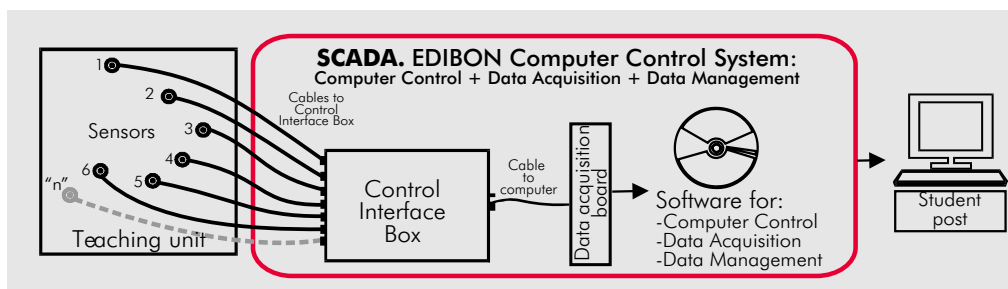


① Unit: TBMC3. Test Bench for Single-Cylinder Engines, 2.2 kW.

**OPEN CONTROL  
+  
MULTICONTROL  
+  
REAL TIME CONTROL**



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- Products
- Products range
- Units
- 9. Thermodynamics & Thermotechnics

**Items supplied as standard**

**① TBM3. Unit:**

Test Bench with wheels for its mobility. Control and load unit for single-cylinder internal combustion engines (two-stroke and four-stroke). Maximum power output of: **2.2 kW**.  
 Metallic structure and panels in painted steel. Main metallic elements in stainless steel.  
 Diagram in the front panel with similar distribution to the elements in the real unit.  
 Asynchronous motor with regenerative feedback unit as the brake for generating the engine load, and can be also used as starter motor.  
 Engine started by asynchronous motor.  
 Force transmission from the engine to the brake unit by means the use of a elastic claw coupling.  
 Adjustment of the braking torque and the braking speed.  
 Quieting vessel for intake air, with air filter and air hose.  
 Vibration insulated base plate for the test engine installation.  
 Coupling cover.  
 Exhaust gas connection.  
 Supply tanks for different fuels and pump.  
 Speed sensor. Temperature sensors for air temperature, fuel temperature and exhaust gas temperature.  
 Force sensor (torque). Flow sensors. Level sensor. Pressure sensors.  
 By the previous sensors we can make measurement of the most representative parameters:  
 Speed. Torque. Air intake quantity. Intake pressure. Fuel consumption. Air temperature. Fuel temperature.  
 Exhaust gas temperature. Etc.  
 Adjustable speed. Pump control. Adjustable torque. Motor and engine control. Consumption control.

The complete test bench requires for working a choice (optional) test engines :

**Test engines available:** (not included in the standard supply)

- TM3-1. Air-cooled single-cylinder four-stroke petrol engine.
- TM3-2. Air-cooled single-cylinder four-stroke diesel engine.
- TM3-3. Air-cooled single-cylinder four-stroke petrol engine, with variable compression.
- TM3-4. Air-cooled single-cylinder two-stroke petrol engine.

**Other accessories available:** (not included in the standard supply)

- TBM3-CG. Computer Controlled Exhaust Gas Calorimeter.
- TBM3-AGE. Exhaust Gas Analyzer.

**② TBM3/CIB. Control Interface Box :**

Control interface box with process diagram in the front panel and with the same distribution that the different elements located in the unit, for an easy understanding by the student.  
 All sensors, with their respective signals, are properly manipulated from -10V. to +10V computer output. Sensors connectors in the interface have different pines numbers (from 2 to 16), to avoid connection errors. Single cable between the control interface box and computer.  
 The unit control elements are permanently computer controlled, without necessity of changes or connections during the whole process test procedure.  
 Simultaneously visualization in the computer of all parameters involved in the process.  
 Calibration of all sensors involved in the process.  
 Real time curves representation about system responses. Storage of all the process data and results in a file. Graphic representation, in real time, of all the process/system responses.  
 All the actuators' values can be changed at any time from the keyboard allowing the analysis about curves and responses of the whole process. All the actuators and sensors values and their responses are placed in only one computer screen.  
 Shield and filtered signals to avoid external interferences.  
 Real time computer control with flexibility of modifications from the computer keyboard of the parameters, at any moment during the process. Real time computer control for pumps, compressors, resistances, control valves, etc.  
 Open control allowing modifications, at any time and in a real time , of parameters involved in the process simultaneously.  
 Three safety levels, one mechanical in the unit, other electronic in control interface and the third one in the control software.

