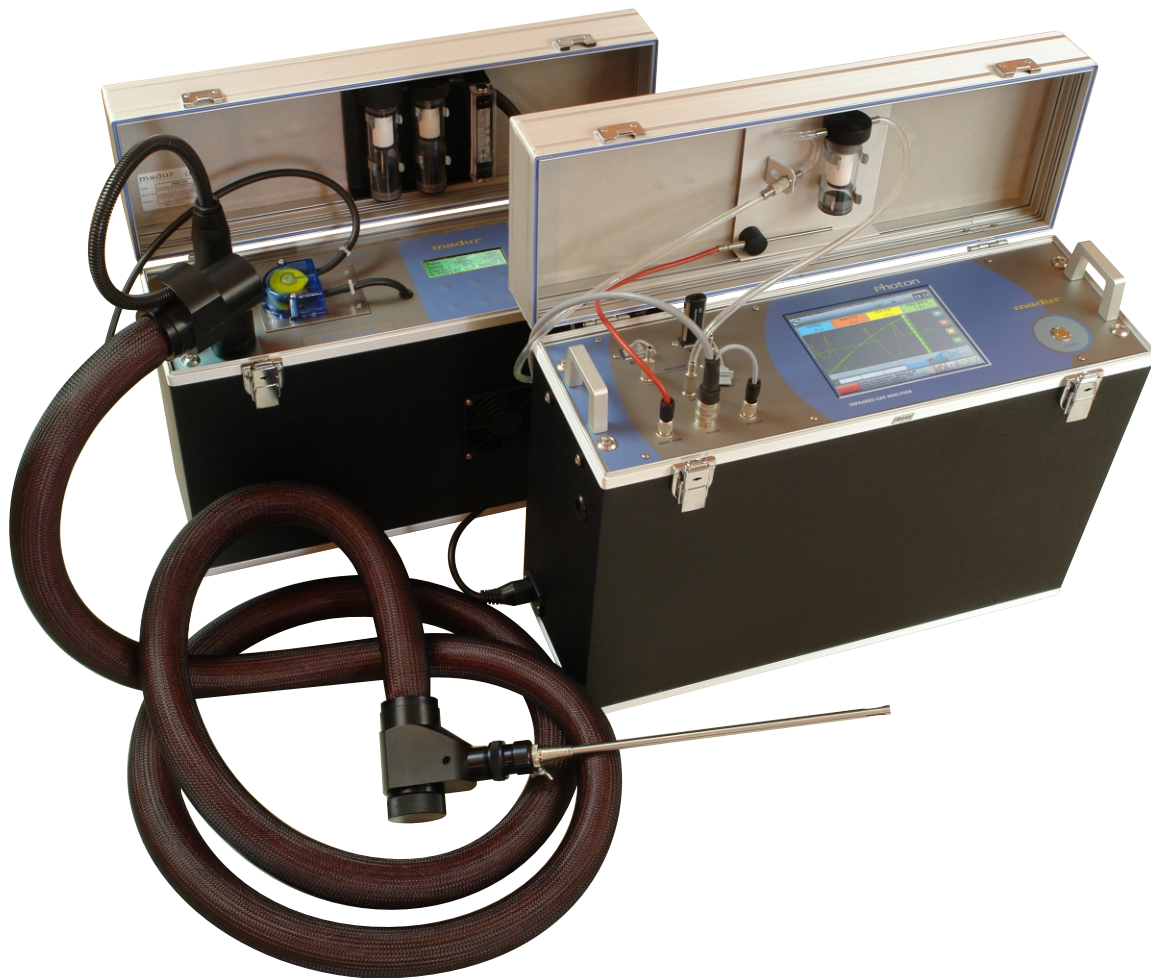


Photon

madur portable gas analyser

www.madur.com



CHARACTERISTIC

FEATURES

TECHNICAL DATA

SENSORS

EQUIPMENT

APPEARANCE

Photon is a portable analyser using the most current technological developments. It is designed to use mostly infrared sensors, but can also be fitted with further electrochemical sensors.

The modular construction allows the instrument to be configured to suit practically any user needs.

In addition to this, it is possible to set the range of each sensor as required for the measuring system.

The analyser also has a plenty of analogue inputs and outputs to ensure ease of data transfer in both directions and documentation of all results.

The analyser can thus also be used for various control operations.

