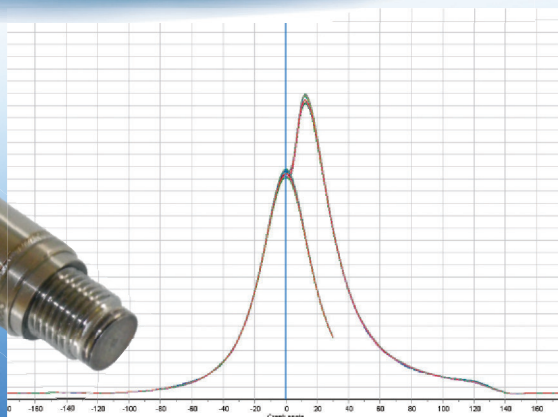
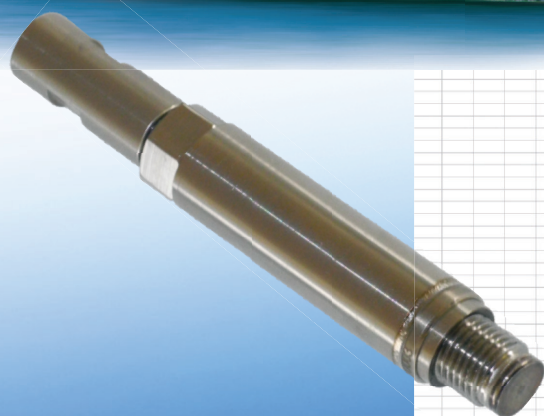




Intelligent Measuring Systems for economic engine operation

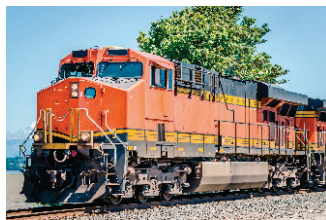


IMES - Intelligent measuring systems



IMES GmbH founded by
Stefan Neumann in 1997

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.

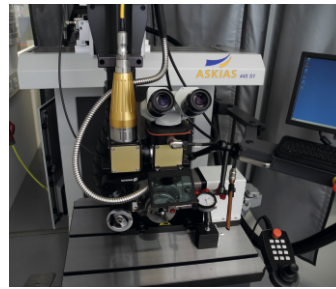
Over the past years we have expanded our machine park enormously. We automated many production and quality assurance processes, e.g. laser welding, bonding or soldering machines enabled us to increase our production depth.



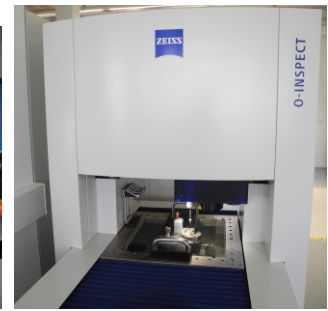
wire bonding



soldering



laser welding



inspection

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, ABS, Lloyd's Register, Class NK or Korean Register.

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

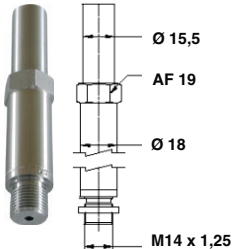
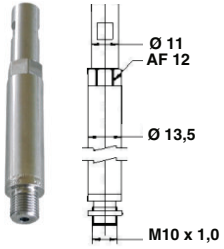
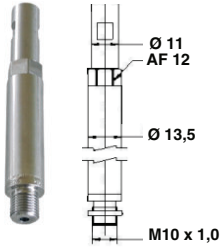
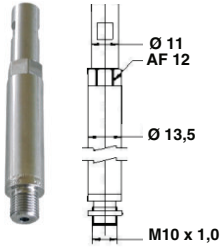
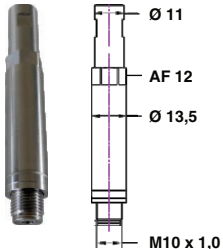
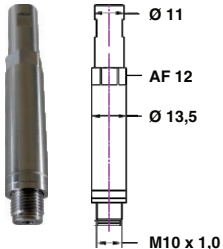


