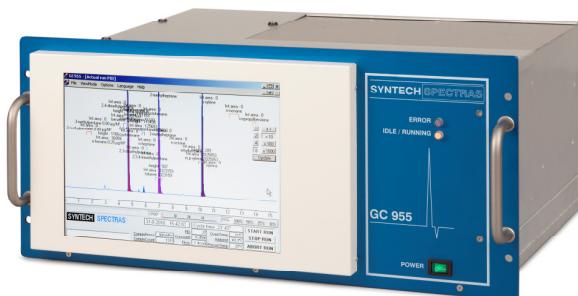


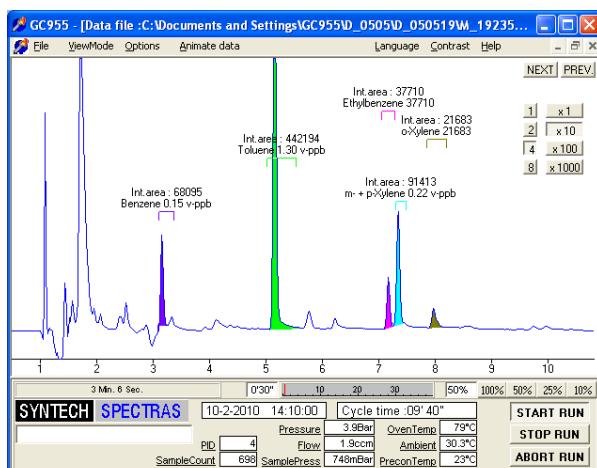
# GC955

# SYNTech SPECTRAS BENZENE / BTEX ANALYSER



**Monitoring of benzene, toluene, ethylbenzene, xylenes (BTEX) and other hydrocarbons in ambient air.**

The Syntech Spectras GC955 series 600 BTEX analyser is built for the measurement of benzene, toluene and xylene isomers in ambient air. Due to the European legislation for monitoring benzene this is our most successful product. Over 1000 of these analysers are measuring BTEX all around the world. Of course this analyser is approved according to EN 14662-3.



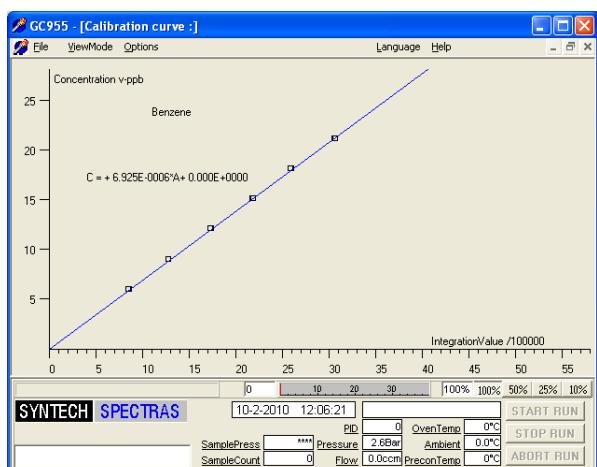
BTEX measurement in ambient air

## Hydrocarbon selection

Benzene is a carcinogenic compound and it is harmful already in very low concentrations: there is no absolute safe concentration limit for benzene. By European regulations measurement of benzene in ambient air is now obligatory. The yearly mean value must be below 5 µg/m<sup>3</sup>. The concentration of benzene in ambient air varies from under 0.1 to above 100 micrograms per m<sup>3</sup>.

Benzene in ambient air is coming from evaporated fuel, either from gas filling stations or from cars. Furthermore, it is emitted by cars by burning fuel and from other burning processes like bio fuel heating or forest fires.

Toluene, Ethylbenzene and o-, m-, p-Xylene are standard included in the analyser configuration. This group of components belong to the most active ozone precursor VOC's and have many sources.



Six point calibration test up to 20 ppb

## Syntech Spectras GC 955 series 601 BTEX analyser can measure up to 40 components.

With different settings and suitable calibration gas it is possible to measure up to 40 components, like octane, chloroethenes, trimethylbenzenes etc. in one 30 minute run. Data processing and communication is prepared for this.

The customer can also specify a list of components that have to be measured and Synspec can include those compounds in the setting of the system. The customer needs to buy the suitable calibration gas to check this and calibrate the system.

As an alternative it is possible to order a 611 ozone precursor (C6 to C12) system or a toxic system 615.

## Details BTEX analyser

The instrument is a gas chromatograph with a built-in pre-concentration system. Hydrocarbons are pre-concentrated on Tenax GR, desorbed thermally and separated on an appropriate column, to reach optimal separation from interfering hydrocarbons. Alternative columns are available for special applications. Analysis is done by a photo ionization detector. This ensures a high specific sensitivity for benzene and aromatic hydrocarbons in general.

A standard industrial PC, running under Windows embedded is used.

The user-friendly software stores all the chromatograms on the hard disk and data can be interpreted easily with this intuitive software. Data can also be transferred by network and modem connection. Besides this, analogue and digital output options are available to communicate with other data logging systems using several data protocols.

Simple operation, good reliability and low maintenance cost are important to us. With a worldwide network of trained distributors the end-user can be sure that the analyser comes with an individualized training and that local support is available to help when needed. The Syntech Spectras GC955 consumes a small quantity nitrogen as carrier gas.

Preventive maintenance is only required once a year. For good data quality it is recommended to have a regular (automatic) calibration or validation. In the software an automatic multipoint validation/calibration is possible using calibration gas of one concentration per component by using different volumes of air passing over the pre-concentration trap.

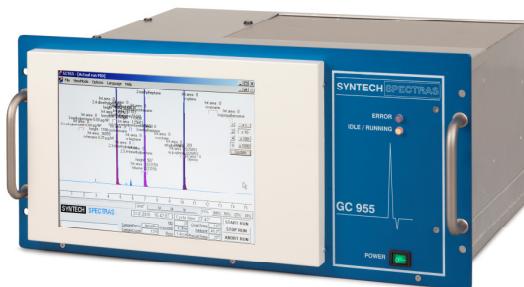
The expected lifetime of the analyser is 10 years. Consumable parts are economically priced.

