



GA-21 *plus*

madur portable gas analyser

www.madur.com



CHARACTERISTIC

FEATURES

TECHNICAL DATA

SENSORS

EQUIPMENT

APPEARANCE

GA21^{plus} is a portable analyser using advanced technologies. However, it remains madur's flagship due to its favorable price. It can be equipped with up to 9 electrochemical and NDIR sensors. Analyser has a built-in pressure sensor, large internal memory for results and built-in ribbon printer for standard (non-thermal) paper.

Optional condensation "miniDryer" completes the offer for our best-selling portable device.

GA21^{plus} as the measurement instrument meets requirements of EN 50379 and EN 50270.

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TECHNICAL DATA

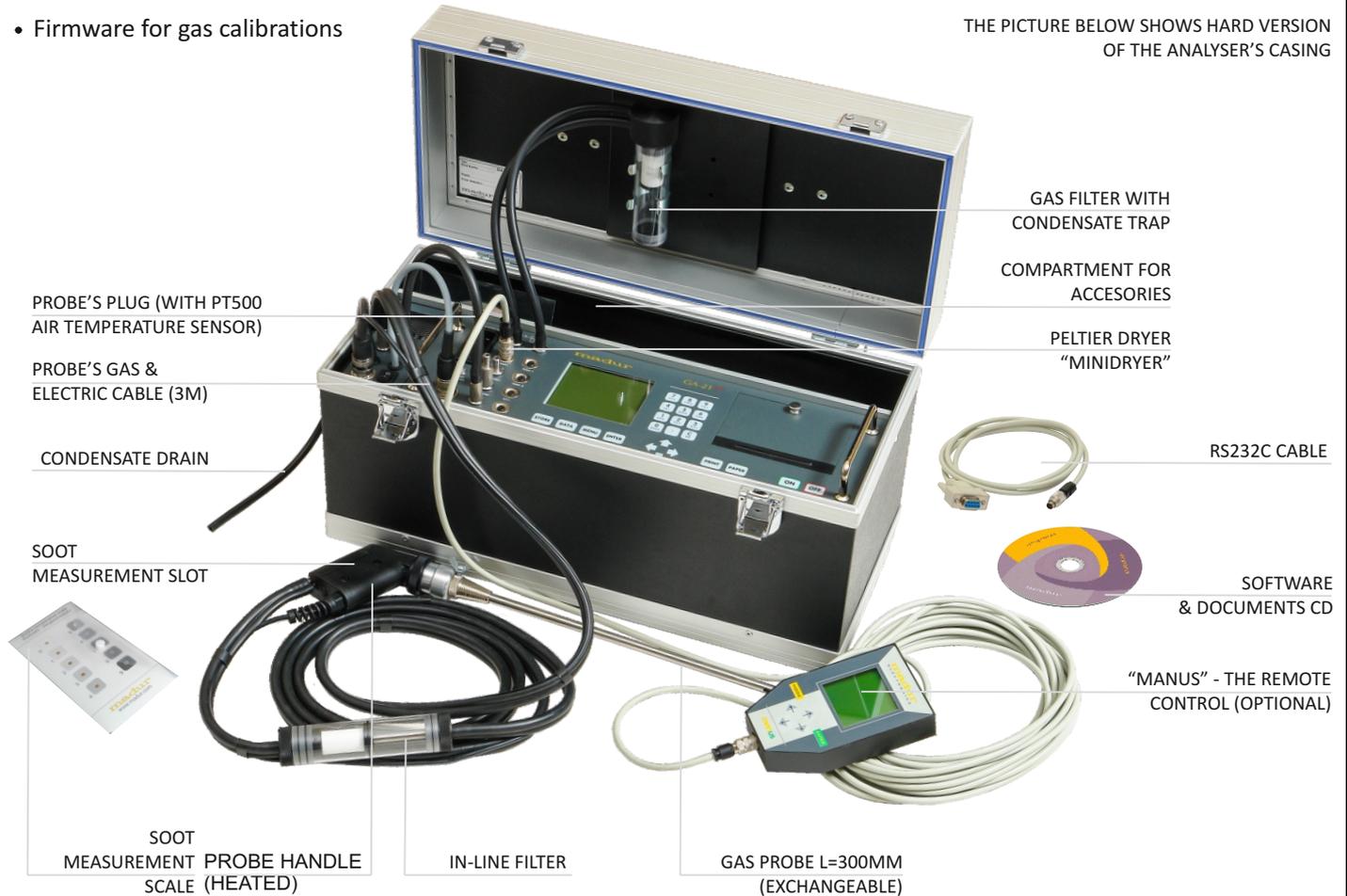
SENSORS

EQUIPMENT

APPEARANCE

- Produced in two kinds of casing: soft and hard
- Equipped with up to 7 electrochemical cells
- Equipped with up to 2 NDIR sensors
- **NEW Thermal Conductivity Detector (TCD) for H₂**
NEW Photoionization Detector (PID) for VOC (Volatile Organic Compound)
- Built-in 58mm ribbon graphic printer
- Built-in rechargeable battery for up to 7 hours of operating
- Peltier "miniDryer" with a peristaltic pump for condensate removal (optional)
- Probe holder with a standard M30x1 fitting, fits all madur gas probes with the K-type thermocouples
- Differential pressure sensor - for measurements of chimney draft and flow velocity (with help of Pitot tube)
- Soot measurement programme
- Measurements of gas and ambient temperatures
- 2 additional inputs for extra temperature sensors
- Analogue outputs (0/4-20mA or 0-10V) - optional
- Built-in large memory for results, two formats of data savings
- Calculations of many additional parameters
- Gas filter with condensate trap & replaceable insert
- Firmware for gas calibrations

THE PICTURE BELOW SHOWS HARD VERSION OF THE ANALYSER'S CASING