- Double thermal stabilization (of entire casing and of each NDIR sensor separately)
 - Thermal stabilization the accuracy of up to 0.01°C
 - Reduced short warm-up time (30 min ÷ 60 min)
 - Improved accuracy of the NDIR sensors
- Up to 6 NDIR sensors, up to 3 electrochemical cells
- **NEW Thermal Conductivity Detector (TCD) for H₂**
NEW Photoionization Detector (PID) for VOC (Volatile Organic Compound)
- Work with PGD-100 gas conditioner
- 6,4", high-resolution - VGA (640 * 480) colorful touch screen
- PC-104 industrial class computer with Windows CE
- Algorithms controlling analyser's work (warming up, compensation of cross-sensitivity values, response time)
- Measurement of temperatures (ambient, gas), pressures (atmospheric, differential), flow velocity (with help of Pitot tube), through-device flow control
- Calculating combustion parameters, like: stack loss, combustion efficiency, excess air coefficient, dew point temperature
- Communication with PC computer via RS232C and Ethernet interface
- 2x USB port for connecting peripherals (mice, keyboards) and Photon add-ons (analogue outputs / inputs)
- Optional portable printer
- Optional analogue output (8 channels) and analogue input (8 channels) modules
- Results stored in database, presenting entire measurement session in graphical form
- Creating measurement reports, exporting data to csv files
- Database for customers and object information

RS232C CABLE



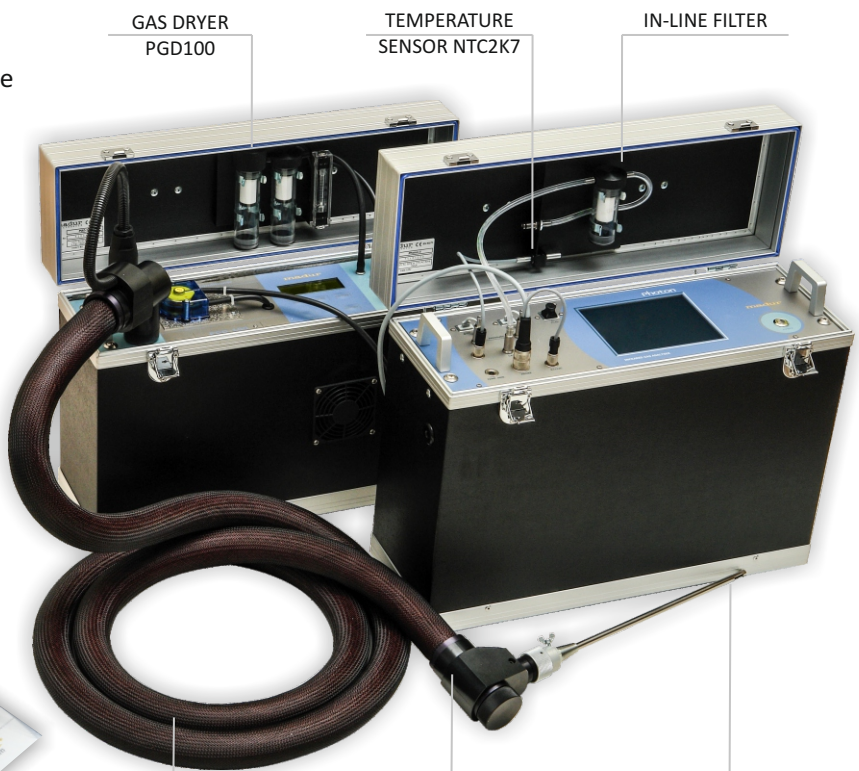
SOFTWARE
& DOCUMENTS CD



SOOT
MEASUREMENT
SCALE



HEATED HOSE
WITH MAGNETIC
FITTING



GAS DRYER
PGD100

TEMPERATURE
SENSOR NTC2K7

IN-LINE FILTER

HEATED FILTER

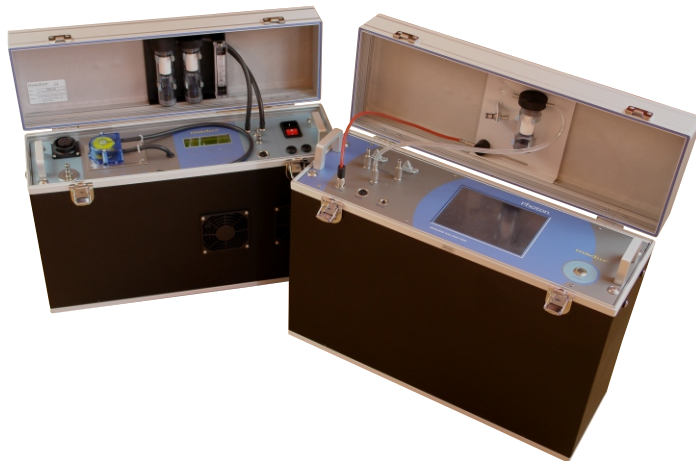
GAS PROBE
L=300MM
(EXCHANGEABLE)

