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HEINZMANN®

Engine & Turbine Management

Safety Systems

CPM 500
Electronic
Peak Pressure Indicator

Operating manual

Software Release l.0.7.8 2017-03-22

Content

Please note:
(*) IPOWER- and IMEP calculation functionality
is only available with Dongle 620-66-002-00

1 Scope of supply

Fig.1: Instrument case with all components

2 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.

2.1 Use of the operator manual

We strongly recommend you to read the complete manual before using the equipment. If you already have experience with **HEINZMANN** systems you may only read the relevant chapters for the required information.

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.

We ask for your understanding, that we will reserve the right to change information and instructions in this manual if necessary without giving notice in advance.

3 Description

3.1 Introduction

The electronic indicator **CPM 500** is a handy, battery powered, portable device to measure and evaluate cylinder pressure on diesel engines at speed up to 1500 RPM.

The **CPM 500** 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 can be stored in memory.

Up to 20 measurement data sets can be stored in the **CPM 500**. 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 visualization of the collected data.

3.2 Measure functions

Pmax:	average maximum pressure of 10 cycles
Pcomp:	compression pressure
RPM:	engine speed

A complete individual pressure curve average over the 10 cycles will be stored in the **CPM 500** memory with each measurement.

3.3 Functional description

The cylinder pressure will be measured with the CPM 500 unit incl. high temperature pressure sensor at the indicator cock on marine diesel engines.

Memory :	for 20 data sets
Application 2 – stroke:	40 – 300 RPM
Application 4 – stroke:	200 – 1500 RPM

The battery must be re-charged after approximately one hour of continuous operation.

4 Operation

4.1 Operator push buttons

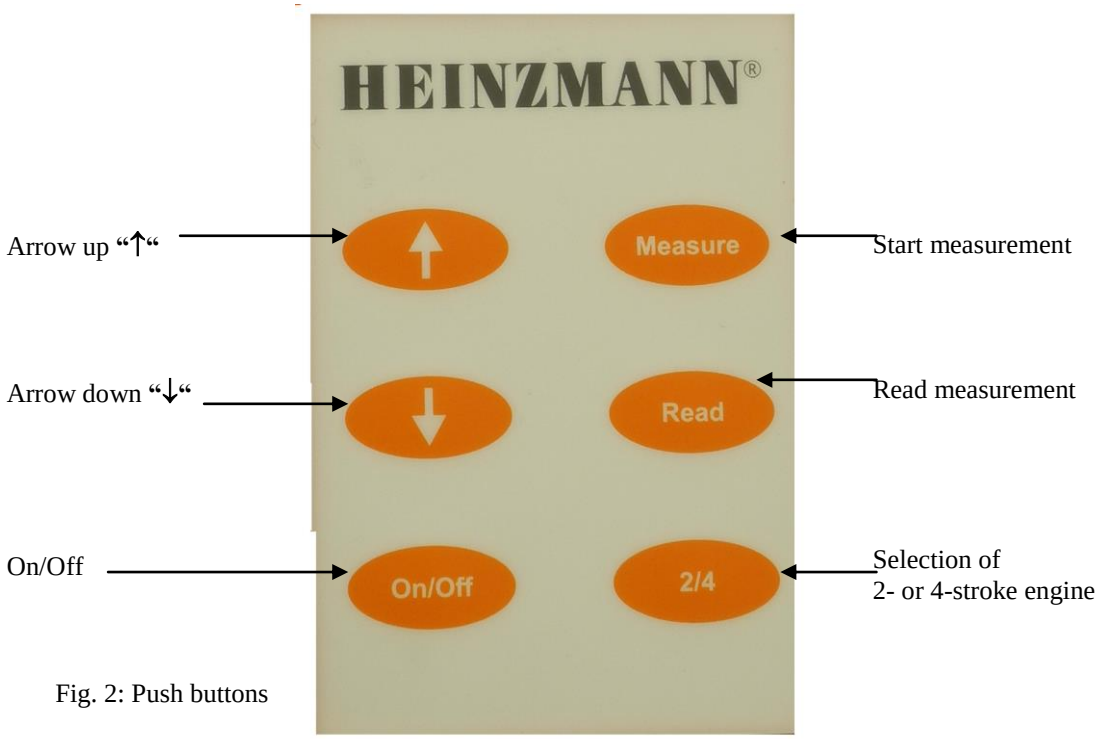


Fig. 2: Push buttons

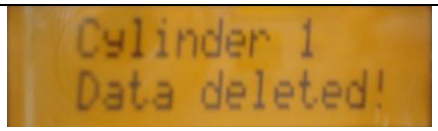
Remarks: After switching "On", the CPM 500 automatically starts in 2-stroke mode. For converting to initial 4-stroke mode, the user must connect the CPM 500 via USB cable to a powered up PC.

When connected, press "Read" and "Measure" simultaneously. The display starts to toggle between 4- and 2-stroke start mode.

After display of the desired mode, immediately unhand the push buttons to store the selected start mode.

The same procedure can be used for switching from 4-stroke start mode to 2-stroke.

4.2 Operating functions

Function	Key board push button	Display	Notes
Switch On/Off			Basic settings will be displayed after switching on: Cyl:1 = cylinder no.1 2 stroke = 2 stroke engine 4 stroke = 4 stroke engine Pmax in bar ; RPM: speed
Selection of 2 -stroke or 4 –stroke engine			Push key **“2/4“** to change the mode of operation to the desired value (4 or 2 stroke application).
Battery check			Push key **“2/4**“ two times to check the battery status. Also temperature at measuring element will be displayed.
Sensor check			Push key **“2/4“** three times to check the sensor status at 0 bar.
Selection of cylinder	 		Push arrow key **“↑↓“** and change the displayed value to the number of the selected cylinder.
Start measurement		 	During measurement the following information “Recording cylinder” will be indicated. Display indication (1-2 s) of measured cylinder values. Then CPM 500 unit automatically switches to the next cylinder.
Read Pmax			The measured value for Pmax of the selected cylinder will be displayed.
Read Pcomp (only on two stroke engines)	 Press 2x		The measured value for Pcomp of the selected cylinder will be displayed.
Delete measurements	 + 		Push “Read” and “↑“ at the same time for 2s to delete the currently displayed measurement.

4.3 Installation of visualisation- and USB driver software

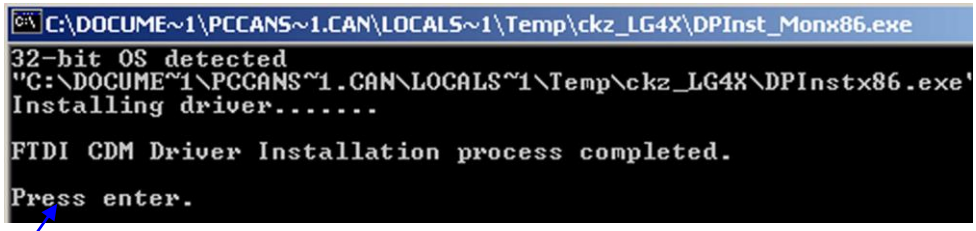
The scope of supply includes the **HEINZMANN** visualisation software on CD-ROM for displaying and analysing the measured data in numeric and graphic format.

