Original operating instruction

Electronic Analyser
## Revision History

<table>
<thead>
<tr>
<th>Version</th>
<th>Brief Description of Changes</th>
<th>Date of Issue</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>EPM-XP&lt;sup&gt;plus&lt;/sup&gt; First version</td>
<td>05-August-2019</td>
</tr>
<tr>
<td>1.1.0.0</td>
<td>New functions: Trending, Save reference files, Optimisation of Pcomp calculation</td>
<td>11-October-2019</td>
</tr>
<tr>
<td>1.2.2.0</td>
<td>New functions: Time indication of loading data set from hard disc, Indication of stored ASCII file on hard disc, Indication of reference curve, direct data transfer to IPE software, small bug fix solved. New firmware release: 1.36</td>
<td>16-December 2019</td>
</tr>
<tr>
<td>1.2.2.0</td>
<td>New firmware release: 1.38</td>
<td>14. January 2020</td>
</tr>
<tr>
<td>1.2.3.0</td>
<td>New functions: p/volume (log) diagram, new optimizing function, small bug fixed solved</td>
<td>06. March 2020</td>
</tr>
<tr>
<td>1.2.4.0</td>
<td>Correction of rounding error of older measurements Bug fix temperature indication of measuring cell solved Selection of *.csv format for export as “default value” or old format “EPM-XP”</td>
<td>25.March 2020</td>
</tr>
</tbody>
</table>
Imprint

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List of figures

1 Important information
   1.1 Use of the operator manual
   1.2 Copyright
   1.3 Warning Notices
   1.4 Address of the manufacturer
   1.5 Obligations of the operator

2 Safety
   2.1 Intended use
   2.2 Personnel requirements
   2.3 Safety notes

3 Transportation and packaging
   3.1 Safety notes for transportation
   3.2 Scope of delivery
   3.3 Packaging

4 Technical data
   4.1 Dimensions and weight of instrument case
   4.2 Other parameters

5 Scope of supply

6 Description
   6.1 Introduction
   6.2 Measure functions
   6.3 Functional description

7 Operation
   7.1 Operator push buttons
   7.2 Operating functions
   7.3 Install rechargeable batteries
      7.3.1 Install batteries to correct pole
      7.3.2 Confirm installed battery type
   7.4 Charge battery
   7.5 Measurements with EPM-XP Plus

8 Installation of visualisation- and USB driver software

9 Visualisation software release 1.2.4.0
   9.1 Screen page “File” Start up Window
   9.2 Download measured data to PC
   9.1 Visualisation of measured data on PC
      9.1.1 P/alpha diagram
      9.1.2 P/volume diagram

Page 4 of 66
9.1.3 P/volume (log) ____________________________________ 29
9.1.4 Open saved data ___________________________________ 29
9.1.5 Balance diagrams __________________________________ 30
9.1.6 Engine report _____________________________________ 31
9.1.7 Trending __________________________________________ 31
9.1.8 Save to ASCII format ________________________________ 33
9.1.9 Change “Engine settings” ______________________________ 34
9.1.10 Solver configuration ________________________________ 34
9.1.11 Optimize TDC calculation ___________________________ 35
9.1.12 Save as reference file ______________________________ 36
9.1.13 Open a reference file ______________________________ 36
9.1.14 Delete measurements on EPM-XPplus ________________ 37

9.1 Online measurements on engines with EPM-XPplus _______ 38
9.1.1 Preparation of EPM-XPplus for online measurements on 2-stroke engines 38
9.1.2 Preparation of EPM-XPplus for online measurements on 4-stroke engines 39
9.1.3 Preparation of EPM-XPplus for online measurements via Ethernet cable 41
9.1.4 Screen page “File” ___________________________________ 42
9.1.5 Screen page “Online” ________________________________ 43
9.1.6 Screen page “Offline” ________________________________ 48

9.2 Update firmware to EPM-XPplus from visualisation software 52
9.2.1 Check actual firmware version ________________________ 52

10 Accuracy check ________________________________________ 53
10.1 Check on pressure calibrator ____________________________ 54
10.1 Example of static pressure indication _____________________ 56

11 Cleaning ______________________________________________ 57
11.1 Periodically cleaning ___________________________________ 57
11.2 Cleaning in case of hard deposit __________________________ 57
11.3 Cleaning procedure of adaptor ____________________________ 58
11.4 Cleaning procedure of cylinder pressure sensor _____________ 58

12 Basic check for fault finding _______________________________ 59

13 Nomenclature __________________________________________ 59

14 Option ________________________________________________ 60
14.1 IMES IPE Performance evaluation software ________________ 60
14.2 Ethernet cable 20m ______________________________________ 61
14.3 USB Extender for connection to Ethernet cable ____________ 62
14.4 Thompson adaptor for 4-stroke continuous online measurement 63
14.5 Pressure pump coupling for Thompson adaptor _____________ 64
14.6 Thread cleaner for Thompson thread ________________________ 65

