NEW MILLENIUM PRODUCTS

RMT Ltd

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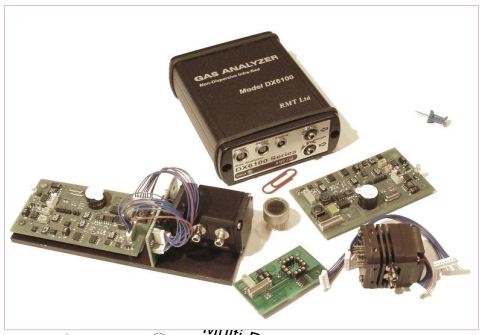
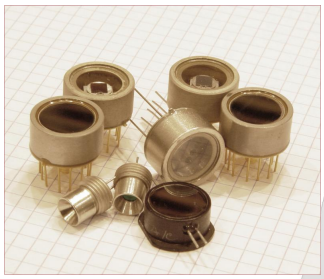
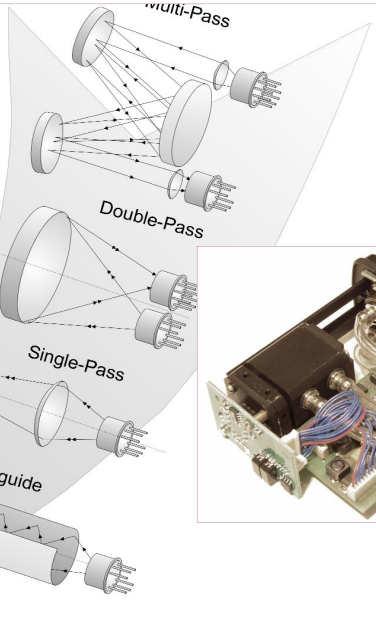






Components for Gas Analysis

Optopairs 2.1

2 Components for Gas Analysis

RMT Ltd.

Contents

Coordinated Optopairs for NDIR Gas Analyzers 5
Features 5
Available Options 5
OPR Series 6
OPR1-3439 Optopair (hydrocarbons) 6
OPR2-3439 TE cooled Optopairs (hydrocarbons) 7
OPR1-3230 Optopairs (methane) 8
OPR2-3230 TE cooled Optopairs (methane) 9
OPR1-4239 Optopairs (carbon dioxide) 10
OPR2-4239 TE cooled Optopairs (carbon dioxide) 11
OPRi Series 12
OPRi2-3439 Integrated Optopair (hydrocarbons) 12
OPRi2-3230 Integrated Optopair (methane) 13
OPRi2-4239 TE cooled Integrated Optopair (carbon dioxide) 14
Dimensional Outlines 16
Optional Optopairs 18
How to Select an Optopair 19

Coordinated Optopairs for NDIR Gas Analyzers

RMT offers coordinated pairs (solid state Light Emitters and Photodetectors) suitable for application in non-dispersive infrared (NDIR) gas analyzers.

The Optopair consists of high-effective Photodetector and special solid state pulsed Light Emitter.

The spectral response of the Photodetector and spectral emission of the Light Emitter are precisely coordinated for effective operation at absorption lines of measured gases.

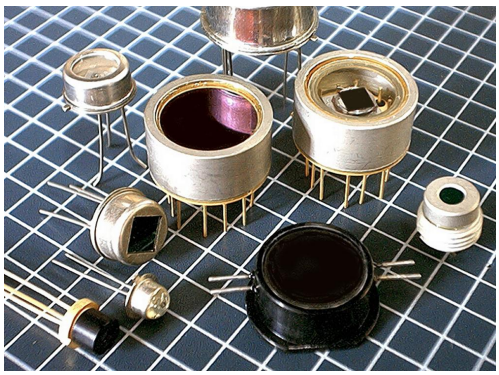
Additional built-in narrow band filters mounted onto Photodetector (or/and Light Emitter) provide high selectivity of measuring schemes.

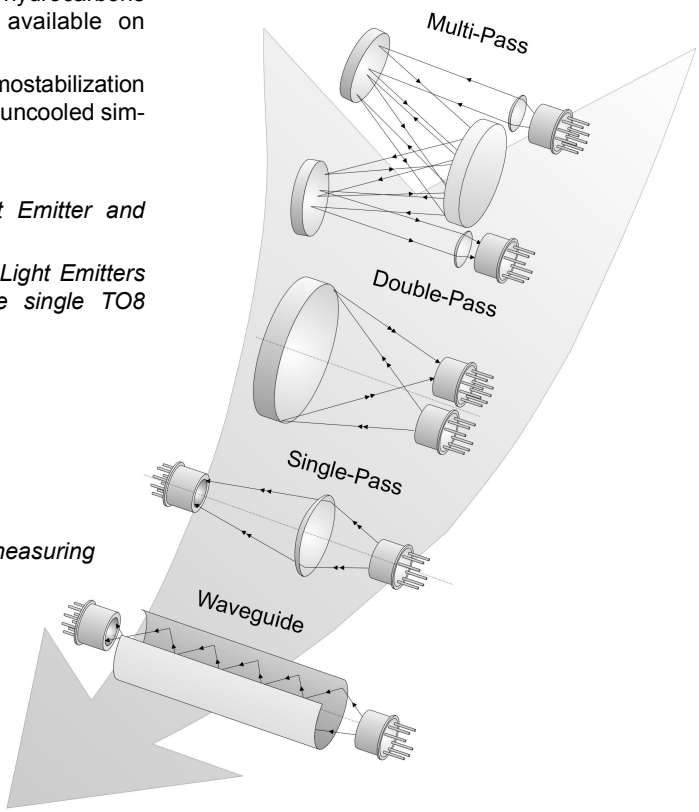
Standard options of the Optopairs are suitable for analyzing of CO_2 (carbon dioxide), CH_4 (methane), hydrocarbons mixtures (C_nH_m). Other gas options are available on request.

Optopairs with built-in TE cooling and thermostabilization are presented as standard options, as well as uncooled simpler types.

Two Optopair series are available:

- *Optopair consisting of discrete Light Emitter and Photodetector*
- *Integrated Optopair consisting of two Light Emitters and Photodetector assembled in the single TO8 package.*





Features

- *No moving parts*
- *Miniature design*
- *Low power consumption*
- *Standard options for a range of measuring schemes*
- *Long operation lifetime*
- *High speed of response*
- *High selectivity*

Available Options

Optopair Type	Measured Gas	Formula	λ_1, µm	λ_2, µm	$\Delta\lambda$, µm
OPR(i)x-4239	Carbon Dioxide	CO_2	4.28	3.90	0.12
OPR(i)x-3439	Hydrocarbons	C_nH_m	3.42	3.90	0.25
OPR(i)x-3230	Methane	CH_4	3.23	3.0	0.08

Notes:

1) Index “i” is valid for integrated type of optopairs

2) Code “x” means uncooled or TE cooled type (see chapter “How to select an Optopair”).

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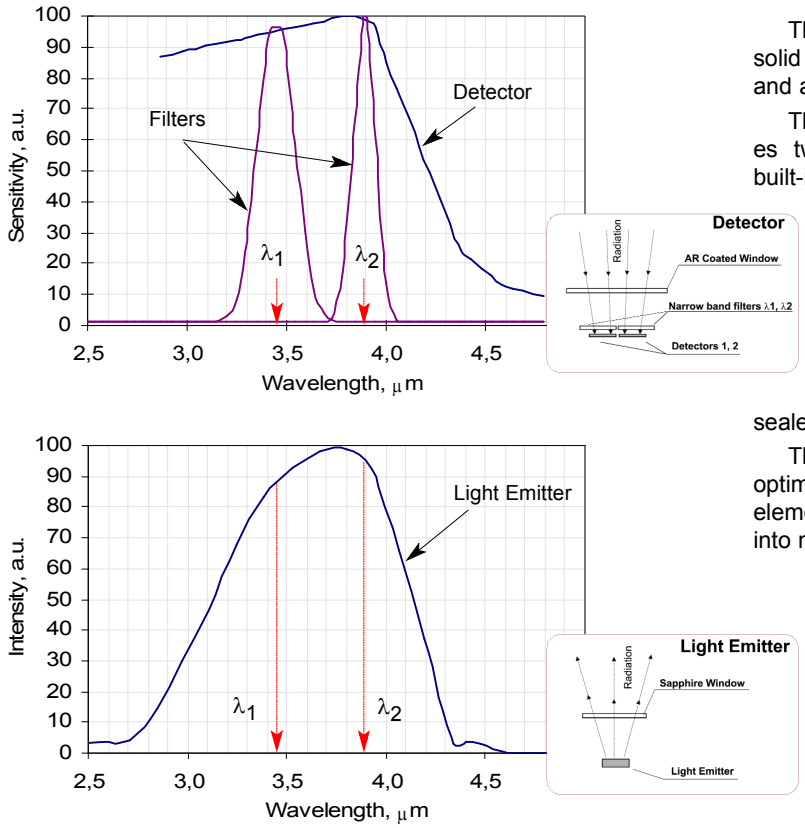
OPR1-3439 Optopair *(hydrocarbons)*



Spectral Responses of Photodetector with narrow-band Filters and light Emitter

The Optopair consists of a special solid state Light Emitter (light source) and a dual-channel Photodetector.

The dual-element detector comprises two photosensitive elements, two built-in narrow band interference filters:

- *one filter is near the absorption band of tested material (base channel)*
- *the other one is far from the absorption band (reference channel)*

The Detector is installed into the sealed metal-glass package.

The semiconductor Light Emitter is optimized for the operation of the dual-element Photodetector. It is mounted into miniature metal package.