## Syntech Spectras GC955 series 601 BTEX analyser

TECHNICAL DESCRIPTION	PID detector. Lowest detection level for benzene 0.1 µg/m3 (0.03 vppb). Range: up to 300 ppb. Included items: SERIES 600, column SY 1 15m, 0.32 mm ID, 1 µm film, cycle time 15 min, temp program 50 - 70 °C
CERTIFICATES	Approval for EN 14662-3, EN 15267-1, EN 15267-2, VDI-Richtlinie 4202 Blatt 1 and VDI-Richtlinie 4203 Blatt 3 CE approval for EMC conformity: EN 61010 incl. A1 and A2, EN 61000-6-2, EN 61000-6-3 and EN 61326
STANDARD CALIBRATION	Standard 4 point calibration provided for BTX in range 4 to 16 ppb.
EXTRA COMPOUNDS AVAILABLE	The software and hardware of the analyser is prepared to measure up to 40 hydrocarbons in the boiling point range from 60 °C up to 250 °C. Ask Synspec for advise about calibration gas and peak window setting. At an additional price Synspec can calibrate these already upon ordering.
REPEATABILITY	Typical <3% at 1 ppb (benzene, with capillary column)
GAS CONNECTIONS	Nitrogen: quality 5.0, 4 bar, 6 ml/min
DIMENSIONS	19" rack, 5 standard Height Units, depth 43 cm (W 48,3 D 43 H 22 CM), WEIGHT 19 kg
HARDWARE and SOFTWARE INCLUDED	Industrial X86 based computer with Windows Embedded suitable for measuring and saving data up to 10 years. Software for running the analyser as well as inspecting data on desktops.
COMMUNICATION	Direct control via touchscreen, keyboard or mouse. External data communication via RS232, analog and digital outputs, via TCP-IP. Standard available protocols : ASCII terminal, Hessen, Gesytec and MODBUS, other protocols on demand
ELECTRICAL CONNECTIONS	230 V AC, 100 VA (115 V AC available) 50/60 Hz

# GC955

## SYNTech SPECTRAS H2S ANALYSER



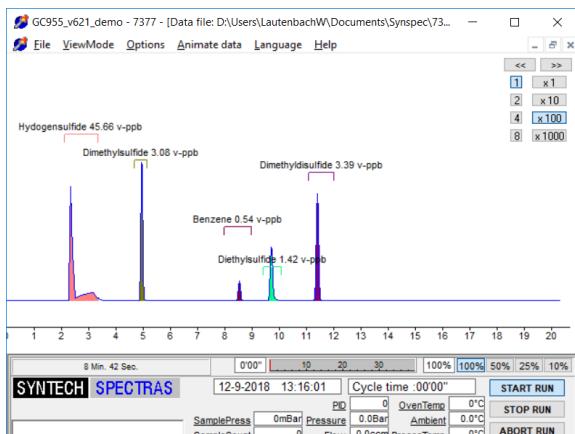
### The Syntech Spectras analyser for measurement of sulfur compounds in ambient air

Many sulphur compounds are toxic.

The smell of sulphur components is a problematic issue at many industrial sites. Sulphur compounds may be emitted at desulfurization in refineries.

Sulphur is also used for producing certain types of paper. Specialized sulphur compounds are produced for odorisation of natural gas. Some essential pharmaceuticals contain sulphur.

At waste deposit sites and at water treatment plants the stench problems are partly due to sulphur components.



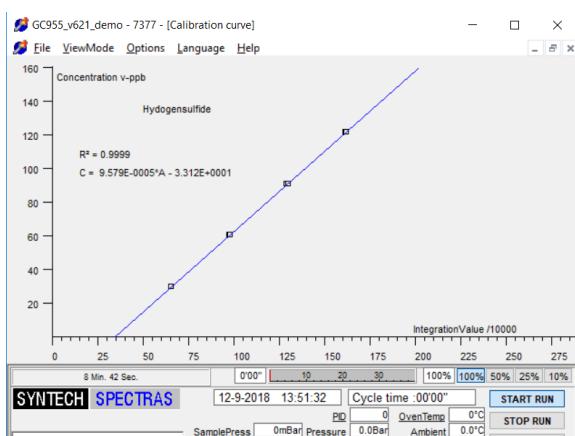
Calibration of mercaptans, sulphides, aromates.

### Hydrocarbon selection

Among the many sulphur components that can be measured two groups stand out: the mercaptans and the sulphides.

Mercaptans: methyl mercaptan, ethyl mercaptan, propyl mercaptan, butyl mercaptan etc. (also named thiols), Sulphides and disulphides : hydrogen sulphide, carbon disulphide, diethylsulphide, Dimethyldisulphide (DMDS), dimethylsulphide (DMS) etc.

With the same system other components like for example benzene can be measured.



Calibration curve of H2S

### Syntech Spectras GC955 810 Mercaptan analyser

This analyser is a gas chromatograph with a built-in cooled pre-concentration system.

Sulfur components and also other hydrocarbons are first pre-concentrated on Tenax TA. To preconcentrate H2S an additional trapping material is added in the same cooled preconcentration system.

After trapping the compounds are desorbed thermally at a relatively low temperature and then

The use of a nafion sample dryer is not advised due to loss of mercaptans by removing them with the water.

The setting for the column has been optimized to avoid interference from higher boiling hydrocarbons.

## Challenges in the analysis of sulfur compounds:

Three issues stand out when monitoring sulfur compounds: all are related to the reactivity of mercaptans. Sulfides are less reactive.

### Reactions of mercaptans in air and on reactive surfaces:

Many customers demand measurement of mercaptans but it is better to also include the sulfides.

Mercaptans are unstable and can be converted by catalytic activity to the more stable sulfides or by oxidation into other compounds.

The disulfides are even more stable and are formed out of the mercaptans.

The smell of these compounds is not very different, so only by measuring all these compounds you can determine the air quality.

To prevent the reaction of mercaptans in/on the sample lines these lines need to be selected carefully.

### Calibration:

Calibrating the mercaptans is complex, bottles with mercaptans are not stable, except if the bottle had special treatment.

We recommend to use permeation tubes. However in reaction with oxygen the mercaptans will turn into sulfides.

Therefor dilution with nitrogen is required. It will take some time to stabilise.

### Sample conditioning:

Drying the sample with a nafion dryer is not recommended as the mercaptans will disappear.

## Analyser details

Standard industrial PC with Windows embedded. User-friendly software stores all the chromatograms on the hard disk and data can be interpreted easily. Data can be transferred by network and modem connection. Analog and digital output options are available to communicate with other data logging systems using several data protocols.

Simple operation, good reliability and low maintenance cost.

## SYNTECH SPECTRAS GC955 SERIES 810 H2S ANALYSER

### SPECIFICATIONS

PID detector.

Lowest detection level depending on component from 0.2 ppb for Methyl mercaptan to 0.01 ppb for disulphides. Standard range: 0-30 ppb (can be extended upon request).

Included items: special cooled pre-concentration trap at 10 °C, column special sulphur, 2 + 28 mm, 0.32 mm ID

Standard cycle time 20 minutes (30 minutes on request), temp program 45 °C – 110 °C, flow program typical <3% at 1 ppb (dimethyl sulphide, with capillary column)

### REPRODUCIBILITY

Nitrogen, quality 5.0, 4 bar, 10 ml/min

### GAS CONSUMPTION

19" rack, 5 standard Height Units, depth 43 cm net  
(W 48,3 D 43 H 22 CM), WEIGHT 20 kg

### DIMENSIONS

230 V AC, 100 VA (115 V AC available) 50/60 Hz

### POWER DEMAND

Internal industrial x86 based computer, solid hard disk, 10.1" full colour touchscreen

### INCLUDED HARDWARE

Direct control via touchscreen, keyboard or mouse. External data communication via RS232, analogue, digital outputs and TCP-IP.

### COMMUNICATION

Windows embedded and GC 955 software.

