Intelligent Measuring Systems

for economic engine operation

www.imes.de
IMES - Intelligent measuring systems

For more than 20 years IMES is specialised in the field of combustion engine cylinder pressure and data acquisition systems. Our sensors, electronic pressure indicators and combustion control and monitoring systems are employed on a wide range of diesel-, gas- and dual-fuel engines, on ships and locomotives and in power and cogeneration plants and pipeline compressor stations all around the world.

Company structure

At our company in Kaubeuren, Germany, we have a close collaboration between all departments, especially between sales, development and production. Our state-of-the-art ISO certificated production facilities equipped with the latest manufacturing technology and our highly qualified development department ensure that our products provide an outstanding quality and know-how.

Global sales organisation

We offer professional support worldwide due to our global sales organisation. Our high skilled sales partners are glad to answer your questions and to support you.

You are looking for a contact in your area? Visit our website! www.imes.de/sales-team.html
Technology made in Germany

**Permanent high quality**

Quality management is a high priority at IMES. With strict quality management regulation in place, we strive to continually enhance the company’s production, organizational and technical process. Therefore we now combine all essential production processes in-house so that our products meet the highest standards and can convince with reliability, robustness, durability and long term accuracy.

Since 2012 we operate our own diesel powered cogeneration plant as a research and development tool which is a significant advancement in the quality management. Product tests can be conducted more efficiently and more quickly by simulating real engine conditions. Also development cycles for new products will be reduced.

**Prompt, flexible, reliable**

Due to our own special setup and connection method and our own special platform strategy we are able to manufacture all our sensors according to our customers requirements with short delivery times.

Depending on customers wishes we provide our sensor types with various sleeve length, cable length, measuring cell and different electronic and with various measuring range and output signal range.

Of course also our various types of electronic indicators and combustion monitoring systems are manufactured in house under high quality standards.

**Marine Type Approvals**

Large engine manufacturers are required to fulfil numerous international safety standards. Marine Type Approval is therefore a mandatory requirement for voyage and safety critical devices installed on any ship.

Our sensor types have received Marine Type Approval from all significant international classification societies, such as Bureau Veritas, DNV GL, ABS, Lloyd's Register, Class NK or China Classification Society.

For our combustion control module CCM, Marine Type Approval from Bureau Veritas and Class NK are in preparation. Other approvals will follow shortly.
## IMES Cylinder pressure sensors