Optical and Electrical Characteristics

Detector			Light Emitter		
Sensitive Element size	mm	2x2	Emitting area size	mm	2x2
Distance between elements	mm	1	Angle of view	deg	70
Wavelength λ_1	μm	3.45	Wavelength λ	μm	3.75
Wavelength λ_2	μm	3.90			
Band Width $\Delta\lambda_{0.5}$	μm	0.25	Band Width $\Delta\lambda_{0.5}$	μm	0.95
Time Constant, τ	μsec	<30	Time Constant, τ	μsec	<2
Detectivity, D*			Output Power(1) (CW)	μW	85
Measuring Channel, λ_1	$smxHz^{1/2}xW^{-1}$	$1.0x10^8$	Output Power(2) (PW)	μW	550
Reference Channel, λ_2	$smxHz^{1/2}xW^{-1}$	$1.0x10^8$			
Sensitivity, S_U			1. I_{op}=80 mA, U=2 V		
Measuring Channel, λ_1	V/W	60	2. I_{op}= 650 mA, U=2 V, Q=15, τ_p= 4 ms		
Reference Channel, λ_2	V/W	60	3. All parameters are referred to 300 K		
Element Dark Resistance	kOhm	20...100			

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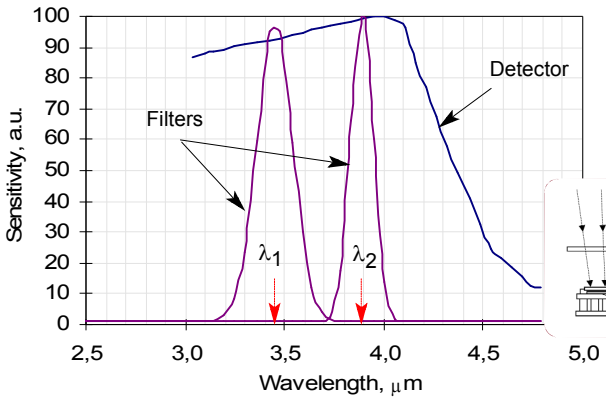
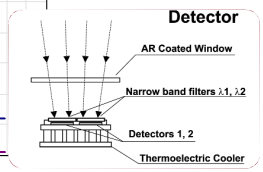
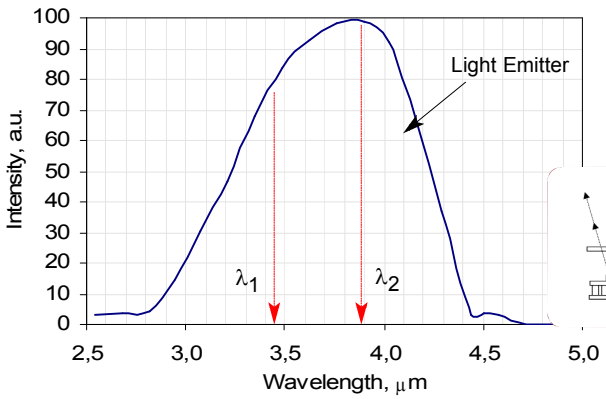
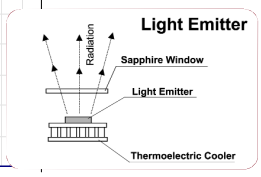
OPR2-3439 TE cooled Optopairs *(hydrocarbons)*









Spectral Responses of Photodetector with narrow-band Filters and light Emitter

The Optopair consists of a special solid state Light Emitter (light source) and a dual-channel Photodetector.

The element detector comprises two photo-sensitive elements, two built-in narrow band interference filters:

- *one filter is near absorption band of tested material (base channel)*
- *the other one - is far from the absorption band (reference channel).*

The sensitive elements with filters are placed onto the cooling surface of a single-stage thermoelectric module.

A thermosensor is used for thermostabilization.

The semiconductor Light Emitter is optimized for operation of the dual-element Photodetector.

The Light Emitter also is also onto the cooling surface of a single-stage thermoelectric module with a thermosensor.

Optical and Electrical Characteristics

Detector			Light Emitter		
Sensitive Element size	mm	2x2	Emitting area size	mm	2x2
Distance between elements	mm	1	Angle of view	deg	70
Wavelength λ_1	μm	3.45	Wavelength λ	μm	3.85
Wavelength λ_2	μm	3.90			
Band Width $\Delta\lambda_{0.5}$	μm	0.25	Band Width $\Delta\lambda_{0.5}$	μm	0.95
Time Constant, τ	μsec	<100	Time Constant, τ	μsec	<2
Detectivity, D*			Output Power(1) (CW)	μW	110
Measuring Channel, λ_1	$smxHz^{1/2}xW^{-1}$	$3.5x10^8$	Output Power(2) (PW)	μW	700
Reference Channel, λ_2	$smxHz^{1/2}xW^{-1}$	$3.5x10^8$			
Sensitivity, S_U					
Measuring Channel, λ_1	V/W	300			
Reference Channel, λ_2	V/W	300			
Element Dark Resistance	kOhm	20...100			

1. I_{op}=80 mA, U=2 V
2. I_{op}= 650 mA, U=2 V, Q=15, τ_p= 4 ms
3. All parameters are referred to 263 K

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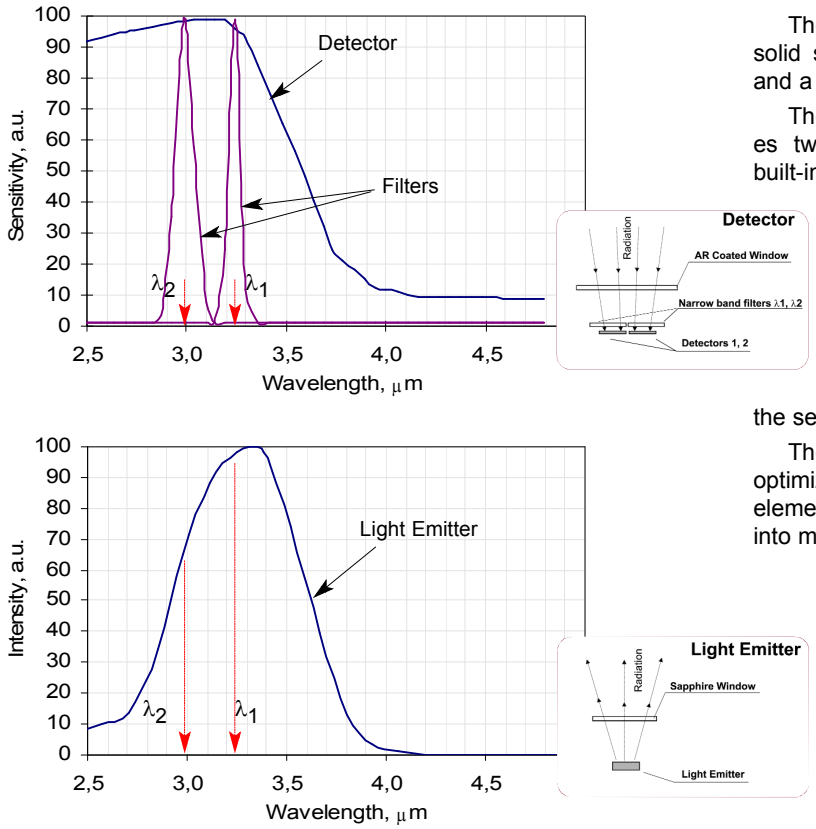
OPR1-3230 Optopairs *(methane)*



Spectral Responses of Photodetector with narrow-band Filters and light Emitter

The Optopair consists of a special solid state Light Emitter (light source) and a dual-channel Photodetector.

The dual-element detector comprises two photosensitive elements, two built-in narrow band interference filters:

- *one filter is near the absorption band of tested material (base channel)*
- *the other one is far from the absorption band (reference channel)*

The Detector is installed into the sealed metal-glass package.

The semiconductor Light Emitter is optimized for the operation of the dual-element Photodetector. It is mounted into miniature metal package.

Optical and Electrical Characteristics

Detector			Light Emitter		
Sensitive Element size	mm	2x2	Emitting area size	mm	2x2
Distance between elements	mm	1	Angle of view	deg	70
Wavelength λ_1	μm	3.23	Wavelength λ	μm	3.3
Wavelength λ_2	μm	3.00			
Band Width $\Delta\lambda_{0.5}$	μm	0.08	Band Width $\Delta\lambda_{0.5}$	μm	0.7
Time Constant, τ	μsec	<30	Time Constant, τ	μsec	<2
Detectivity, D*			Output Power(1) (CW)	μW	85
Measuring Channel, λ_1	$smxHz^{1/2}xW^{-1}$	$0.4x10^8$	Output Power(2) (PW)	μW	550
Reference Channel, λ_2	$smxHz^{1/2}xW^{-1}$	$0.4x10^8$			
Sensitivity, S_U					
Measuring Channel, λ_1	V/W	30			
Reference Channel, λ_2	V/W	30			
Element Dark Resistance	kOhm	20...100			

1. I_{op}=80 mA, U=2 V
2. I_{op}= 650 mA, U=2 V, Q=15, τ_p= 4 ms
3. All parameters are referred to 300 K

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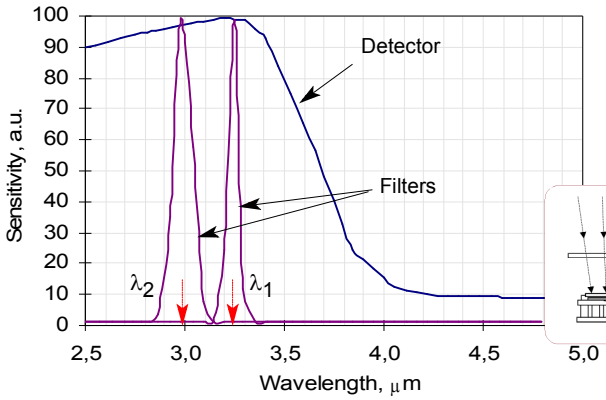
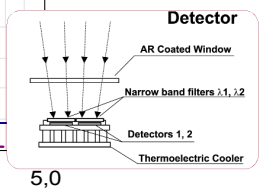
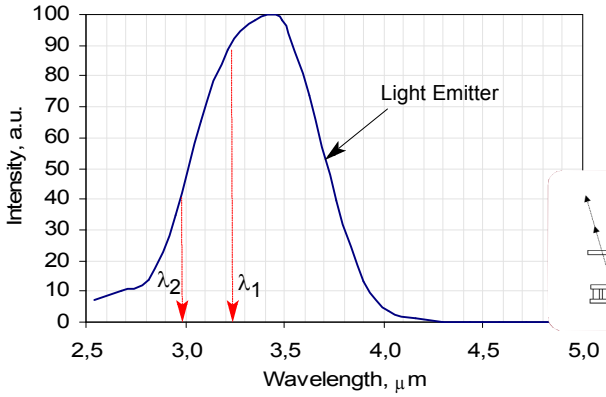
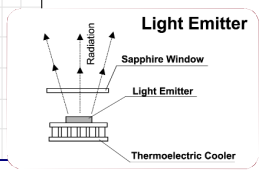
OPR2-3230 TE cooled Optopairs*(methane)*









Spectral Responses of Photodetector with narrow-band Filters and light Emitter

The Optopair consists of a special solid state Light Emitter (light source) and a dual-channel Photodetector.