Standard available protocols: ASCII-terminal, Hessen, Gesytec, MODBUS, other protocols on request

### INCLUDED SOFTWARE

CE approval for EMC conformity: EN 61000-6-2, EN 61000-6-3, EN 61010, EN 61326

### APPROVALS

It is possible to monitor also benzene and toluene in a 20 minute cycle. In a 30 minute cycle also xylenes can be monitored.

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# GC955

## SYNTech SPECTRAS MERCAPTAN AND SULFIDE ANALYSER



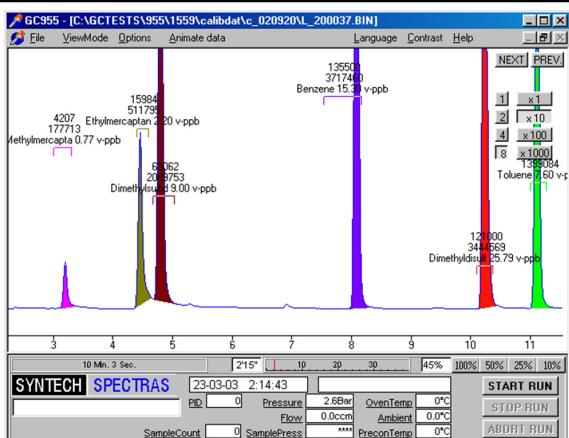
### The Syntech Spectras analyser for measurement of sulfur compounds in ambient air

Many sulfur compounds are toxic.

The smell of sulfur components is a problematic issue at many industrial sites. Sulfur compounds may be emitted at desulfurization in refineries.

Sulfur is also used for producing certain types of paper. Specialized sulfur compounds are produced for odourisation of natural gas. Some essential pharmaceuticals contain sulfur.

At waste deposit sites and at water treatment plants the stench problems are partly due to sulfur components.



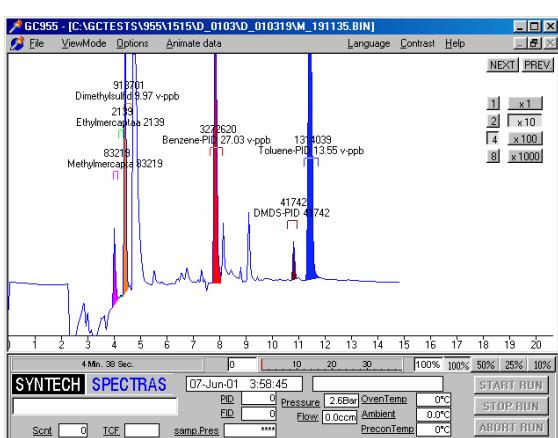
### Hydrocarbon selection

Among the many sulfur components that can be measured two groups stand out: the mercaptans and the sulfides.

Mercaptans: methylmercaptan, ethylmercaptan, propylmercaptan, butylmercaptan etc. (also named thiols), Sulfides and disulfides : hydrogensulfide, carbondisulfide, diethylsulfide, Dimethyldisulfide (DMDS), dimethylsulfide (DMS) etc.

Many other sulfur compounds are present in air, for instance thiophene, many of those can also be monitored.

With the same system other components like for example benzene can be measured.



### Syntech Spectras GC955 810 Mercaptan analyser

This analyser is a gas chromatograph with a built-in cooled pre-concentration system.

Sulfur components and also other hydrocarbons are first pre-concentrated on Tenax TA then desorbed thermally at a relatively low temperature and then separated on a special strongly separating column combination. The same type of sulfur column is used that is standardly used in the petrochemical industry.

The use of a sample dryer is not advised, to avoid loss of mercaptans by removing them with the water.

The setting for the column has been optimized to avoid interference from higher boiling hydrocarbons. In a standard instrument up to 40 peaks can be quantified.

## Challenges in the analysis of sulfur compounds:

Three issues stand out when monitoring sulfur compounds: all are related to the reactivity of mercaptans. Sulfides are less reactive.

### Reactions of mercaptans in air and on reactive surfaces:

Many customers demand measurement of mercaptans but it is better to also include the sulfides.

Mercaptans are unstable and can be converted by catalytic activity to the more stable sulfides or by oxidation into other compounds.

The disulfides are even more stable and are formed out of the mercaptans.

The smell of these compounds is not very different, so only by measuring all these compounds you can determine the air quality.

To prevent the reaction of mercaptans in/on the sample lines these lines need to be selected carefully.

### Calibration:

Calibrating the mercaptans is complex: bottles with mercaptans are not stable, except if the bottle had special treatment.

A permeation tube is better. However in reaction with oxygen the mercaptans will turn into sulfides.

The only real option is to dilute with nitrogen.

In that way the reaction cannot take place. However it will take some time to stabilize.

### Sample conditioning:

Drying the sample with a Perma Pure dryer is not recommended because mercaptans will disappear.

## Analyser details

A standard industrial PC with Windows embedded is used in the GC. The user-friendly software stores all the chromatograms on the hard disk and data can be interpreted easily with this intuitive software. Data can be transferred by network and modem connection. Besides this, analog and digital output options are available to communicate with other data logging systems using several data protocols.

Simple operation, good reliability and low maintenance cost are important to us. With a worldwide network of distributors you can be sure that your instrument comes complete with an individualized training and that support is available to help if you do encounter problems.

## SYNTECH SPECTRAS GC955 SERIES 810 MERCAPTAN AND SULFUR ANALYSER

TECHNICAL DESCRIPTION	PID detector. Lowest detection level depending on component from 0.2 ppb for Methylmercaptan to 0.01 ppb for disulfides. Standard range: 0-30 ppb (can be extended upon request). Included items: special cooled pre-concentration trap at 10 °C, column special sulfur, 2 + 28 mm, 0.32 mm ID, 3 to 5 µm film, Standard cycle time 15 minutes (30 minutes on request), temp program 45 °C – 110 °C, flow program typical <3% at 1 ppb (dimethylsulfide, with capillary column)
REPRODUCIBILITY	
GAS CONSUMPTION	Nitrogen, quality 5.0, 4 bar, 10 ml/min
DIMENSIONS	19" rack, 5 standard Height Units, depth 43 cm net (W 48,3 D 43 H 22 CM), WEIGHT 20 kg
POWER DEMAND	230 V AC, 100 VA (115 V AC available) 50/60 Hz
INCLUDED HARDWARE	Internal industrial x86 based computer, hard disk, full color touchscreen, various data connection options
COMMUNICATION	Direct control via touchscreen, keyboard or mouse. External data communication via RS232, analog and digital outputs, via TCP-IP.
INCLUDED SOFTWARE	Windows embedded and GC 955 software. Control of instrument: direct control via keyboard or mouse, or via remote host (RS232 / modem), Ethernet. Standard available protocols: ASCII-terminal, Hessen, Gesytec, MODBUS, other protocols on request
Approvals	CE approval for EMC conformity: EN 61000-6-2, EN 61000-6-3, EN 61010, EN 61326
OPTIONS	It is possible to monitor also benzene and toluene in a 20 minute cycle. In a 30 minute cycle also xylenes can be monitored.