15 EU Declaration of Conformity _______________________________ 66

List of figures
Figure 1: EPM-XPplus incl.all components in instrument case........................................14
Figure 2: Push buttons ......................................................................................................15
Figure 3: 4 pcs. re-chargeable battery in the transport case.............................................17
Figure 4: Back side of EPM-XP incl. protection cover  Figure 5: Battery case ..................17
Figure 6: Battery holder .................................................................18
Figure 7: 4 x NiMH AAA 930 mAh installed on battery holder .................18
Figure 8: Selection of installed battery type ........................................18
Figure 9: Indication during charging process .......................................19
Figure 10: Indication charging process completed ..................................19
Figure 11: Indicator cock Figure 12: Adaptor installed on indicator cock ..........19
Figure 13: Indication of 2-stroke mode Figure 14: Indication of 4-stroke mode .......19
Figure 15: Warming up sensor Figure 16: Indication during measurement ..........20
Figure 17: Indication of measurement results on display for 3s ...................20
Figure 18: Indication over temperature on measuring cell of sensor ..............20
Figure 19: Dialog of installation ..........................................................21
Figure 20: Select Destination Location ..................................................21
Figure 21: Start Menu Folder .............................................................22
Figure 22: Select additional tasks .........................................................22
Figure 23: Ready to install .................................................................22
Figure 24: Ready to install .................................................................23
Figure 25: Installation completed ..........................................................23
Figure 26: EPM-XPplus connected via USB cable to PC ...............................24
Figure 27: Start up window of EPM-XPplus ............................................24
Figure 28: EPM-XPplus unit connected to visualisation software .................25
Figure 29: Selection of engine configuration ...........................................25
Figure 30: Entering of specific engine data ..............................................25
Figure 31: Selection of directory on hard disc of PC for saving data ...............26
Figure 32: Downloading and optimization process of measured data .............26
Figure 33: p/alpha diagram .................................................................27
Figure 34: Functions of p/alpha diagram ................................................27
Figure 35: Cursor line functions of p/alpha diagram ....................................28
Figure 36: p/volume diagram ...............................................................28
Figure 37: p/volume (log) diagram ........................................................29
Figure 38: Button “Open” ....................................................................29
Figure 39: Stored measurement file .......................................................29
Figure 40: Information about cylinder during uploading process ..................30
Figure 41: Balance diagram ..................................................................30
Figure 42: Engine report diagram ..........................................................31
Figure 43: Overview of bush puttons ....................................................31
Figure 44: Selection criteria for measurement files ......................................31
Figure 45: Selection of measurement files ...............................................32
Figure 46: Selection criteria for values and cylinder ....................................32
Figure 47: Display of trending function ...................................................33
Figure 48: Tools ...............................................................................33
Figure 49: CSV .............................................................................33
Figure 50: CSV file selection ..................................................................33
Figure 51: Selection field ......................................................................34
Figure 52: “Engine settings” ..................................................................34
Figure 53: “Motor data” .....................................................................34
Figure 54: “Options” .........................................................................34
Figure 55: “Options” .........................................................................34
Figure 56: Cylinder pressure curve incl. motored curve ...............................35
Figure 57: Shifted Cylinder pressure curve incl. motored curve .....................35
Figure 58: Button “Save REF” ..............................................................36
Figure 59: Save the reference on hard disc of PC .......................................36
Figure 60: Button “Open REF” .............................................................36
Figure 61: Selection of reference curve on hard disc of PC ............................36
Figure 62: Display of selected reference curve in comparison to a cylinder curve ...37
Figure 63: Close reference curve ..............................................................37
Figure 64: Button “Del.Meas”.................................................................37
Figure 65: Indicator cock .................................................................38
Figure 66: Adaptor installed on indicator cock ........................................38
Figure 67: EPM-XPplus connected to notebook ....................................38
Figure 68: Disconnection of spring ......................................................39
Figure 69: Disconnection of sensor from adaptor ...................................39
Figure 70: Connection of HTT-04 sensor on special cooling adaptor .......39
Figure 71: Indicator cock .................................................................40
Figure 72: Adaptor installed on indicator cock ......................................40
Figure 73: EPM-XPplus connected via USB cable to notebook .............40
Figure 74: Overview of online measurement with EPM-XPplus ..........41
Figure 75: Overview of Ethernet connection to EPM-XPplus .............41
Figure 76: Indication on display for successful connection to PC ..........42
Figure 77: Start up window of EPM-XPplus ........................................42
Figure 78: EPM-XPplus unit connected to visualisation software ..........43
Figure 79: Indication of online pressure curve ......................................43
Figure 80: Online pressure curve manual shifted by arrow function .......44
Figure 81: Example for over temperature on measuring cell of sensor ...44
Figure 82: Button “Pressure curve save” ..............................................45
Figure 83: Register for saving the file ..................................................45
Figure 84: Indication of online pressure curve during saving process ....46
Figure 85: Button “Working cycle save” ................................................46
Figure 86: Register for saving the file ..................................................46
Figure 87: Indication of online Pmax data ..............................................47
Figure 88: Indication of Pmax data during recording process ...............47
Figure 89: Example for over temperature on measuring cell of sensor ...48
Figure 90: Screen page “Offline” ..........................................................48
Figure 91: Button “100 Pressure curve open” .........................................49
Figure 92: Register of saved file ..........................................................49
Figure 93: Indication of pressure cycles ...............................................49
Figure 94: Button “Working cycle open” ...............................................50
Figure 95: Screen page “working cycle offline” .....................................50
Figure 96: Register of saved working cycle data file .............................50
Figure 97: Selection of saved Pmax working cycle ...............................51
Figure 98: Indication of selected Pmax data ..........................................51
Figure 99: Button “Connect” ..............................................................52
Figure 100: Selection “Tools” ..............................................................52
Figure 101: Selection “Firmware” ........................................................52
Figure 102: Load-and update firmware ...............................................52
Figure 103: Indication of main menu ....................................................52
Figure 104: Indication of device info ...................................................52
Figure 105: Indication of actual firmware ............................................53
Figure 106: Calibration certificate of EPM-XPplus unit ..........................53
Figure 107: Thompson Adaptor mounted on pressure plate ...............54
Figure 108: Example for indication of static pressure @ 0 bar ...............54
Figure 109: Example for indication of static pressure @ 50 bar ...............55
Figure 110: Indication of main menu ...................................................55
Figure 111: Indication of measuring mode ............................................55
Figure 112: Indication of sensor test ....................................................55
Figure 113: Indication @ 0 bar on display ............................................55
Figure 114: Indication @ 50 bar ............................................................56
Figure 115: Indication on pressure pump .............................................56
Figure 116: Periodical cleaning of gas channel ....................................57
Figure 117: Disconnection of spring ...................................................57
Figure 118: Disconnection of sensor from adaptor .............................57
Figure 119: Drill 2.5 mm .................................................................58
Figure 120: Drill in gas channel of adaptor for cleaning ....................58
Figure 121: Special drill tool ..............................................................58
Figure 122: Special drill tool in gas channel of sensor .......................58
Figure 123: Example IPE software .....................................................60
Figure 124: Ethernet cable ...............................................................61
Figure 125: USB-Ethernet Extender ..................................................62
List of tables

- Table 1: Dimensions and weight
- Table 2: Technical specification
- Table 3: Functions of push buttons
- Table 4: Static pressure comparison
- Table 5: Basic check for fault finding
- Table 6: Nomenclature
1 Important information

Please study this manual carefully, before using the equipment. This will ensure that you will receive maximum benefits from using this engine performance tuning tool with its versatile functionality and it will guarantee optimum benefits over its lifetime.