The element detector comprises two photo-sensitive elements, two built-in narrow band interference filters:

- *one filter is near absorption band of tested material (base channel)*
- *the other one - is far from the absorption band (reference channel).*

The sensitive elements with filters are placed onto the cooling surface of a single-stage thermoelectric module.

A thermosensor is used for thermostabilization.

The semiconductor Light Emitter is optimized for operation of the dual-element Photodetector.

The Light Emitter also is also onto the cooling surface of a single-stage thermoelectric module with a thermosensor.

Optical and Electrical Characteristics

Detector			Light Emitter		
Sensitive Element size	mm	2x2	Emitting area size	mm	2x2
Distance between elements	mm	1.0	Angle of view	deg	70
Wavelength λ_1	μm	3.23	Wavelength λ	μm	3.4
Wavelength λ_2	μm	3.00			
Band Width $\Delta\lambda_{0.5}$	μm	0.08	Band Width $\Delta\lambda_{0.5}$	μm	0.7
Time Constant, τ	μsec	<100	Time Constant, τ	μsec	<2
Detectivity, D*			Output Power(1) (CW)	μW	110
Measuring Channel, λ_1	$smxHz^{1/2}xW^{-1}$	$1.2x10^8$	Output Power(2) (PW)	μW	700
Reference Channel, λ_2	$smxHz^{1/2}xW^{-1}$	$1.2x10^8$			
Sensitivity, S_U			1. I_{op}=80 mA, U=2 V		
Measuring Channel, λ_1	V/W	200	2. I_{op}= 650 mA, U=2 V, Q=15, τ_p= 4 ms		
Reference Channel, λ_2	V/W	200	3. All parameters are referred to 263 K		
Element Dark Resistance	kOhm	20...100			

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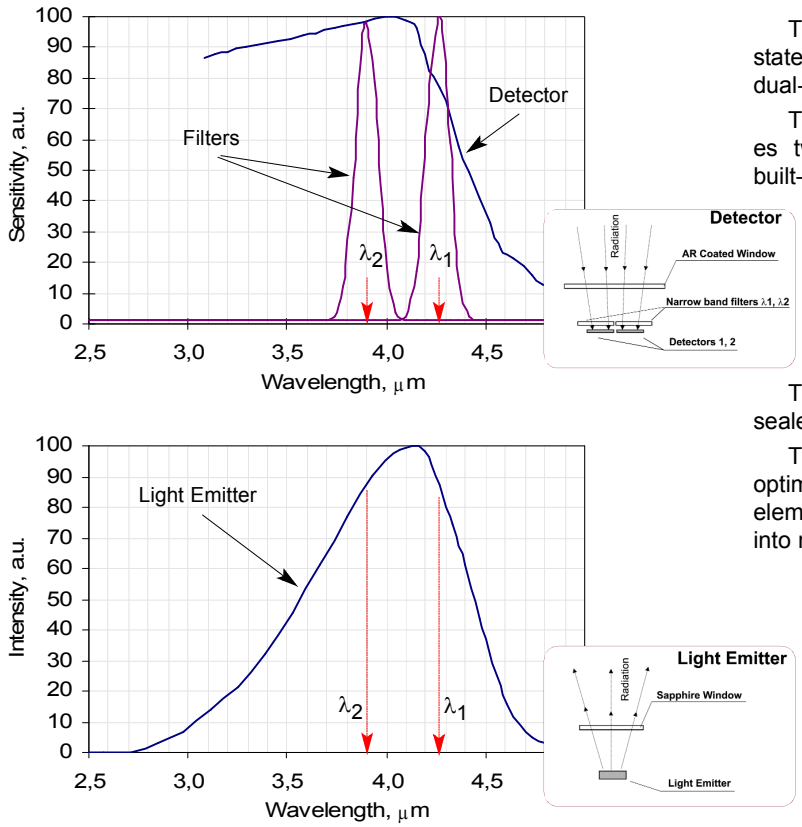
OPR1-4239 Optopairs *(carbon dioxide)*



Spectral Responses of Photodetector with narrow-band Filters and light Emitter

The pair consists of a special solid state Light Emitter (light source) and a dual-channel Photodetector.

The dual-element detector comprises two photosensitive elements, two built-in narrow band interference filters:

- *one filter is near the absorption band of tested material (base channel)*
- *the other one is far from the absorption band (reference channel)*

The Detector is installed into the sealed metal-glass package.

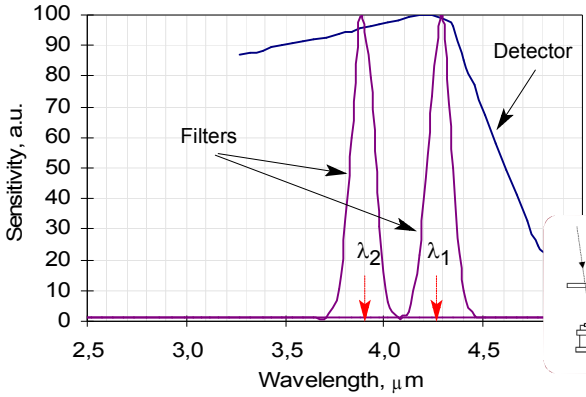
The semiconductor Light Emitter is optimized for the operation of the dual-element Photodetector. It is mounted into miniature metal package.

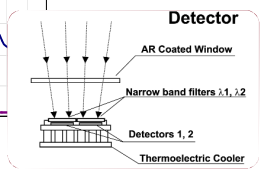
Optical and Electrical Characteristics

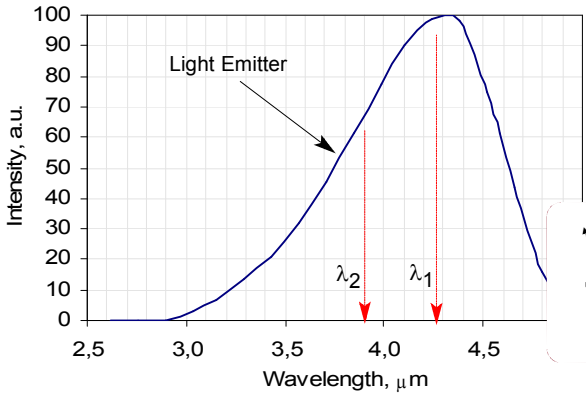
Detector			Light Emitter		
Sensitive Element size	mm	2x2	Emitting area size	mm	2x2
Distance between elements	mm	1.0	Angle of view	deg.	70
Wavelength λ_1	μm	4.28	Wavelength λ	μm	4.15
Wavelength λ_2	μm	3.90			
Band Width $\Delta\lambda_{0.5}$	μm	0.12	Band Width $\Delta\lambda_{0.5}$	μm	0.80
Time Constant, τ	μsec	<10	Time Constant, τ	μsec	<2
Detectivity, D*			Output Power(1) (CW)	μW	80
Measuring Channel, λ_1	$smxHz^{1/2}xW^{-1}$	$0.5x10^8$	Output Power(2) (PW)	μW	500
Reference Channel, λ_2	$smxHz^{1/2}xW^{-1}$	$0.5x10^8$			
Sensitivity, S_U					
Measuring Channel, λ_1	V/W	30			
Reference Channel, λ_2	V/W	30			
Element Dark Resistance	kOhm	20...100			

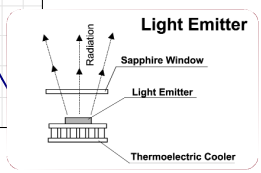
1. I_{op}=80 mA, U=2 V
2. I_{op}= 650 mA, U=2 V, Q=15, τ_p= 4 ms
3. All parameters are referred to 300 K

OPR2-4239 TE cooled Optopairs*(carbon dioxide)*









Spectral Responses of Photodetector with narrow-band Filters and Light Emitter

The Optopair consists of a special solid state Light Emitter (light source) and a dual-channel Photodetector.

The element detector comprises two photo-sensitive elements, two built-in narrow band interference filters:

- *one filter is near absorption band of tested material (base channel)*
- *the other one - is far from the absorption band (reference channel).*

The sensitive elements with filters are placed onto the cooling surface of a single-stage thermoelectric module.

A thermosensor is used for thermostabilization.

The semiconductor Light Emitter is optimized for operation of the dual-element Photodetector.

The Light Emitter also is also onto the cooling surface of a single-stage thermoelectric module with a thermosensor.