<table>
<thead>
<tr>
<th>All our sensors offer</th>
<th>Output signal range</th>
<th>Frequency range</th>
<th>Accuracy error</th>
<th>max. temperature measuring cell</th>
<th>Thermal shock</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4...20 mA</td>
<td>2 or 10 kHz</td>
<td>≤ 1% Full scale</td>
<td>300°C (short time 1 min, 350°C)</td>
<td>1500 RPM pmi=10 bar</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Specification and technical data</th>
<th>HTT-04(^\circ)</th>
<th>HTT-04CA(^\circ)</th>
<th>HTT-05(^\circ)</th>
<th>CPS-01</th>
<th>CPS-01CA(^\circ)</th>
<th>CPS-02</th>
</tr>
</thead>
<tbody>
<tr>
<td>On-line combustion control on diesel- and gas engines for increasing engine performance and optimised engine control.</td>
<td><img src="images/htt-04.png" alt="HTT-04" /></td>
<td><img src="images/htt-04ca.png" alt="HTT-04CA" /></td>
<td><img src="images/htt-05.png" alt="HTT-05" /></td>
<td><img src="images/cps-01.png" alt="CPS-01" /></td>
<td><img src="images/cps-01ca.png" alt="CPS-01CA" /></td>
<td><img src="images/cps-02.png" alt="CPS-02" /></td>
</tr>
</tbody>
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<thead>
<tr>
<th>Application</th>
<th>Closed loop control on diesel-, gas- and dual-fuel engines</th>
<th>Closed loop control on internal combustion engines</th>
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</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>0...300 bar</td>
<td>0...300 bar</td>
<td>0...300 bar</td>
<td>0...300 bar</td>
</tr>
<tr>
<td>Over pressure static</td>
<td>1200 bar (option 1500 bar)</td>
<td>1200 bar (option 1500 bar)</td>
<td>1200 bar (option 1500 bar)</td>
<td>1200 bar (option 1500 bar)</td>
</tr>
<tr>
<td>Electrical connector</td>
<td>Plug DIN M12</td>
<td>MIL-C-26482</td>
<td>Plug DIN M12</td>
<td>Plug DIN M12</td>
</tr>
<tr>
<td>Thread</td>
<td>M14 x 1.25</td>
<td>M14 x 1.25</td>
<td>M14 x 1.25</td>
<td>M10 x 1</td>
</tr>
</tbody>
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<tr>
<th>Specification and technical data</th>
<th>TCS-01CA</th>
<th>FPS-01</th>
<th>FPS-01CA</th>
<th>FPS-02</th>
<th>FPS-02CA</th>
<th>SPS-01</th>
</tr>
</thead>
<tbody>
<tr>
<td>Two-stroke combustion sensor for continuous measurement of combustion pressure. Perfectly suitable for cylinder balancing and performance evaluation.</td>
<td><img src="images/tcs-01ca.png" alt="TCS-01CA" /></td>
<td><img src="images/fps-01.png" alt="FPS-01" /></td>
<td><img src="images/fps-01ca.png" alt="FPS-01CA" /></td>
<td><img src="images/fps-02.png" alt="FPS-02" /></td>
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<th>Application</th>
<th>Permanent installation on two-stroke diesel engines.</th>
<th>Permanent installation on four-stroke diesel engines or dual fuel engines.</th>
<th>Permanent installation at close proximity.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>0...250 bar</td>
<td>0...300 bar</td>
<td>0...300 bar</td>
</tr>
<tr>
<td>Over pressure static</td>
<td>400 bar</td>
<td>400 bar</td>
<td>400 bar</td>
</tr>
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All data sheets with more specific information may be found on our web site www.imes.de/support.html
precise and durable

Our sensors convince with their long term accuracy with minimal signal drift over long periods. Designed for a minimum of 16,000 operating hours they enable the acquisition of highly accurate, processable data during periodic checks and during continuous monitoring of combustion pressure.

Mounting

The sensor should be installed close to the combustion chamber, the length of the pressure bore between sensor and combustion chamber depends on engine speed. Generally there are two possibilities for the installation position of cylinder pressure sensors:

Head mounted or set-back mounted. We recommend the head mounted installation.

Protection cover

For all our cylinder pressure sensors we offer protection covers for the signal conditioning unit (SCU). They are temperature and oil resistant. The protection cover reduces the vibration level of SCU on engines and it enables an easy mounting on the engines.
Combustion Monitoring Systems

Fixed and portable CCM systems for diesel and gas engines

CCM is an easy to use plug and play system, which enables real time data acquisition of cylinder pressure on engines. Data can be recorded from up to 20 cylinders for closed loop control applications and to diagnose malfunctions or to assist in the setting and optimising of engine parameters e.g. cylinder balancing.

The heart of our CCM systems

The main component of our CCM systems is the combustion control module. It is a smart combustion signal processing device for marine engines and stationary gas engines. Its function is to acquire and process real time data from cylinder pressure sensors. Every combustion cycle will be evaluated on every cylinder in order to calculate key parameters engine builders need to implement cylinder pressure based control on engines.

CCM is designed as a plug and play module, that means CCM communicates via CAN bus with the engine control system and it can be integrated to the engine management system. A further important function is that all data can be transmitted via internet to the server of the engine operator. This enables to control the engine from land.

Event record

CCM offers an event storing, this means that a large memory buffer records combustion data and pressure curves from the latest 40 combustion cycles on 4-stroke engines or rather the latest 80 cycles on 2-stroke engines.

In case of deviation from engine performance parameters set by the engine operator or engine builder CCM records automatically the failure cycle plus the latest 39 cycles before on 4-stroke engines respectively the latest 79 cycles before on 2-stroke engines. This means all combustion data are stored in CCM and the CCM visualisation software is able to compare and analyse the cause of the malfunction.