1.1 Use of the operator manual

We strongly recommend you to read the complete manual before using the equipment.

It was our intention to structure this manual in a clear layout, to enable you to get easy and instant access to the information you are looking for. Please keep this manual in a safe place where it is always available for easy access.

1.2 Copyright

These operating instructions have to be treated confidentially. They may only be used by the persons authorised to this effect. They may only be given to third parties with the written consent of IMES GmbH.

All documents are protected under copyright law. Dissemination and reproduction of documents or parts of documents as well as the utilisation and communication of their contents are prohibited, unless expressly permitted. Infringements are punishable and liable to damages. We reserve all rights to exercise industrial property rights.

1.3 Warning Notices

In the present operating instructions the following warning notices are used:

A warning notice of this risk level signals a potentially dangerous situation. If the dangerous situation is not prevented, this could lead to death or serious injury to persons. Follow the instructions in this warning notice to prevent the possible risk of death or serious injury to persons.
A warning notice of this risk level signals a potentially dangerous situation. If the dangerous situation is not prevented, this could lead to damage to property. Follow the instructions in this warning notice to prevent damage to property.

A note identifies additional information that facilitates the handling of the device.

### 1.4 Address of the manufacturer

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Germany

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e-mail: info@imes.de

Web: www.imes.de
1.5 **Obligations of the operator**

The EPM-XP\textsuperscript{plus} may be a source of danger if used in an improper manner or not in proper condition. The operator is obliged to operate the EPM-XP\textsuperscript{plus} only in proper condition. Hazard areas arising between IMES devices and customer equipment are to be secured by the operator.

The operator must designate and instruct responsible persons:
- Only employ trained or instructed personnel.
- Clearly define the responsibilities of the personnel for operation, maintenance, and repair.
- Regularly check if the personnel is working with due safety and risk awareness whilst observing the operating instructions.
- Before starting work, the personnel assigned to work with the EPM-XP\textsuperscript{plus} must have read and understood the operating instructions, in particular the "Safety" chapter, as well as the applicable regulations.
- Keep the operating instructions and applicable regulations accessible to the operating and servicing personnel.
- Determine the responsibility of the user and allow him to reject all third party instructions that are in breach of safety regulations.
- For safe operation of this EPM-XP\textsuperscript{plus} it is required to wear safety glasses and gloves. Further protective equipment has to be worn according to the applicable regulations of the operator.

\section*{NOTE}

In addition to the operating instructions, observe and follow general legal and other binding accident prevention and environmental protection regulations.

\section*{2 Safety}

2.1 **Intended use**

\section*{WARNING}

Risk of injury due to non-intended use.
EPM-XP\textsuperscript{plus} may be a source of danger if operated not in compliance with the intended use and/or being used otherwise.

- Use the EPM-XP\textsuperscript{plus} for its intended purpose only.
- Observe the procedure described in the operating instructions.

The EPM-XP\textsuperscript{plus} may only be used for measuring combustion pressure on engines. Any other use of the EPM-XP\textsuperscript{plus} is impermissible. The manufacturer/supplier accepts no liability for damage resulting from non-intended use. The risk exclusively rests with the user/operator.
2.2 Personnel requirements

**Warning**

Work on/with the EPM-XP\textsuperscript{plus} may only be carried out by persons who, because of their education and qualification, are qualified to do so. Furthermore, they must have been commissioned to do so by the operator.

Personnel to be trained, instructed or briefed or operating personnel receiving general training may only be allowed to work with the device under the permanent supervision of an experienced operating person. Maintenance and repair work may only be carried out by the manufacturer.

2.3 Safety notes

Observe the following notes for preventing accidents while using the EPM-XP\textsuperscript{plus}:

- Operate the EPM-XP\textsuperscript{plus} only in proper condition.

- Adjustment and/or maintenance work is to be carried out by authorised professionals.

- Before using the EPM-XP\textsuperscript{plus}, check it for defects and deficiencies visible on the outside. Immediately notify any changes (including changes in operating behaviour) to the competent staff/person. If necessary, immediately put the device out of service and lock/tag it out!

- Keep the operating instructions near the EPM-XP\textsuperscript{plus} so as to be readily available at any moment.

- Non-observance of the safety notes contained in these operating instructions may result in property damage, injuries or even death of persons.

3 Transportation and packaging

3.1 Safety notes for transportation

**CAUTION**

Property damage due to improper transportation! Improper transportation may cause property damage.

- During unloading of packing pieces upon delivery and during internal transportation proceed with care, do not let the packing pieces fall.

- Do not subject the device to any hard shocks and protect it against all kinds of acts of violence.
3.2 Scope of delivery
For the exact scope of supply please refer to the order documents and compare to the delivery note.

Check for completeness
Check the entire delivery for completeness based on the attached delivery note. In this context, we are referring to our conditions of sale and delivery.

Report any damage
Immediately report to the carrier, insurance company and the delivering factory any damage to the device due to improper packaging or transportation identified after delivery. Take action to mitigate the damage that has occurred and prevent further damage.

3.3 Packaging
Unless an agreement was made with IMES GmbH regarding the return of the packaging material, the packaging material remains with the customer.
The most commonly used packaging materials cardboard.

Disposal that is environmentally compatible and in compliance with the applicable disposal regulations must be ensured. If necessary, employ a waste disposal company to dispose of the packaging material.