Optical and Electrical Characteristics

Detector			Light Emitter		
Sensitive Element size	mm	2x2	Emitting area size	mm	2x2
Distance between elements	mm	1.0	Angle of view	deg	70
Wavelength λ_1	μm	4.28	Wavelength λ	μm	4.30
Wavelength λ_2	μm	3.90			
Band Width $\Delta\lambda_{0.5}$	μm	0.12	Band Width $\Delta\lambda_{0.5}$	μm	0.80
Time Constant, τ	μsec	<30	Time Constant, τ	μsec	<2
Detectivity, D*			Output Power(1) (CW)	μW	100
Measuring Channel, λ_1	smxHz$^{1/2}$xW^{-1}	1.5x10^8	Output Power(2) (PW)	μW	700
Reference Channel, λ_2	smxHz$^{1/2}$xW^{-1}	1.5x10^8			
Sensitivity, S_U					
Measuring Channel, λ_1	V/W	200			
Reference Channel, λ_2	V/W	200			
Element Dark Resistance	kOhm	20...100			

1. I_{op}=80 mA, U=2 V
2. I_{op}= 650 mA, U=2 V, Q=15, τ_p= 4 ms
3. All parameters are referred to 263 K

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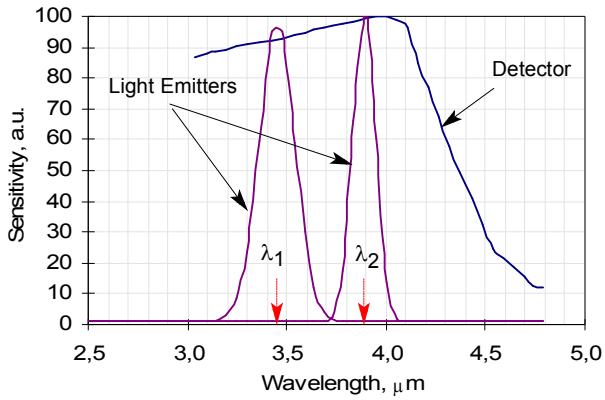
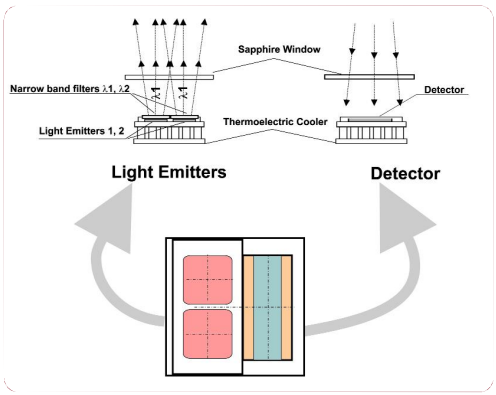
OPRi2-3439 Integrated Optopair *(hydrocarbons)*



Spectral Responses of Photodetector and Light Emitters with narrow-band filters



The integrated device consists of two solid state Light Emitters (light sources) and one Photodetector.

Each Light Emitter has built-in narrow band interference filters:

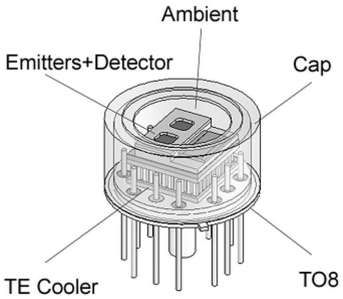
- *one (the first emitter) filter is adjusted to absorption line of a tested gas (the base channel)*
- *the other (the second emitter) - is far from the absorption band (the reference channel).*

Detector is the broad-band PbSe photoresistor.

The Light Emitters and the Detector are mounted on the same plane at cold side of a miniature thermoelectric (TE) cooler and integrated in the single housing.

The TE cooler is used for cooling down and precise temperature stabilizating of the Detector and Light Emitters.

The semiconductor Light Emitters are optimized for operation of the Photodetector.

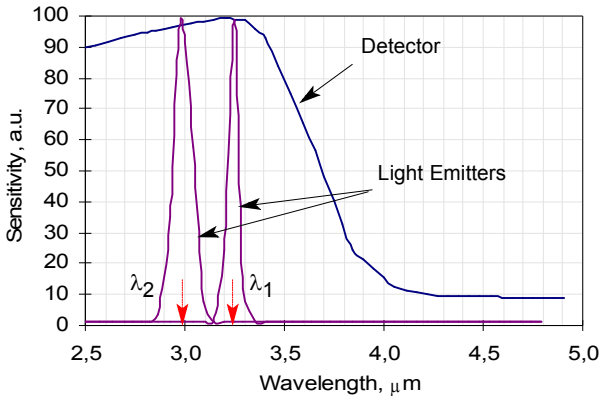


Optical and Electrical Characteristics

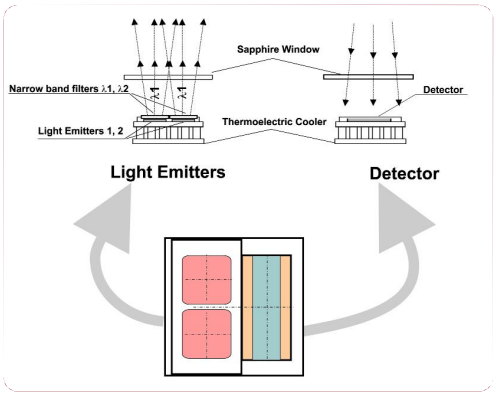
Detector			Light Emitters		
Sensitive Element size	mm	1.5x5.5	Emitting area size	mm	2x2
Spectral Range	μm	2...4.5	Distance between elements	mm	1.0
Wavelength max λ_{max}	μm	4.0	Angle of view	deg	70
Time Constant, τ	μsec	<100	Channels		
Detectivity, D*			Wavelength λ_1	μm	3.4
Measuring Channel, λ_1	$smxHz^{1/2}xW^{-1}$	$>3.5x10^8$	Wavelength λ_2	μm	3.9
Reference Channel, λ_2	$smxHz^{1/2}xW^{-1}$	$>3.5x10^8$	Band Width $\Delta\lambda_{0.5}$	μm	0.25
Sensitivity, S_U			Time Constant, τ	μsec	<2
At Measuring Channel, λ_1	V/W	>300	Output Power at λ_1 and λ_2		
At Reference Channel, λ_2	V/W	>300	CW(1)	μW	110
Dark Resistance	kOhm	6…30	Pulsed(2)	μW	700

1. I_{op}= 80 mA, U=2 V
2. I_{op}= 650 mA, U=2 V, Q=15, τ_p= 4 ms
3. All parameters are referred to 263 K

OPRi2-3230 Integrated Optopair *(methane)*



Spectral Responses of Photodetector and Light Emitters with narrow-band filters



The integrated device consists of two solid state Light Emitters (light sources) and one Photodetector.

Each Light Emitter has built-in narrow band interference filters:

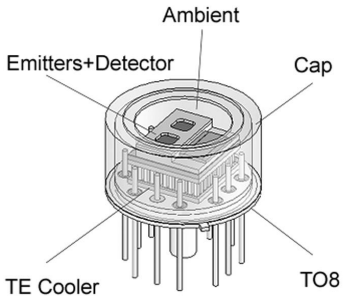
- *one (the first emitter) filter is adjusted to absorption line of a tested gas (the base channel)*
- *the other (the second emitter) - is far from the absorption band (the reference channel).*

Detector is the broad-band PbSe photoresistor.

The Light Emitters and the Detector are mounted on the same plane at cold side of a miniature thermoelectric (TE) cooler and integrated in the single housing.

The TE cooler is used for cooling down and precise temperature stabilizating of the Detector and Light Emitters.

The semiconductor Light Emitters are optimized for operation of the Photodetector.



Optical and Electrical Characteristics

Detector			Light Emitters		
Sensitive Element size	mm	1.5x5.5	Emitting area size	mm	2x2
Spectral Range	μm	1…3.8	Distance between elements	mm	1.0
Wavelength max λ_{max}	μm	3.2	Angle of view	deg.	70
Time Constant, τ	μsec	<100	Channels		
Detectivity, D*			Wavelength λ_1	μm	3.23
Measuring Channel, λ_1	$smxHz^{1/2}xW^{-1}$	$>1.2x10^8$	Wavelength λ_2	μm	3.0
Reference Channel, λ_2	$smxHz^{1/2}xW^{-1}$	$>1.2x10^8$	Band Width $\Delta\lambda_{0.5}$	μm	0.08
Sensitivity, S_U			Time Constant, τ	μsec	<2
At Measuring Channel, λ_1	V/W	>200	Output Power at λ_1 and λ_2		
At Reference Channel, λ_2	V/W	>200	CW(1)	μW	110
Dark Resistance	kOhm	6…30	Pulsed(2)	μW	700

1. I_{op}= 80 mA, U=2 V
2. I_{op}= 650 mA, U=2 V, Q=15, τ_p= 4 ms
3. All parameters are referred to 263 K

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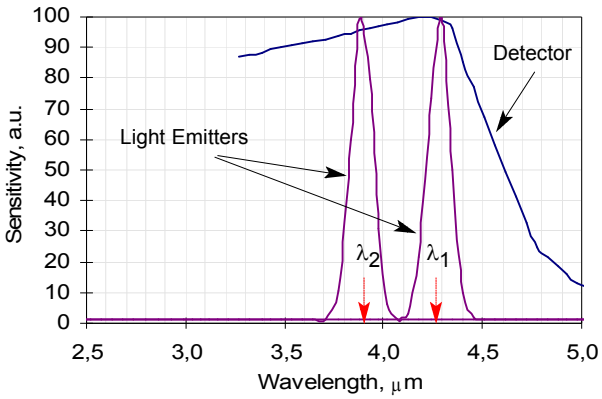
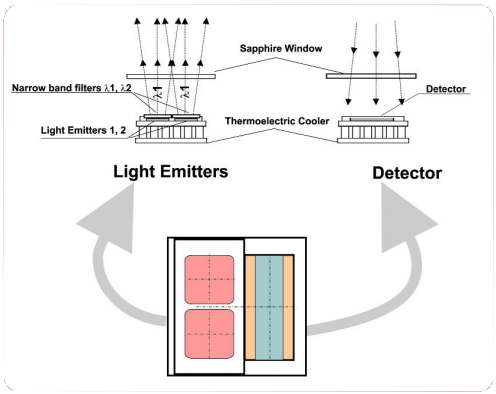
OPRi2-4239 TE cooled Integrated Optopair *(carbon dioxide)*



Spectral Responses of Photodetector and Light Emitters with narrow-band filters



The integrated device consists of two solid state Light Emitters (light sources) and one Photodetector.

Each Light Emitter has built-in narrow band interference filters:

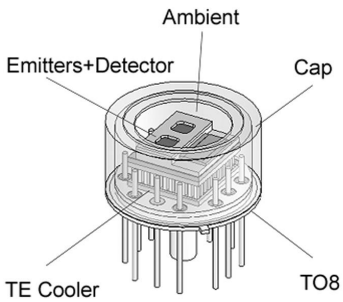
- *one (the first emitter) filter is adjusted to absorption line of a tested gas (the base channel)*
- *the other (the second emitter) - is far from the absorption band (the reference channel).*

Detector is the broad-band PbSe photoresistor.