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CHARACTERISTIC | FEATURES | **TECHNICAL DATA** | SENSORS | EQUIPMENT | APPEARANCE

GA-21 ^{plus} GAS ANALYSER	VERSION A - SOFT CASING	VERSION B - HARD CASING		
Dimensions (W * H * D)	460 mm * 260 mm * 240 mm	455 mm * 270 mm * 220 mm		
Weight (without accessories)	6,2 kg ÷ 7,2 kg	8,2 kg ÷ 9,2 kg		
Casing material	textile (polyester)	wood & aluminum		
Operating conditions	T: 10°C ÷ 50°C RH: 5% ÷ 90% (non-condensing)			
Storing temperature	0°C ÷ +55°C			
Power supply	90 ÷ 240 VAC			
Maximal power consumption	70 W			
Battery: type work time charging time	Lead-acid, rechargeable 12V / 2,2 Ah 7 h 14 h			
Data memory: size number of results	32 kB 30 reports + 10 banks (1024 sets of data)			
Display	Graphical LCD 128 * 128 with variable contrast and backlighting			
Printer	High-speed dot matrix, graphic printer for 58 mm normal paper			
Analogue outputs (optional)	Two (0/4-20 mA or 0-10V)			
Gas pump gas flow	Diaphragm, max 2 l/min (with automatic flow control) 90l/h (1,5l/min)			
Purging pump for CO sensor (optional)	Diaphragm, max 1,5 l/min			
Communication interface with PC computer	RS-232C			
Gas filtering	1. In-line filter included in the gas probe hose 2. Built-in input filter with water-trap and replaceable insert			
MEASUREMENTS				
Variable	Method	Range Resolution	Accuracy	Time (T ₉₀)
T _{gas} - gas temperature	K-type thermocouple	-10 ÷ 1000°C 0,1°C	± 2°C	10 sec
T _{gas} - gas temperature	S-type thermocouple	-10 ÷ 1500°C 0,1°C	± 2°C	10 sec
T _{amb} - boiler intake air temperature	PT500 resistive sensor	-10 ÷ 100°C 0,1°C	± 2°C	10 sec
T ₁ – external temperature	K-type thermocouple	-10 ÷ 1000°C 0,1°C	± 2°C	10 sec
T ₁ – external temperature	S-type thermocouple	-10 ÷ 1500°C 0,1°C	± 2°C	10 sec
T ₂ – external temperature	PT500 resistive sensor	-10 ÷ 100°C 0,1°C	± 2°C	10 sec
T ₃ – external temperature	K-type thermocouple	-10 ÷ 1000°C 0,1°C	± 2°C	10 sec