4 Technical data

4.1 Dimensions and weight of instrument case

<table>
<thead>
<tr>
<th></th>
<th>cm</th>
<th>kg</th>
</tr>
</thead>
<tbody>
<tr>
<td>Length:</td>
<td>45</td>
<td></td>
</tr>
<tr>
<td>Width:</td>
<td>35</td>
<td></td>
</tr>
<tr>
<td>Height:</td>
<td>11</td>
<td></td>
</tr>
<tr>
<td>Weight of instrument case</td>
<td>2.7</td>
<td></td>
</tr>
</tbody>
</table>

Table 1: Dimensions and weight

4.2 Other parameters

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Measuring range</td>
<td>0...300 bar</td>
</tr>
<tr>
<td>Accuracy (EPM-XDplus unit incl. HTT® sensor)</td>
<td>+/- 0.5 % full scale</td>
</tr>
<tr>
<td>Sampling resolution</td>
<td>0.05°CA on two-stroke ; 0.1°CA on four stroke</td>
</tr>
<tr>
<td>Resonance frequency HTT®-sensor</td>
<td>&gt;100 kHz</td>
</tr>
<tr>
<td>Max. temperature at measuring cell</td>
<td>300 °C (short time 1 minute 350 °C)</td>
</tr>
<tr>
<td>Storing capacity</td>
<td>20 measurements / engine</td>
</tr>
<tr>
<td>Online measurement</td>
<td>Via USB- / Ethernet cable</td>
</tr>
<tr>
<td>Interface</td>
<td>USB—HID</td>
</tr>
<tr>
<td>Battery</td>
<td>4 x NiMh AAA 930 mAh</td>
</tr>
<tr>
<td>Weight incl. sensor and adaptor</td>
<td>1100 g</td>
</tr>
<tr>
<td>Dimension incl. protection cover</td>
<td>210 x 100 x 80 mm</td>
</tr>
</tbody>
</table>

Table 2: Technical specification
5 Scope of supply

The scope of supply includes the following components:

- EPM-XP<sup>plus</sup> unit incl. protection cover incl. cylinder pressure sensor mounted on Thompson adaptor
- Tool for to open- and close the Thompson adapter
- 4 pcs. 4 x NiMh AAA 930 mAh
- 1 x USB-cable (1m)
- 1 x USB stick (documentation English/German and visualisation software)
- 1 x Quickstep manual in English language(printed)
- 1 x Certificate of calibration (printed)

Figure 1: EPM-XP<sup>plus</sup> incl.all components in instrument case

6 Description

6.1 Introduction

The electronic indicator EPM-XP<sup>plus</sup> is a handy-, battery powered-, portable device to measure and evaluate cylinder pressure on 2- and 4-stroke diesel engines at speed up to 1800 RPM.

The EPM-XP<sup>plus</sup> collect 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 can be stored in memory.

Up to 20 measurement data sets can be stored in the EPM-XP<sup>plus</sup>. The stored data can be downloaded via USB-interface to a personal computer for evaluation.

The scope of supply includes software for Windows which allows additional evaluation and visualisation of the collected data.

Additional continuous online measurement on one cylinder to analyse actual engine condition by direct data transfer via USB/Ethernet (max. length 50m) to PC
6.2 Measure functions

Offline function
Pmax: Average of 10 cycles
Pressure curve: Average of 10 cycles
RPM: engine speed

Online function
Continuous online measurement on one cylinder

6.3 Functional description

The cylinder pressure will be measured with the EPM-XP⁺ unit incl. high temperature pressure sensor and thompson adaptor at indicator cock on diesel engines.

Memory: 20 data sets
Application 2-stroke: 40 – 950 RPM
Application 4-stroke: 200 – 1800 RPM

NOTE
The EPM-XP⁺ turns off automatically after 10 minutes without pressing any push button

7 Operation

7.1 Operator push buttons

Arrow up “↑” — Start measurement
Arrow down “↓” — Read measurement
On/Off — 2- or 4-stroke Set-up menu

Figure 2: Push buttons
### 7.2 Operating functions

<table>
<thead>
<tr>
<th>Function</th>
<th>Key board push button</th>
<th>Display</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Switch On/Off</td>
<td></td>
<td><img src="image1.png" alt="Image" /></td>
<td>Indication after switch “On/Off” button. The user will be informed about engine selection. Basic settings will be displayed after switching on: Date and time Cyl:1 = cylinder no.1 2- or 4-stroke Pmax in bar ; RPM: speed After connection on cylinder and opening on indicator cock the Pmax value in bar and engine speed will be displayed.</td>
</tr>
<tr>
<td>Engine selection</td>
<td></td>
<td><img src="image2.png" alt="Image" /></td>
<td>Push key “2/4&quot; to select 2- or 4-stroke engine “Indication 2-stroke” “Indication 4-stroke”</td>
</tr>
<tr>
<td>Setup</td>
<td></td>
<td><img src="image3.png" alt="Image" /></td>
<td>Push 3s key “2/4&quot; to select settings: Clear memory, Battery type, Device info, Measuring mode, Selection of cylinder Push arrow key “↑↓“ and change the displayed value to the number of the selected cylinder. “Indication cylinder no.1” “Indication cylinder no.2”</td>
</tr>
<tr>
<td>Start measurement</td>
<td><img src="image4.png" alt="Image" /></td>
<td><img src="image5.png" alt="Image" /></td>
<td>During measurement the following information “Recording cylinder” will be indicated. Display indication (1-2 s) of measured cylinder values. Then EPM-XPPLUS unit switches automatically to the next cylinder.</td>
</tr>
</tbody>
</table>
Table 3: Functions of push buttons

<table>
<thead>
<tr>
<th>Function</th>
<th>Keyboard push button</th>
<th>Display</th>
<th>Notes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Show measurements</td>
<td></td>
<td><img src="image" alt="Read" /></td>
<td>The measured value for Pmax and speed of the selected cylinder will be displayed.</td>
</tr>
</tbody>
</table>

### 7.3 Install rechargeable batteries

IMES recommends to use rechargeable battery type Panasonic envelope AAA pro 930 mAH

![Figure 3: 4 pcs. re-chargeable battery in the transport case](image)

Please disconnect EPM-XP\textsuperscript{plus} from protection cover (fig.4) and open battery case (fig.5) and put re-chargeable batteries into the the battery holder (fig.6).

![Figure 4: Back side of EPM-XP incl. protection cover](image)

![Figure 5: Battery case](image)
7.3.1 Install batteries to correct pole.