Hardware requirements:
IBM PC Pentium or 100 % compatible, USB port
Windows 7, XP
Main memory minimum 16 MB RAM,
Monitor with minimum resolution of 1024 x 768.

Install CD ROM on your Personal Computer. Open directory "software" and make a double click at ***setup.exe*** for installation of visualisation- and necessary USB driver software.

The program will automatically install a new directory and places an icon on the desktop of your computer.

USB driver will be installed automatically



Press enter to finalize USB driver installation

4.4 Select COM port of PC

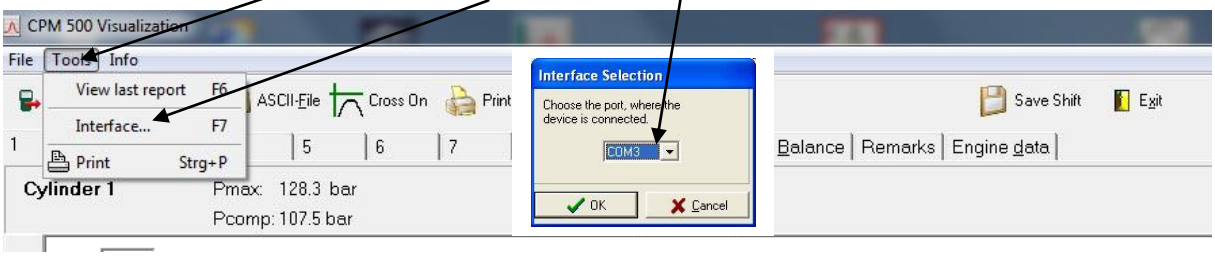
For selection of COM Port the CPM 500 should be connected via USB cable to PC

- Switch on **CPM 500**
- Connect USB port of PC via USB cable to CPM 500
- Run **"Visualisation software"** by double click on the desktop icon.

Fig.3: CPM 500 connected via USB cable to PC

For selection of COM Port the CPM 500 should be connected via USB cable to PC and visualisation software should be started by double click on desktop icon.

With mouse click on **"Tools"** and selection **"Interface"** the **COM port** of PC will be selected.



4.5 Charge battery

The CPM 500 has a re-chargeable battery. The battery charging will start automatically after the CPM 500 unit has been connected via USB cable from USB port to PC (fig. 4,5,6,7)

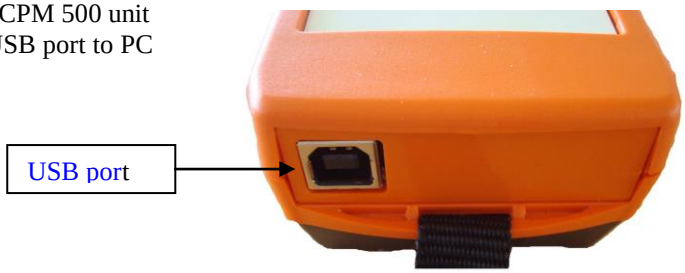


Fig. 4: USB-port of CPM 500

Note: At first usage please connect CPM 500 via USB cable to PC.
Charge battery for 2h continuously without disconnecting from PC !

Fig. 5: CPM 500 connected via USB cable to PC

Fig. 6: Indication during charging process

Fig. 7: Indication charging process completed

Do not change battery during charging process while CPM 500 is connect via USB cable to PC.

When the indicator is connected by USB, the battery charging runs automatically. The indicator can detect the charging status and continues charging until the battery is fully loaded. Then the charging process stops automatically. It is not recommended to interrupt the charging process before it is automatically stopped. The charging process is finished when the display message "CPM 500 charging..." has disappeared.

If the battery status is low and the charging process stops after 5-10 minutes, then the user can manually force the unit to charge the battery for 90 minutes by pressing both arrows + at the CPM 500 unit for 2 seconds (Forced Charging Mode).

Note: It is not recommended to use the Forced Charging Mode when the battery charge condition is more than 40%, due to the risk of overcharging. Please see chapter 5.2 for a description how to check the charge state.

4.6 Change battery

Note: Please only use re-chargeable battery E-block type "ANSMANN 250 mAh NiMH"

For changing the re-chargeable battery the battery cover on the back side of CPM 500 must be opened (fig.9,10,11). Do not change battery during charging process while CPM 500 is connect via USB cable to PC.

over

Fig.9: Re-chargeable E-block battery type:Ansmann

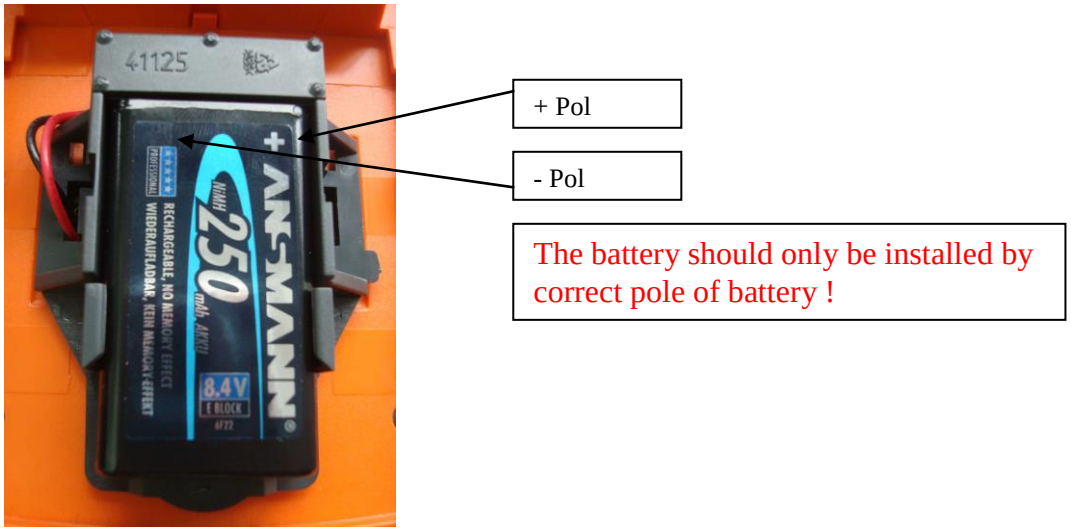


Fig.10: Battery installed on backside of CPM 500

Note: If battery of standard NiMh 250 mAh type Ansmann can not be charged or is not available, then the operator can use for measurements Alkaline battery 9V only for a short time. **In this case please immediately disconnect the CPM 500 unit after transferring data to PC !**

4.7 Mounting instructions on marine engines

Measuring at the indicator valve

- Before mounting the adapter, please clean the indicator valve by opening (1-2s).

