


Zero Adjustments Window

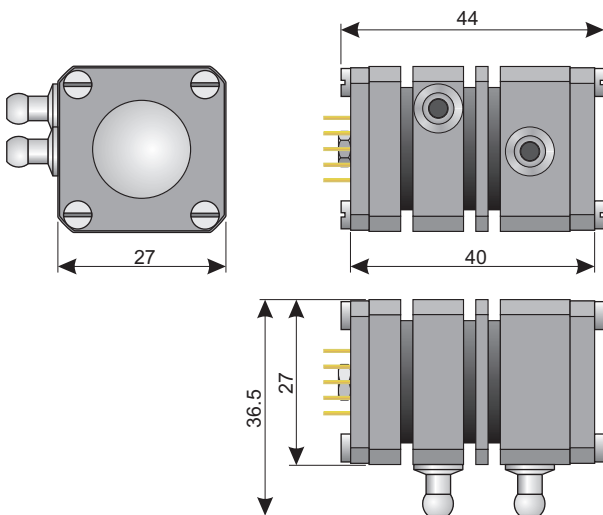
Housing and Dimensions

The enclosure of the analyzer is made of painted aluminum alloy. Extruded body of the enclosure is closed by covers from end faces. The rubber

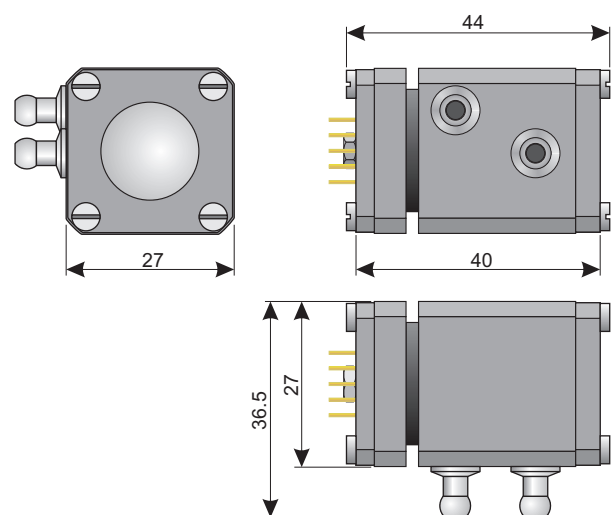
gaskets placed between body and covers provide the enclosure with water resistance.



DX6100 Analyzer Outline Dimensions (in millimeters)



DX6106.C2 Optical Unit Outline Dimensions (in millimeters)



DX6106.C4 Optical Unit Outline Dimensions (in millimeters)

Specifications

Type	NDIR gas analyzer
Detector	Lead selenide with TE cooler
Measured gases (available options)	
Carbon Dioxide	CO ₂
Hydrocarbons	C _m H _n
Parameters	
Concentration Range ¹⁾	0...5 % vol
Noise level ^{2,3)}	<0.15 %
Zero Drift ³⁾	0.02%
Accuracy ³⁾	0.5%
Timing	
Output Repeating Rate ⁴⁾	0.01...20 Hz
Average Time Constant ⁴⁾	0.1...60 sec
Alarms	
Light	Two color LED
Sound	> 85 dB

Supply requirements

Supply voltage	+6 to +15 V DC
Supply current	300 mA (max)

Interfaces

Digital	RS-232C
Analog	0...4.095 V

Operation conditions

Moisture protection	IP65
Temperature range	-10° to 50°C
Relative humidity	5 to 100%

Mechanical

Dimensions	60 × 80 × 122 mm
Weight	310 g (max)

- 1) *Optional ranges up to 100% vol. are available.*
- 2) *At Averaging Time Constant =0.2 s.*
- 3) *If value in %, then it means relative units.*
- 4) *Software Adjustable.*

Standard Kits

DX6100

#	Item	Code	Quan.
1	Gas Analyzer	DX6100	1
2	Power supply cable	DX6100-C-02	1
3	RS-232 cable	DX6100-C-03	1
4	Analog interface cable	DX6100-C-04	1
5	AC/DC adaptor		1
6	DX6100 User Manual		1
7	DX6100 Vision software CD		

DX6100 OEM

#	Item	Code	Quan.
1	Gas Analyzer	DX6100	1
2	Optical Unit	DX6106	1
3	Controller module	6101-x.xx	1
4	Optocomponent Mating module	6102-x.xx	1
5	Module interconnection cable	DX6100-C-11	1
6	Power supply cable	DX6100-C-12	1
7	RS-232 cable	DX6100-C-13	1
8	Analog interface cable	DX6100-C-14	1
9	DX6100 User Manual		1
10	DX6100 Vision software CD		1

Optical Gas Analyzers



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