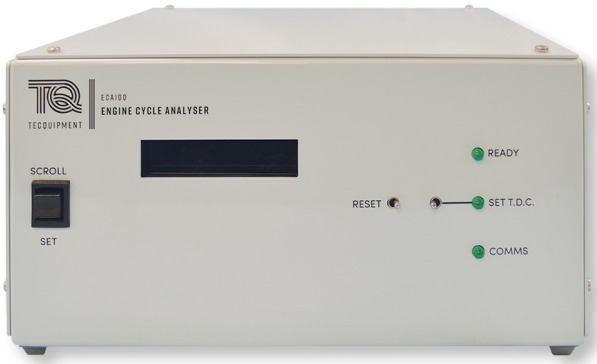
ECA100 PACKAGE

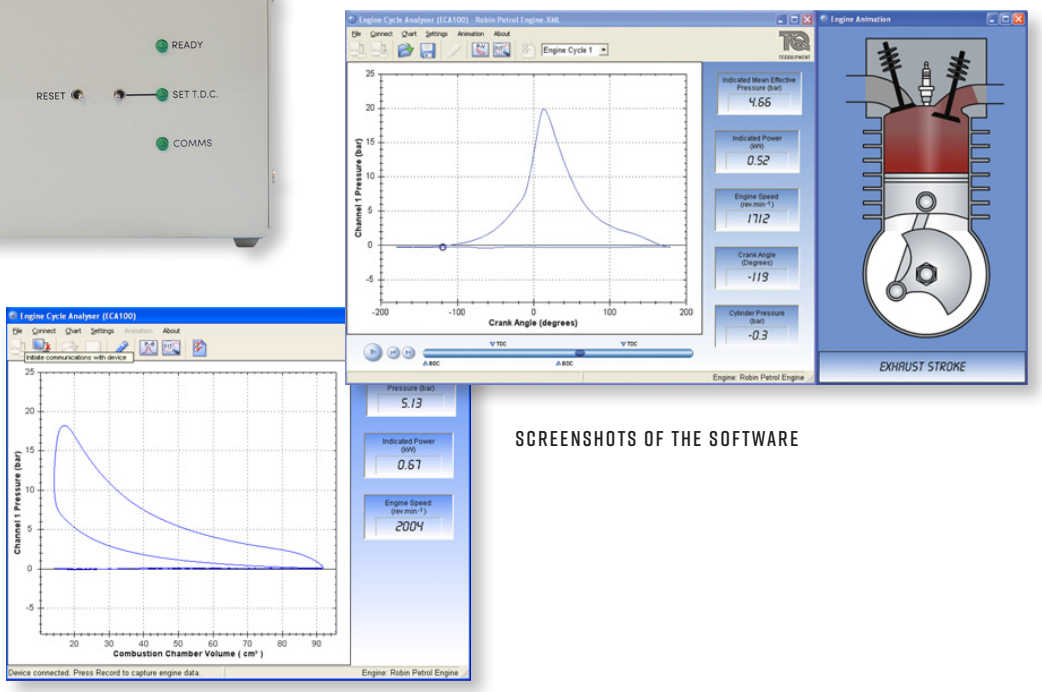
ECA100S

ENGINE CYCLE ANALYSER INFORMATION

ECA100I

Hardware and software to measure internal combustion engine cylinder pressure and crank angle.





SCREENSHOTS OF THE SOFTWARE

KEY FEATURES

- Significantly enhances practical investigations, demonstrations and studies of internal combustion engines
- For use with TecQuipment's Small Engine Test Set (TD200) and Regenerative Engine Test Set (TD300) and engines
- Can also be used with other engines fitted with suitable cylinder head transducers and crank angle encoders
- Includes powerful Windows®-based software specially designed for educational use
- Automatic calculation and real-time display of p-θ plots and p-V plots and other important parameters
- Useful snap-shot, replay and animation functions
- Accurate, clear animations of crank, piston, inlet and exhaust valve positions help students visualise the engine cycle
- Students can export data for further analysis

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DESCRIPTION

Ideal for student experiments, laboratory demonstrations or project work, TecQuipment's Engine Cycle Analyser enables students to investigate a variety of engine performance characteristics.

