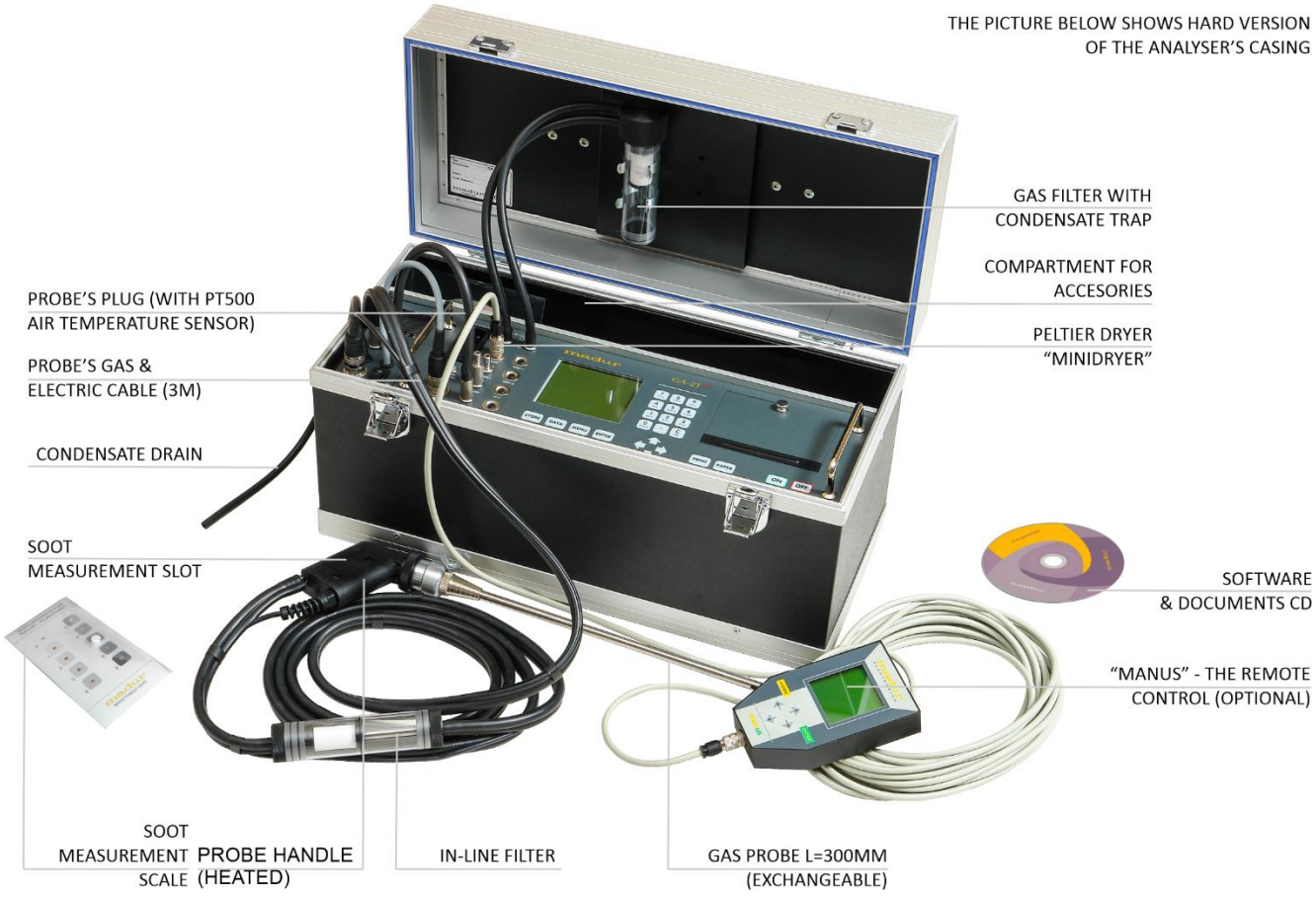
GA-21*plus*

madur portable gas analyser

CHARACTERISTICS | FEATURES | TECHNICAL DATA | SENSORS | EQUIPMENT | APPEARANCE

GA-21*plus* is a portable analyser using advanced technologies. However, it remains madur's flagship due to its affordable price. It can be equipped with up to 9x electrochemical, 3x NDIR sensors, TCD and VOC sensors.
The analyser has a built-in pressure sensor, large internal memory for results and built-in ribbon printer for standard (non-thermal) paper.
An optional condensation "miniDryer" completes the offering for our best-selling portable instrument.
As a measuring instrument, the GA-21*plus* meets the requirements of EN 50379 and EN 50270.

- Available in two kinds of casing: soft and hard
- Can be fitted with up to 7 electrochemical cells
- Can be fitted with up to 3 NDIR sensors
- Can be equipped with one thermal conductivity detector (TCD) to measure H_2 or He
- Can be equipped with one photo-ionic detector (PID) to measure VOC (volatile organic compounds)
- Built-in 58mm ribbon graphic printer
- Built-in Li-ion battery – the standard 4 cells (6400mAh)
    - optional battery – 6 cells (9600mAh)
- 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 program
- Gas and ambient temperature measurements
- 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
    - Optional SD datalogger – results stored to csv file on microSD >4GB card
- Calculations of many additional parameters



GA-21plus GAS ANALYSER	VERSION A – SOFT CASING	VERSION B – HARD CASING
Dimensions (W * H * D)	460mm x 260mm x 240mm	455mm x 270mm x 220mm
Weight (without accessories)	5,0 kg ÷ 6,2 kg	7,0 kg ÷ 8,2 kg
Casing material	textile (polyester)	wood & aluminium
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	