The Light Emitters and the Detector are mounted on the same plane at cold side of a miniature thermoelectric (TE) cooler and integrated in the single housing.

The TE cooler is used for cooling down and precise temperature stabilizating of the Detector and Light Emitters.

The semiconductor Light Emitters are optimized for operation of the Photodetector.



Optical and Electrical Characteristics

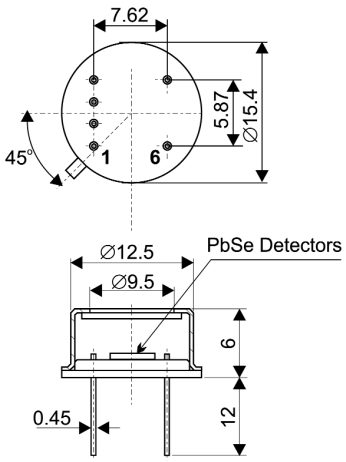
Detector			Light Emitters		
Sensitive Element size	mm	1.5x5.5	Emitting area size	mm	2x2
Spectral Range	μm	2...4.5	Distance between elements	mm	1.0
Wavelength max λ_{max}	μm	4.2	Angle of view	deg.	70
Time Constant, τ	μsec	<30	Channels		
Detectivity, D*			Wavelength λ_1	μm	4.27
Measuring Channel, λ_1	$smxHz^{1/2}xW^{-1}$	$>1.5x10^8$	Wavelength λ_2	μm	3.9
Reference Channel, λ_2	$smxHz^{1/2}xW^{-1}$	$>1.5x10^8$	Band Width $\Delta\lambda_{0.5}$	μm	0.12
Sensitivity, S_U			Time Constant, τ	μsec	<2
At Measuring Channel, λ_1	V/W	>200	Output Power at λ_1 and λ_2		
At Reference Channel, λ_2	V/W	>200	CW(1)	μW	100
Dark Resistance	kOhm	6…30	Pulsed(2)	μW	700

1. I_{op}= 80 mA, U=2 V
2. I_{op}= 650 mA, U=2 V, Q=15, τ_p= 4 ms
3. All parameters are referred to 263 K

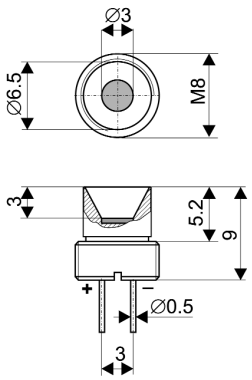
Dimension Outlines (all dimensions are given in mm)

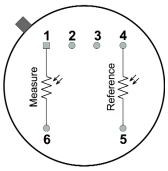
D5-11 Uncooled Optopair

Detector - TO8 housing



Light Emitter - Standard metal housing



Pin	Function	Bottom View
1	Photoresistor, measuring channel	
2	Not connected	
3	Not connected	
4	Photoresistor, reference channel	
5	Photoresistor, reference channel	
6	Photoresistor, measuring channel	

Absolute Maximum Ratings

Detector	Light Emitter	
Bias Voltage	Direct Current, max	Pulsed Current, max
V	mA	A
6	200	1.5

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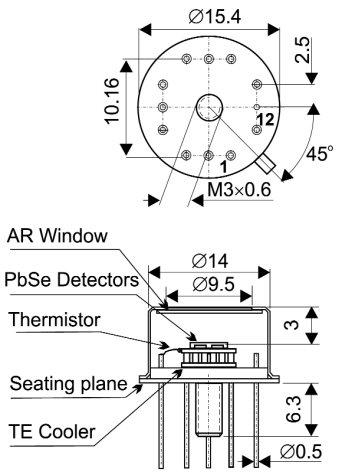
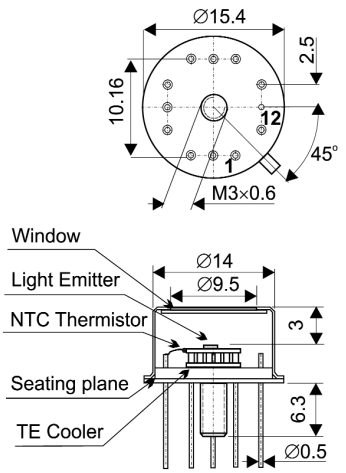
Dimension Outlines (all dimensions are given in mm)

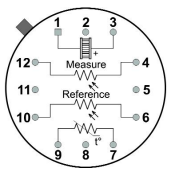
D12-12 **TE cooled Optopair**

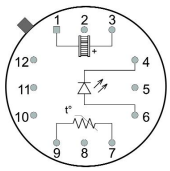
Detector - TO8 housing



Light Emitter - TO8 housing



Pin	Function	Bottom View
1	TE Cooler (-)	
2	Not connected	
3	TE Cooler (+)	
4	Photoresistor, measuring channel	
5	Not connected	
6	Photoresistor, reference channel	
7	Thermistor	
8	Not connected	
9	Thermistor	
10	Photoresistor, reference channel	
11	Ground	
12	Photoresistor, measuring channel	

Pin	Function	Bottom View
1	TE Cooler (-)	
2	Not connected	
3	TE Cooler (+)	
4	LED, cathode	
5	Not connected	
6	LED, anode	
7	Thermistor	
8	Not connected	
9	Thermistor	
10	Not connected	
11	Ground	
12	Not connected	

Absolute Maximum Ratings

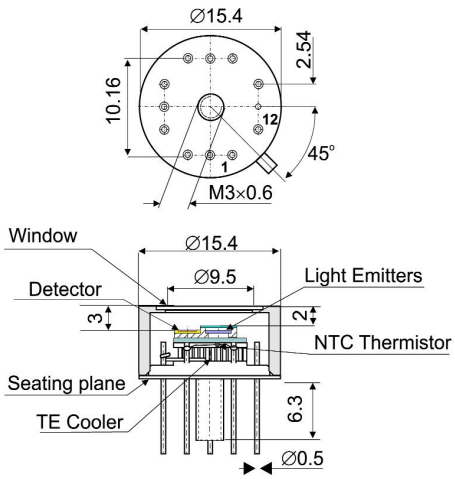
Detector	Light Emitter		Both		
Bias Voltage	Direct Current, max	Pulsed Current, max	Typical TE Cooler Power near maximal cooling		Thermosensor
V	mA	A	Current, A	Voltage, V	
6	200	1.5	1.3	2.2	2.2 kOhm & -3.4%/deg
			0.4*	4*	

Note: * - option for portable applications.

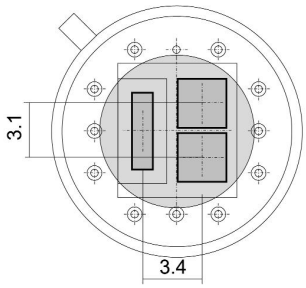
Dimension Outlines (all dimensions are given in mm)

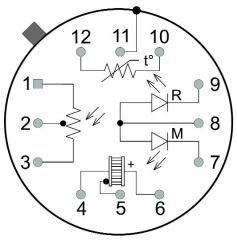
D17	Integrated TE cooled Optopair

TO8 housing



Emitter-Detector Plan (top view)



Pin	Function	Top View
1	Detector	
2	Not connected	
3	Detector	
4	TE Cooler (-)	
5	Shield	
6	TE Cooler (+)	
7	LED1, cathode	
8	LED1&2, anode	
9	LED2, cathode	
10	Thermistor	
11	Ground	
12	Thermistor	

Absolute Maximum Ratings

Detector	Light Emitter		Both		
Bias Voltage	Direct Current, max	Pulsed Current, max	Typical TE Cooler Power near maximal cooling		Thermosensor
V	mA	A	Current, A	Voltage, V	
6	200	1.5	0.4	4	2.2 kOhm & -3.4%/deg

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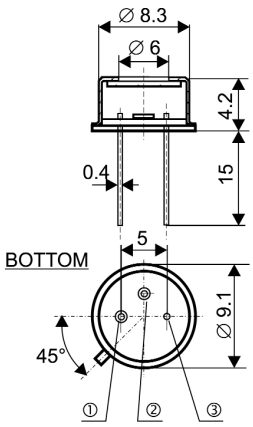
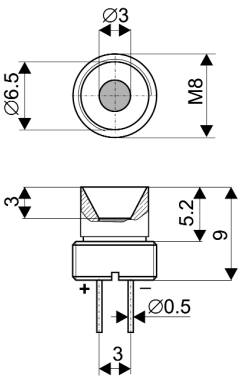
Optional Optopairs

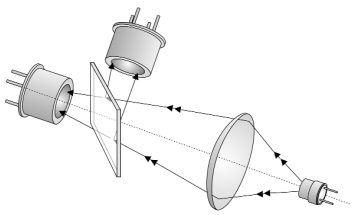
D4-11 Single element Detectors, standard Light Emitter

Detector - TO5 housing



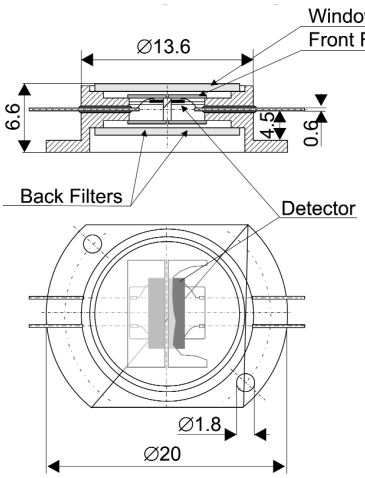
Light Emitter - metal housing



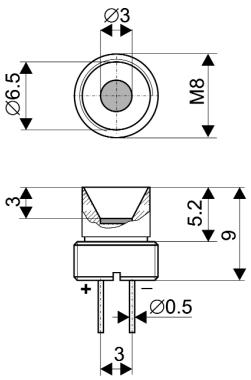


D15-11 Double-side, dual-element Detector, standard Light Emitters

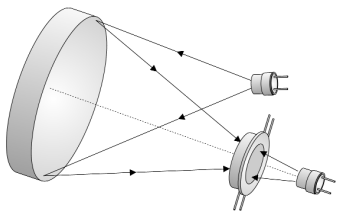
Detector - metal-glass double side housing