The versatile equipment consists of both hardware and software specially designed for educational use. It enables students to investigate the relationship between crank angle or volume and the cylinder pressure in an internal combustion engine. The equipment is primarily for use with TecQuipment engine test sets and engines (TD200 and TD300 series) but it can also be used with other engines fitted with compatible cylinder head transducers and crank angle encoders.

The equipment consists of a hardware unit with connectors and leads, plus Windows®-based data acquisition and analysis software. The hardware consists of a microprocessor-based signal conditioning unit with high-speed PC interface, housed in a rugged, protective enclosure. It accepts and conditions signals from the Cylinder Head Pressure Transducer (ECA101) and Crank Angle Encoder (ECA102), available separately. The cylinder pressure input includes a precision charge amplifier with a digital thumb-wheel for calibration. As well as crank angle position, the signal from the Crank Angle Encoder is also used to determine engine speed.

NOTE: Although interchangeable between engines, TecQuipment recommened that you buy and fit one ECA101 and one ECA102 to each of your test engines. This will reduce setting up time and any chance of damage.

The output from the hardware unit connects to a computer (computer not included) running the Engine Cycle Analyser software. The hardware unit includes LED indicators to show the processor readiness, encoder top dead-centre position and PC communication status.

The software provides real-time display of pressure versus crank angle (p-θ) and pressure versus volume (p-V) plots. It performs calculations on the data to accurately display indicated mean effective pressure (IMEP) and indicated power for comparison with brake mean effective pressure (BMEP), and brake power to determine the mechanical efficiency of the test engine.

The software has useful snap-shot, replay and animation functions to help students visualise and better understand the engine cycle. The snap-shot and replay allow students to capture several engine cycles and study them using an animation showing the relative position of the crank, piston, inlet and exhaust valves. The software also allows students to create and recall engine configuration files for convenient entry of test engine data needed for calculations such as crank radius and engine swept volume. Data can also be exported to other software for further analysis.

LEARNING OUTCOMES

When used with suitable test engines, the analyser allows investigations into a variety of internal combustion engine characteristics, including:

- The thermodynamic cycle of an internal combustion engine
- Calculation of indicated mean effective pressure and indicated power
- Comparison of indicated mean effective pressure and brake mean effective pressure
- Mechanical efficiency of the test engine
- Further work using exported data such as combustion analysis

ESSENTIAL ANCILLARIES

- Cylinder Head Pressure Transducer (ECA101)*
- Crank Angle Encoder (ECA102)*
- Suitable Computer - see specifications

* TecQuipment also offers a complete package (the ECA100s). This includes the ECA100, one ECA101 and one ECA102.

For engine test sets or engines other than TecQuipment's TD200 or TD300 series, please contact TecQuipment or your local TecQuipment Agent.

REOMMENDED ANCILLARIES

Suitable computer (not supplied)

See VDAS® datasheet for latest computer specification.

ANCILLARY FOR

- Modified Four-Stroke Petrol Engines (TD211, TD211ES)
- Modified Four-Stroke Diesel Engine (TD212, TD212ES)
- Four-Stroke Petrol Engine (TD301)
- Four-Stroke Diesel Engine (TD302)

STANDARD FEATURES

- Supplied with comprehensive user guide
- Five-year warranty
- Made in accordance with the latest European Union directives
- ISO9001 certified manufacturer

ESSENTIAL SERVICES

ELECTRICAL SUPPLY:

Single-phase a.c. 90 to 240 V, 50/60 Hz

ECAI00 PACKAGE

ECAI00S

OPERATING CONDITIONS

OPERATING ENVIRONMENT:

Well ventilated laboratory

STORAGE TEMPERATURE RANGE:

–25°C to +55°C (when packed for transport)

OPERATING TEMPERATURE RANGE:

+5°C to +40°C

OPERATING RELATIVE HUMIDITY RANGE:

80% at temperatures < 31°C decreasing linearly to 50% at 40°C

SPECIFICATIONS

TecQuipment is committed to a programme of continuous improvement; we reserve the right to alter the design and product specification without prior notice.