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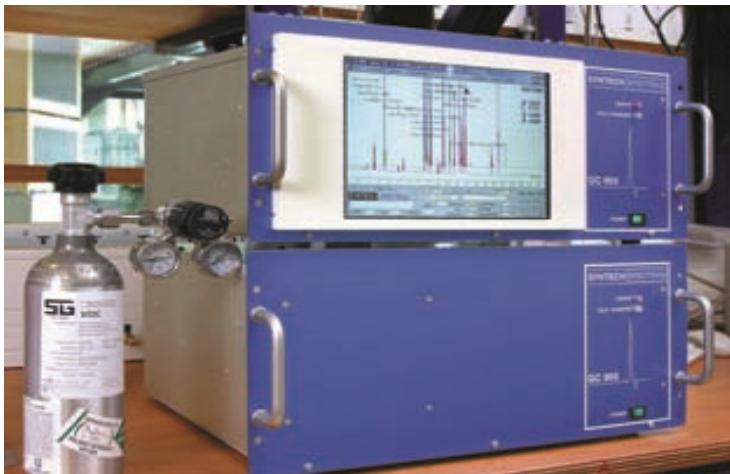
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# GC955

## SYNTECH SPECTRAS OZONE PRECURSOR HYDROCARBON

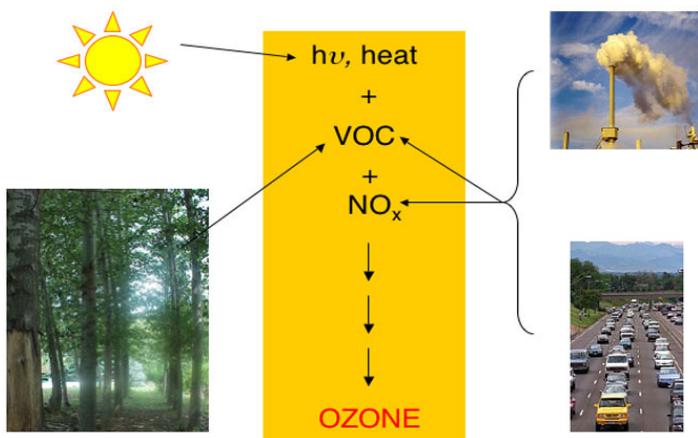


**Analyser for the measurement of hydrocarbon ozone precursors in ambient air.**

Ozone is one of the most reactive substances in ambient air. In the stratosphere it has a protecting function as it will filter the strongest sun radiation. But in the troposphere, the lowest layer of the air, it can be harmful for humans, agriculture and nature in general.

Ozone is formed naturally but also by reaction of nitrogen oxides with hydrocarbons in certain atmospheric conditions. The production of ozone proceeds faster under strong sun radiation, high temperature and high humidity. The products of these reactions are photochemical smog, containing not only ozone, but also very toxic hydrocarbons and fine dust particles.

### Photochemical Production of Ozone



### Hydrocarbons to measure

It is important to monitor hydrocarbons that are emitted into the air and to focus on those that have a major effect on the ozone formation.

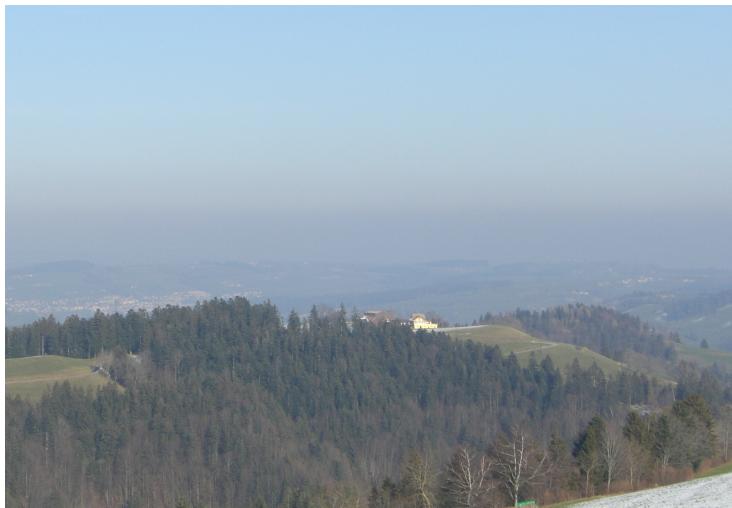
At this moment the USA has defined a group of 58 hydrocarbons, the EU has defined a list of 28 hydrocarbons. The first list is responsible for ca. 90 %, the second for ca. 80 % of ozone formation. Knowledge of the main precursors for ozone formation is developing. A revision of the compound lists is made from time to time. In other areas of the world other compounds may be more important. Hydrocarbons emitted by nature must also be included.

In addition, the equipment is capable of measuring hydrocarbons that do not contribute to the formation of ozone, but these are toxic, for instance chlorinated solvents. Including these solvents means that the equipment is used more effectively.

### Syntech Spectras GC 955 series 611/811 ozone precursor analyser can measure up to 80 components

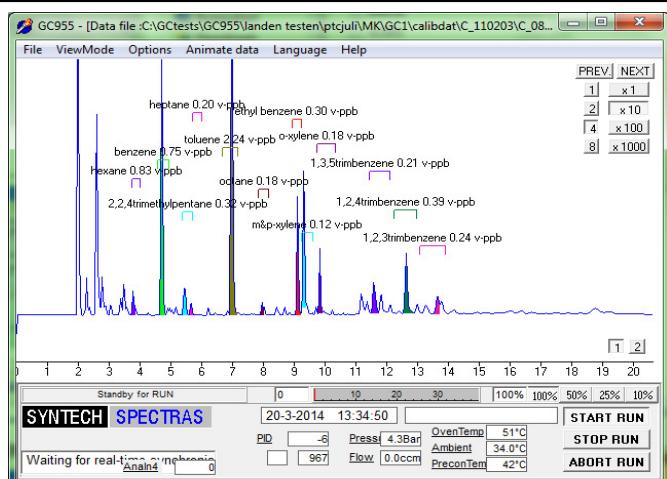
The ozone precursor measurement is done by a combination of two analysers that enables measurement of all components. For hydrocarbons with higher boiling points (BP range > 50 °C) a trap with a low memory effect and a column suitable for separating species present in this BP range is used

For the low boiling hydrocarbon a cooled trap and a column that is dedicated to separate the low boiling hydrocarbons, especially the C4 alkanes and alkenes and the C6 alkane isomers, are used.



# SYNTECH SPECTRAS

# 611 HIGH BOILING FRACTION OZONE PRECURSOR



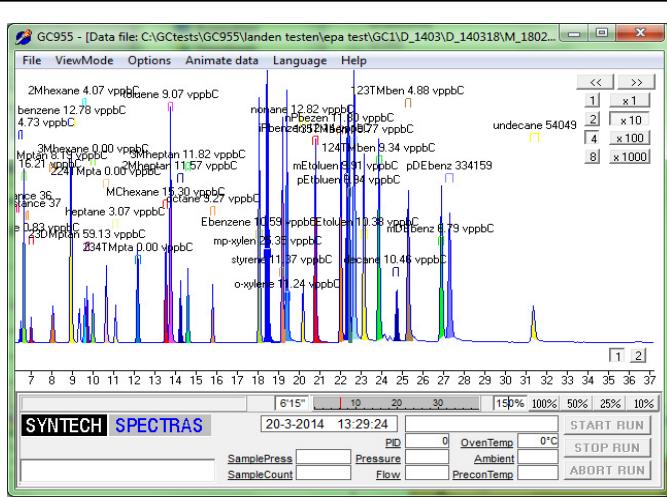
### Chromatogram of ambient measurement

## **Selection of the hydrocarbons C6 to C12**

In the group measured on GC 955-611 analyser the source of the hydrocarbons is predominantly fossil fuels. The sources are refineries, evaporation during transport and incomplete burning.