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CHARACTERISTIC	FEATURES	TECHNICAL DATA	SENSORS	EQUIPMENT	APPEARANCE
Variable		Method	Range Resolution	Accuracy	Time (T ₉₀)
T ₃ – external temperature		S-type thermocouple	-10 ÷ 1500°C 0,1°C	± 2°C	10 sec
T ₄ – external temperature		PT500 resistive sensor	-10 ÷ 100°C 0,1°C	0,3 m/s abs. or 5% rel.	10 sec
Differential pressure		Silicon piezoresistive pressure sensor	-25 hPa ÷ +25 hPa 10 Pa (0,01hPa)	± 2Pa abs. or 5% rel.	10 sec
Gas flow velocity		Indirect, with Pitot tube & pressure sensor	1 ÷ 50 m/s 0,1 m/s	0,3 m/s abs. or 5% rel.	10 sec
Lambda λ - excess air number		Calculated	1 ÷ 10 0,01	± 5% rel.	10 sec
qA - stack loss		Calculated	0 ÷ 100% 0,1%	± 5% rel.	10 sec
Eta η - combustion efficiency		Calculated	0 ÷ 120% 0,1%	± 5% rel.	10 sec
U ₁ ÷ U ₂ - external analogue input (voltage)		Delta - sigma ADC	-20 V ÷ 20V 0,01V	± 2% rel.	10 sec
I ₁ ÷ I ₂ - external analogue input (current)		Delta - sigma ADC	-20 mA ÷ 20 mA 0,01mA	± 2% rel.	10 sec
CHARACTERISTIC	FEATURES	TECHNICAL DATA	SENSORS	EQUIPMENT	APPEARANCE
Method		Range Resolution	Accuracy	Time (T ₉₀)	Conformity
O₂ - OXYGEN					
Electrochemical		20,95% 0,01%	± 0,2% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochemical, partial pressure		20,95% 0,01%	± 0,2% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochemical, partial pressure		25% 0,01%	± 0,2% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochemical, partial pressure		100% 0,1%	± 0,2% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Paramagnetic		25% 0,01%	± 0,2% abs. or 5% rel.	45 sec	EN 14789, OTM-13
Paramagnetic		100% 0,1%	± 0,2% abs. or 5% rel.	45 sec	EN 14789, OTM-13
CO - CARBON MONOXIDE					
Electrochemical		4 000 ppm 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochemical		20 000 ppm 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochemical		10% 0,001%	± 0,005% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochem., with H2 compensation		2 000 ppm 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	ISO 12039; CTM-030
NDIR		10% 0,01%	± 0,05% abs. or 5% rel.	45 sec	EN 15058
NDIR		100% 0,1%	± 0,5% abs. or 5% rel.	45 sec	EN 15058