NETT DIMENSIONS AND WEIGHTS:

Analyser: 250 mm x 250 mm x 110 mm and 3.5 kg

Pressure Transducer: Supplied in a storage box 140 mm x 140 mm x 70 mm and 0.5 kg

Angle encoder: Supplied in a protective bag, roughly 120 mm x 120 mm x 70 mm and 0.5 kg

APPROXIMATE TOTAL PACKED DIMENSIONS AND WEIGHT:

0.04 m^3 and 6.5 kg

CRANK ANGLE INPUT:

Shaft encoder with 360 pulses per revolution

RESOLUTION:

1 degree

PRESSURE SIGNAL CONDITIONING:

Precision charge amplifier with digital thumb-wheel calibration

MAXIMUM ENGINE SPEED:

7000 $rev.min^{-1}$

PC CONNECTION:

Via USB type 1.1 or 2

AUXILIARY INPUT:

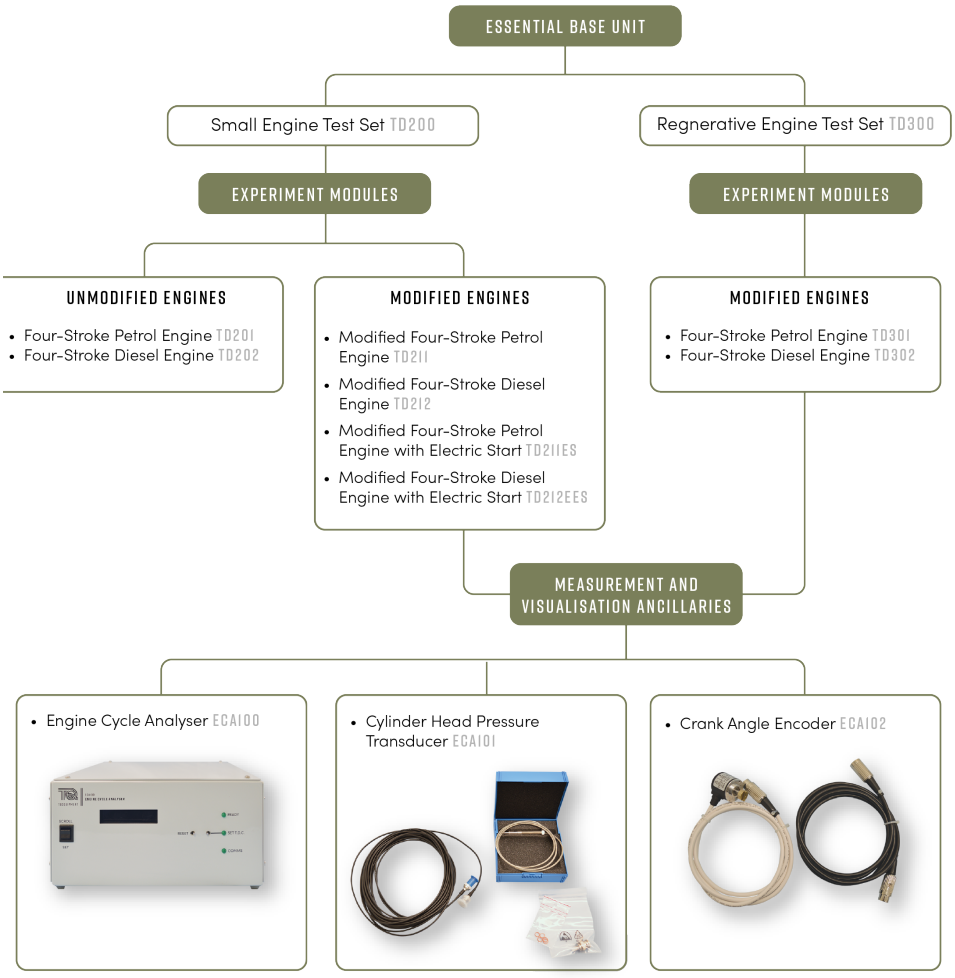
0 to 10 V via BNC connector

RECOMMENDED COMPUTER HARDWARE:

- See the VDAS® datasheet for the latest hardware specification

OPERATING SYSTEM:

- See the VDAS® datasheet for the latest OS specification



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ECA100S

CYLINDER HEAD PRESSURE TRANSDUCER INFORMATION

ECA101

A ground-insulated high-temperature pressure sensor with an integral connecting cable for measuring cylinder pressures in combustion engines.