IMES Cylinder pressure sensors

All our sensors offer

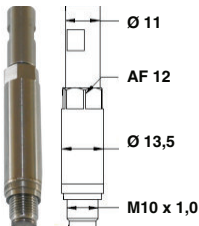
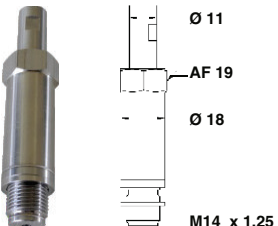
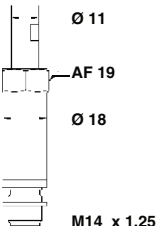
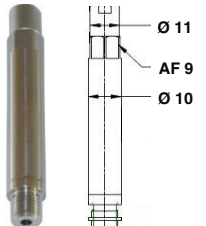

Output signal range	Frequency range	Accuracy error	max. temperature measuring cell	Thermal shock
4...20 mA option 0,5...4,5 V	2 or 10 kHz (others on request)	≤ 1% Full scale	300°C (short time 1 min. 350°C)	1500 RPM pmi=10 bar < +/- 0,5 bar

NEW sensor type

Specification and technical data	HTT-04®	HTT-04CA®	CPS-01	CPS-01CA®	CPS-03	CPS-03CA
						
	On-line combustion control on diesel- and gas engines for increasing engine performance and optimised engine control.	On-line combustion control on diesel- and gas engines for increasing engine performance and optimised engine control.	On-line combustion control on diesel- and gas engines for increasing engine performance and optimised engine control.	On-line combustion control on diesel- and gas engines for increasing engine performance and optimised engine control. Extreme robust against high dp/dt and against vibration. Protection class IP69.	On-line combustion control on diesel- and gas engines for increasing engine performance and optimised engine control. Extreme robust against high dp/dt and against vibration. Protection class IP69.	On-line combustion control on diesel- and gas engines for increasing engine performance and optimised engine control. Extreme robust against high dp/dt and against vibration. Protection class IP69.
Application	Closed loop control on diesel-, gas- and dual-fuel engines		Closed loop control on diesel-, gas- and dual-fuel engines		Closed loop control on internal combustion engines.	
Measuring range	0...300 bar	0...300 bar	0...300 bar (others on request)	0...300 bar (others on request)	0...300 bar	0...300 bar
Over pressure static	1200 bar (option 1500 bar)	1200 bar (option 1500 bar)	1200 bar (option 1500 bar)	1200 bar (option 1500 bar)	1200 bar (option 800 bar)	1200 bar (option 800 bar)
Electrical connector	Plug DIN M12	MIL-C-26482	Plug DIN M12	MIL-C-26482	Plug DIN M12	MIL-C-26482
Thread	M14 x 1,25	M14 x 1,25	M10 x 1	M10 x 1	M10 x 1	M10 x 1

NEW sensor type

NEW sensor type

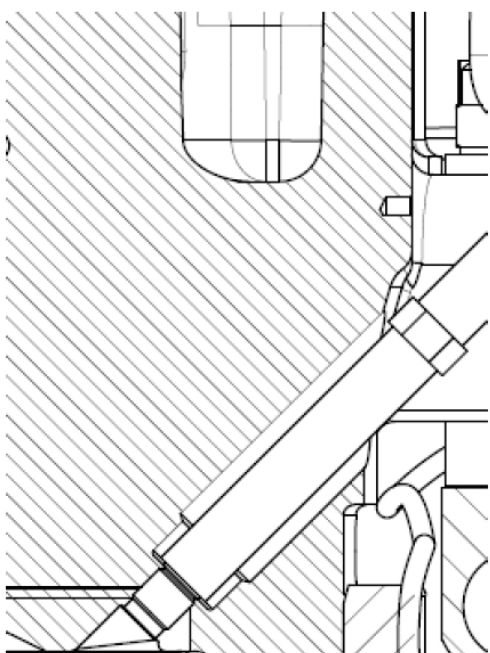
Specification and technical data	TCS-01CA	HTT-06	HTT-06CA	SPS-01	HTT-05CA for compressors
					