The CCM event record enables to analyse the data before, during and after a failure. So it is possible to determine the cause of failure and to find solutions how to prevent it in the future.
CCM Marine for 2- and 4- stroke diesel engines

CCM Marine Performance

CCM Marine Performance designed for fixed and continuous operation is a system which includes a high speed data acquisition unit (CCM) for up to 12 cylinders, permanently installed cylinder pressure sensors and an advanced visualisation- and performance software.

The combustion pressure is measured on each cylinder continuously and in all speed ranges. It is easy to use as an online solution for condition and performance monitoring. The data can be transmitted for evaluation directly via LAN / Ethernet to a PC where the CCM software is installed. The software allows an easy collection, management and comparison of engine performance data. This enables a quick overview about engine condition for an optimal engine performance. Furthermore the data can be transmitted from CCM by CAN-Bus to an automation system which acts to stabilise engine operation.

CCM Marine portable

CCM Marine Portable for periodic operation is a multi cylinder combustion monitoring system for 2- and 4-stroke marine diesel engines. It is designed as a portable box, a comprehensive, transportable system which can be rapidly installed on-site to enable acquisition of cylinder pressure data on engines in the field. Data can be recorded from up to 20 cylinders.

The easy installation of CCM Marine Portable enables a quick data acquisition. The recorded data can be transferred via Ethernet to a PC where the data acquisition and visualisation software can be used to diagnose malfunctions or to assist in the setting and optimising of engine operating parameters. At the centre of efforts is cylinder balancing - the equalisation of output across all cylinders of an engine.

HTT-04® sensors mounted on special Thompson adaptors for continuous combustion monitoring on a MAN L48/60B 4-stroke diesel engine. The adaptors have cooling fins to keep the operation temperature for continuous operation of the HTT-04® sensors below 300°C.
CCM Gas Engine

CCM Gas Engine Control

CCM Gas Engine control is designed for pressure control in a closed loop system. It enables continuously cylinder balancing to increase the engine operating stability and to keep the peak cylinder pressures at a suitable level. Combustion knock can be realised and operating parameters can be adjusted immediately. The misfire detection prevents incomplete combustion which makes the engine unstable and decreases the efficiency.

The data can be transmitted for evaluation directly via LAN / Ethernet to a PC where the CCM software is installed. The software allows an easy collection, management and comparison of engine performance data. This enables a quick overview about engine condition for an optimal engine performance. Furthermore the data can be transmitted from CCM by CAN-Bus to an automation system which acts to stabilise engine operation.

CCM Gas portable

CCM Gas portable for periodic operation is a comprehensive system which can be rapidly installed on-site to enable acquisition of cylinder pressure data on spark ignited- and dual-fuel engines in the field. Data can be recorded from up to 20 cylinders. Using CCM Gas portable for cylinder balancing and the adjustment of the knock detection system is much easier than using the traditional method which operates with an acceleration sensor.

The easy installation of CCM Gas portable enables a quick data acquisition. The recorded data can be transferred via Ethernet to a PC where the data acquisition and visualisation software can be used to monitor and analyse the measured knock intensity and misfiring of each cylinder. The information on knock intensity is used to adjust the engine combustion parameters.

HTT-04CA® installed on a gas engine
The cylinder pressure sensors are installed near to the combustion chamber.
Using CCM Gas portable for the adjustment of the knock detection system is both, easier and more accurate. The engine specific knock parameters are permanently stored in the manufacturer’s engine settings.
Advanced visualisation- and performance evaluation software

The CCM Marine and the CCM Gas PC software is a modernised version for online combustion monitoring. The recorded data can be used to diagnose malfunctions or to assist in the setting and optimising of engine operating parameters.