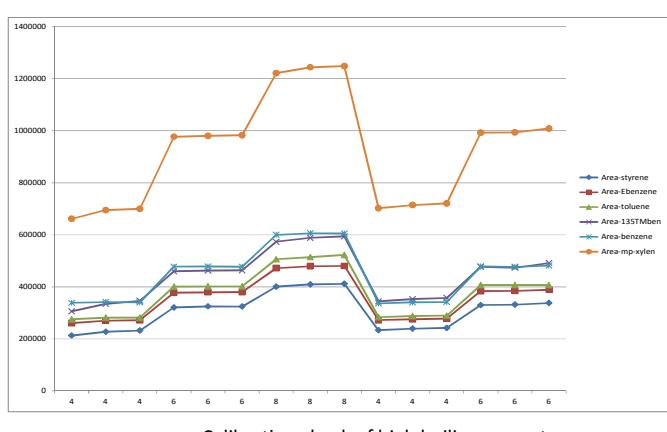
The list contains one carcinogenic compound, benzene. A few of the compounds are being investigated as suspected carcinogens. Some compounds can cause long term damage to liver or brains. But the function as ozone precursor is for all compounds, except benzene, the main reason for monitoring them.

In the list below all USA EPA C6 to C12 compounds are shown. The compounds which are also selected by the EU are marked in **bold**.



### Chromatogram of calibration in one hour mode

<b>N-Hexane</b>	<b>N-Octane</b>	N-Propylbenzene
2-Methylpentane	2-Methylheptane	<b>1,2,4-Trimethylbenzene</b>
<b>3-Methylpentane</b>	3-Methylheptane	<b>1,3,5-Trimethylbenzene</b>
2,2-Dimethylbutane	<b>2,2,4-Trimethylpentane</b>	<b>1,2,3-trimethylbenzene</b>
2,3-Dimethylbutane	2,3,4-Trimethylpentane	O-Ethyltoluene
Cyclohexane	<b>Benzene</b>	M-Ethyltoluene
Methylcyclopentane	<b>Toluene</b>	P-Ethyltoluene
<b>N-Heptane</b>	<b>Ethylbenzene</b>	M-Diethylbenzene
2-Methylhexane	<b>M,P-Xylene</b>	P-Diethylbenzene
2,3-Dimethylpentane	<b>O-Xylene</b>	N-Nonane
2,4-Dimethylpentane	Styrene	N-Decane,
3-Methylhexane	Isopropylbenzene	Undecane
Methylcyclohexane		Also $\alpha$ and $\beta$ pinene



## Calibration check of high boiling aromatics

Syntech Spectras GC955 611 analyser

Online measurements show concentrations from detection limit (<0.1 ppb) up to over 20 ppb. Daily concentration variation of one compound is often a factor 4. Hydrocarbons are not only emitted by traffic, but also by industrial or household processes.

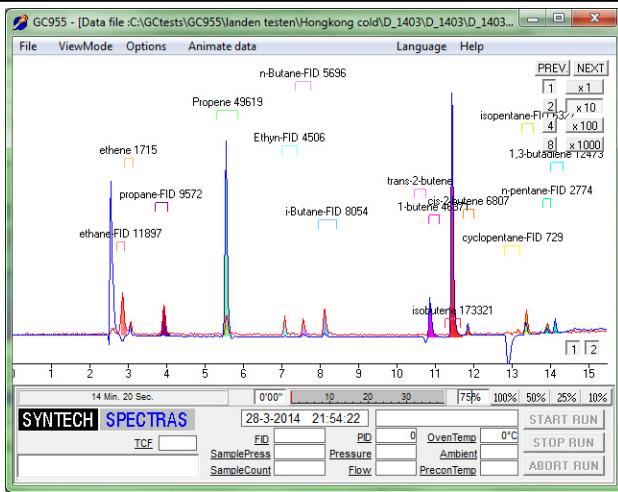
The semi continuous analyser of Synspec can follow these changes easily with the 30 minute cycles. A one hour cycle is also possible on request. The hydrocarbons are concentrated inside the system to reach a low detection level.

The detector used is a photo ionization lamp: the detector is sensitive to all the hydrocarbons on the list. It is possible to add a FID as second detector.

Boiling point range +50 °C to 250 °C

# SYNTECH SPECTRAS

# 811 LOW BOILING FRACTION OZONE PRECURSOR



## Chromatogram of ambient measurement

## **Selection of the hydrocarbons form C2 to C5**

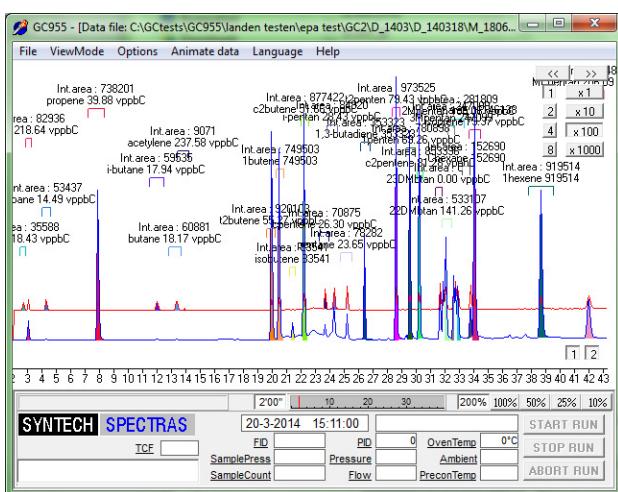
The components measured on the GC 955-811 analyser are predominantly emitted by the petrochemical industry. Either from refineries, evaporation during transport or incomplete burning. These light hydrocarbons are part of LNG and form the main compounds of LPG. Propane and Butane are also widely used for cooking. Ethene and isoprene are also of biogenic origin.

The list contains one carcinogenic compound: butadiene. Some compounds can cause short term damage when inhaled and long term damage to liver or brains. But the function as ozone precursor is for all compounds except 1,3-butadiene the main reason to monitor them.

In the list below all USA EPA C2 to C5/C6 compounds are shown.

The compounds also selected by the EU are marked in **bold**.

Compounds that are underlined are also measured with the 611 system.