	Two-stroke combustion sensor for continuous measurement of combustion pressure. Perfectly suitable for cylinder balancing and performance evaluation.	On-line combustion control on diesel- and gas engines for increasing engine performance and optimised engine control. Extreme robust against high dp/dt and against vibration. Protection class IP69.	On-line combustion control on diesel- and gas engines for increasing engine performance and optimised engine control. Extreme robust against high dp/dt and against vibration. Protection class IP69.	Small pressure sensor for continuous measurement of combustion pressure on diesel- and gas engines.	Compression pressure sensor for real time pressure inputs from the compressor cylinders, e.g. indicated HP, rod load, volumetric efficiencies. Received approval for hazardous area Div1, class1, Group A-D.
Application	Permanent installation on two-stroke diesel engines.	Closed loop control on diesel-, gas- and dual-fuel engines.		Permanent installation at close proximity.	Pressure measurements on compression pump.
Measuring range	0...250 bar	0...300 bar	0...300 bar	0...300 bar (others on request)	0...300, 600, 1000, 1500, 3000, 5000 psi
Over pressure static	400 bar	1200 bar (option 800 bar)	1200 bar (option 800 bar)	1200 bar	3000, 4000, 10000 psi
Electrical connector	MIL-C-26482	Plug DIN M12	MIL-C-26482	Plug DIN M12 / MIL-C-26482	MIL-C-26482
Thread	M10 x 1	M14 x 1,25	M14 x 1,25	M8 x 0,75	1/2" NPT

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 combustion pressure sensors 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.

Head mounted installation near to the combustion chamber

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.



CCM module for real time operation



CCM portable for periodic operation

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.

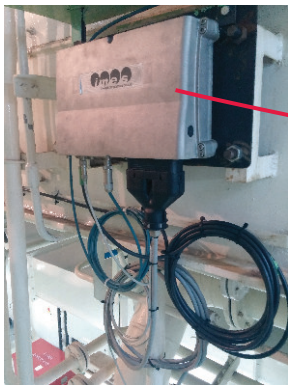
CCM is designed as a plug and play module, that means CCM communicates via CAN bus with the engine control system and it can be integrated to the engine management system. A further important function is that all data can be transmitted via internet to the server of the engine operator. This enables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

CCM Marine for 2- and 4- stroke diesel engines

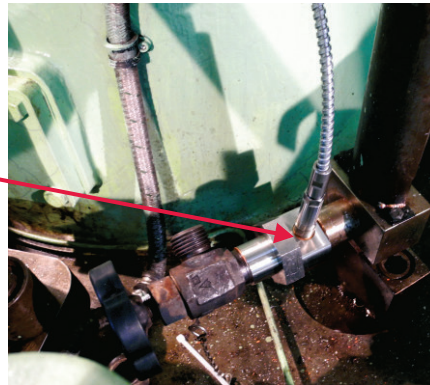
CCM Marine Performance

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 Performance installed on container ship Hedda Schulte



Installation of two-stroke combustion sensor TCS-01CA® including adaptor on a Wärtsilä 6 RTFlex84 engine

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.

▼ Cylinder pressure		MEASURED BY EPM-XP/CCM														
		ISO CORRECTED														
		REF	ISO	AVG	Cyl 1	Cyl 2	Cyl 3	Cyl 4	Cyl 5	Cyl 6	Cyl 7	Cyl 8	Cyl 9	Cyl 10	Cyl 11	Cyl 12
Maximum pressure	bar	85.84	86.67	86.07	85.50	88.31	86.82	87.26	89.15	89.78	87.48	88.45	82.73	84.27	82.19	80.86
Maximum pressure deviation	bar				-0.56	2.24	0.75	1.20	3.09	3.71	1.41	2.38	-3.33	-1.79	-3.87	-5.21
Compression pressure	bar	74.83	75.78	75.24	74.88	76.34	75.14	76.02	75.44	75.11	76.39	74.99	73.73	74.87	74.61	75.32
Compression pressure deviation	bar				-0.36	1.11	-0.09	0.78	0.20	-0.13	1.15	-0.25	-1.51	-0.37	-0.63	0.08
Mean indicated pressure	bar	10.09		9.01	9.14	9.13	9.20	8.76	8.93	8.89	9.44	9.45	9.08	9.37	8.36	8.37
Mean indicated pressure deviation	bar				0.13	0.12	0.19	-0.25	-0.08	-0.12	0.43	0.44	0.07	0.36	-0.65	-0.64
Power indicated	kW			24486.10	2071.43	2067.19	2080.98	1984.67	2022.38	2012.91	2138.76	2135.37	2056.82	2123.43	1895.54	1896.61
Load balance deviation	%				1.52	1.31	1.98	-2.74	-0.89	-1.35	4.82	4.65	0.80	4.06	-7.10	-7.05
Mean effective pressure (MEP)	bar	9.01		8.04												
Pmax - Pcomp	bar	11.01	10.89	10.83	10.63	11.97	11.68	11.25	13.72	14.67	11.09	13.46	9.01	9.41	7.58	5.54
Pcomp / Pscav	-	35.39	34.90	34.65	34.49	35.16	34.61	35.01	34.74	34.59	35.18	34.54	33.97	34.49	34.37	34.69