Figure 7: 4 x NiMh AAA 930 mAh installed on battery holder

Note: It is also possible to use Alkaline batteries type AAA

7.3.2 Confirm installed battery type

Start EPM-XPplus by pressing “On/Off”. The setup menu (fig.8) asked for confirmation of installed battery type. The standard battery type is NiMh rechargeable.

Figure 8: Selection of installed battery type

Select item by arrow key and confirm selection by pressing “2/4” button
7.4 Charge battery

The EPM-XPplus has 4 pcs. re-chargeable battery type AAA. The battery charging (fig.9) will start after the EPM-XPplus unit is connected via USB cable to PC and battery voltage is lower than 5,3 V.

Indication of USB connection to PC

![Figure 9: Indication during charging process](image)

The indicator can detect the charging status and continuous charging until the rechargeable batteries are fully loaded (fig.10). Then the charging process stops automatically. It is not recommended to interrupt the charging process before it is automatically stopped.

7.5 Measurements with EPM-XPplus

- **Start measurements on the engine**
  
  *2- and 4- stroke application*

  Open indicator cock and close (fig.11). Install sensor with adaptor on cylinder no.1 and open indicator cock (fig.12)

![Figure 11: Indicator cock](image)

![Figure 12: Adaptor installed on indicator cock](image)

Press button “On/Off” at EPM-XPplus

![Figure 13: Indication of 2-stroke mode](image)

![Figure 14: Indication of 4-stroke mode](image)

The EPM-XP starts always in the last selected engine mode (fig.13 and fig.14). Press button “2/4” for to change adjusted engine mode.
Press “Measure” and the measurement starts after warming up sensor to minimum temperature of 50°C (fig.15). After achieving minimum sensor temperature the measurement starts incl. the following indication (fig.16)

![Figure 15: Warming up sensor](image1)

![Figure 16: Indication during measurement](image2)

Note: It is possible to start without warming up sensor by press “Measure”

- **Indication of measurement results**

  No. of cylinder  Date and time  engine type 2- or 4-stroke

![Figure 17: Indication of measurement results on display for 3s](image3)

Engine speed  Temperature of measuring element during measurement

After indication of measured cylinder values (fig.17) the display switches automatically to next cylinder. Repeat measuring procedure for all remaining cylinders.

---

**WARNING**

DANGER! The indicator valve ejects hot gas under high pressure. Danger of sparks and burning. Hot gases and particles may be ejected. Please use safety gloves and safety glasses!

---

**NOTE**

The EPM-XPplus has an overheating protection of measuring cell for temperature >300°C. In case of indication “Over temp.!” (fig.18) on display the indicator cock should be immediately closed and Thompson adaptor disconnected for cooling down sensor (10 min).

![Figure 18: Indication over temperature on measuring cell of sensor](image4)
8 Installation of visualisation- and USB driver software

The user must have administrator rights on the PC for soft- and USB driver installation.

For installation the Setup_EPMXPP_Win7_1230.exe file is necessary. The software installed USB driver and visualization in one step.

The installation will be started by double click on „Setup_EPMXPP_Win7_1240.exe“.

For installation of software the user must have administrator rights on PC.

![Figure 19: Dialog of installation](image)

![Figure 20: Select Destination Location](image)
Figure 21: Start Menu Folder

Figure 22: Select additional tasks

Figure 23: Ready to install
Figure 24: Ready to install

Figure 25: Installation completed
9 Visualisation software release 1.2.4.0

Please connect EPM-XP\textsuperscript{plus} by USB cable to PC (fig. 26). Start by double click visualisation software and press “Connect” (fig. 27).

![Image of EPM-XP\textsuperscript{plus} connected via USB cable to PC]

**Figure 26:** EPM-XP\textsuperscript{plus} connected via USB cable to PC

9.1 Screen page “File” Start up Window

Press “Connect”

![Image of Start up window of EPM-XP\textsuperscript{plus}]

**Figure 27:** Start up window of EPM-XP\textsuperscript{plus}
9.2 Download measured data to PC

Press \[ \text{Download} \] to download measured data from EPM-XP\(^{\text{plus}}\) to visualisation software. The following information will appear.

![Image](image.png)

Figure 29: Selection of engine configuration

Entering engine no.; selection of engine and entering ship name and press “OK”

![Image](image.png)

Figure 30: Entering of specific engine data
Figure 31: Selection of directory on hard disc of PC for saving data

After selection of directory the information of downloading process will appear.

Figure 32: Downloading and optimization process of measured data
9.1 Visualisation of measured data on PC

9.1.1 P/alpha diagram

Figure 33: p/alpha diagram

Figure 34: Functions of p/alpha diagram
9.1.2 P/volume diagram

Figure 35: Cursor line functions of p/alpha diagram

Arrow function to shift curves with 0.05 resolution on 2 strokes.
On 4-strokes shift curves with 0.1 resolution.

Figure 36: p/volume diagram
9.1.3 P/volume (log)

Figure 37: p/volume (log) diagram

9.1.4 Open saved data

Press button “Open” (fig.38) for opening register of stored measurement files.

![Open button](image)

Figure 38: Button “Open”

The data file is stored on hard disc on PC on the following directory:
Select measurement file and klick “Open” (fig.39)

![Stored measurement file](image)

Figure 39: Stored measurement file

Information during uploading process to visualization software (fig.39)
9.1.5 Balance diagrams

Selection for indication of Pmax, Pcomp, IMEP and Ipower

Figure 41: Balance diagram
9.1.6 Engine report

Figure 42: Engine report diagram

9.1.7 Trending

Figure 43: Overview of bush puttons

Figure 44: Selection criteria for measurement files
Figure 45: Selection of measurement files

Press “Open”

Figure 46: Selection criteria for values and cylinder

Selection of data files with similar outputs

Deviation of data files

Selection of values

Selection of cylinder

Press “Show values”
9.1.8 Save to ASCII format

Press tools (fig.48) and select “CSV” (fig.49) for storing data in ASCII format. The user can select data for export to “EPM-XP csv-format” or as “Default csv-format” (fig.50). Customers which have an expert system of ABB/Tekomar should select “EPM-XP csv-format” for data export/import.