To avoid measurement distortion:

- Check adaptor and sensor periodically for dirtiness and clean it if necessary.

DANGER!
The indicator valve ejects hot gas under high pressure. Danger of sparks and burning.

Hot gases and particles may be ejected.

Wear gloves and safety glasses!

4.8 Measuring with CPM 500

- **Charge battery**
  Charging time: min. 2 hours

- **Start measurements on the engine**
  2-and 4 stroke application
  Open indicator cock and close. Install sensor with adaptor at cylinder no.1 and open indicator cock
  Press "**On**" at CPM 500
  Press **"Measure"** and wait about 5-10 s

Fig.11: Indication during measurement on cylinder

Fig.12: Indication (1-2 s) of measured values from cylinder

After indication of measured cylinder values (1-2s) the display switches automatically to next cylinder.
Repeat measuring procedure for all remaining cylinders!
For to change engine mode 2- or 4-stroke press "2/4" to select application on a 2- or 4 stroke engine

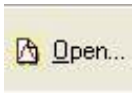
Remark: The CPM 500 has a overheating protection of measuring cell for temperature > 300°C

Remark: The CPM 500 turns off automatically after 2 minutes without pressing any push button!

5 Visualisation software release 1.0.7.8

5.1 Main tool bar buttons

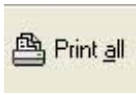
Load new measurement data from EPM-XP



Open stored measurement data set

Save all data to ASCII file

Print screen page



Print all screen pages

Cross On function

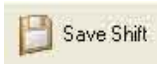
Program exit

Delete measurements at EPM-XP

Selection of “Motored curve “ on 4-strokes
Selection of derivative curve

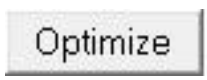
Selection of all cylinder in screen page “Engine diagram”

Selection of Pmax bar graph function

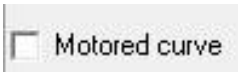


Save value of shifted curves

Function “Derivative curve”

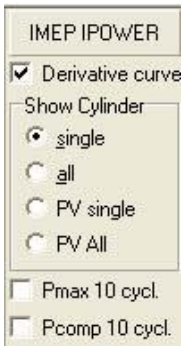


Function for optimizing Pcomp position



Function “Motored curve”

Functions for power calc. function. Only visible with Dongle 620-66-002-00

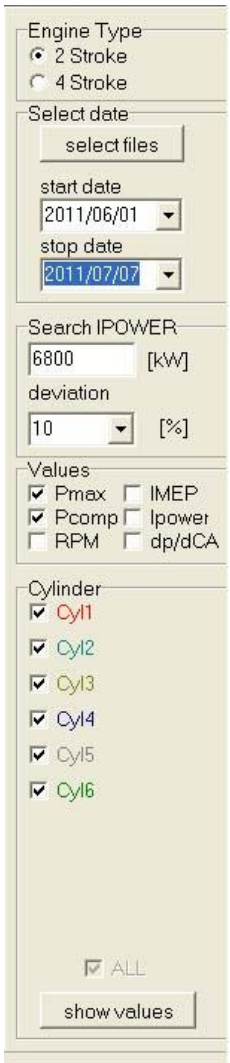


Selection window of cylinder
Derivative curve
p/alpha, p/v diagram

Indication Pmax 10 cycles
Indication of Pcomp 10 cycles (only on two strokes)

Close and open reference file

Save a reference file



Selection of engine type

Select files (*.ext format)

Select start and stop date

Input of indicated engine power and selection deviation in %

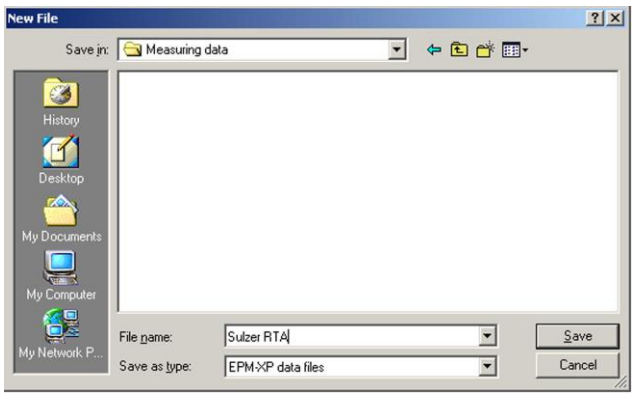
Selection of values

Selection of cylinder

5.2 Load measured data from CPM 500 to PC

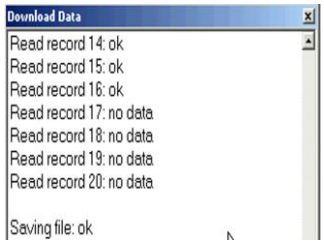
At first visualisation software must be started. CPM 500 must be connected via USB cable to PC
Press “New” to load measurement data from CPM 500 to PC

The software opens a window to name the file for storing on PC



Remark: The format of data files are *.ext. The software release 1.0.6.0 or higher can read and open old data formats of *.exd

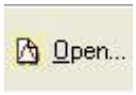
After entering a file name and storing the data will be transmitted to PC.



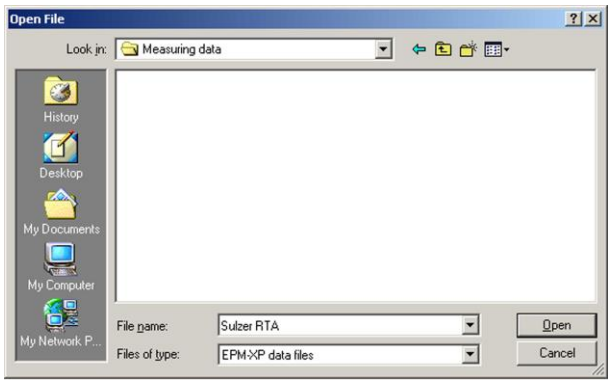
After this procedure the measured data will be monitored at visualisation software.

5.3 Load measured data from hard disc to PC

At first the visualisation software must be started.
Press “Open” to load measurement data from CPM 500 to PC.



The software opened a window for to open a stored file on PC.