| | |
|--|--|
| Dimensions (W * H * D) | 500 mm * 395 mm * 173 mm |
| Weight | 14 kg ÷ 18 kg |
| Casing material | Plywood covered with aluminium |
| Operating conditions | T: 10°C÷50°C RH: 5%÷90% (non-condensing) |
| Storing temperature | -20°C ÷ +55°C |
| Power supply input | 115 or 230 VAC |
| Maximal power consumption | 150 W |
| Operating system | Windows CE 5.0 |
| Display | 6,4" VGA (640 * 480) |
| Data storage: type capacity | Compact Flash card max. 4 GB |
| Interface for external devices (USB disk, mouse, keyboard) | 2 x USB |
| Communication interface with PC | RS-232C, RJ45 (Ethernet) |
| Warming-up time | 90 min maximum |
| Warming-up temperature | About 18°C above ambient temperature |
| Maximum outside temperature drift (not affecting warm-up temperature) | ±5°C |

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 |
| Differential pressure | Silicon piezoresistive pressure sensor | -25 hPa ÷ +25 hPa 1 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°C | 10 sec |
| qA - stack loss | Calculated | 0 ÷ 100% 0,1% | ± 5°C | 10 sec |
| Eta η - combustion efficiency | Calculated | 0 ÷ 120% 0,1% | ± 5°C | 10 sec |
| IL - incomplete combustion | Calculated | 0 ÷ 100% 0,1% | ± 5°C | 10 sec |

| Method | Range Resolution | Accuracy | Time (T ₉₀) | Conformity |
|--|--------------------|-------------------------|-------------------------|----------------------|
| O₂ - OXYGEN | | | | |
| Electrochemical | 20,95% 0,01% | ± 0,01% abs. or 5% rel. | 45 sec | ISO 12039; CTM-030 |
| Electrochemical, partial pressure | 20,95% 0,01% | ± 0,01% abs. or 5% rel. | 45 sec | ISO 12039; CTM-030 |
| Electrochemical, partial pressure | 25,00% 0,01% | ± 0,01% abs. or 5% rel. | 45 sec | ISO 12039; CTM-030 |
| Electrochemical, partial pressure | 100,00% 0,1% | ± 0,1% abs. or 5% rel. | 45 sec | ISO 12039; CTM-030 |
| Paramagnetic | 25,00% 0,01% | ± 0,01% abs. or 5% rel. | 45 sec | EN 14789; OTM-13 |
| Paramagnetic | 100,00% 0,1% | ± 0,1% abs. or 5% rel. | 45 sec | EN 14789; OTM-13 |
| CO - CARBON MONOXIDE | | | | |
| NDIR | 20 000 ppm 1 ppm | ± 3 ppm abs. or 3% rel. | 45 sec | EN 15058; METHOD 10 |
| NDIR | 10% 0,01% | ± 0,03% abs. or 3% rel. | 45 sec | EN 15058; METHOD 10 |
| NDIR | 100% 0,1% | ± 0,3% abs. or 3% rel. | 45 sec | EN 15058; METHOD 10 |
| CO₂ - CARBON DIOXIDE | | | | |
| NDIR | 5% 0,01% | ± 0,03% abs. or 3% rel. | 45 sec | ISO 12039; OTM-13 |
| NDIR | 25% 0,01% | ± 0,03% abs. or 3% rel. | 45 sec | ISO 12039; OTM-13 |
| NDIR | 100% 0,1% | ± 0,3% abs. or 3% rel. | 45 sec | ISO 12039; OTM-13 |
| CH₄ – METHANE | | | | |
| NDIR | 5% 0,01% | ± 0,03% abs. or 3% rel. | 45 sec | |
| NDIR | 25% 0,01% | ± 0,03% abs. or 3% rel. | 45 sec | |
| NDIR | 100% 0,1% | ± 0,3% abs. or 3% rel. | 45 sec | |
| NO - NITRIC OXIDE | | | | |
| NDIR | 1 000 ppm 1 ppm | ± 3 ppm abs. or 3% rel. | 45 sec | ISO 10849; METHOD 7E |
| NDIR | 5 000 ppm 1 ppm | ± 3 ppm abs. or 3% rel. | 45 sec | ISO 10849; METHOD 7E |
| NO₂ - NITROGEN DIOXIDE | | | | |
| NDIR | 1 000 ppm 1 ppm | ± 3 ppm abs. or 3% rel. | 45 sec | ISO 10849; METHOD 7E |
| Electrochemical | 1 000 ppm 1 ppm | ± 5ppm abs. or 5% rel. | 60 sec | CTM-022 |