Standard battery: type | work time | charging time	4-cells Li-Ion 7,2V / 6,4 Ah | 4,5h / 11 h (without the dryer) | 6 h	
Optional battery: type | work time | charging time	6-cells Li-Ion 7,2V / 9,6 Ah | 6,0h / 18 h (without the dryer) | 9 h	
Internal memory: size | number of results	32 kB | 30 reports + 10 banks (1024 sets of data)	
Datalogger (optional)	≥4GB micro-SD card, records stored to CSV with 2 sec. interval	
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	Diaphragm, max 2 l/min (with automatic flow control)	
gas flow	90l/h (1,5l/min)	
Purging pump for CO sensor (optional)	Diaphragm, max 1,5 l/min	
Wired communication interface	USB with PC Windows	
Wireless communication (optional)	Bluetooth: with Windows PC and Android (app included)	
Coarse gas filter grade | inside diameter | length	Inline filter installed on a probe holder with condensate trap 20µm | 12mm | 32mm	
Fine gas filter grade | inside diameter | length	Installed on the analyser's lid / attached to a bag with a condensate trap 5µm | 15mm | 32mm	

MEASUREMENTS: ENVIRONMENT SENSORS AND CALCULATIONS

Variable	Method	Range | Resolution		Accuracy	T_{90} time
T_{gas} – gas temperature	K-type thermocouple	-10°C ÷ 1150°C	0,1°C	±2°C	10 sec
T_{amb} – boiler intake air temperature	PT500 resistive sensor	-10°C ÷ 100°C	0,1°C	±2°C	10 sec
Differential pressure (draft)	Silicon piezoresistive pressure sensor	-25 hPa ÷ +25 hPa	10 Pa	±2Pa abs. or 5% rel.	10 sec
Gas flow velocity	Indirect: with L-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 ÷ 100%	0,1%	± 5% rel.	10 sec
$U_1 \div U_2$ - external analogue input (voltage)	Delta - sigma ADC	-20V ÷ +20V	0,01V	± 2% rel.	10 sec
$I_1 \div I_2$ - external analogue input (current)	Delta - sigma ADC	-20mA ÷ +20mA	0,01mA	± 2% rel.	10 sec