KEY FEATURES

- Significantly enhances practical investigations, demonstrations and studies of internal combustion engines.
- For use with TecQuipment's Engine Cycle Analyser (ECA100).
- Designed to measure in-cylinder pressure during compression, combustion and expansion strokes.
- Captures rapid pressure changes during engine operation, making it suitable for combustion analysis and pressure v/s Crank-angle measurements.
- Suitable for the thermal conditions associated with engine combustion, with temperature limits specified for the sensing element, mounting interface, and electrical connector.
- Provides consistent pressure readings over repeated engine cycles, supporting the evaluation of peak cylinder pressure, compression pressure and combustion behaviour.

ECA100 PACKAGE

ECA100S

DESCRIPTION

A cylinder head pressure transducer measures the rapid, dynamic pressure changes inside an engine cylinder through an access port in the cylinder head. It converts the pressure into an electrical signal for monitoring, testing, and analysing engine performance.

The features include:

- Ground-isolated
- Additional cooling not required
- Low thermal shock error, very low load-change drift
- High sensitivity using a piezo-star crystal

The sensing element used is a Quartz crystal that generates an electrical charge proportional to changing pressure. The sensor is characterised by minimal thermal shock and outstanding linearity. They capture high-frequency pressure spikes during the engine cycle. Its ground-isolated design makes it ideal for test stands with ground loop problems. The shoulder sealing of the sensor allows it to be mounted with its front flush with the cylinder head.

The high-temperature sensor is supplied with a shielded cable to withstand peak combustion temperatures and to eliminate false pressure changes. The precision charge amplifier has a digital thumb wheel for calibration purposes.

The sensor assembly can be easily fitted to a plug, which can then be fitted onto the cylinder head.

Pressure Range: 0-300bar

Sensitivity: approximately 37 p.C/bar

LEARNING OUTCOMES

When used with Engine Cycle Analyser (ECA100) and Crank Angle Shaft Encoder (ECA102), it allows investigations into a variety of internal combustion engine characteristics, including:

- The thermodynamic cycle of an internal combustion engine
- Calculation of indicated mean effective pressure and indicated power
- Comparison of indicated mean effective pressure and brake mean effective pressure
- Mechanical efficiency of the test engine
- Further work using exported data such as combustion analysis

ESSENTIAL ANCILLARIES

- Engine Cycle Analyser (ECA100)
- Crank Angle Shaft Encoder (ECA102)
- Suitable Computer – see specifications

TecQuipment also offers a complete package (the ECA100S). This includes the ECA100, one ECA101 and one ECA102.

For engine test sets or engines other than TecQuipment's TD200 or TD300 series, please get in touch with TecQuipment or your local TecQuipment Agent.

ANCILLARY FOR

- Modified Four-Stroke Petrol Engines (TD211, TD211ES)
- Modified Four-Stroke Diesel Engine (TD212, TD212ES)
- Four-Stroke Petrol Engine (TD301)
- Four-Stroke Diesel Engine (TD302)

STANDARD FEATURES

- Five-year warranty
- Made in accordance with the latest European Union directives
- ISO9001 certified manufacturer

OPERATING CONDITIONS

OPERATING ENVIRONMENT:

Well ventilated laboratory

STORAGE TEMPERATURE RANGE:

–25°C to +55°C (when packed for transport)

OPERATING TEMPERATURE RANGE:

+5°C to +40°C

OPERATING RELATIVE HUMIDITY RANGE:

80% at temperatures < 31°C decreasing linearly to 50% at 40°C

SPECIFICATIONS

TecQuipment is committed to a programme of continuous improvement; we reserve the right to alter the design and product specification without prior notice.