Figure 47: Display of trending function

Figure 48: Tools

Figure 49: CSV

Figure 50: CSV file selection
9.1.9 Change “Engine settings”
Press “Edit” and select “Engine” (see fig. 51) to change engine selection or select “Motor data” for manual input of changed specific engine data.

Figure 51: Selection field

Figure 52: “Engine settings”

Figure 53: “Motor data”

9.1.10 Solver configuration
The solver configuration allows an additional method of TDC calculation. Press “Options” (fig. 54) . Select Solver selection (fig.55) and select recalculate TDC.

Figure 54: “Options”

Figure 55: “Options”
9.1.11 Optimize TDC calculation

For optimizing TDC calculation the user has the possibility to shift the TDC by use of arrow functions (fig.56)

Figure 56: Cylinder pressure curve incl. motored curve

Figure 57: Shifted Cylinder pressure curve incl. motored curve
9.1.12 Save as reference file
Press button “Save REF” (fig. 58) to save a curve as a reference file.

![Save REF](image)

Figure 58: Button “Save REF”

![Save the reference on hard disc of PC](image)

Figure 59: Save the reference on hard disc of PC

9.1.13 Open a reference file
Press button “Open REF” (fig. 60) to open a curve as a reference file.

![Open REF](image)

Figure 60: Button “Open REF”

![Selection of reference curve on hard disc of PC](image)

Figure 61: Selection of reference curve on hard disc of PC
9.1.14 Delete measurements on EPM-XP\textsuperscript{plus}

Press button “Del.Meas.” (fig.64) to delete all measurements on EPM-XP\textsuperscript{plus}.

Figure 62: Display of selected reference curve in comparison to a cylinder curve

Figure 63: Close reference curve

Figure 64: Button “Del.Meas”
9.1 Online measurements on engines with EPM-XPplus

For online measurements on an indicator cock of a selected cylinder the EPM-XPplus must be connected via USB cable to notebook.

9.1.1 Preparation of EPM-XPplus for online measurements on 2-stroke engines

Open indicator cock and close (fig.65). Install sensor with adaptor on selected cylinder and open indicator cock (fig.66). Start measure on EPM-XPplus and connect EPM-XPplus to notebook via USB cable (fig.67). Please select engine type 2-or 4 stroke on EPM-XPplus and press by arrow file the selected cylinder.

Figure 65: Indicator cock

Figure 66: Adaptor installed on indicator cock

Figure 67: EPM-XPplus connected to notebook
9.1.2 Preparation of EPM-XPplus for online measurements on 4-stroke engines

Warning

For online measurements with EPM-XPplus on 4-stroke engines it is not allowed to use standard Thompson adaptor because of extreme high temperature. The user must use a special cooling adaptor for online measurements on 4-strokes.

Please disconnect sensor from adaptor by using tools with wrench size 19 mm and 27 mm (fig.68). Before disconnection of sensor from adaptor spring must be disconnected from adaptor (fig.69). with hexagon socket screw key (2.5mm).

Please connect sensor to special cooling adaptor and use wrench size 19 mm and 27 mm (fig.70). The tightening torque should be 25 Nm.

Figure 68: Disconnection of spring

Figure 69: Disconnection of sensor from adaptor

Figure 70: Connection of HTT-04 sensor on special cooling adaptor
Open indicator cock and close (fig. 71). Install sensor with adaptor on the selected cylinder and open indicator cock (fig. 72). Start “Measure” on EPM-XP\textsuperscript{plus} and connect EPM-XP\textsuperscript{plus} to notebook via USB cable (fig. 73). Please select engine type 2-or 4 stroke on EPM-XP\textsuperscript{plus} and press by arrow file the selected cylinder.

Figure 71: Indicator cock

Figure 72: Adaptor installed on indicator cock

Figure 73: EPM-XP\textsuperscript{plus} connected via USB cable to notebook
9.1.3 Preparation of EPM-XPplus for online measurements via Ethernet cable

In case the notebook or PC is installed more than 2m distance to EPM-XPplus, it is necessary to use Ethernet cable with max. cable length 50m incl. USB/Ethernet converters (fig.74 and fig.75). Please use shielded Ethernet cable (see chapter 14).

Figure 74: Overview of online measurement with EPM-XPplus

Figure 75: Overview of Ethernet connection to EPM-XPplus
Open indicator cock and close (fig.71). Install sensor with adaptor on selected cylinder and open indicator cock.

**Please do the following procedure:**

1. Start measure on EPM-XP\(^{+}\) plus and select engine type by arrow function
2. Connect USB cable (1 m) to EPM-XP\(^{+}\) plus
3. Connect USB/Ethernet converter to USB cable (1m) and to Ethernet cable
4. Connect USB/Ethernet converter incl. USB cable (0,2m) to Ethernet cable
5. Connect USB/Ethernet converter incl. USB cable (0,2m) to PC

USB-indication should be indicated on display (see fig.76).

![USB-indication on display](image)

Figure 76: Indication on display for successful connection to PC

### 9.1.4 Screen page “File”

Start by double click visualisation software and press “Connect” (fig. 77).

Press “Connect”

![Start up window of EPM-XP\(^{+}\) plus](image)

Figure 77: Start up window of EPM-XP\(^{+}\) plus
Indication of successful connection of EPM-XP\textsuperscript{plus} to visualisation software(fig.78)

![Image of EPM-XP\textsuperscript{plus} unit connected to visualisation software]

Figure 78: EPM-XP\textsuperscript{plus} unit connected to visualisation software

9.1.5 Screen page “Online”

Please click “Online” for pressure curve visualisation (fig.79)

![Image of pressure curve on screen]

Figure 79: Indication of online pressure curve
2- or 4-stroke Engine speed

Manual input of scavenge air pressure

Temperature of measuring element during measurement

Figure 80: Online pressure curve manual shifted by arrow function

Figure 81: Example for over temperature on measuring cell of sensor
Warning

In case of temperature indication of more than 300 °C please close indicator cock immediately and disconnect Thompson adaptor from indicator cock for cooling down adaptor.