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)

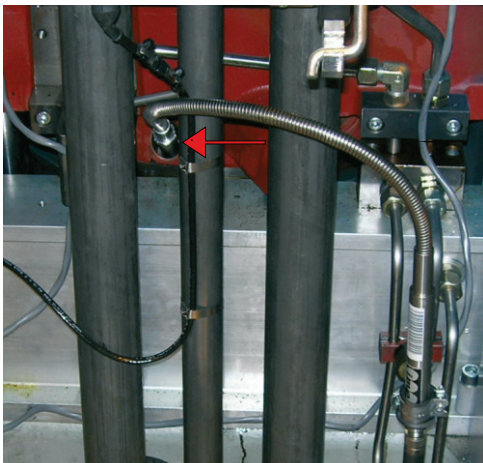
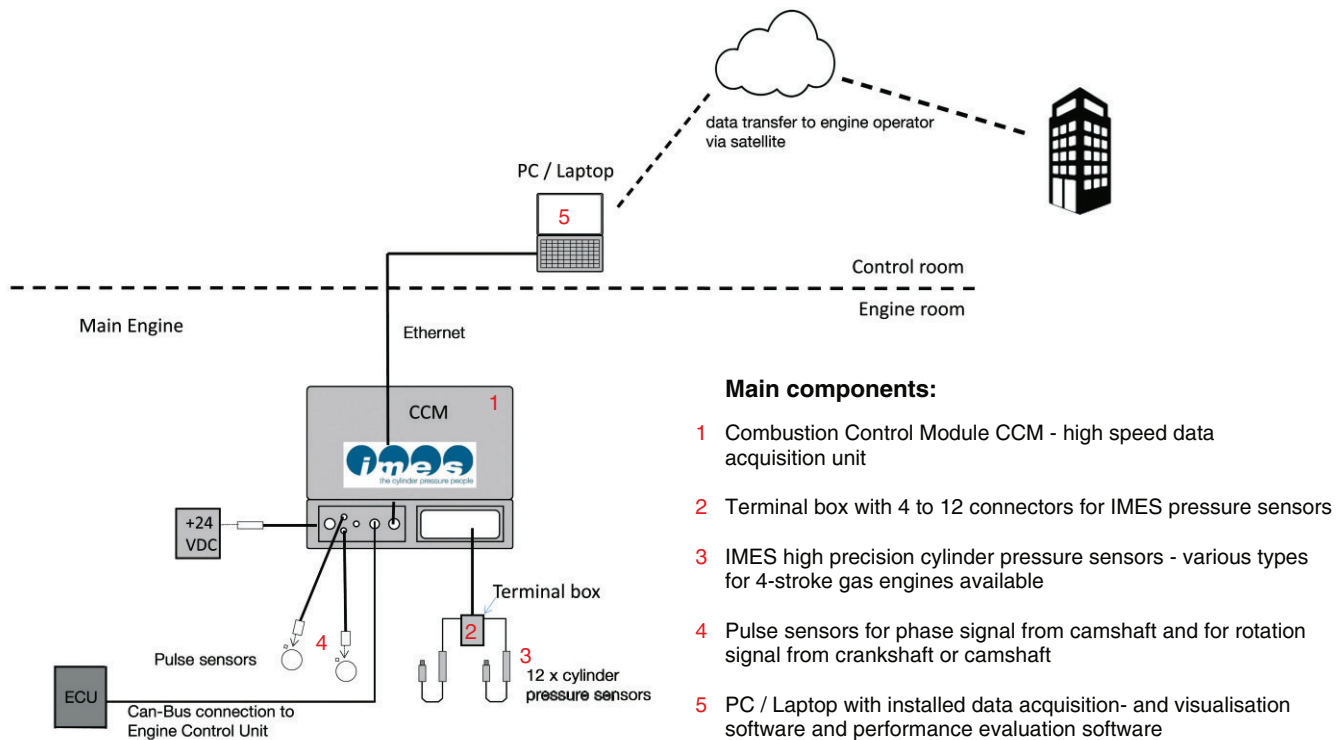
CCM Gas Engine