NETT DIMENSIONS AND WEIGHTS:

Supplied in a storage box 140 mm x 140 mm x 70 mm and weighs 0.5 kg

ACCESSORIES (INCLUDED):

- BNC adaptor with 1 m lead
- Tapping Sealing Washer
- Extension cable, 10 m long (BNC Socket to BNC plug)

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ECA100S

CRANK ANGLE SHAFT ENCODER INFORMATION

ECA102

A precision measurement device used to measure the angular position, rotational speed and timing of an engine's crankshaft. It is commonly used in Petrol and Diesel engine testing to determine crankshaft position relative to Top Dead Centre (TDC).

KEY FEATURES

- Significantly enhances practical investigations, demonstrations and studies of internal combustion engines.
- For use with TecQuipment's Engine Cycle Analyser (ECA100).
- Designed to measure the angular position and rotational speed in engines during compression, combustion and expansion strokes.
- Captures rapid changes in rotational speed and angular position during engine operation, making it suitable for combustion analysis and Crank-angle measurements.
- Suitable for Piston Position Tracking to identify when the piston reaches Top Dead Centre (TDC).

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ECA100S

DESCRIPTION

A crank angle shaft encoder is a precision measurement device used to measure the angular position, rotational speed and timing of a rotating shaft. In engine testing, it is particularly important because it identifies the exact angular position of the crankshaft during each engine cycle, allowing pressure, combustion, injection and other measurements to be related to crank angle.

For engine-testing applications, a crank angle encoder is especially useful when measuring cylinder pressure in petrol or diesel engines, calculating indicated power, analysing combustion, and synchronising pressure transducer data with crankshaft position.

The encoder's rotating element is mechanically coupled to the crankshaft, and as the shaft rotates, a code disc, magnetic pattern, or toothed target moves past a sensor. The sensor generates electrical pulses, which are counted by the electronics to determine direction and position. An absolute position Top Dead Centre (TDC) establishes a repeatable angular origin. The data acquisition system on ECA100 and ECA101 associates each pressure sample with the corresponding crank angle.

Crank angle input: Shaft encoder with 360 pulses per revolution with 1° resolution.

LEARNING OUTCOMES

When used with Engine Cycle Analyser (ECA100) and Cylinder Head Pressure Transducer (ECA101), it allows investigations into a variety of internal combustion engine characteristics, including:

- The thermodynamic cycle of an internal combustion engine
- Calculation of indicated mean effective pressure and indicated power
- Comparison of indicated mean effective pressure and brake mean effective pressure
- Mechanical efficiency of the test engine
- Further work using exported data such as combustion analysis

ESSENTIAL ANCILLARIES

- Engine Cycle Analyser (ECA100)
- Cylinder Head Pressure Transducer (ECA101)
- Suitable Computer – see specifications

TecQuipment also offers a complete package (the ECA100S). This includes the ECA100, one ECA101 and one ECA102.

For engine test sets or engines other than TecQuipment's TD200 or TD300 series, please get in touch with TecQuipment or your local TecQuipment Agent.

ANCILLARY FOR

- Modified Four-Stroke Petrol Engines (TD211, TD211ES)
- Modified Four-Stroke Diesel Engine (TD212, TD212ES)
- Four-Stroke Petrol Engine (TD301)
- Four-Stroke Diesel Engine (TD302)

STANDARD FEATURES

- Five-year warranty
- Made in accordance with the latest European Union directives
- ISO9001 certified manufacturer

OPERATING CONDITIONS

OPERATING ENVIRONMENT:

Well ventilated laboratory

STORAGE TEMPERATURE RANGE:

–25°C to +55°C (when packed for transport)

OPERATING TEMPERATURE RANGE:

+5°C to +40°C

OPERATING RELATIVE HUMIDITY RANGE:

80% at temperatures < 31°C decreasing linearly to 50% at 40°C

SPECIFICATIONS

TecQuipment is committed to a programme of continuous improvement; we reserve the right to alter the design and product specification without prior notice.

PACKED DIMENSIONS AND WEIGHTS:

Approximatley 370 mm x 260 mm x 50 mm and weighs 0.34 kg

ACCESSORIES (INCLUDED):

- Torque Disc
- Encoder Extension Cable
- Cap Head Screws and Locking Washers