Light Emitter - metal housing



Double-beam, double-channel Scheme



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How to Select an Optopair

OPR(i)2-3439-121

Built-in filter

0 - Special Options
1 - FWHM 0.25 μm
2 - FWHM 0.12 μm
3 - FWHM 0.08 μm

TE Cooler option*

0 - No Options (uncooled type)
1 - Standard type
2 - Low currect TEC

Package*

0 - D5-11
1 - D12-12
2 - Special

Wavelength

First element, μm

Wavelength

Second element, μm

Built-in Cooling

1 - Uncooled
2 - Cooled, Single-Stage TEC
3 - Cooled, Two-Stage TEC

Code of Integrated Optopairs

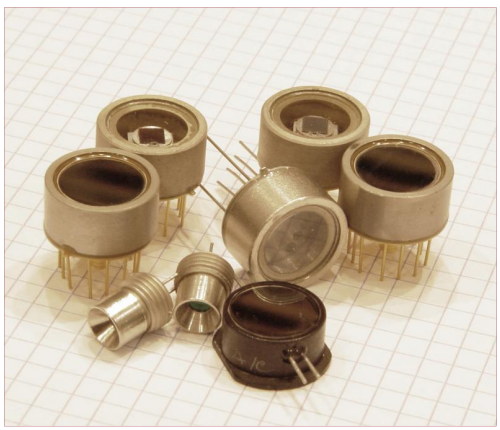
Series designator

Note: * - Is not valid for the OPRi Series (always "0")

An Example:

OPR2-3439-121

- *TE cooled Optopair*
- *First wavelength - 3.4 μm (hydrocarbions)*
- *Second wavelength - 3.9 μm (reference)*
- *Housing type D12-12:*
  - *Detector - D12 housing (TO8 package)*
  - *Light Emitter - D12 housing (TO8 package)*
- *TE coolers of low current*
- *Built-in narrow band filters with FWHM 0.25 μm.*



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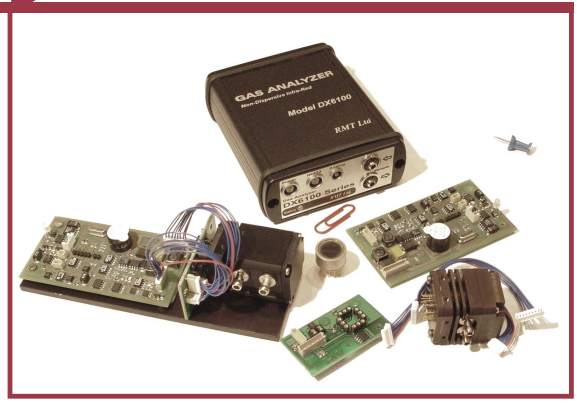
Gas Analyzers 2.2



2 Components for Gas Analysis

RMT Ltd.

Contents

Modular Gas Analyzer DX6100 Series 23
Advantages 23
Design Features 24
Principles of Operation 24
Operation Overview 25
Noise level 25
Inside the Analyzer 26
Output Connectors 26
Functional Diagram 26
DX6102 Optocomponent Mating Module 27
DX6106 Optical Unit 27
DX6101 Controller Module 27
Working with DX6100 Analyzer 28
DX6100 Vision II Software 28
System Requirements 28
Zero Adjustment 29
Calibration 29
Parameters of Analyzer Adjustment 29
Housing and Dimensions 30
Specifications 31
Common 31
Carbon Dioxide (CO_2) 31
Hydrocarbons (C_nH_m) 32
Methane (CH_4) selective 32
Standard Kits 32
DX6100 32
DX6100 OEM 32

Modular Gas Analyzer DX6100 Series

The company RMT Ltd introduces DX6100 series of Modular and OEM non-dispersive infrared (NDIR) Gas Analyzers.

The principle of operation is based on selective absorption of IR radiation by gas molecules.

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

A new type of middle infrared (IR) integrated Optopair (Detector and Light Emitters) with built-in thermoelectric cooling is used.

The light sources are pulsed solid state middle-IR Light Emitters. The Photodetector is based on the Lead Selenide (or Lead Sulphide) photoresistor.

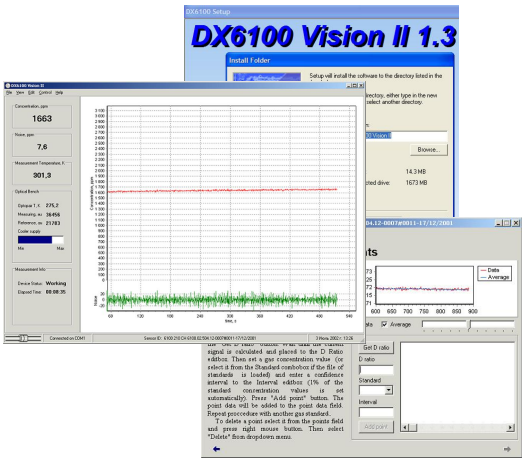
There are several models suitable for the following gases: CO_2, CH_4, C_nH_m.

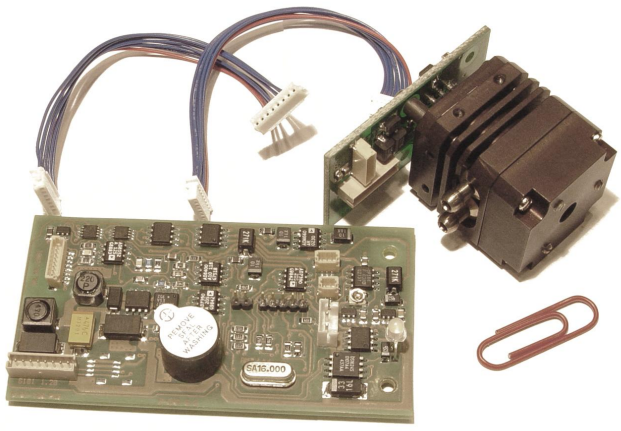
Other optional gas analyzers are available on request.

Both complete modular and OEM versions are available.

Advantages

- *High selectivity and stability*
- *Wide range of measured concentrations*
- *Small gas sampling cell*
- *Fast response*
- *Long service life*
- *No moving parts*
- *Miniature design and small weight*
- *Low power consumption*





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Gas Analyzers

Principles of Operation

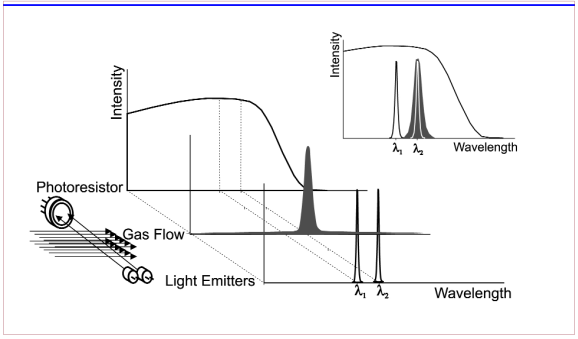
The Non-Dispersive Infra-Red Spectroscopy (NDIR) measurement method is implemented in the DX6100 Analyzer.

The analyzer provides gases concentration measurement based on the classical double channel optical scheme.

One of the beams (measuring channel) has the wavelength tuned to the optical absorption line of the measured gas. The other beam (reference channel) has the wavelength that is out of the adsorption band of the measured gas.

After passing through the gas sampling cell the two light beams intensities are compared.

The reference channel is used for indirect measuring of the initial light intensity 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 the 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 operating in a microsecond range. The light sources have long life (more than 10,000 hours).*
- *Radiation from Light Emitters passes through gas sampling cell, reflects from the mirrors and is focused onto wide-band Photodetector.*
- *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 the ambient value down to –20°C.*
- *Heat dissipated from the warm side of TE coolers results in few degrees of overheating of gas sampling cell above the ambient. This factor plays the role of vapor anti-condensation at high moisture operation.*
- *All driving function of Light Emitters and Detector are operated by the on-board microcontroller.*
- *Pre-amplified outputs are maintained by the microcontroller. The final result is digital data of measured gas concentration and is available in realtime through the RS-232C or an analog port.*
- *For the signal processing the calibrated data of Optical Unit is used. The data is stored in Optical Unit's EEPROM.*
- *The RS-232C port is also used for the remote control from a computer.*

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Operation Overview

The order of measurements with the DX6100 device is as follows:

1. The individual calibration of device is required using standard gas mixtures.

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

The Detector output signals (both measuring and reference channels) are measured while calibration gases with known concentration are passing 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 the manufacturer.

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

Several calibrations are made at different ambient temperatures (in the 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 output signals are measured. Using a 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 know ambient temperature and pressure.

The values of ambient temperature and pressure can be inputted 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 the ambient conditions at calibration procedure.

It is also possible to use the value of measured ambient temperature provided by the on-board digital thermosensor.

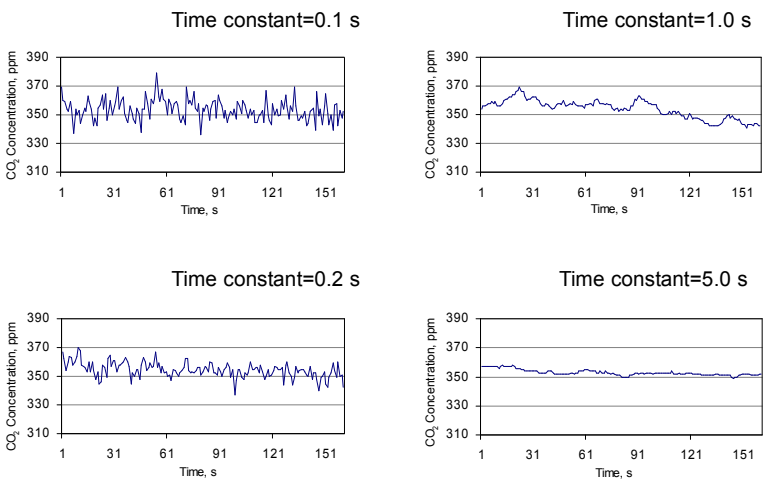
3. To preserve high accuracy of the device it is necessary to make “zero” adjustments periodically as recommended in the DX6100 User’s Guide.