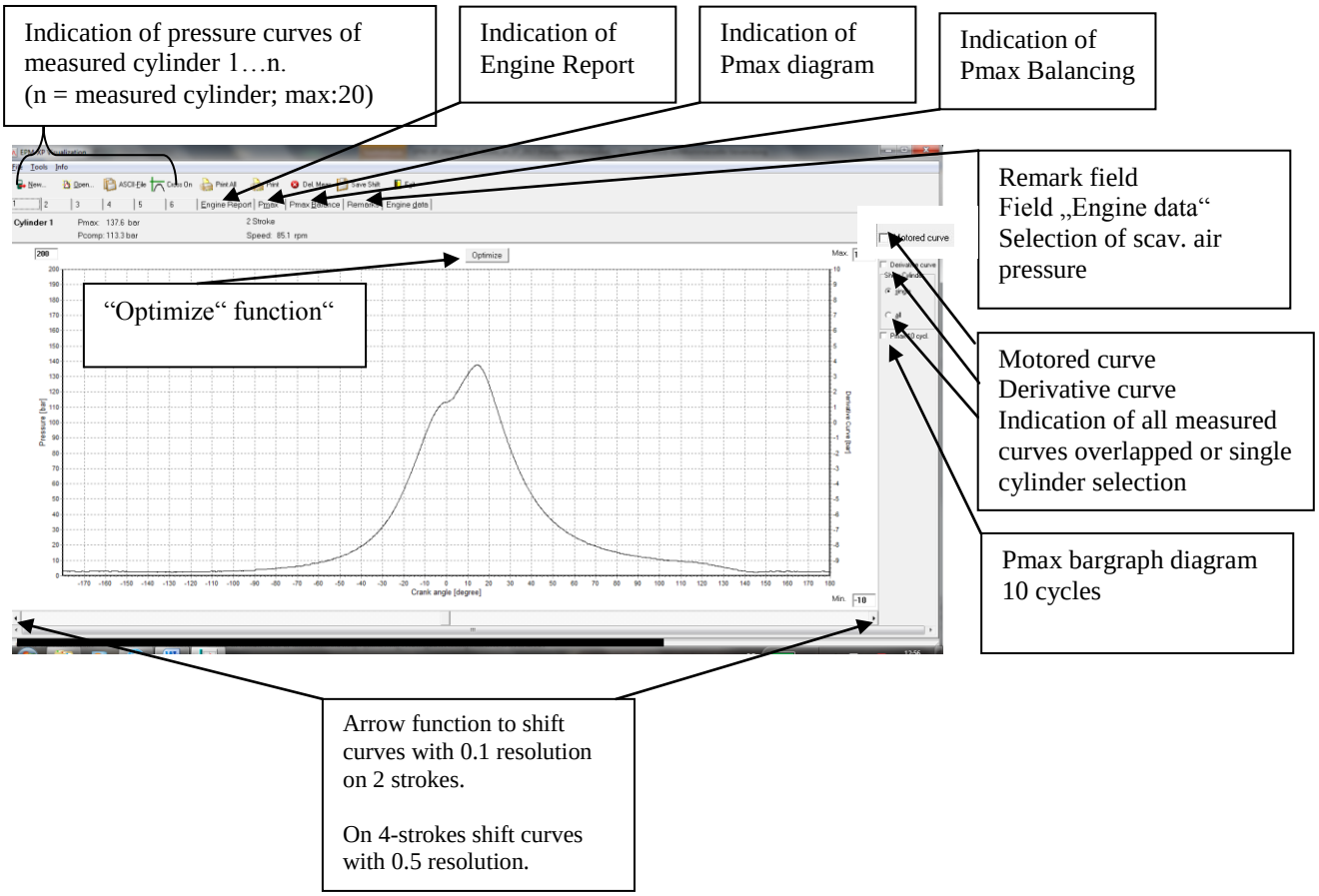


Remark: The format of data files are *.ext. The software release 1.0.6.0 or higher can read and open old data formats of *.exd

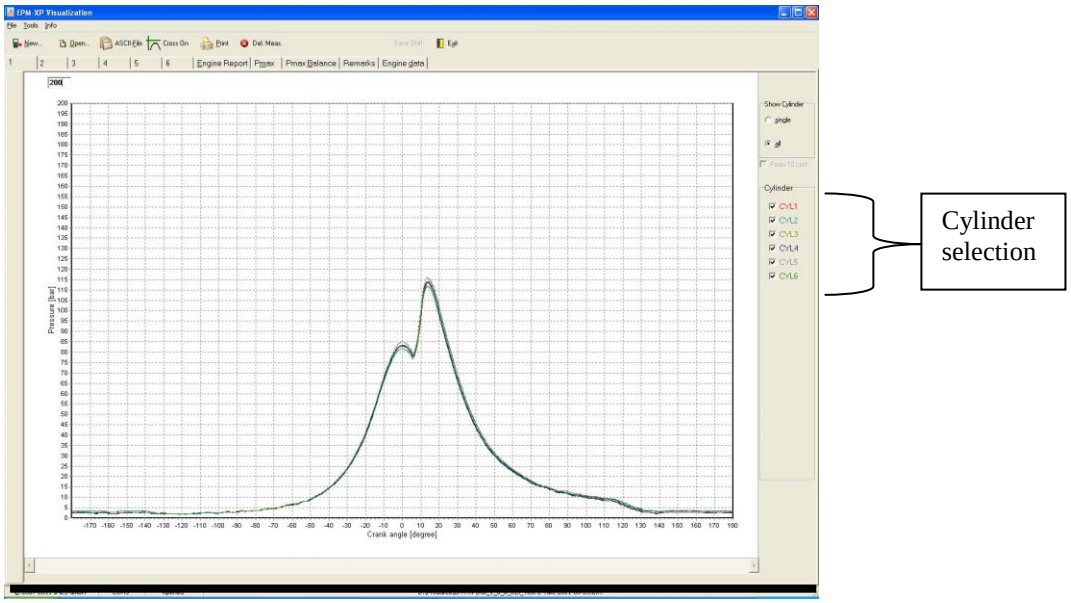
After this procedure the selected data file will be monitored at visualisation software.