Chromatogram of calibration gas in one hour mode

<i>Ethene (ethylene)</i>	<i>Iso-Pentane</i>	2-Methyl-1-Pentene
<i>Ethane</i>	Iso-Butene	<i>Ethyne (acetylene)</i>
<i>Propene (propylene)</i>	<i>N-Pentane</i>	2,3-dimethylbutane
<i>Propane</i>	<i>1-Pentene</i>	<b>2-Methylpentane</b>
<i>1-Butene</i>	<i>Cyclopentane</i>	2,2-dimethylbutane
<i>Iso-Butane</i>	Cis-2-Pentene	<b>3-Methylpentane</b>
<i>Cis-2-Butene</i>	1,3-Butadiene	1-Hexene
<i>N-Butane</i>	Trans-2-pentene	<b>Hexane</b>
<i>Trans-2-Butene</i>	<i>Isoprene (2-methyl-1,3-butadiene)</i>	



Sample conditioning unit with Perma Pure dryer and humidity sensor

Syntech Spectras GC955 811 analyser

Online measurements show concentrations between detection limit (<0.1 ppb) up to over 30 ppb. Daily variation is often at least a factor 4. The GC955-811 analyser of Synspec can follow these changes easily with the 30 minutes cycles, one hour setting is possible on request.

The hydrocarbons are concentrated on a cooled trap inside the system. Two detectors are used: a photo ionization and a flame ionization: the unsaturated hydrocarbons on the list are detected by the PID, the saturated hydrocarbons are detected by the FID. This makes identification easy. The sensitivity for unsaturated hydro-carbons is very high.

Sample humidity must be controlled preferably by using the Synspec SCU sample conditioning unit, see separate data sheet.

Boiling point range –80°C to +50 °C

## Technical details of the system

The system 611 is a gas chromatograph with a built-in pre-concentration system. Hydrocarbons are pre-concentrated on Tenax GR, thermally desorbed and separated on a SY1 column, to reach optimal separation from interfering hydrocarbons. Analysis is done by a photo ionization detector. This ensures high sensitivity and good identification. Optionally an FID can be included.

The system 811 is a gas chromatograph with a built-in cooled pre-concentration system. Hydrocarbons are pre-concentrated on Carbosieves SIII at a temperature well below 10° C, ( can go down to -10 °C), desorbed thermally and separated on a combination of two columns, a capillary film column and a capillary PLOT column. In this way the low boiling hydrocarbons can be separated. Analysis is done by a photo ionization detector and a flame ionization detector. This ensures high sensitivity and good identification. We advise to use the Synspec SCU sample conditioning unit to control the humidity of the sample.

A standard industrial PC with Windows Embedded is used, one PC can control both analysers. The user-friendly software stores all the chromatograms on the hard disk and data can be interpreted easily with the intuitive software. Data can also be transferred by network and modem connection. Besides this, analog and digital output options are available to communicate with other data logging systems using several data protocols.

Simple operation, good reliability and low maintenance cost are important to us. With a world wide network of distributors you can be sure that your instrument comes complete with an individualized training and that support is available to help if you do encounter problems.

Preventive maintenance is only required once a year. For of good quality data it is recommended to have a regular (automatically) calibration or validation. In the software an automatic multipoint validation / calibration is possible using calibration gas of one concentration per component.

The expected lifetime of the analyser is 10 years. Our warranty is 2 years, ask for maintenance requirements. Consumable part cost is low.

## Syntech Spectras GC955 series 611 ozone precursor analyser High boiling hydrocarbon fraction

### TECHNICAL DESCRIPTION

PID and optionally FID detector. Lowest detection level for benzene <0.4 µg/m<sup>3</sup> (0.15 vppb). Please contact us for the lowest detection levels for the other components.

Standard range: 0-30 ppb ( can be extended upon request).

Included items: column SY1 type, 30m, 0.32 mm ID, 1.0 µm film,

Standard cycle time 30 minutes (60 minutes on request), temp program 50 - 90 °C, flow program

Pre-concentration trap at room temperature.

### REPEATABILITY

Typical <3% at 1 ppb (benzene, with capillary column)

### GAS CONNECTIONS

Instrument air: dry and clean, 3 bar, 250 ml/min (when optional FID is installed)

Nitrogen, quality 5.0, 4 bar, 25 ml/min

Hydrogen, quality 5.0, 3 bar, 20 ml/min

## Syntech Spectras GC955 series 811 ozone precursor analyser Low boiling hydrocarbon fraction

### TECHNICAL DESCRIPTION

PID and FID detector. Lowest detection level for 1-butene <0.4 µg/m<sup>3</sup>. Please contact us for the lowest detection levels for the other components.

Standard range: 0-30 ppb ( can be extended upon request).

Included items: column SY5, Al<sub>2</sub>O<sub>3</sub>-Na<sub>2</sub>SO<sub>4</sub>, 5+10 m, 0.32 mm ID.

Standard cycle time 30 minutes (60 minutes on request), temp program 50 - 120 °C , flow program

Cooled pre-concentration trap .

### REPEATABILITY

Typical <3% at 1 ppb (butane), with capillary column)

### GAS CONNECTIONS

Instrument air: dry and clean, 3 bar, 2 x 250 ml/min ( for FID and permapure dryers)

Nitrogen, quality 5.0, 4 bar, 25 ml/min

Hydrogen, quality 5.0, 3 bar, 20 ml/min

### GENERAL CERTIFICATES

CE approval for EMC conformity: EN 61000-6-2, EN 61000-6-3, EN 61010, EN 61326

### STANDARD CALIBRATION

Standard calibration provided for ozone precursors, UK NPL primary ozone precursor standard at 4 or 5 ppb as the USA Spectra Gases PAMS standard in the range 5-20 ppb.

### DIMENSIONS

19" rack, 5 standard Height Units, depth 43 cm net

(W 48,3 D 43 H 22 CM), WEIGHT 19 and 21 kg

### HARDWARE AND SOFTWARE INCLUDED

Industrial PC with Windows Embedded suitable for measuring and saving data up to 10 years.

Software for running the analyser and demo version for data evaluation and reprocessing on desktops is included.

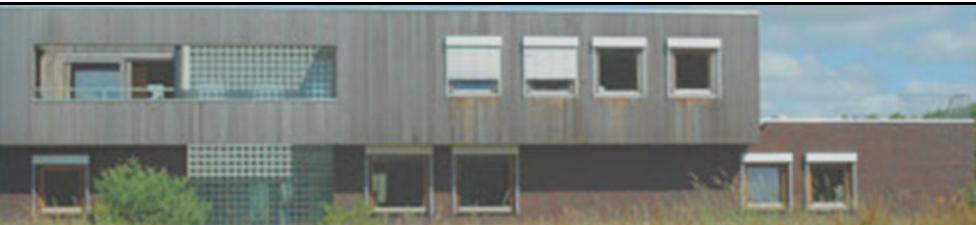
### POWER CONSUMPTION

230 V AC, 400 VA (115 V AC available), 50/60 HZ

### OPTIONS

Synspec Sample Conditioning Unit (SCU) with internal Perma Pure dryer, humidity sensor and switch between zero, span and sample for both analysers. This item is strongly recommended.

