GA-21 plus

madur portable gas analyser

www.madur.com

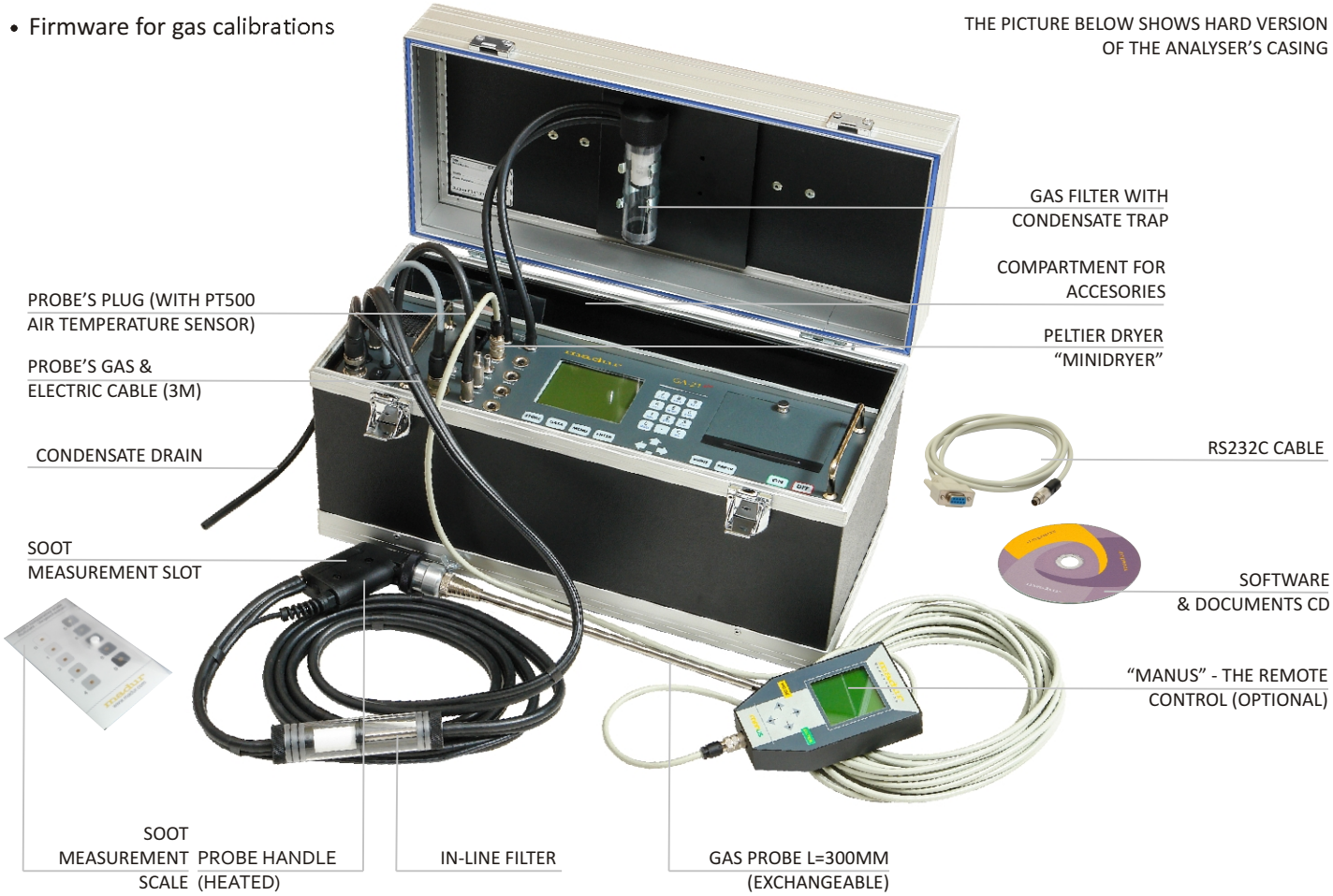
CHARACTERISTIC | FEATURES | TECHNICAL DATA | SENSORS | EQUIPMENT | APPEARANCE

GA21^{plus} is a portable analyser using advanced technologies. However, it remains madur's flagship due to its favourabe 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.

GA-21 *plus*

- 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 H_2**
  NEW Photoionization Detector (PID) for VOC (Volatile Organic Compound)
- Built-in 58mm ribbon graphic printer
- Built-in rechargeable battery for up to 8 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) - 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



GA-21 plus

GA-21plus 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 & 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	
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 57 mm normal paper	
Analogue outputs	Optional Two current (0/4 mA | 20 mA)	
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 ÷ 70 °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

GA-21 plus

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 ÷ 70°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