9.1.5.1 Save pressure curve

Press button “Pressure curve save”.
The file will be saved under Press_year_month-date in the register (fig.82)
C:\Users\name\documents\IMES_EPMXplus_Data\press_year_month_data (fig.83)

Figure 82: Button “Pressure curve save”

Figure 83: Register for saving the file
Please press button “Stop Saving” for to stop saving pressure curves (fig.84).

Figure 84: Indication of online pressure curve during saving process

9.1.5.2 Save Working cycle

Press button “Working cycle save”. (fig.85)
The file will be saved under “WorkCycl_year_month-date” in the register (see fig.86)
C:\Users\name\documents\IMES_EPMXPplus_DATA\WorkCycl_year_month_data

Figure 85: Button “Working cycle save”

Figure 86: Register for saving the file
Please button “close recording” for to stop saving pressure curves.
Figure 89: Example for over temperature on measuring cell of sensor

**Warning**

In case of temperature indication of more than 300 °C please close indicator cock immediately and disconnect Thompson adaptor from indicator cock for cooling down adaptor.

### 9.1.6 Screen page “Offline”

Select screen page “Offline” (fig.90)

Figure 90: Screen page “Offline”
9.1.6.1 Open saved pressure curves

Press button “100 Pressure curve open”. (fig.91)
The file will be opened under “Press_year_month-date” in the register
C:\Users\name\documents\IMES_EPMXPplus_DATA\WorkCycl_year_month_data (fig.92)

Figure 91: Button “100 Pressure curve open”

![Open EPM Xplus pressure curve data](image1)

Figure 92: Register of saved file

Buttons for cycle selection and indication

![Indication of pressure cycles](image2)

Figure 93: Indication of pressure cycles
9.1.6.2 Open saved working cycles

Click on button “Working cycle open” (fig.94)

Figure 94: Button “Working cycle open”

Select “Open file” (fig.95)

Figure 95: Screen page “working cycle offline”

Press button “Working cycle open”. (fig.95)

The file will be opened under “WorkCycl_year_month-date” in the register
C:\Users\name\documents\IMES_EPMXPplus_DATA\WorkCycl_year_month_data (fig.96)

Figure 96: Register of saved working cycle data file
Please select start- and end time and press “Load data”

Figure 97: Selection of saved Pmax working cycle

Figure 98: Indication of selected Pmax data
9.2 Update firmware to EPM-XP plus from visualisation software

In case a new firmware update for EPM-XP plus is available. The user has the possibility to update the EPM-XP plus to new firmware.

The user has to do the following.

1. Press “On” at EPM-XP plus
2. Connect EPM-XP plus to PC by USB cable
3. Start visualisation software and press “Connect” (fig.99)
4. Select “Tools” (fig.100) and select “Firmware Update” (fig.101)
5. Load firmware (fig.102) from register C:\Users\name\documents\ 
6. Update firmware
7. Press On/OFF at EPM-XP for to check actual firmware release
8. Press 3s “2/4” button and select “device info” (fig.103 + fig.104 + fig.105)

9.2.1 Check actual firmware version

Press “On/Off” EPM-XP plus and press 3s button “2/4” the main menu will appear (fig.103)

Select by arrow function “device info” and select with button “2/4” (fig. 104)
Select with button “2/4” to indicate firmware version (fig.105)

Figure 105: Indication of actual firmware

10  Accuracy check

The EPM-XPplus is adjusted at IMES workshop at different pressure values (0…300 bar) and temperature values (50°C-200°C). The values are described at calibration certificate (see fig.106). A calibration certificate will be delivered with each EPM-XPplus unit.

The EPM-XPplus has a very stable and long life cylinder pressure sensor type HTT. We emphasize to check calibration values of EPM-XPplus on static pressure calibrator by hydraulic oil once a year.

Figure 106: Calibration certificate of EPM-XPplus unit
10.1 Check on pressure calibrator

We emphasize to mount thompson adaptor of EPM-XP\textsuperscript{plus} direct on a pressure plate (fig.107) which is connected by hydraulic house to pressure generator.

![Thompson Adaptor mounted on pressure plate](image)

**NOTE**

Remarks: The pressure plate (product-no.: IW-1574) is not in the scope of supply of EPM-XP\textsuperscript{plus} and can be ordered additional by IMES

Pressure connection thread G1/4” to hydraulic house to pressure generator

Figure 107: Thompson Adaptor mounted on pressure plate

We emphasize to check EPM-XP\textsuperscript{plus} at most frequently measured Pmax-value (fig.108) on engine. For example pressure values at 0 bar and between 50 bar – and 200 bar (fig.109).

![Example for indication of static pressure @ 0 bar](image)

Figure 108: Example for indication of static pressure @ 0 bar
Figure 109: Example for indication of static pressure @ 50 bar

Static pressure checking procedure on EPM-XPplus:

   a) Switch – On by pressing operating key “On/Off“ on EPM-XPplus
   b) Press 3s button “2/4“ for to enter into main menu (fig.110)

Figure 110: Indication of main menu

   c) Select by arrow function “Measuring mode” (fig. 111) and confirm with button “2/4”

Figure 111: Indication of measuring mode

   d) Select “Sensor test” (fig.112) and confirm with button “2/4”

Figure 112: Indication of sensor test

   e) Confirm with button “2/4“ and change to “Exit” by arrow function and confirm with button “2/4”. The following indication @ 0 bar will be displayed after 3-5 s on display (fig.113)

Figure 113: Indication @ 0 bar on display
f) Generate pressure calibrator for example 50 bar and compare displayed pressure value on EPM-XP\textsuperscript{plus} with indicated pressure value on pressure generator (fig.114 and fig.115)

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure114.png}
\caption{Indication @ 50 bar}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure115.png}
\caption{Indication on pressure pump}
\end{figure}

\section*{10.1 Example of static pressure indication}

\begin{table}[h]
\centering
\begin{tabular}{ccc}
\hline
Display on pressure generator [bar] & Display on EPM-XP\textsuperscript{plus} & Dev. in [bar] \\
\hline
0 & 0 & 0 \\
100 & 99 & 1 \\
200 & 198 & 2 \\
\hline
\end{tabular}
\caption{Static pressure comparison}
\end{table}

\textbf{NOTE}

The max. acceptable difference between adjusted pressure at pressure calibrator by ambient (20-25°C) temperature and displayed static pressure at EPM-XP\textsuperscript{plus} is +/- 2.5 bar. By increasing pressure difference we emphasize to send the unit to IMES workshop for new adjustment and calibration.
11 Cleaning

11.1 Periodically cleaning
Clean gas channel of thompson adaptor by compressed air periodically (see fig. 116)

![Periodical cleaning of gas channel](image)

Figure 116: Periodical cleaning of gas channel

---

**WARNING**

Before starting cleaning procedure the temperature of complete adaptor must have ambient temperature. It is not allowed to start cleaning process short after measurement on engine.