SYNSPEC BV  
DE DEIMTEN 1  
9747AV GRONINGEN  
NEDERLAND



# SYNTECH SPECTRAS TOXIC HYDROCARBON ANALYSER



SYNTECH SPECTRAS 615/815 SYSTEM IN A

## Contents

Synspec provides two different modules for the monitoring of toxic hydrocarbons:

### **the Syntech Spectras GC955 615 and the Syntech Spectras GC955 615/815**

In this leaflet we give you some background information about toxic hydrocarbons and a description of the Synspec solution for measuring them. The technical details are shown at the back. Additional equipment needed is also mentioned.

### **WHY MEASURE TOXIC HYDROCARBONS**

Industrial activity may lead to the emission of toxic hydrocarbons in the air. These can be emitted by quite different processes, like producing polymers, refining oil, synthesizing pharmaceuticals etc. In general industries emit as little as possible, yet for some chemicals a persistent background of a few ppb or lower must be monitored. Unwanted spills can happen due to transport, explosions, leaks etc. These can lead to short term concentrations rising to ppm level. Monitoring can be done by one industry, by a group of industries or by the local authorities. If a limit is exceeded the measurements should trigger an alarm. The results must also be saved for long term evaluation.

Another application is indoor monitoring , either in industry or in houses. For such applications a mobile version is practical.



SYNTECH SPECTRAS 615 SYSTEM FOR MOBILE USE

### **HYDROCARBONS TO MEASURE**

Depending on the area only a few up to fifty different hydrocarbons can reach problematic concentrations. Toxicity to humans can have quite different forms: from short term skin or lung effects to long term brain, kidney or liver damage. Hydrocarbons considered carcinogenic are a separate group that is also measured.

The hydrocarbons consist of 3 main groups:

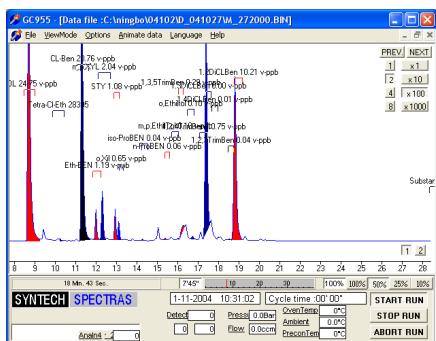
- monomers used for polymer production,
- chlorinated compounds used as solvents and
- aromatic hydrocarbons from refineries or from use as solvents.

These hydrocarbons are listed in for instance the USA TO-14 and in the Japanese JHAP lists.

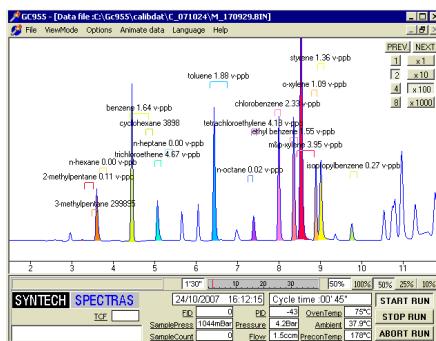
However specific industries may use many other hydrocarbons that are toxic, making it necessary to measure also those compounds down to low ppb concentrations

# SYNTech SPECTRAS

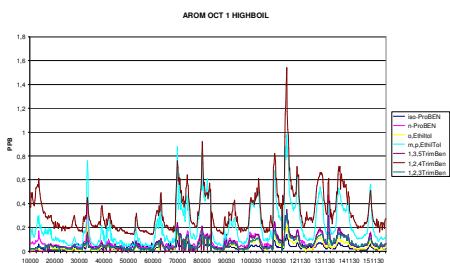
## 615 HIGH BOILING FRACTION TOXIC HYDROCARBONS



### AMBIENT MEASUREMENT



### CALIBRATION WITH USA EPA MIXTURE



RE-

SULTS OF 14

DAYS AMBIENT MEASUREMENTS

### SELECTION OF THE HYDROCARBONS

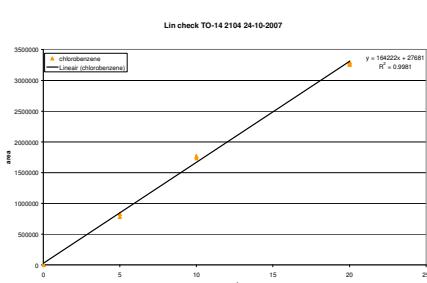
The hydrocarbons monitored in this analyser fullfill three criteria: They are toxic and/or carcinogenic and some of the compounds are also contributing to the formation of ozone.

For carcinogenic hydrocarbons there is no lower limit below which safety is guaranteed. For toxic hydrocarbons such a limit can be set. Toxic hydrocarbons can have short term as well as long term effects. This often leads to two sets of exposure levels: higher STEL for the short term as well as the long term value. The Synspec alarm setting software contains such features.

The list below contains four carcinogenic compounds, acrylonitrile, trichloroethene, tetrachloroethene and benzene. A few of the compounds are researched as suspect carcinogens. Some compounds can cause long term damage to liver or brains.

### A typical compound list

<b>Acrylonitrile</b>	Benzene
Trichloroethene	Toluene
Tetrachloroethene	Ethylbenzene
<b>Chloroform</b>	M,P-Xylene
<b>Tetrachloromethane</b>	O-Xylene
<b>1,2-Dichloroethane</b>	Styrene
<b>Trichloroethane</b>	Isopropylbenzene
Epichlorohydrin	N-Propylbenzene
Chlorobenzene	1,2,4-Trimethylbenzene
1,2-Dichlorobenzene	1,3,5-Trimethylbenzene
<b>Hexane</b>	1,2,3-trimethylbenzene
<b>Heptane</b>	O-Ethyltoluene
<b>Octane</b>	M,P-Ethyltoluene
	M,P-Diethylbenzene



CALIBRATION TEST: CHLOROBENZENE 0-20 PPB

### Syntech Spectras GC955 615 toxic analyser results

Online measurements show concentrations from detection limit (<0.1 ppb) up to over 200 ppb. Daily concentration variation is enormous and depends very much on wind direction, process changes and possible emergencies. Very different from BTEX or ozone precursor measurements : the toxic hydrocarbons are not only emitted by traffic, but mainly by industry.

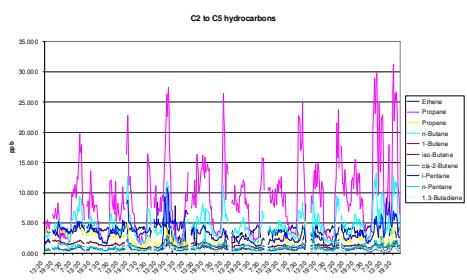
The hydrocarbons are concentrated inside the system to reach a low detection level.

The system uses two detectors for easy identification, the compounds in italic bold on the typical list are measured by FID, the other compounds by PID.