Method	Range Resolution	Accuracy	Time (T ₉₀)	Conformity
CO₂ - CARBON DIOXIDE				
NDIR	25% 0,01%	± 0,05% abs. or 5% rel.	45 sec	ISO 12039
NDIR	50% 0,01%	± 0,05% abs. or 5% rel.	45 sec	ISO 12039
NDIR	100% 0,1%	± 0,5% abs. or 5% rel.	45 sec	ISO 12039
CH₄ - METHANE				
NDIR	5% 0,01%	± 0,05% abs. or 5% rel.	45 sec	
NDIR	25% 0,01%	± 0,05% abs. or 5% rel.	45 sec	
NDIR	100% 0,1%	± 0,5% abs. or 5% rel.	45 sec	
NO - NITRIC OXIDE				
Electrochemical	1 000 ppm 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	EN 50379; CTM 022
Electrochemical	5 000 ppm 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	EN 50379; CTM 022
NO₂ - NITROGEN DIOXIDE				
Electrochemical	1 000 ppm 1 ppm	± 5 ppm abs. or 5% rel.	60 sec	EN 50379; CTM 022
SO₂ - SULPHUR DIOXIDE				
Electrochemical	2 000 ppm 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	EN 50379
Electrochemical	5 000 ppm 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	EN 50379
H₂S - HYDROGEN SULPHIDE				
Electrochemical	1 000 ppm 1 ppm	± 5 ppm abs. or 5% rel.	70 sec	
H₂ - HYDROGEN				
Electrochemical	2 000 ppm 1 ppm	± 10 ppm abs. or 5% rel.	50 sec	
Electrochemical	20 000 ppm 1 ppm	± 10 ppm abs. or 5% rel.	70 sec	
Thermal Conductivity Detector	10% 0,1%	± 0,5% abs. or 5% rel.	45 sec	
Thermal Conductivity Detector	25% 0,1%	± 0,5% abs. or 5% rel.	45 sec	
Thermal Conductivity Detector	50% 0,1%	± 0,5% abs. or 5% rel.	45 sec	
Thermal Conductivity Detector	100% 0,1%	± 0,5% abs. or 5% rel.	45 sec	
Cl₂ - CHLORINE				
Electrochemical	250 ppm 1 ppm	± 5 ppm abs. or 5% rel.	60 sec	
HCL - HYDROGEN CHLORIDE				
Electrochemical	100 ppm 1 ppm	± 5 ppm abs. or 5% rel.	70 sec	
N₂O - NITROUS OXIDE				
NDIR	2000 ppm 1 ppm	± 10 ppm abs. or 5% rel.	45 sec	ISO 21258
VOC - VOLATILE ORGANIC COMPOUNDS				
PID - Photoionization Detector	100 ppm 1 ppm	± 5 ppm abs. or 5% rel.	120 sec	METHOD 21
PID - Photoionization Detector	1000 ppm 1 ppm	± 5 ppm abs. or 5% rel.	120 sec	METHOD 21

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STANDARD EQUIPMENT

SUPPLIED ALONG WITH THE DEVICE

- 3m mains cable (with selectable plug type)
- Single gas filter with condensate trap and filter insert (pore size 5µm)
- 2,5m RS-232C communication cable with DB9 female connector
- Software CD with program and manuals
- Quick coupling for the probe holder (1pc)
- Comparison scale with paper filters for the soot test

ADDITIONAL EQUIPMENT

NECESSARY FOR THE ANALYSER TO WORK

• Probe holder

Together with an exchangeable gas probe pipe the holder is a complete gas probe for extraction of gas samples. It has a single gas tube ended with quick coupler and electric cable ended with a 7-pin connector. Gas probe pipe is mounted with a M30x1 fastening.

In the electric connector there is a PT500 sensor for measurement of ambient temperature.

Probe holder can be equipped with an in-line filter with a condensation trap (pore size of the filter inlet is 20µm). Probe holder is available in two versions:

- heated (with a slit for a filter for soot measurement test),
- unheated (without a possibility to perform soot test).

• Gas probe pipe

Gas probe is immersed in the gas duct and is supposed to extract the gas sample and to measure its temperature.

Exchangeable probes are easily connected to probe holders (with M30x1 fastening). They have thermocouple type K (in some configurations type S) for measurement of gas temperature and a threaded fixing cone. With the probe holder is a complete gas probe.

There are many probe pipes available. They differ in length and working temperature.

For work efficiency it is advised to own different probe pipes to be able to adjust to the measurement place.



OPTIONAL EQUIPMENT & SPARE PARTS

• Mini Dryer

Condensation dryer based on the Peltier element with a built-in peristaltic pump for condensation removal.

It is powered via the analyser, and installed inside the analyser's casing.

It has electric cable with a 7-pin connector and a 25cm gas tube ended with quick couplers - to connect it to the analyser.