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

Noise level

Adjustable noise level is realized due to application of digital filtration algorithm.

The main parameter of the digital filter is Time constant. It is adjustable in the range 0.1…60 s.



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Gas Analyzers

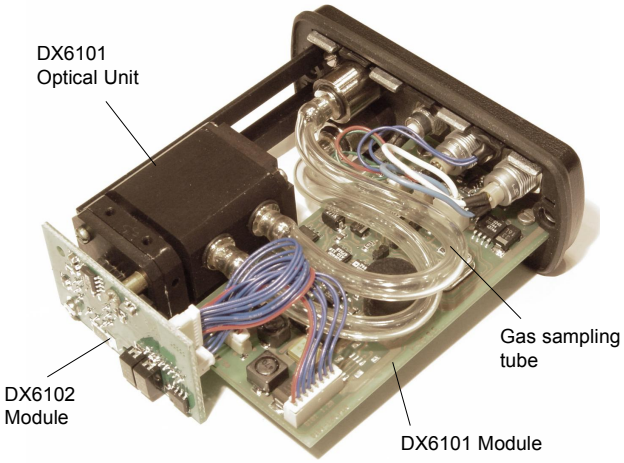
Inside the Analyzer

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 complete version of the DX6100 Analyzer.

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

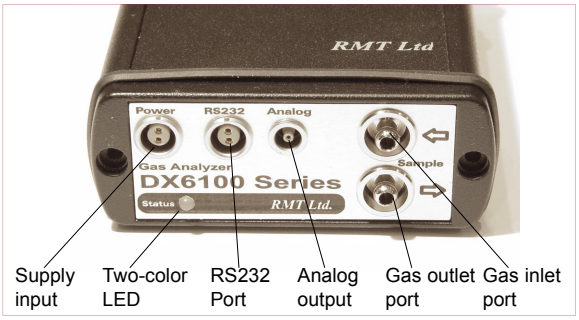


DX6100 Analyzer, the cover removed

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 and outlet gas ports*

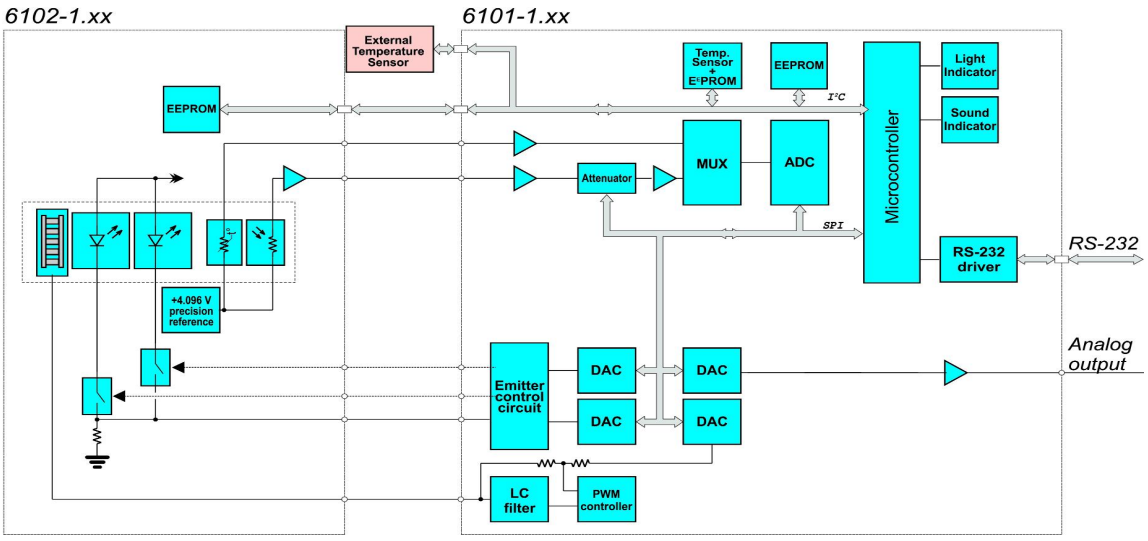


Output Connectors

Functional Diagram

The DX6102 Optopair Mating Module is connected with DX6101 Controller Module by special cable via miniature 20 pin System Interface connectors.

Digital Thermometer is an optional module for the measurement of the absolute value of ambient temperature with 0.5°C accuracy.



Functional Diagram of the DX6100 Gas Analyzer

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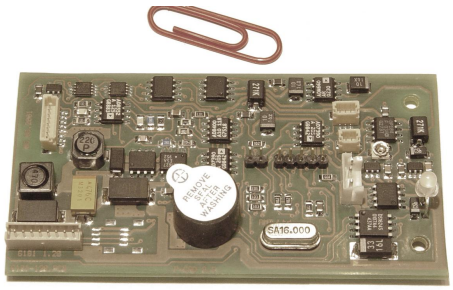
DX6101 Controller Module

The 6010 Controller Module provides the following functions:

- *Amplification and processing of Detector's output signals*
- *Storage of identifier and individual calibration parameters*
- *Thermostabilization of Optopair using built-in PID driving algorithm of built-in TE cooler with thermosensor signals forming for Light Emitters driving*
- *Filtering and digitizing of Detector pre-amplified output*
- *Conversion of amplified output signals into gas concentration value using the stored calibration data*
- *Driving by the gas analyzer through the RS-232 port*
- *Light and sound alarm.*



6101 Controller Module

DX6106 Optical Unit

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 the DX6102 electronic mating module.

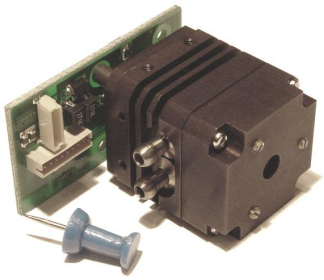
The internal volume of the gas cell depends on the Optical Unit version. The gas sampling cell has two gas inlets with 5.0 mm internal diameter.

The gas sampling cell can be easily disassembled for the service of the internal optics (mirror and window). For this purpose both the top and bottom covers can be removed and the optical components extracted.

The mirror has a special SiO_2 safety layer.

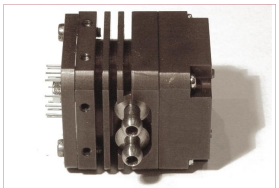
The DX6106 Optical Units are manufactured in two versions: with DX6106.C2 and DX6106.C4 gas sampling cells (See Table).

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

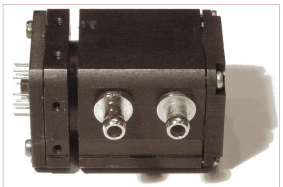


Optical Unit

Gas sampling cell	Number of passes	Total path length, mm	Internal volume, ml
DX6106.C2	2	25	1
DX6106.C4	4	85	10

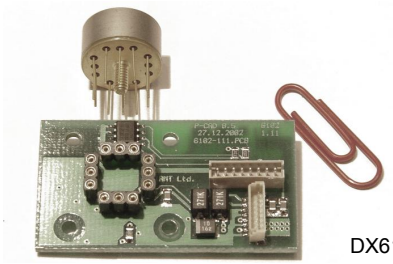


DX6106.C2 Sampling Cell



DX6106.C4 Sampling Cell

DX6102 Optocomponent Mating Module



DX6102 Mating Module

The DX6102 Optocomponent Mating Module provides:

- *Pre-amplification of photodetector's signals*
- *Light Emitters driving*
- *Power supply of Photodetector and Thermistors with precise voltage supply*

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Working with DX6100 Analyzer

In general nothing is required 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.

A user can control the Analyzer with computer in two ways:

1) The remote control by the Analyzer is available using the RS-232 port by a set of microcontroller commands.

The commands can be divided into two groups: driving commands and setting commands.

All commands have the same format – the symbol string, which consists of the command name identifier and a list of its parameters. Some commands have no parameters. The commands are described in User's Guide.

This way is very useful if a user is going to integrate the DX6100 analyzer into a more complicated system.

2) The second way is based on using the DX6100 Vision II software.

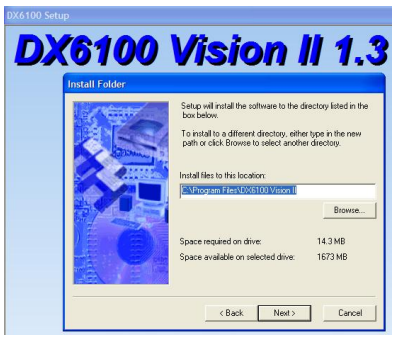
DX6100 Vision II Software

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

The software is delivered with the DX6100 Gas Analyzer.

Also it is available for free dawnload from RMT website:

www.rmtltd.ru

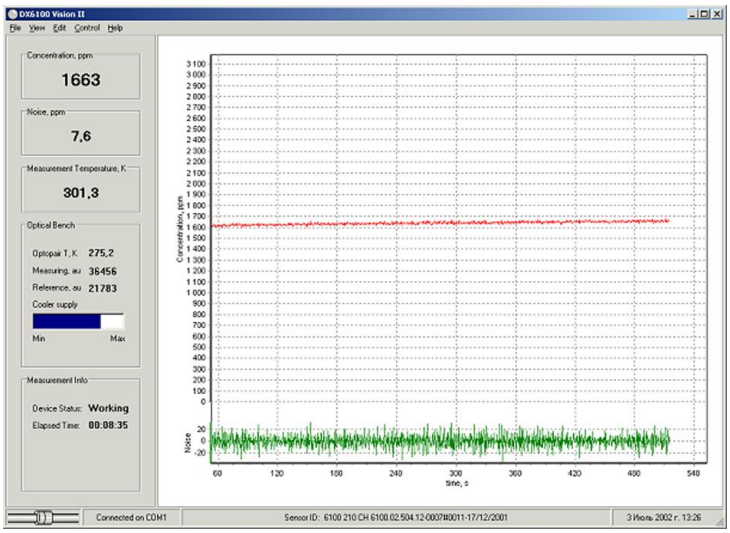


Setup Window

System Requirements

To run the DX6100 Vision II software the following system requirements must be met or exceeded:

- *Intel Pentium class computer with Windows 95/98/2000 operating system*
- *Free COM port*
- *16 MB of RAM (32 MB recommended)*
- *6 MB free hard drive space*
- *CD ROM drive*
- *Mouse or compatible pointing device*



Main Window

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Parameters of Analyzer Adjustment

The DX6100 Vision II program allows an adjustment of various operation parameters of the device. The following parameters are among them:

- *Parameters of Light Emitters and Photodetector operation (pulse duration, Emitter current, Detector gain, synchronization and others)*
- *Telemetry structure (output parameters, repeating rate, duration of measurements and others)*
- *Warning levels*
- *Analog output adjustment and others*

But before editing a parameter study the device description thoroughly, please. Many of available parameters should be adjusted very carefully by experienced users only or along the manufacturer's recommendation.