5.4 Monitoring of combustion data

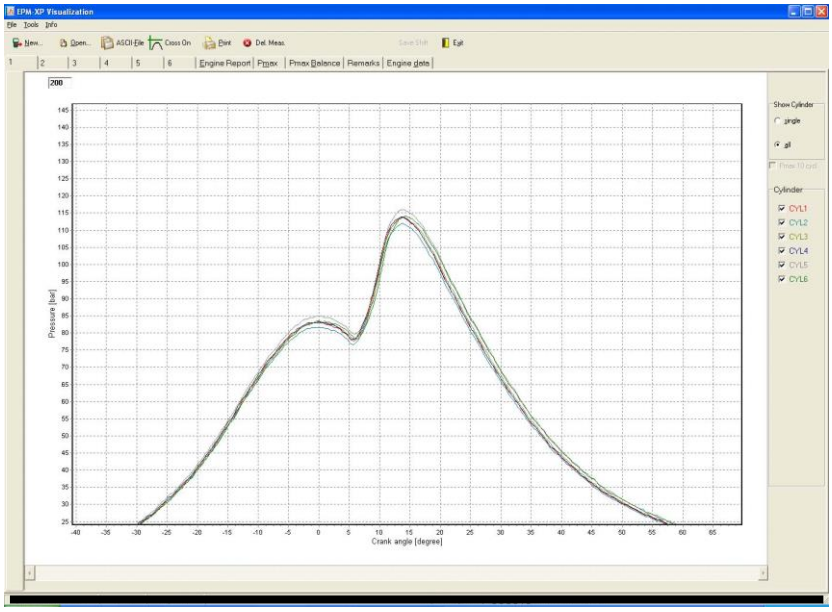
5.4.1 Screen page “Cylinder pressure curve”



5.4.1.1 Indication of all cylinders



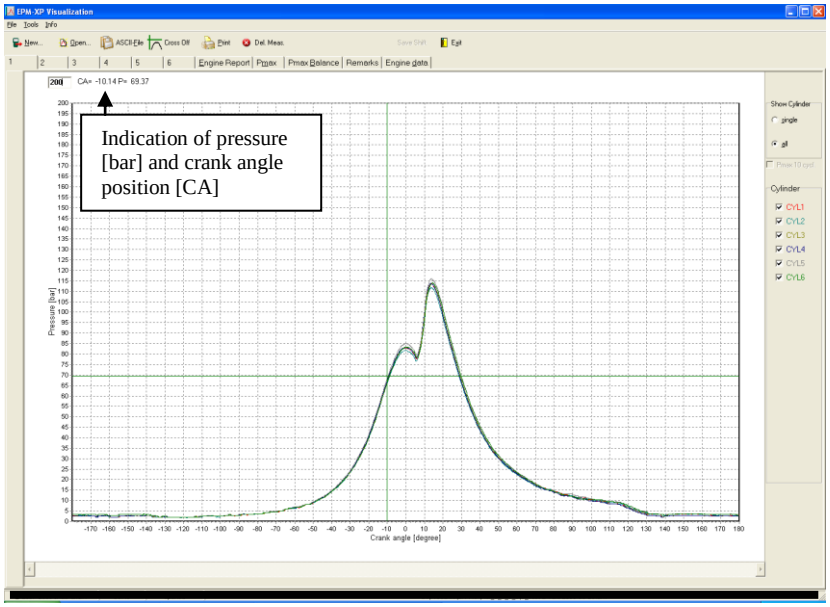
Zoom-function



Zoom function on: Hold left mouse button pushed down and draw across the curve from top left down to right bottom corner.

Zoom function off: Hold left mouse button pushed down and draw across the curve from right bottom up to top left corner.

5.4.1.2 Cross On function

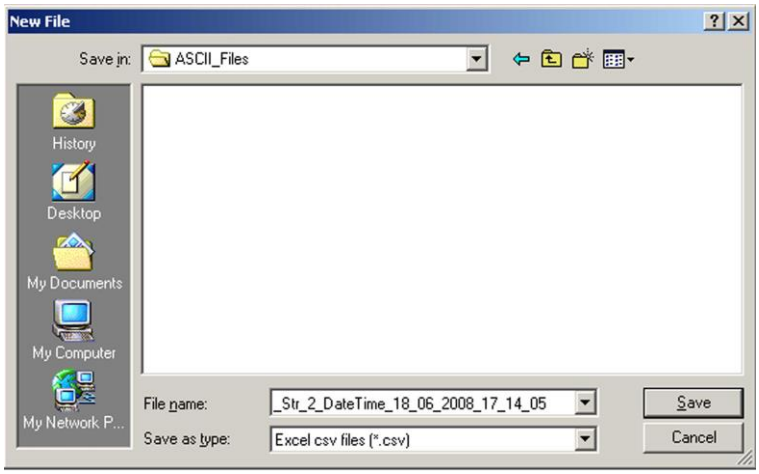


Cross On: Push with mouse “Cross On” button and move mouse to the position of curve
Cross Off: Push with mouse “Cross Off” button

5.4.1.3 Save to ASCII

Press “ASCII-File” to save all measurement data to Excel (*.csv) files.

The software opened a window to store data to (*.csv) files.