METHOD	RANGE	RESOLUTION	ACCURACY	T_{90} TIME	CONFORMITY
O_2 - 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	ISO 12039; CTM-030
Paramagnetic	100%	0,1%	± 0,2% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
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 with H_2 compensation	10 000 ppm	1 ppm	± 0,005% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
NDIR	20 000 ppm	10 ppm	± 50 ppm abs. or 5% rel.	45 sec	ISO 12039; CTM-030
NDIR	10%	0,01%	± 0,05% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
NDIR	100%	0,1%	± 0,5% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
CO_2 – 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
C_XH_Y – HYDROCARBONS (CALIBRATED WITH METHANE)					
NDIR	25%	0,01%	± 0,05% abs. or 5% rel.	45 sec	
NDIR	50%	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
NO_2 – NITROGEN DIOXIDE					
Electrochemical	1 000 ppm	1 ppm	± 5 ppm abs. or 5% rel.	60 sec	EN 50379; CTM-022
Electrochemical	5 000 ppm	5 ppm	± 25 ppm abs. or 5% rel.	60 sec	EN 50379; CTM-022
SO_2 – 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
NDIR	20 000 ppm	10 ppm	± 50 ppm abs. or 5% rel.	45 sec	EN 50379;Method 6C
H_2S – HYDROGEN SULPHIDE					
Electrochemical	1 000 ppm	1 ppm	± 5 ppm abs. or 5% rel.	70 sec	
Electrochemical	5 000 ppm	1 ppm	± 5 ppm abs. or 5% rel.	70 sec	
H_2 – HYDROGEN					
Electrochemical	1 000 ppm	1 ppm	± 5 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	

METHOD	RANGE | RESOLUTION		ACCURACY	T_{90} TIME	CONFORMITY
N_2O – NITROUS OXIDE					
NDIR	2 000 ppm	1 ppm	± 10 ppm abs. or 5% rel.	45 sec	ISO 21258
NH_3 – ANHYDROUS AMMONIA (MEASUREMENT OF DRY OR NON-CONDENSING GAS ONLY)					
Electrochemical	100 ppm	1 ppm	± 5 ppm abs. or 5% rel.	45 sec	
Electrochemical	1 000 ppm	1 ppm	± 5 ppm abs. or 5% rel.	45 sec	
VOC – VOLATILE ORGANIC COMPOUNDS					
PID - Photoionization Detector	100 ppm	1 ppm	± 5 ppm abs. or 5% rel.	120 sec	METHOD 21
PID - Photoionization Detector	1 000 ppm	1 ppm	± 5 ppm abs. or 5% rel.	120 sec	METHOD 21

STANDARD EQUIPMENT

SUPPLIED WITH THE DEVICE

- 3m mains cable with selected plug type (EU, US, UK, AU, BR)
- Single condensate trap with fine filter (5µm mean pore size)
- 3m USB A-B cable
- Quick coupler for the probe holder

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 is 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:
  - unheated (standard probe holder without a possibility to perform soot test),
  - heated (with a slit for a filter for soot measurement 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.

MINI-DRYER

OPTIONAL, YET VERY RECOMMENDED EQUIPMENT

Condensation dryer based on the Peltier element with a built-in peristaltic pump for condensation removal. It is powered by the analyser and installed inside the analyser's casing. It has electrical cable with a 7-pin plug and a 25cm gas tube ended with quick coupling connection to the analyser.
It is not essential for use with the analyser but is strongly recommended as it improves the quality of measurements and extends the life of the analyser.
The selection of the minidryer requires a change from the analyser's standard battery size (4 cells) to the larger one (6 cells).