Setting Window

Calibration

One of the very useful utility of the DX6100 Vision II software is Calibration subroutine.

The program allows users to carry out quite a complex procedure of the device calibration.

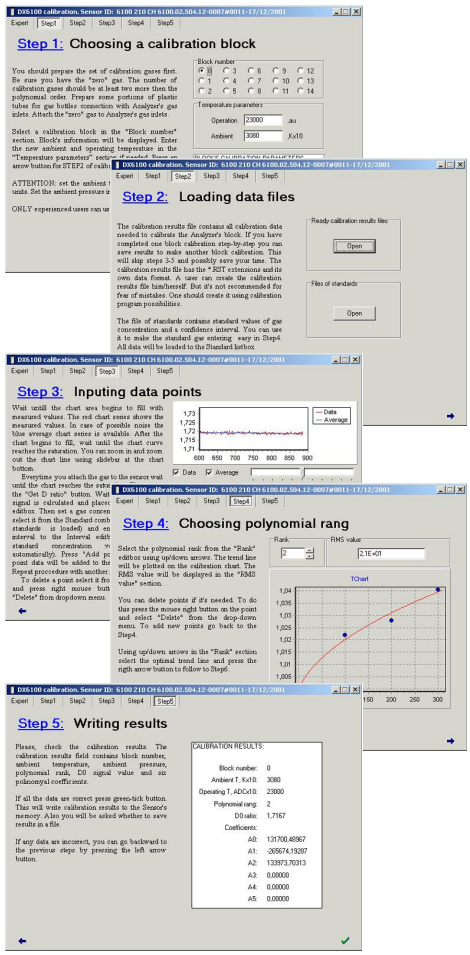
The first calibration in a specified concentration range is made by the manufacturer.

A user can perform any recalibration with the use of the program.

According to the instructions the procedure consists of several steps that must be completed by a user.

First of all, a user need to have a set of standard gases with concentrations in specified range. Then a user is to start the Calibration program and follow instructions step-by-step.

The advisable periodicity of the device recalibration is 1 (one) year. It could be done at the factory of the manufacturer or by a User with the help of DX6100 Vision software.



Calibration Procedure

Zero Adjustment

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

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

The new "zero" coefficient will be stored in EEPROM in place of the old value after the adjustment procedure is complete.

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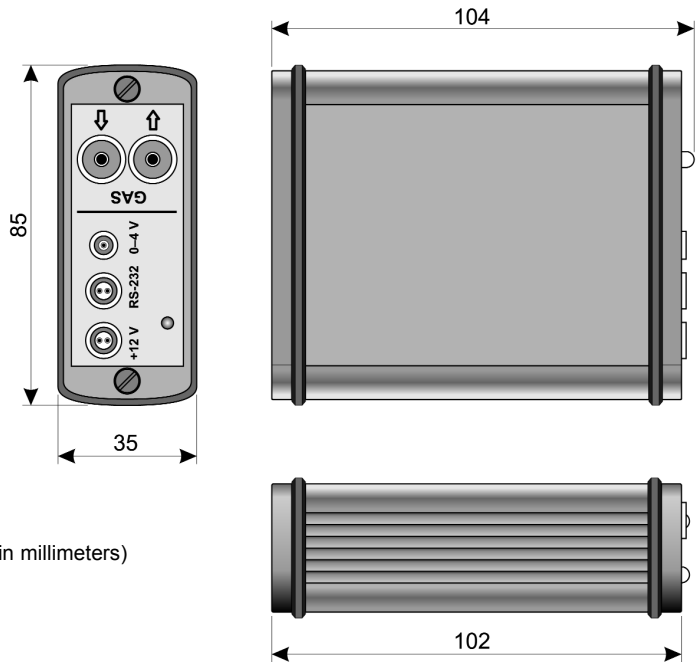
Housing and Dimensions

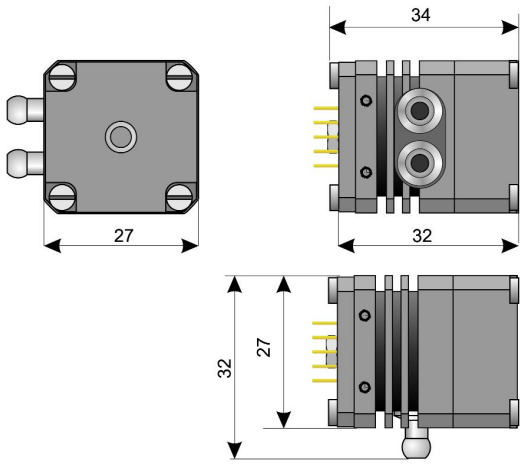
The enclosure of the Analyzer is made of a painted aluminum alloy.

The extruded body of the enclosure is closed by covers from end faces.

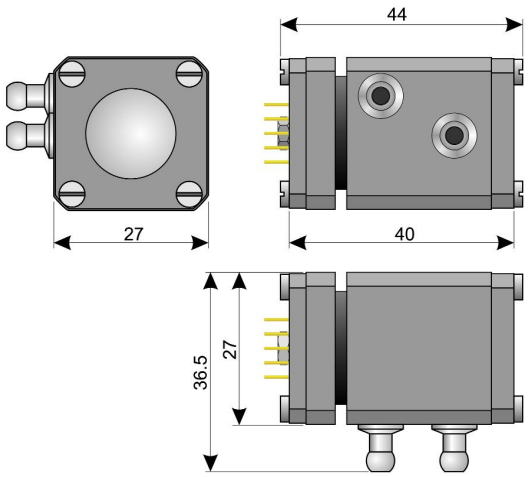
The rubber gaskets placed between the body and covers provide the enclosure with water resistance.



DX6100 Analyzer Outline Dimensions (in millimeters)



DX6106.C2 Optical Unit Outline Dimensions (in millimeters)



DX6106.C4 Optical Unit Outline Dimensions (in millimeters)

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Specifications

Common

Type		NDIR Gas Analyzer
Detector		Lead Selenide with TE cooler
Measured Gases *(available options)*		
	Carbon Dioxide	CO_2
	Hydrocarbons	C_nH_m
	Methane	CH_4
Timing		
	Output Repeating Rate	0.01…20 Hz
	Average Time Constant	0.1…60 sec
Alarms		
	Light	Two-color LED
	Sound	>85 dB
Supply Requirements		
	Voltage	+6 to +15 VDC
	Current	300 mA (max)
Interface		
	Digital	RS-232C
	Analog	0…4095 mV
Operation Conditions		
	Moisture Protection	IP65 (excluding OEM version)
	Temperature Range	-10 to +50 ºC
	Relative Humidity	5 to 100%
Mechanical *(Modular Option)*		
	Dimensions	60x80x122 mm
	Weight	310 g
Mechanical *(OEM Option)*		
Dimensions		
	DX6101 Controller Module	80x43x14 mm
	DX6102 Mating Plate	47x26x8 mm
	DX6106.20 Sampling Cell	34x32x27 mm
	DX6106.40 Sampling Cell	40x36.5x27 mm
	Mounting Base	135x48x3.5 mm
Weight		
	DX6101 Controller Module	24 g (max)
	DX6102 Mating Plate	8 g (max)
	DX6106.20 Sampling Cell	50 g (max)
	DX6106.40 Sampling Cell	55 g (max)
	Mounting Base	20 g (max)

Carbon Dioxide (CO_2)

Concentration Range [1)]	0…1000 ppm	0…5 %vol	0…20 %vol
Noise Level [2,3)]	< 3 ppm	< 0.15 %	< 0.15 %
Accuracy [3)]	10 ppm	0.50%	0.50%
Zero Drift [3)]		0.02%	

Information furnished by RMT Ltd is believed to be reliable. However, no responsibility is assumed for possible inaccuracies or omission. Specifications are subject to change without notice.

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Specifications *(...continued)*

Hydrocarbons (C_nH_m)

Concentration Range [1]	0…1000 ppm	0…5 %vol	0…100 %vol
Noise Level [2,3]	< 3 ppm	< 0.10 %	< 0.15 %
Accuracy [3]	10 ppm	0.50%	0.50%
Zero Drift [3]		0.02%	

Methane (CH_4) selective

Concentration Range [1]	0…1000 ppm	0…5 %vol	0…100 %vol
Noise Level [2,3]	< 25 ppm	< 0.3 %	< 0.5 %
Accuracy [3]	100 ppm	1.0%	1.0%
Zero Drift [3]		0.02%	

Notes:

1) Optional concentration ranges are available on request.

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	Q-ty, pcs
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		1

DX6100 OEM

#	Item	Code	Q-ty, pcs
1	Optical Unit	DX6106.xx	1
2	Controller module	DX6101-x.xx	1
3	Optopair mating module	DX6102-x.xx	1
4	Module interconnect cable	DX6100-C-11	1
5	Power supply cable	DX6100-C-12	1
6	RS-232 cable	DX6100-C-13	1
7	Analog interface cable	DX6100-C-14	1
8	AC/DC adaptor		1
9	DX6100 User Manual		1
10	DX6100 Vision software CD		1

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Notes

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Components for Gas Analysis

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