SENSORS

Method	Range | Resolution	Accuracy	Time (T_{90})	Conformity
O_2 - OXYGEN				
Electrochemical sensor	20,95% | 0,01%	± 0,1% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochemical, partial pressure	20,95% | 0,01%	± 0,1% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochemical, partial pressure	25% | 0,01%	± 0,1% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochemical, partial pressure	100% | 0,1%	± 0,1% abs. or 5% rel.	45 sec	ISO 12039; CTM-030
CO - CARBON MONOXIDE				
Electrochemical sensor	20 000 ppm | 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochemical with H2 comp.	2 000 ppm | 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	ISO 12039; CTM-030
Electrochemical sensor	10% | 10 ppm	± 50 ppm abs. or 5% rel.	45 sec	ISO 12039; CTM-030
NDIR as a second sensor only	10% | 0,01%	± 0,05% abs. or 5% rel.	45 sec	ISO 12039; METHOD 10
NDIR as a second sensor only	100% | 0,1%	± 0,5% abs.or 5% rel.	45 sec	ISO 12039; METHOD 10

GA-21 plus

Method	Range | Resolution	Accuracy	Time (T_{90})	Conformity
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 - TOTAL HYDROCARBONS				
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 sensor	5 000 ppm | 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	EN 50379; CTM 022
NO_2 - NITROGEN DIOXIDE				
Electrochemical sensor	1 000 ppm | 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	EN 50379; CTM 022
SO_2 - SULPHUR DIOXIDE				
Electrochemical sensor	5 000 ppm | 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	EN 50379; CTM 022
H_2S- HYDROGEN SULPHIDE				
Electrochemical sensor	1 000 ppm | 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	
H_2- HYDROGEN				
Electrochemical sensor	2 000 ppm | 1 ppm	± 10 ppm abs. or 5% rel.	45 sec	
Electrochemical sensor	20 000 ppm | 1 ppm	± 10 ppm abs. or 5% rel.	45 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	
N_2O - NITRUS OXIDE				
NDIR	2 000 ppm | 1 ppm	± 3 ppm abs. or 3% rel.	45 sec	ISO 21258
Cl_2- CHLORINE				
Electrochemical sensor	250 ppm | 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	
VOC - VOLATILE ORGANIC COMPOUNDS				
PID- Photo Ionization Detector	1 000 ppm | 1 ppm	± 5 ppm abs. or 5% rel.	45 sec	METHOD 21
CHF_3 - FLUOROFORM (REFRIGERANT R23)				
NDIR	2,5% | 0,01%	± 0,5% abs. or 5% rel.	45 sec	

GA-21 *plus*

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 programmes and manuals
- Quick coupling for the probe holder (1pc)
- Comparison scale with paper filters for the soot test
- A casing of the user's choice (hard or soft one - see pictures above)

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 DATA

MINIDRYER'S PARAMETERS

OPTIONAL

Dimensions (W * H * D)	24 mm * 120 mm *1 24 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 stabilised | 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

- Manus - the remote control

  Extra display with simplified keyboard, allows to observe the results and to control the analyser from distance. It is equipped with a 10m cable, connected to the analyser's RS232C connector. Manus is powered from the analyser.