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

| Method | Range Resolution | Accuracy | Time (T ₉₀) | Conformity |
|---|--------------------|--------------------------|-------------------------|---------------------|
| SO₂ - SULPHUR DIOXIDE | | | | |
| NDIR | 1 000 ppm 1 ppm | ± 3 ppm abs. or 3% rel. | 45 sec | ISO 7935; METHOD 6C |
| NDIR | 5 000 ppm 1 ppm | ± 3 ppm abs. or 3% rel. | 45 sec | ISO 7935; METHOD 6C |
| 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 | |
| N₂O - NITROUS OXIDE | | | | |
| NDIR | 2 000 ppm 1 ppm | ± 3 ppm abs. or 3% rel. | 45 sec | ISO 21258 |
| CHF₃ - FLUOROFORM (REFRIGERANT R23) | | | | |
| NDIR | 2,5% 0,01% | ± 0,03% abs. or 3% rel. | 45 sec | |
| VOC - VOLATILE ORGANIC COMPOUNDS | | | | |
| PIT - Photoionization Detector | 100 ppm 1 ppm | ± 5ppm abs. or 5% rel. | 120 sec | METHOD 21 |
| PIT - Photoionization Detector | 1 000 ppm 1 ppm | ± 5ppm abs. or 5% rel. | 120 sec | METHOD 21 |

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 (3pc)
- Ambient temperature sensor with 300mm cable

This NTC2k7 temperature sensor with a 300mm cable is used for measuring the ambient air temperature. It helps to set the optimal target temperature for Photons thermal stabilization. The sensor is connected to the Temp. Aux socket (in some units the socket is without label). The head of NTC2k7 sensor is installed in analyser's lid. For calculations, where ambient temperature is required, Photon uses readings from PT500 3m sensor (boiler's inlet air temperature sensor). In case of absence of this PT500 sensor, readings from NTC2k7 are being used.

ordering code:

sensor NTC2k7 with 300mm long cable (grey) - ZPH2-SENS-NTC

- Photon — PGD-100 electric communication cable

2.5m communication cable for connecting the PGD-100 gas dryer to the Photon analyser. Spare part for Photon - also available separately.

ordering code:

ZMPH-KAB-RS232

- Photon — PGD-100 gas hose connection

2.5m long gas hose for connecting the PGD-100 gas dryer to the Photon analyser. Quick couplers on both ends. Spare part for Photon - also available separately.

ordering code:

Z10-GAS-CON-02



ADDITIONAL EQUIPMENT

NECESSARY FOR THE ANALYSER TO WORK

- PGD 100 gas conditioner

PGD-100 is a powerful gas conditioner preparing gas sample for the co-operating analyser by removing dust, salts particles and condensate, so the sample is dry and clean.

Using gas conditioner is essential in case of majority measurements with gas analysers.

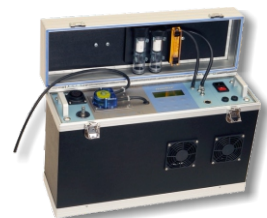
Photon communicates with, and controls PGD-100 dryer via 2.5m electric cable. Gas sample is delivered via 2.5m Tygon tube.

- Heated hose

Heated hose with heated gas filter supplies gas sample to the analyser's conditioning module. Thanks to the heaters that coil the tube and thermal insulation of the hose, the gas in its inside is protected against uncontrolled water condensation. The hose has M30x1 threaded connection to fix gas probe pipe. The other end has magnetic quick-coupler and electric connector to connect it with analyser.

Standard length of hose is 3m, it is possible to order other lengths of hoses.

Hose is provided with a carrying bag and filter inlet (glass fibre 70 µm. pores).



- 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) and to heated hoses. They have thermocouple type K (in some configurations type S) for measurement of gas temperature and a threaded fixing cone.