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.

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.

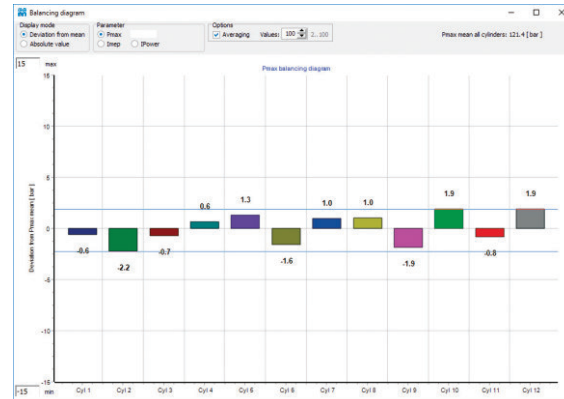
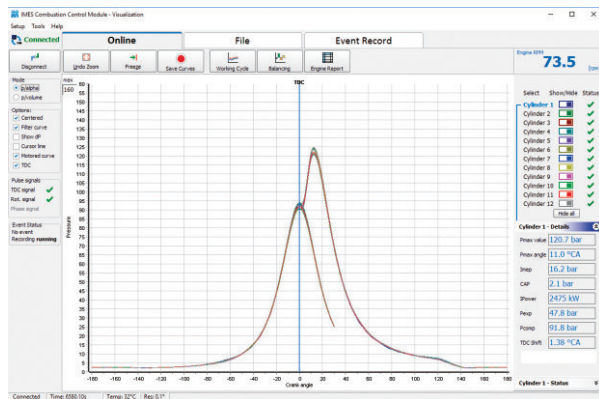
The data can be transmitted for evaluation directly via LAN / Ethernet to a PC where the CCM software is installed. The software allows an easy collection, management and comparison of engine performance data. This enables a quick overview about engine condition for an optimal engine performance. Furthermore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



HTT-04CA® installed on a gas engine.
The cylinder pressure sensors are installed near to the combustion chamber.

Advanced visualisation- and performance evaluation software

The CCM 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.