CCM Gas PC software

The visualisation software offers the possibility of selecting advanced monitoring functions in the following diagrams: *Pressure/CA, Pmax balance, IMEP balance, event recording*

CCM Marine PC software

The visualisation software offers the possibility of selecting advanced monitoring functions in the following diagrams and reports: *Pressure curve diagram, Pmax and Pcomp diagram, Pmax balance, pressure volume diagram, engine report, event recording*

IPE IMES Performance Evaluation software

The measured data can be transmitted to the IMES Performance Evaluation software (IPE). In addition to IMES data acquisition software it offers advanced functions to facilitate the collection, evaluation, management and comparison of engine performance data for marine diesel engines. The software evaluates the current engine performance automatically by comparing the actual ISO corrected measurement with the reference data at any load point. Due to this the user receives a quick and reliable overview on many operational aspects.

Main benefits

**Cost effectiveness due to:**
- reduced fuel consumption
- less wear and tear
- reliable detection of irregular combustion
- maximising power and efficiency

**Environmental protection due to:**
- minimising NOx emission
- compliance with IMO TIER III limits in Emission Control Areas (ECAs)
Periodic combustion monitoring

Electronic indicator EPM-XP

Electronic pressure indicator EPM-XP is a battery powered hand held electronic device for periodic monitoring of cylinder pressure on 2- and 4-stroke diesel engines. It provides important measurement data for engine diagnostic and condition monitoring at the point of use.

EPM-XP was the first electronic indicator without TDC pick-up and it records cylinder pressure values on a maximum of 20 cylinders on 2-stroke diesel engines operating at speeds of 40 to 300 rpm and on 4-stroke medium and high speed diesels with rated speeds from 200 to 1,500 rpm. After acquisition recorded data can be downloaded immediately to a PC or notebook via USB connection. Recorded data can be simply processed by IMES' visualisation software.

The new generation

Engine Analyser - EPM-XP\textsuperscript{plus}

EPM-XP\textsuperscript{plus} is a further development of EPM-XP with advanced features e.g.: higher battery capacity, short term online measurements, comprehensive software package.

The data acquired can be directly transmitted via USB / Ethernet to a PC for evaluation on visualisation software. Online measurements enable to control cylinder pressure permanently and therefore it is easier to diagnose and to fix malfunctions of combustion.

Standard Features of EPM-XP

- Pcomp calculation
- IPOWER calculation
- automatic TDC correction
- advanced trending functions
- advanced visualisation and data processing software
- compatible to IPE (IMES Performance evaluation software)

New advanced features of EPM-XP\textsuperscript{plus}

- online measurement up to one hour to analyse actual engine condition by direct data transfer via USB / Ethernet to PC software
- higher battery capacity - power more than 20 hours
- comprehensive analysing software for ships and power plant application
- vibro sensor for definition of fuel injection timing and valves timing in preparation
to keep your engine in balance

**Peak pressure indicator - EPM-Peak**

EPM-Peak, designed for 4-stroke diesel engines, collects 10 consecutive pressure measurements (cycles) and calculates peak pressure and engine speed. The measured data are displayed in numerical format on the LCD screen and stored on memory. In comparison to conventional peak pressure meter EPM-Peak offers an easy handling, the measurements have an higher accuracy, the data Pmax and speed will be displayed exactly on the LCD screen and up to 200 measurements can be stored.

- light weight, battery powered hand held device
- high accuracy
- battery charging from PC via USB port
- 200 measurements storing capacity
- including visualisation software

**Gas Engine Balancer - EPM-XG**

The EPM-XG is a highly accurate and easy to use gas engine balancer. The operator can collect cylinder pressure data and balance the engine without leaving the engine.

The EPM-XG battery recharges while it is connected to the PC. Plug-in battery chargers are also available for charging multiple batteries.

The EPM-XG comes with powerful analysis software that includes the following features:

- Balancing bar chart
- Peak pressure chart
- 50 cycles per pressure history for each cylinder
- Excel-based analysis report includes peak pressure, standard deviation, Pmax and Pmin for each cylinder

Due to its high accuracy and ease-of-use EPM-XG is very popular in pipeline compressor applications. The EPM-XG keeps your engine in balance for best power, optimum fuel efficiency, lowest emission and long engine life.
We deliver worldwide!

Professional support worldwide due to our global sales organisation.

www.imes.de/sales-team.html