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

- 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 Photon assumes the boiler's inlet air temperature to be equal to the temperature measured with the NTC2k7 sensor installed in the device's lid.

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 length 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



- Analogue outputs module

Optional module with 8 current and 8 voltage galvanically separated outputs. Installed into the device's lid. Connected to the USB Photon socket.

ordering code:
ZPH2-ANA-OUT



- Analogue inputs module

Optional module with 8 current and 8 voltage galvanically separated inputs. Installed into the device's lid. Connected to the USB socket of Photon.

ordering code:
ZPH2-ANA-IN



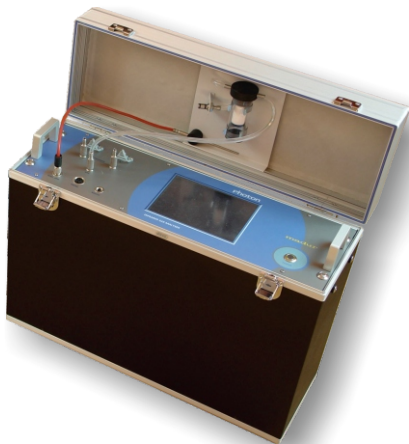
- Martel portable printer with USB cable

Photon can be equipped with portable printer - Martel MCP8810 with RS232C communication protocol (converted to USB port). Small, portable, battery operated printer. Must be connected to Photon USB socket.

ordering codes:

Martel MCP-8810, thermal printer with USB interface - MPH-PRINT1
USB cable for connecting the printer to analyser - ZPH2-PRINTER-USB-KAB





CHARACTERISTIC

FEATURES

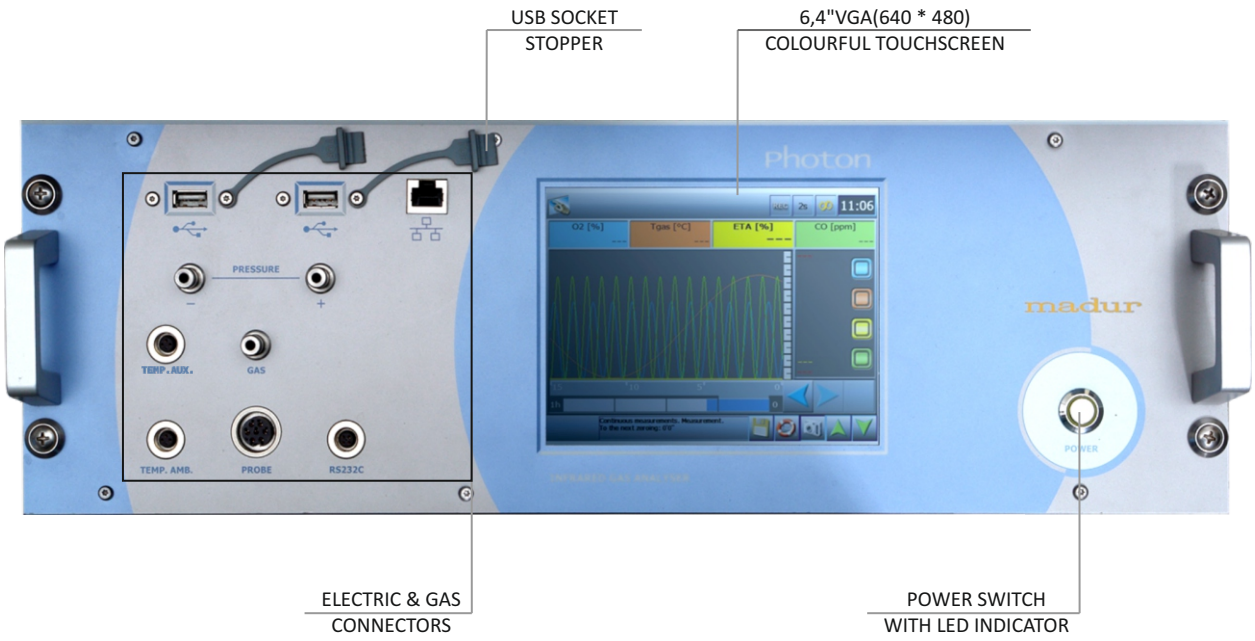
TECHNICAL DATA

SENSORS

EQUIPMENT

APPEARANCE

FRONT PANEL
WITH LCD AND SOCKETBOARD



EXAMPLE PRINTSCREENS
RESULTS GRAPH