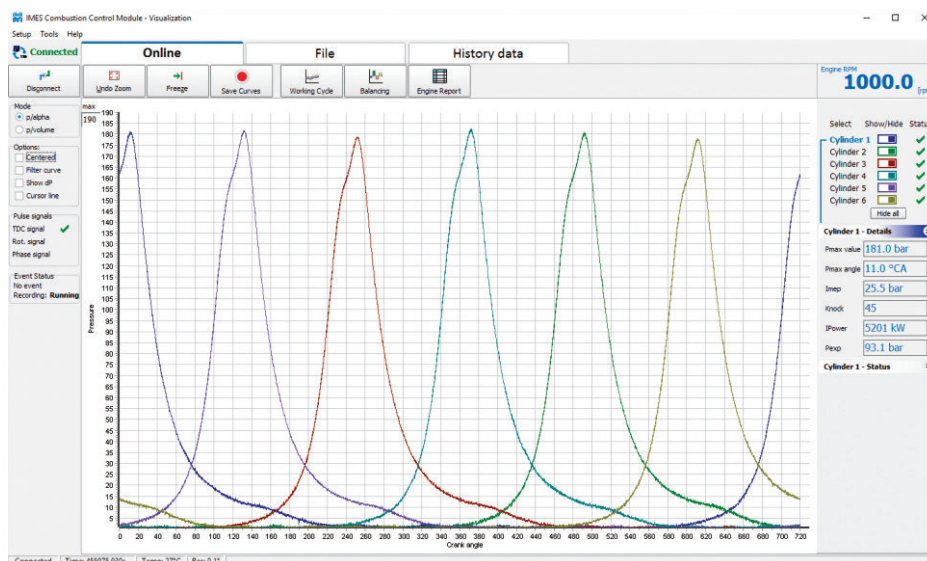
The visualisation software offers the possibility of selecting advanced monitoring functions in the following diagrams and reports: **Pressure curve diagram, Pmax and Pcomp diagram, Pmax balance, pressure volume diagram, engine report, event recording**

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 visualisation software displays all combustion processes before, at and after a failure.

Electronic instruments for periodic combustion monitoring

Three different devices - one design

IMES electronic instruments for periodic combustion monitoring on 2- and 4-stroke diesel engines are battery powered, compact and lightweight handheld devices. They are very robust, easy to use and convince with their high accuracy and their sophisticated visualisation and data processing software.

We offer three indicator types:

- EPM-Peak
Electronic Peak Pressure Indicator
- EPM-XP
Electronic Indicator
- EPM-XP ^{plus}
Electronic Engine Analyser