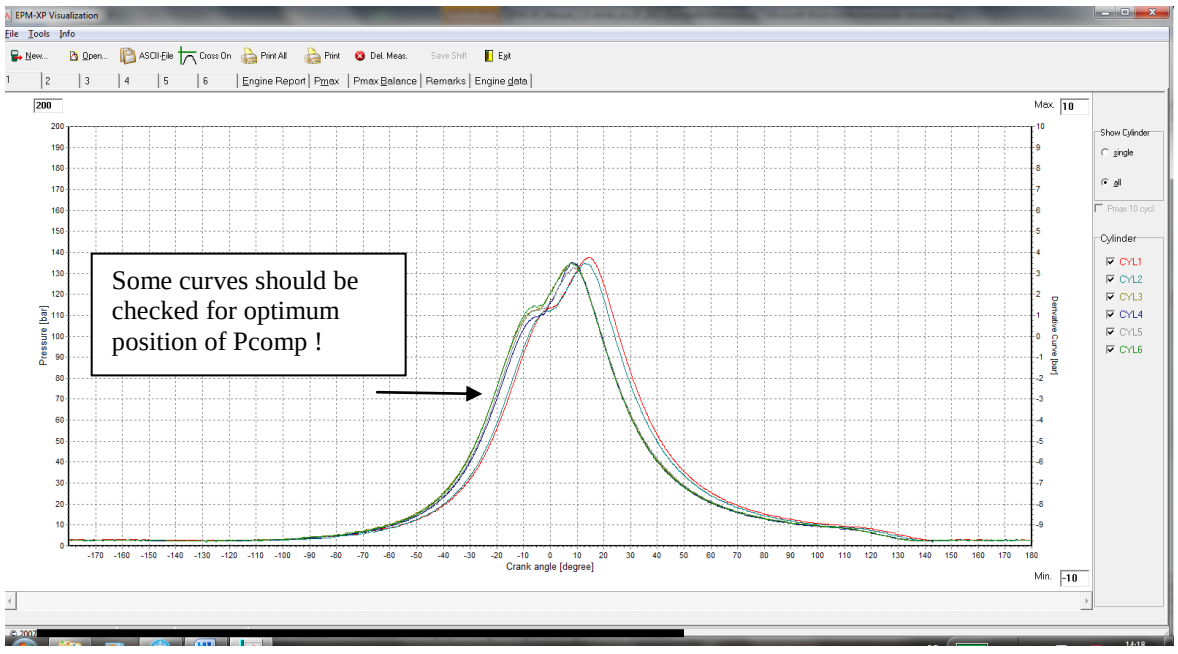


5.4.1.4 Optimize function for application on two-strokes

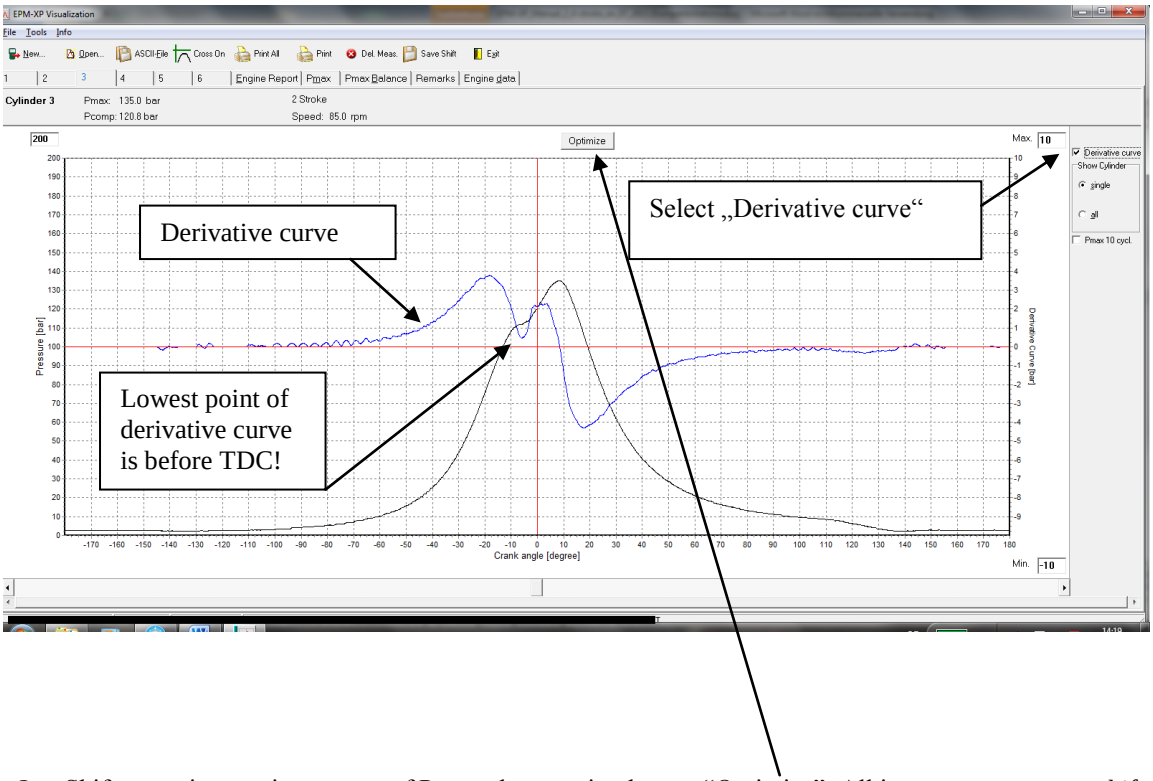
IMES algorithm for automatic Pcomp position calculation on two-strokes can be influenced by some noises on the pressure signal. If Pcomp Position is not exact centred on TDC position than please press button “OPTIMIZE”

Remarks: Optimum Pcomp position influences also IPOWER and IMEP calculation for application with dongle 620-66-002-00!