  ordering code:
  Z40P-MANUS

- 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

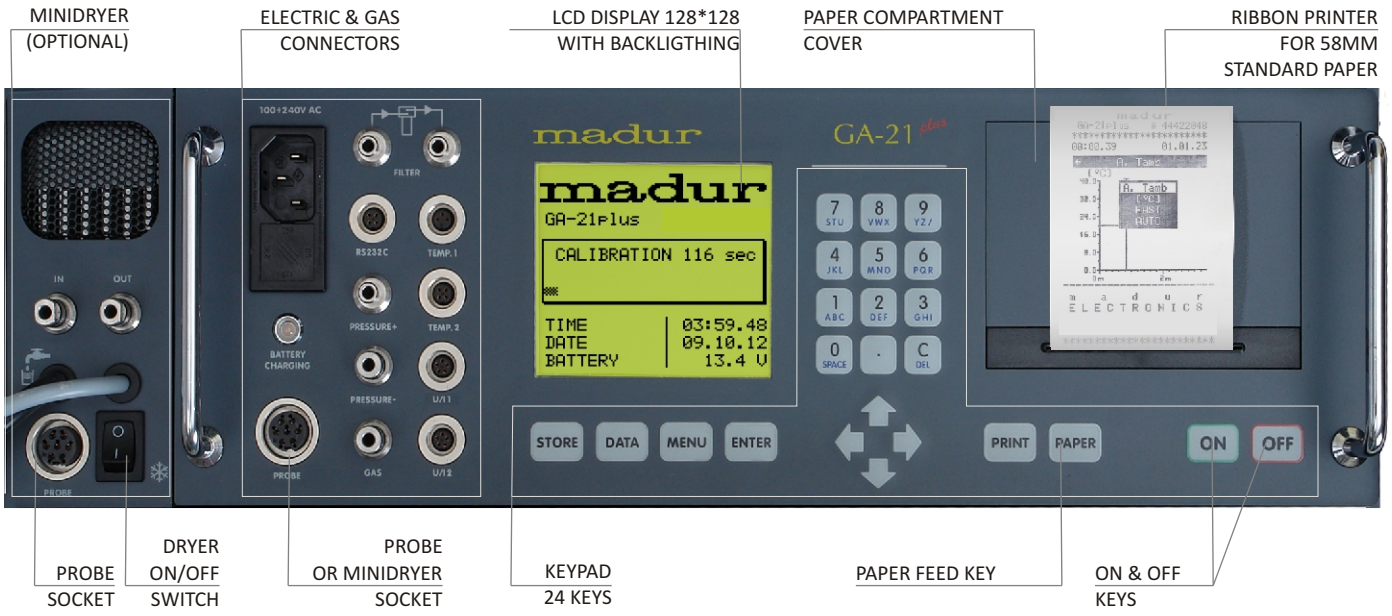
- Bluetooth communication module

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

  ordering code:
  Z40P-BLUE-TOOTH

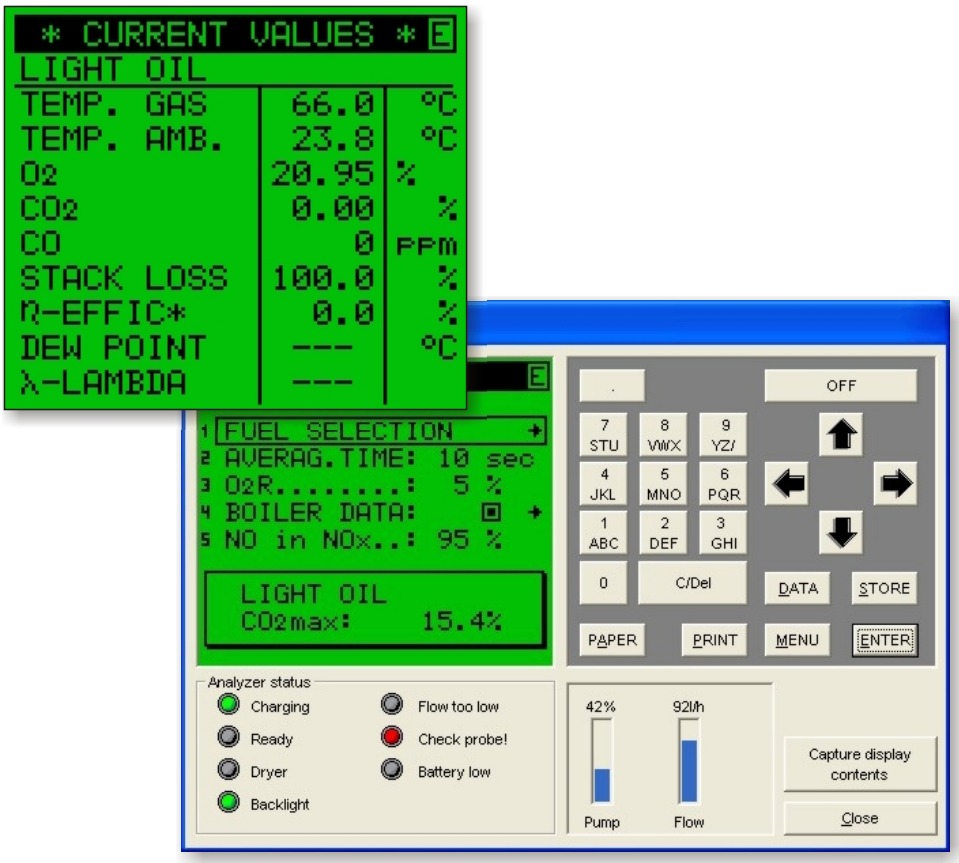
FRONT PANEL

WITH LCD AND SOCKETBOARD



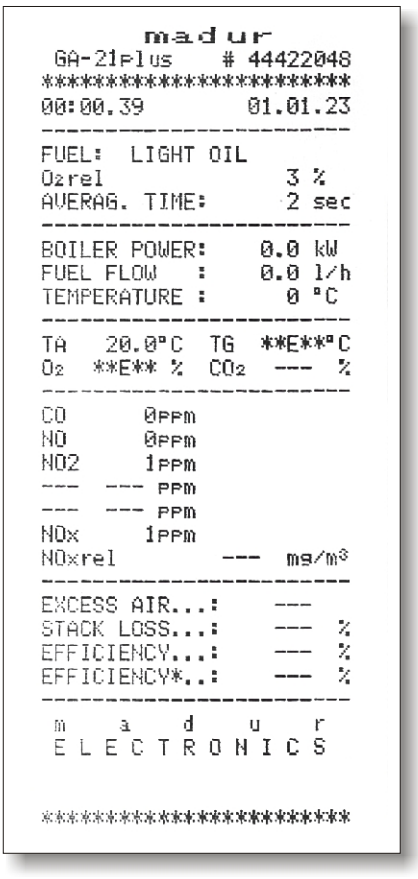
EXAMPLE PRINTSCREEN

CURRENT RESULTS



EXAMPLE PRINTOUT

CURRENT RESULTS



EXAMPLE SCREENSHOT FROM THE PC PROGRAMME