**③ DAB. Data Acquisition Board:**

PCI Data acquisition board (National Instruments) to be placed in a computer slot. Bus PCI.  
**Analog input:** Channels= 16 single-ended or 8 differential. Resolution=16 bits, 1 in 65536. Sampling rate up to: 250 KS/s (Kilo samples per second). Input range (V)= $\pm 10V$ . Data transfers=DMA, interrupts, programmed I/O. DMA channels=6.  
**Analog output:** Channels=2. Resolution=16 bits, 1 in 65536. Maximum output rate up to: 833 KS/s.  
 Output range(V)= $\pm 10V$ . Data transfers=DMA, interrupts, programmed I/O.  
**Digital Input/Output:** Channels=24 inputs/outputs. D0 or DI Sample Clock frequency: 0 to 1 MHz.

**④ TBM3/CCSOF. Computer Control + Data Acquisition + Data Management Software:**

Compatible with actual Windows operating systems. Graphic and intuitive simulation of the process in screen.  
 Compatible with the industry standards.  
 Registration and visualization of all process variables in an automatic and simultaneously way.  
 Flexible, open and multicontrol software, developed with actual windows graphic systems, acting simultaneously on all process parameters.  
 Management, processing, comparison and storage of data. Sampling velocity up to 250,000 data per second guaranteed.  
 Calibration system for the sensors involved in the process.  
 It allows the registration of the alarms state and the graphic representation in real time.  
 Comparative analysis of the obtained data, after the process and modification of the conditions during the process.  
 Open software, allowing to the teacher to modify texts, instructions. Teacher's and student's passwords to facilitate the teacher's control on the student, and allowing the access at different work levels.  
 This unit allows that the 30 students of the classroom can visualize simultaneously all results and manipulation of the unit, during the process, by using a projector.

**⑤ Cables and Accessories,** for normal operation.

**⑥ Manuals:** This unit is supplied with 8 manuals: Required Services, Assembly and Installation, Interface and Control Software, Starting-up, Safety, Maintenance, Calibration & Practices Manuals.

**\* References 1 to 6: TBM3 + TBM3/CIB + DAB + TBM3/CCSOF + Cables and Accessories + Manuals are included in the minimum supply, enabling a normal operation.**

## EXERCISES AND PRACTICAL POSSIBILITIES

### Some Practical Possibilities of the Unit (in conjunction with a test engine)

- 1.- Familiarisation with four-stroke petrol and diesel engines.
- 2.- Familiarisation with two-stroke petrol engines.
- 3.- Determination of specific fuel consumption.
- 4.- Torque curves.
- 5.- Power curves.
- 6.- Determination of volumetric efficiency.
- 7.- Determination of excess air factor.
- 8.- Measurement of the most important parameters involved in the process: temperature, torque, speed, etc.
- 9.- Determination of engine friction loss.
- 10.- Study of the effect of compression ratio, mixture and ignition point on engine characteristic curves and exhaust gas temperature.
- 11.- Determination of air ratio.
- 12.- Sensors calibration.

## ORDER INFORMATION

### Items supplied as standard

**Minimum configuration** for normal operation includes:

- ① **Unit: TBMC3. Test Bench for Single-Cylinder Engines, 2.2 kW.**
- ② **TBMC3/CIB. Control Interface Box.**
- ③ **DAB. Data Acquisition Board.**
- ④ **TBMC3/CCSOF. Computer Control + Data Acquisition + Data Management Software.**
- ⑤ **Cables and Accessories, for normal operation.**
- ⑥ **Manuals.**

**\* IMPORTANT:** Under **TBMC3** we always supply all the elements for immediate running as **1, 2, 3, 4, 5 and 6.**

## REQUIRED SERVICES

- Electrical supply.
- Computer (PC).

## DIMENSIONS & WEIGHTS

- TBMC3. Unit:                      -Dimensions: 1230 x 1000 x 1500 mm. approx.  
   -Weight: 125 Kg. approx.
- Control Interface Box: -Dimensions: 490 x 330 x 310 mm. approx.  
   -Weight: 10 Kg. approx.

## AVAILABLE TEST ENGINES AND ACCESSORIES

### Test engines:

- TM3-1. Air-cooled single-cylinder four-stroke petrol engine.
- TM3-2. Air-cooled single-cylinder four-stroke diesel engine.
- TM3-3. Air-cooled single-cylinder four-stroke petrol engine, with variable compression.
- TM3-4. Air-cooled single-cylinder two-stroke petrol engine.

### Other accessories:

- TBMC-CG. Computer Controlled Exhaust Gas Calorimeter.
- TBMC-AGE. Exhaust Gas Analyzer.

## AVAILABLE VERSIONS

### Offered in this catalogue:

- TBMC3. **Computer Controlled Test Bench for Single-Cylinder Engines, 2.2 kW.**

### Offered in other catalogues:

- TBMC8. **Computer Controlled Test Bench for Single-Cylinder Engines, 7.5 kW.**
- TBMC12. **Computer Controlled Test Bench for Single-Cylinder and Two-Cylinders Engines, 11 kW.**
- TBMC75. **Computer Controlled Test Bench for Four-Cylinders Engines, 75 kW.**

\* Specifications subject to change without previous notice, due to the convenience of improvements of the product.



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