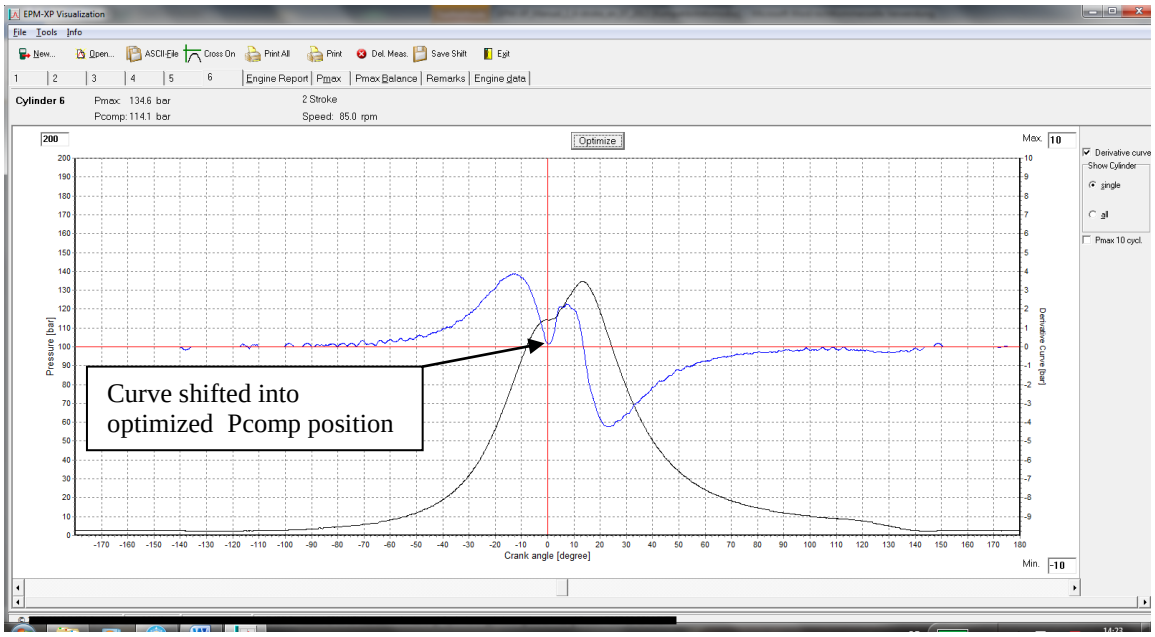
1. Check all curves



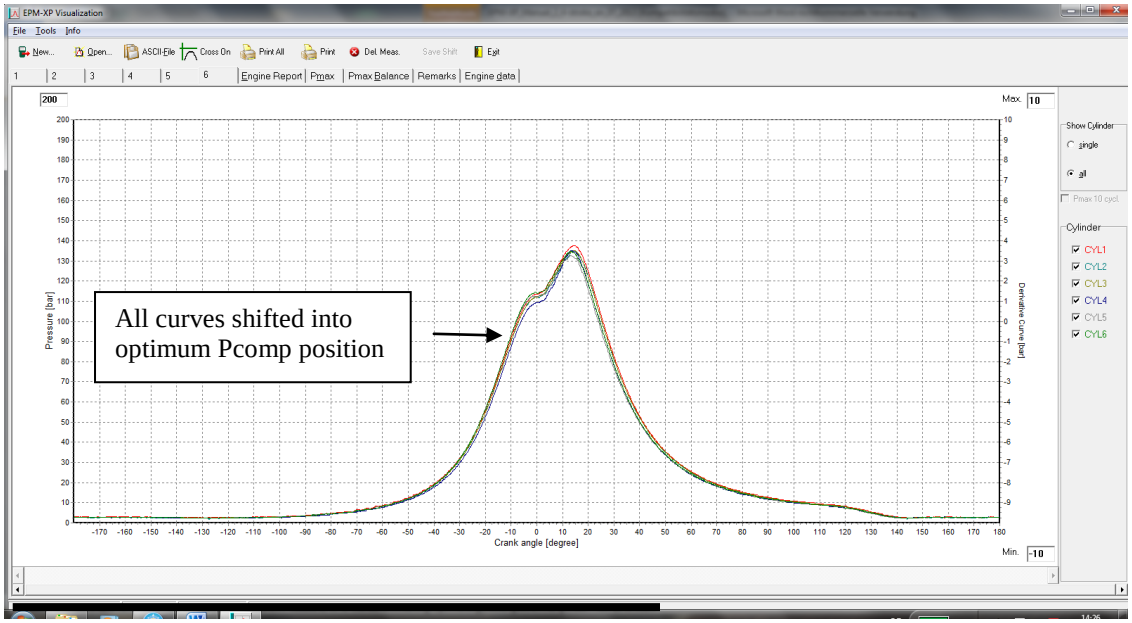
2. Check lowest position of derivative curve



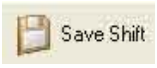
3. Shift curve into optimum pos. of Pcomp by pressing button “Optimize”. All incorrect curves are shifted automatically into optimum position of Pcomp.



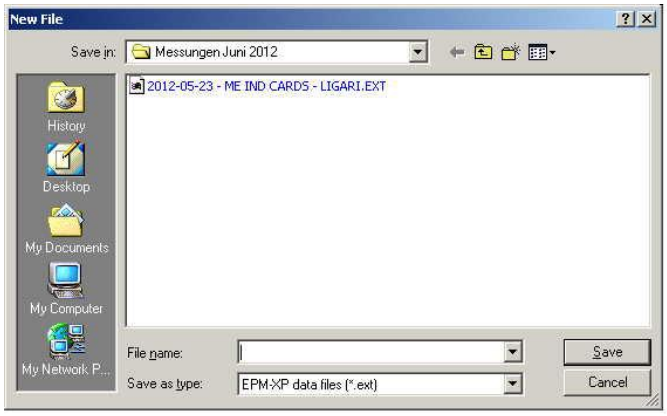
4. All curves shifted



5.4.1.5 Save Shift

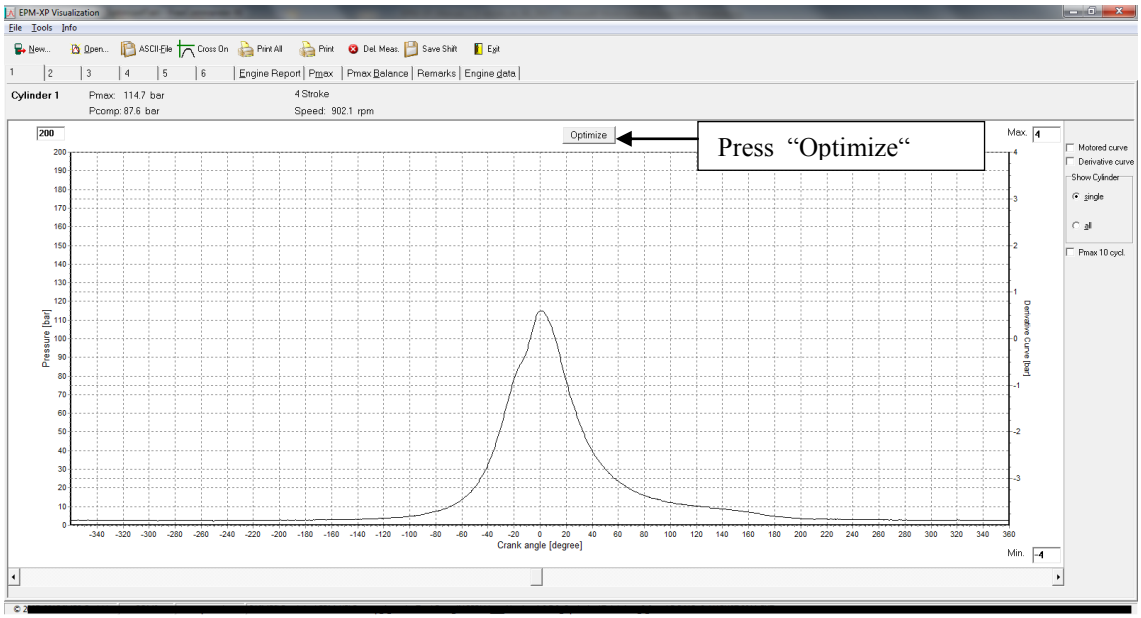


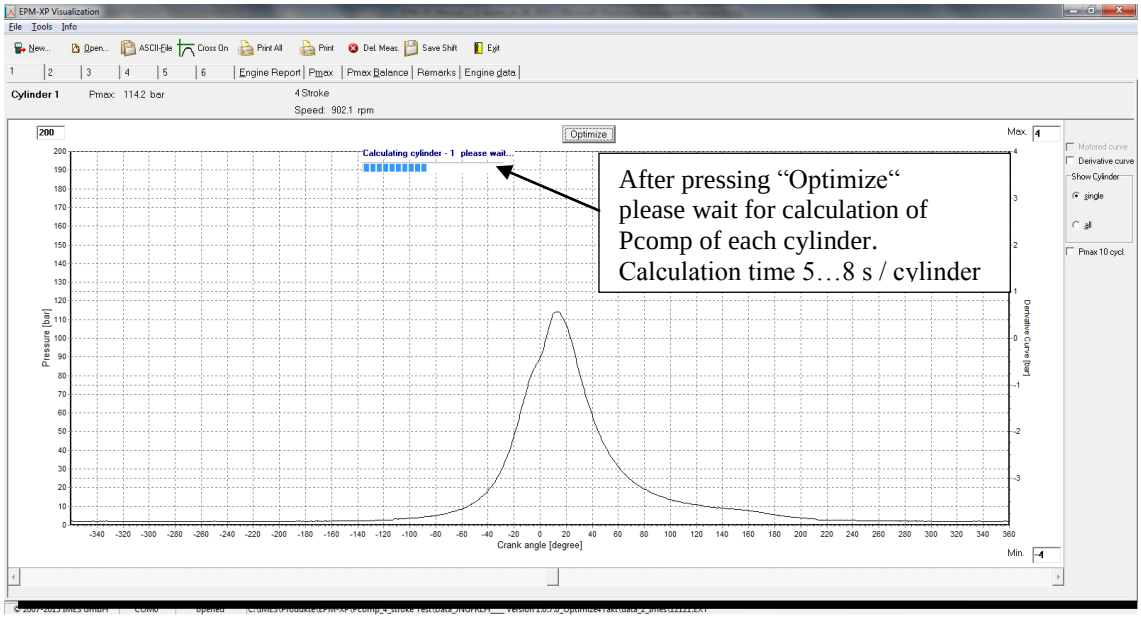
After shifting curves the operator has the possibility to save shifted data as *.ext file under new name.