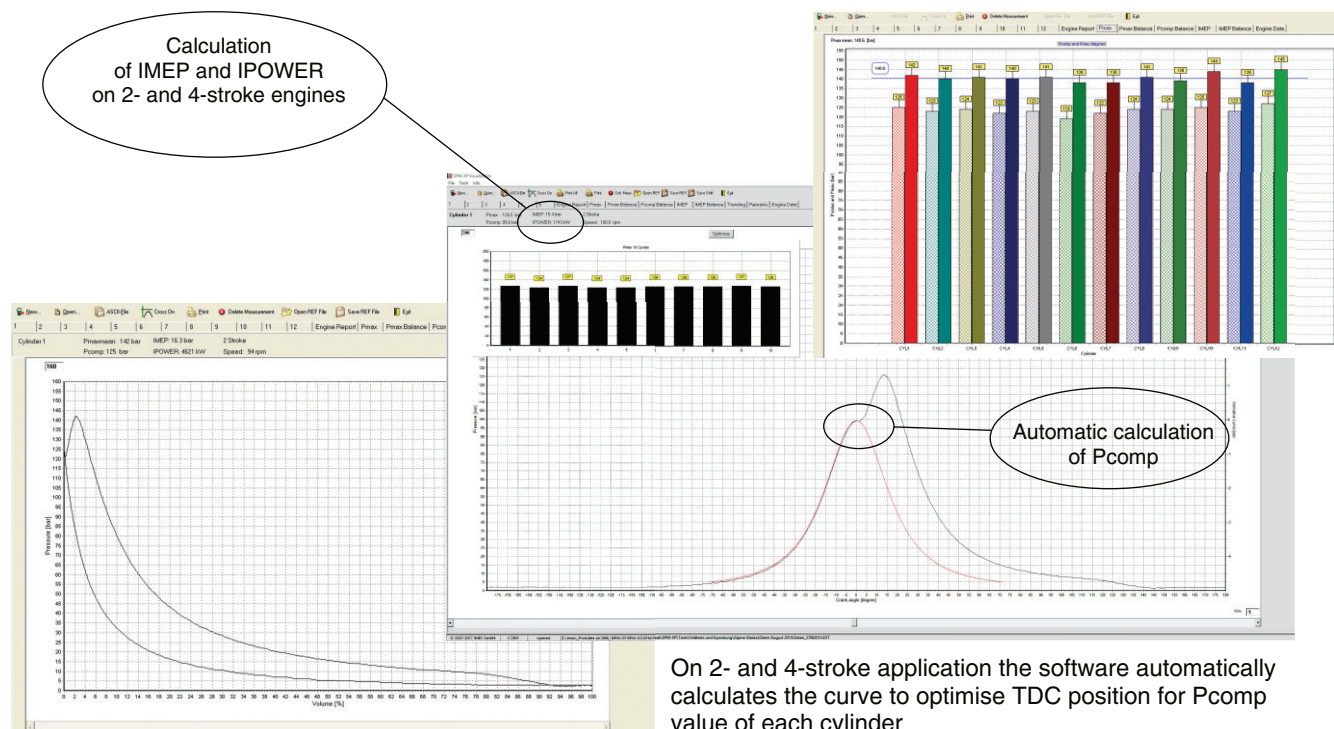


EPM-XP - Electronic pressure indicator

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.

Calculation
of IMEP and IPOWER
on 2- and 4-stroke engines



On 2- and 4-stroke application the software automatically calculates the curve to optimise TDC position for Pcomp value of each cylinder

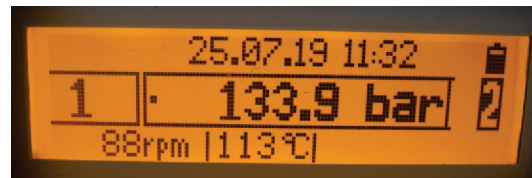
to keep your engine in balance

EPM-XP^{plus} - Engine Analyser

The engine analyser EPM-XP^{plus} is a further development of the well-proven electronic indicator EPM-XP. It offers new functions that enable a specific combustion analysis for an increased engine diagnostic.

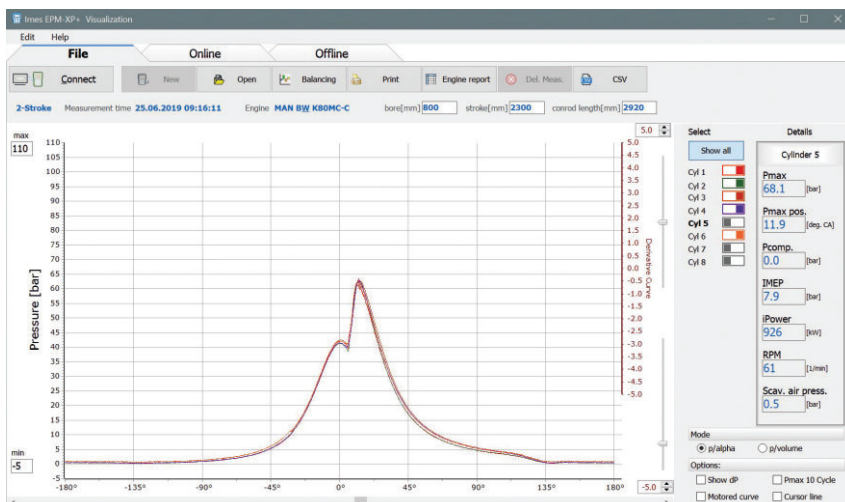
Advanced features of EPM-XP^{plus}

- Higher battery capacity - power more than 20 hours
- Continuous measurement to analyse actual engine condition by direct data transfer via USB/Ethernet to PC software
- Comprehensive analysing software for ships- and power plant application
- **Optional** direct data transfer to IPE (IMES Performance Evaluation software)
- **Optional** vibro sensor for definition of fuel injection timing and valves timing in preparation



The enhanced display gives detailed information about:

- **date**
- **time**
- **battery status**
- **cylinder no.**
- **pressure**
- **2- or 4-stroke engine**
- **RPM**
- **temperature of measuring element**



The visualisation software displays cylinder pressure sequences and the stored measurement data can be used for offline analysis to identify abnormal combustion behaviour.

Furthermore, the software enables an extensive evaluation of engine performance data and important combustion parameters can be directly transferred to the IMES expert software (IPE).

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 a higher accuracy, the data Pmax and speed will be displayed exactly on the LCD screen and up to 200 measurements can be stored.



We deliver worldwide!

Professional support worldwide due to our global sales organisation.

www.imes.de/sales-team.html