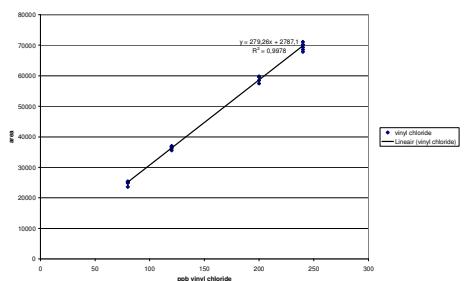
Boiling point range +50°C to 250 °C

# SYNTech SPECTRAS

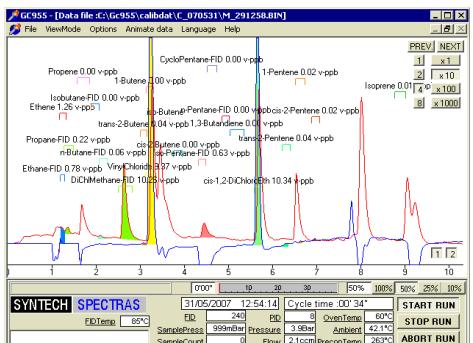
## 615 / 815 TOXIC HYDROCARBON ANALYSER



### RESULTS OF 7 DAYS OF AMBIENT MEASUREMENTS



### CALIBRATION OF VINYL CHLORIDE



### CHROMATOGRAM OF USA EPA TO-14 MIXTURE

### SELECTION OF THE HYDROCARBONS

Synspec proposes as default to use the system 615 for toxic hydrocarbons. For toxic hydrocarbons we propose that system and will furnish you with a list of hydrocarbons that can be measured on that system. But certain toxic hydrocarbons have low boiling points and cannot be preconcentrated, separated and analyzed well at low levels with only one GC 615. In those cases either the high boiling compounds cannot be analysed, or a double system is necessary: the system 615 / 815.

The list of low boiling hydrocarbons contains two carcinogenic compounds, 1,3-butadiene and vinyl chloride. It contains also several very toxic compounds, either leading to problems with short term exposure, or to long term damage. If such compounds are used in an industrial area it is necessary to monitor them. Once such a system is in use, also several major ozone precursors, like Butenes, Butanes and Propane can be monitored on the same system. The only requirement is that they are calibrated.

The hydrocarbons are concentrated inside the system on a cooled trap to reach a low detection level. The compounds are separated on a dedicated column.

The system uses two detectors for easy identification, the compounds in italic bold on the typical list are measured by FID, the other compounds by PID.

Vinyl Chloride
<b>1,1-Dichloroethene</b>
<b>Dichloromethane</b>
<b>Methyl chloride</b>
1,3-Butadiene
Isoprene
<b>Chloroethane</b>
Bromomethane

<b>And additional for instance:</b>
1-Butene
Iso-Butene
<b>Ethyn</b>
<b>Propane</b>
1-Pentene
n-Butane
n-Pentane
Ethene



Sample conditioning unit with Perma Pure dryer and humidity sensor

### SYNTech SPECTRAS GC955 615/815 TOXIC ANALYSER RESULTS

Online measurements show concentrations between detection limit (<0.1 ppb) up to over 30 ppb. Daily concentration variation is often at least a factor 4. On many locations the hydrocarbons are not only emitted by traffic, but also by industrial or household processes.

The semi continuous analyser of Synspec can follow these changes easily with the 30 minute cycles.

At industrial areas with multiple production sites the variation in the measurements can be enormous: depending on wind direction, process changes, leaks, ozone development activity.

Identification is difficult if the retention times are not stable. Sample humidity must be removed by a drier, else these retention times will shift. For precise control of this we propose using a well working zero air generator with the Synspec SCU sample conditioning unit, see separate data sheet.

Boiling point range -80°C to +50 °C

## Technical details of the system

The system 615 is a gas chromatograph with a built-in pre-concentration system. Hydrocarbons are pre-concentrated on Tenax GR, thermally desorbed and separated on an SY1 equivalent column, to reach optimal separation from interfering hydrocarbons. Analysis is done by a photo ionization detector and a flame ionization detector. This ensures high sensitivity and good identification. (Optionally a detector can be left out)

The system 815 is a gas chromatograph with a built-in cooled pre-concentration system. Hydrocarbons are pre-concentrated on Carbosieves SIII at a temperature below 10° C, (optionally to go down below -10 °C), desorbed thermally and separated on a combination of two columns, a capillary film column and a capillary PLOT column. In this way the low boiling hydrocarbons can be separated. Analysis is done by a photo ionization detector and a flame ionization detector. This ensures high sensitivity and good identification. We advise to use the Synspec SCU sample conditioning unit to control the humidity of the sample. (Optionally a detector can be left out)

A standard industrial PC with Windows Embedded is used, one PC can control both analyzers. The user-friendly software stores all the chromatograms on the hard disk and data can be interpreted easily with the intuitive software. Data can also be transferred by network and modem connection. Besides this, analog and digital output options are available to communicate with other data logging systems using several data protocols.

Simple operation, good reliability and low maintenance cost are important to us. With a world wide network of distributors you can be sure that your instrument comes complete with an individualized training and that support is available to help if you do encounter problems.

**615**

### Syntech Spectras GC955 series 615 toxic hydrocarbon analyzer High boiling hydrocarbonfraction

#### TECHNICAL DESCRIPTION

PID and FID detector. Lowest detection level for benzene <0.4 µg/m<sup>3</sup> (0.15 ppb). Range: up to 300 ppb.  
Included items: SERIES 600, column SY1 type, 30m, 0.32 mm ID, 1.0 µm film,  
cycle time 30 or 60 minutes, temp program 50 - 90 °C, flow program  
Pre-concentration trap at room temperature.

#### REPEATABILITY

Typical <3% at 1 ppb (benzene, with capillary column)

#### GAS CONNECTIONS

Instrument air: dry and clean, 3 bar, 250 ml/min  
Nitrogen, quality 5.0, 4 bar, 25 ml/min  
Hydrogen, quality 5.0, 3 bar, 20 ml/min

**815**

### Syntech Spectras GC955 series 815 toxic hydrocarbon analyzer Low boiling hydrocarbon fraction

#### TECHNICAL DESCRIPTION

PID and FID detector. Lowest detection level for 1-butene <0.4 µg/m<sup>3</sup>.  
Range: up to 300 ppb. Included items: SERIES 800, column SY5, Al<sub>2</sub>O<sub>3</sub>-Na<sub>2</sub>SO<sub>4</sub>, 5+25m, 0.32 mm ID, 10 µm film,  
cycle time 30 or 60 minutes, temp program 50 - 120 °C, flow program  
Cooled pre-concentration trap, temp. Range min <-10 °C, max +10 °C.

#### REPEATABILITY

Typical <3% at 1 ppb (butane), with capillary column)

#### GAS CONNECTIONS

Instrument air: dry and clean, 3 bar, 2 x 250 ml/min  
Nitrogen, quality 5.0, 4 bar, 25 ml/min  
Hydrogen, quality 5.0, 3 bar, 20 ml/min

#### GENERAL

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#### STANDARD CALIBRATION

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#### DIMENSIONS

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#### HARDWARE AND SOFTWARE INCLUDED

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Software for running the analyzer as well as for data evaluation and processing on desktops is included.

#### POWER CONSUMPTION

230 V AC, 400 VA (115 V AC available), 50/60 HZ

#### OPTIONS

Synspec Sample Conditioning Unit (SCU) with internal Perma Pure dryer, humidity sensor and switch between zero, span and sample for both analyzers. This item is strongly recommended.

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