It is not essential to work with the analyser, but is strongly recommended as it improves the measurements quality and extends the analyser's life-time.



ordering code:
M21-MDRY1

MINIDRYER'S PARAMETERS

OPTIONAL

Dimensions (W * H * D)	24 mm * 120 mm * 124 mm
Weight	800 g
Operating conditions	T: 10°C ÷ 50°C RH: 5% ÷ 90% (non-condensing)
Storing temperature	-20°C ÷ +55°C
Power supply	15 V DC (from analyser's Probe socket)
Maximal power consumption	10 W
Drying method	Water condensation by rapid cooling down
Cooler type	Based on Peltier element
Cooling temperature	Down to +4°C electronically stabilized Dew point of outlet gas at least 8°C below the ambient air temp.
Maximum gas flow for efficient drying	90 l/h
Condensate pump	Peristaltic, 38 ml/min

- Boiler's inlet air temperature sensor

Ambient air temperature (or rather boiler's intake air temperature) is a parameter used for calculation of many combustion parameters. This PT500 temperature sensor on a 3m cable is used for measurement of the aforesaid temperature. It is optional equipment. The sensor has to be connected to the Temp. Amb. socket. If this sensor is not connected analyser assumes the boiler's inlet air temperature to be equal to the temperature measured with the NTC2k7 sensor installed in the connector of the gas probe holder.

ordering code:
Z40P-SENS-TEMP



- Pitot tube

Pitot tube is an accessory that allows to perform measurement of the flow velocity of the gas stream. The measurement is performed indirectly – Pitot tube is connected to analyser's differential pressure sensor. Analyser recalculates the differential pressure on the Pitot tube's outlets to velocity.

A few lengths of tubes are available. Pitot tube has 2m gas tubings to connect it with the analyser.

ordering codes:
pitot tube 800mm - Z00-PITOT-8002
pitot tube 500mm - Z00-PITOT-5002



- RS232C to USB converter

2.5m cable that allows to connect the analyser (its RS232C port) with USB port in PC computer (especially valuable when PC is not equipped with COM port).

ordering code:
Z40P-USB-ADAP



- Bluetooth communication module

Module connected to the analyser's RS232C port, allows to communicate with PC computer over Bluetooth protocol.

ordering code:
Z40P-BLUE-TOOTH



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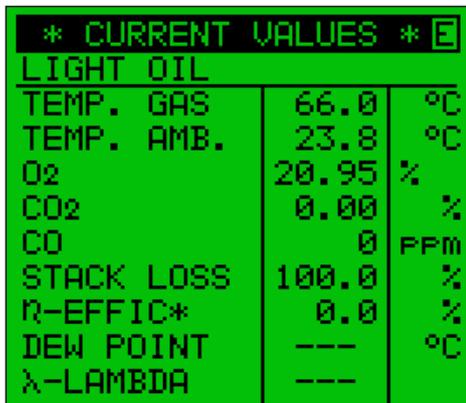
CHARACTERISTIC FEATURES TECHNICAL DATA SENSORS EQUIPMENT APPEARANCE

FRONT PANEL

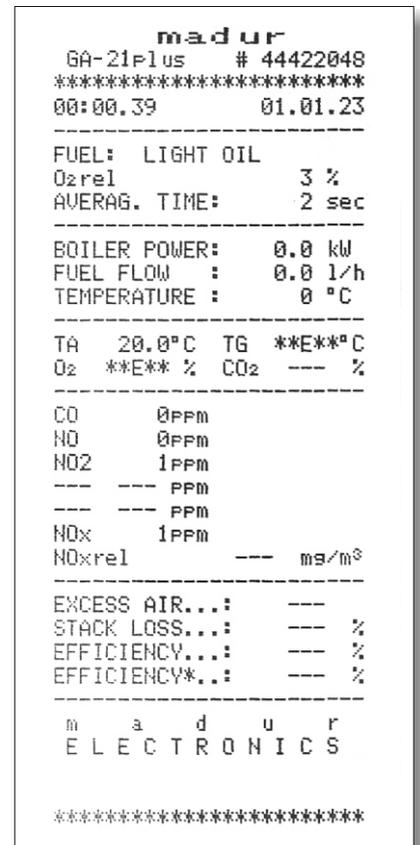
WITH LCD AND SOCKETBOARD



EXAMPLE PRINTSCREEN CURRENT RESULTS



EXAMPLE PRINTOUT CURRENT RESULTS



EXAMPLE SCREENSHOT FROM THE PC PROGRAM