---

11.2 Cleaning in case of hard deposit
For elimination hard deposit please disconnect sensor from adaptor by using tools with wrench size 19 mm and 27 mm (fig.117). Before disconnection of sensor from adaptor spring must be disconnected from adaptor (fig.118). with hexagon socket screw key (2.5mm)

![Disconnection of spring](image)

Use with hexagon socket screw key(2,5 mm) for disconnection of spring from adaptor

![Disconnection of sensor from adaptor](image)

19 mm wrench size tool

27 mm wrench size tool

![Disconnection of sensor from adaptor](image)

Figure 117: Disconnection of spring

Figure 118: Disconnection of sensor from adaptor
11.3 Cleaning procedure of adaptor
Please use a drill with 2.5 mm diameter for to clean gas channel of adaptor (fig. 119 and fig. 120)

Figure 119: Drill 2.5 mm
Figure 120: Drill in gas channel of adaptor for cleaning

11.4 Cleaning procedure of cylinder pressure sensor
Please use the special drill tool and clean gas channel of HTT cylinder pressure sensor. (fig. 121 and fig. 122).
The length of gas channel is 29 mm. The max. entering length of special drill tool into gas channel is 28 mm which is marked. Do not try to drill more than 28 mm into gas channel!

Figure 121: Special drill tool
Figure 122: Special drill tool in gas channel of sensor
12 Basic check for fault finding

<table>
<thead>
<tr>
<th>Problem</th>
<th>Indication on EPM-XP/CAT</th>
<th>Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>No display indication after switch “On”</td>
<td><img src="image1.png" alt="Image" /></td>
<td>Charge battery by connecting to USB port from EPM-XPplus to PC</td>
</tr>
<tr>
<td>Over temperature indication <em>Indication after temperature of measuring cell &gt; 300 °C</em></td>
<td><img src="image2.png" alt="Image" /></td>
<td>Disconnect sensor from indicator cock and wait 5-10 minutes</td>
</tr>
<tr>
<td>Sensor defect</td>
<td><img src="image3.png" alt="Image" /></td>
<td>Sensor is defect. Please send EPM-XPplus unit to IMES workshop</td>
</tr>
</tbody>
</table>

Table 5: Basic check for fault finding

13 Nomenclature

<table>
<thead>
<tr>
<th>Item</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>RPM</td>
<td>Engine speed</td>
</tr>
<tr>
<td>Pmax</td>
<td>Maximum pressure [bar]</td>
</tr>
<tr>
<td>Pcomp</td>
<td>Compression pressure [bar]</td>
</tr>
<tr>
<td>dp/ca</td>
<td>Maximum rise of pressure curve [bar/ca]</td>
</tr>
<tr>
<td>Cycles</td>
<td>Number of working cycles</td>
</tr>
<tr>
<td>IMEP</td>
<td>Mean indicated pressure [bar]</td>
</tr>
<tr>
<td>lpower</td>
<td>Indicated power [kW]</td>
</tr>
</tbody>
</table>

Table 6: Nomenclature
14 Option

14.1 IMES IPE Performance evaluation software

- Order no. IW-8050  License for one 2-stroke engine and four 4-stroke engines (same type).

The IMES performance evaluation software (IPE) is designed to facilitate the collection, evaluation, management and comparison of engine performance data for marine diesel engines. It loads recorded cylinder pressure data from EPM-XP plus directly. Additional required information and parameters have to be entered so the programme can do ISO corrections and compare against new-engine performance benchmarks. Performance graphs and reports give a quick status of an engine and suggest actions to take for optimising engine conditions.

![Example IPE software](image)

Figure 123: Example IPE software
14.2 Ethernet cable 20m

- Order no. IW-8130

Figure 124: Ethernet cable
14.3 USB Extender for connection to Ethernet cable

- Order no. IW-1559

Figure 125: USB-Ethernet Extender
14.4 Thompson adaptor for 4-stroke continuous online measurement

- Order no. IW-1222

Figure 126: Thompson adaptor for 4-stroke online measurement
### 14.5 Pressure pump coupling for Thompson adaptor

- Order no. IW-1574

---

**Figure 127: Pressure pump coupling**

- Pressure connection thread W27x1/10 for Thompson adaptor
- Pressure connection thread G1/4" to hydraulic house to pressure generator
14.6 Thread cleaner for Thompson thread

- Order no. IW-1571

Figure 128: Thread cleaner for Thompson thread
15 EU Declaration of Conformity

In accordance with EN ISO 17050-1:2010

Manufacturer: IMES GmbH
Dr.-Herbert-Kittel-Str.2
D-87600 Kaufbeuern

Name: Electronic Indicator
Type: EPM-XPPLUS

The object of the declaration described above is in conformity with the relevant EU harmonisation legislation:

- 2014/30/EU Electromagnetic Compatibility Directive
- 2014/35/EU Low Voltage Directive
- 2011/65/EU Restrictions of Hazardous Substances Directive

Conformity is shown by compliance with the applicable requirements of the following documents:

- DIN EN 61326, including
- DIN EN 61000-4-2
- DIN EN 61000-4-3
- DIN EN 61000-4-4
- DIN EN 61000-4-5
- DIN EN 61000-4-6
- DIN EN 61000-4-11

Signed for and in behalf of:

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Kaufbeuren, 02nd. April 2019

Stefan Neumann
(Managing director)