Parameters

Dimensions (W x H x D)	24mm x 120mm x 124mm
Weight	800g
Operating conditions	T: 10°C ÷ 50°C RH: 5% ÷ 90% (non-condensing)
Storing temperature	-20° ÷ +55°C
Power supply	15 VDC (from analyser's probe socket)
Maximal power consumptions	10W
Drying method	Condensation by rapid cooling down
Cooler type	Peltier element
Cooling temperature	Down to +4°C electronically stabilized Dew point of outlet the gas at least 8°C below the ambient air temperature
Maximum gas flow for efficient drying	90 l/h
Condensate pump	12VDC peristaltic, 38ml/min

OTHER OPTIONAL EQUIPMENT

- **Boiler's inlet air temperature sensor**
  The ambient air temperature (or rather the temperature of the air entering the boiler) is a parameter used to calculate many combustion parameters.
  This PT500 temperature sensor on a 3m cable is used to measure this temperature and must be connected to the Temp. Amb. socket.
  If the sensor is not connected, the analyser will assume that the boiler air inlet temperature is equal to the temperature measured by the NTC2k7 sensor (installed in the connector of the gas probe holder).

- **Pitot tube**
  A pitot tube is an accessory used to measure the flow velocity of a gas stream. The measurement is indirect – the pitot tube is connected to the analyser's differential pressure sensor. The analyser then recalculates the differential pressure at the pitot tube's outlets to determine the velocity of the gas stream.
  A variety of lengths of tubes are available for purchase. The pitot tube is supplied with 2m of gas tubing to connect to the analyser.

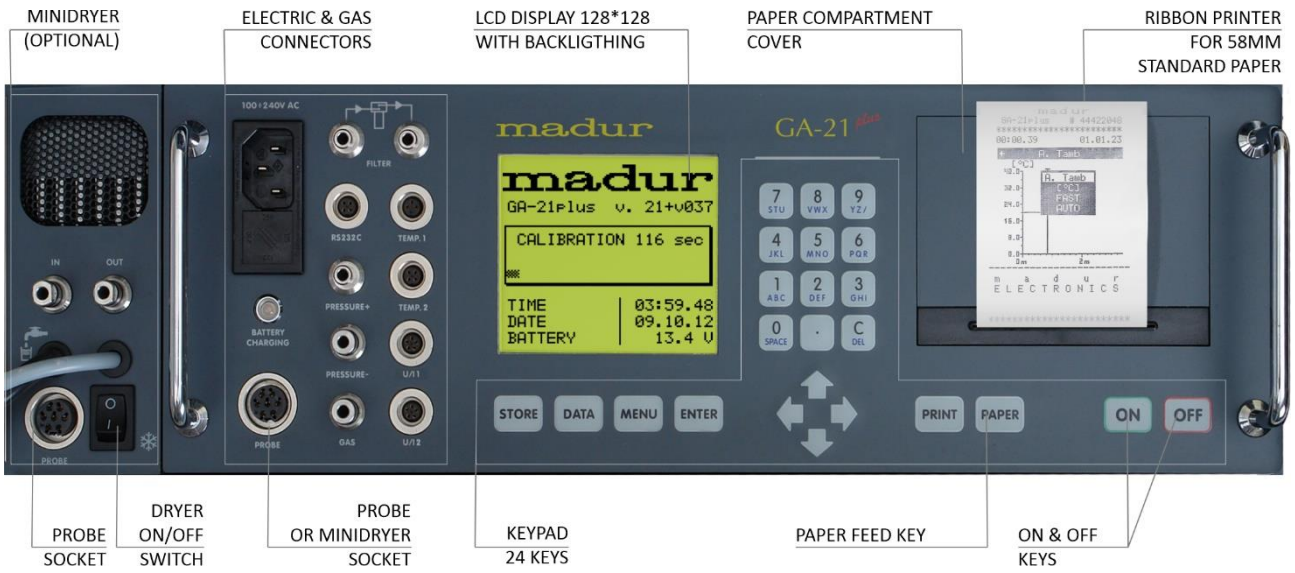
- **Data-logger**
  In addition to the analyser's standard built-in memory for storing results, it is possible to order a data logger module. This is a card reader with ≥ 4GB micro SD card. Results are saved directly to a CSV file at 2 second intervals.

- **Bluetooth**
  Wireless communication protocol with:
  - Windows PC via madur's madcom software
  - Android device via madur's TabCom app

Bluetooth

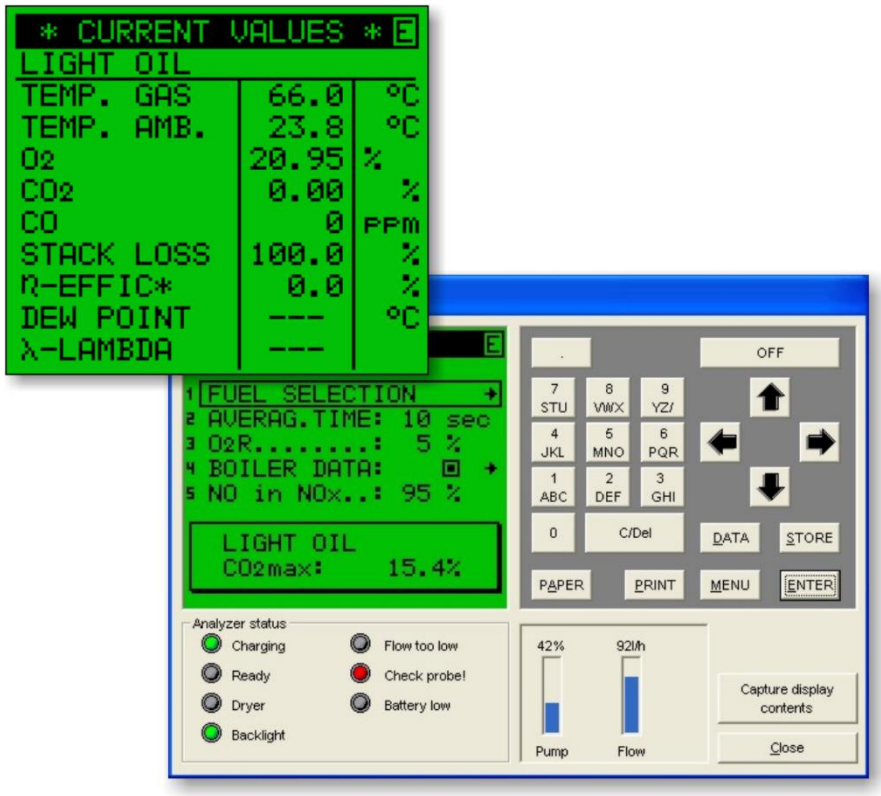
FRONT PANEL

WITH LCD AND SOCKET BOARD



EXAMPLE PRINTSCREENS

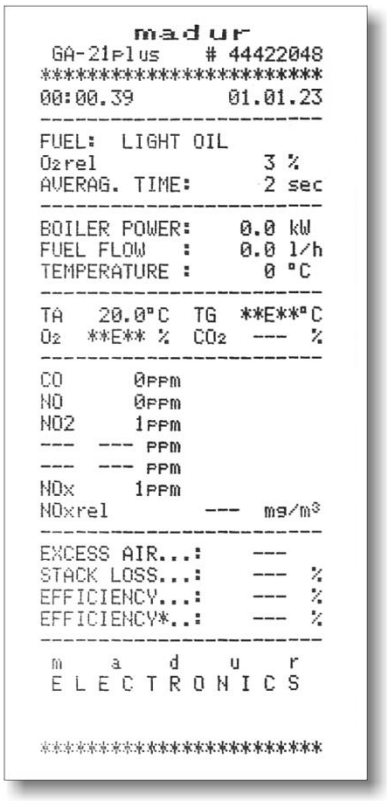
CURRENT RESULTS



EXAMPLE SCREENSHOT FROM THE PC PROGRAM

EXAMPLE PRINTOUTS

CURRENT RESULTS



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