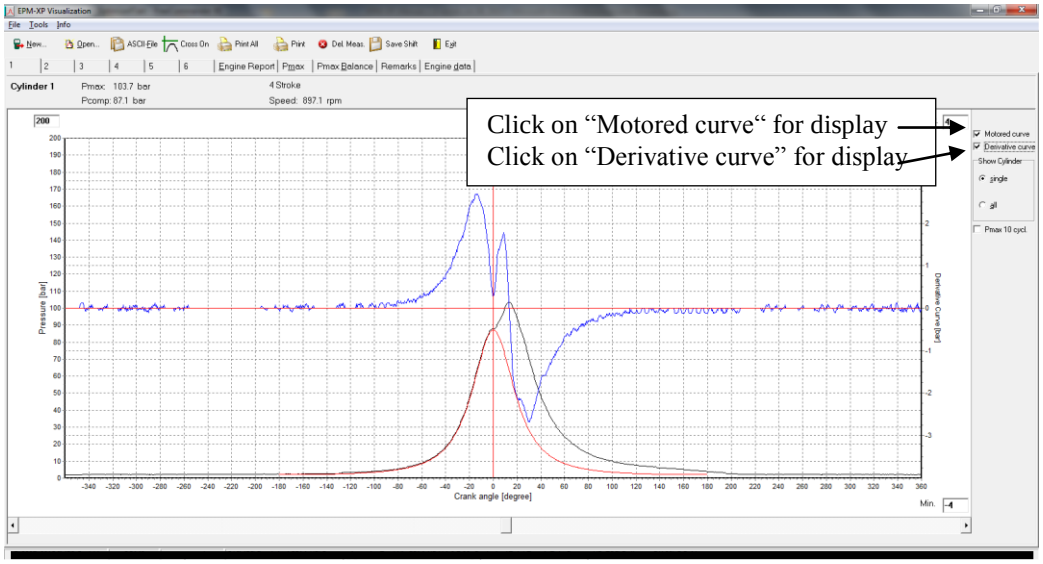


5.4.1.6 Automatic Pcomp calculation on four-strokes

During the first opening of measurement data file (*.ext) the Pmax value is centered at TDC (0°CA). For Pcomp calculation on 4-stroke calculation the operator should press “Optimize” button.

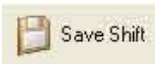






5.4.1.7 Additional functions

5.4.1.7.1 Save shift



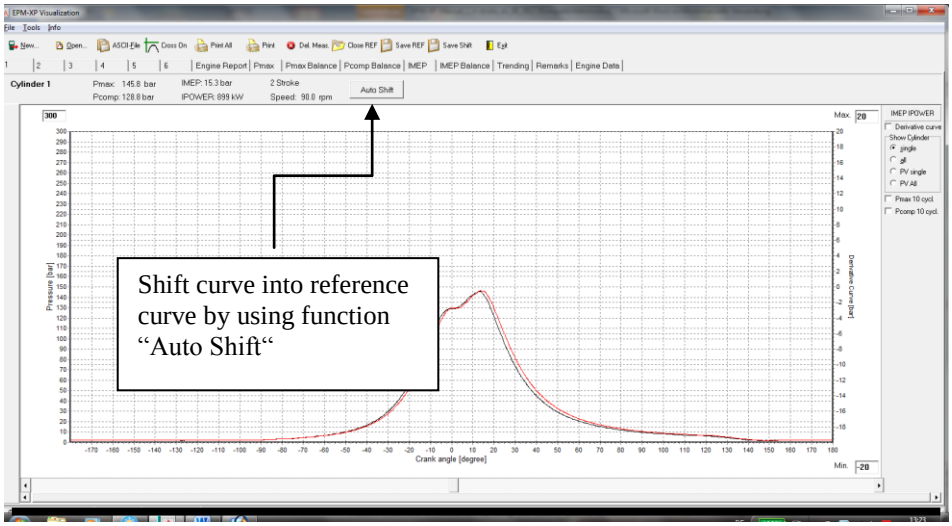
After automatic Pcomp calculation the operator has the possibility to save shifted data as *.ext file a under new file name.

5.4.1.7.2 Save reference curve

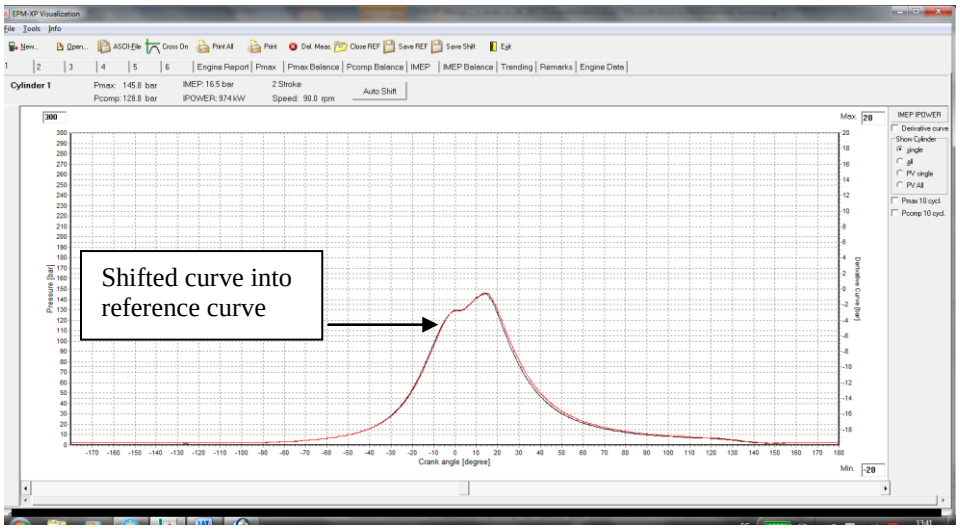
After selecting a cylinder as a reference curve press button “Save Ref-File”.

5.4.1.7.3 Open reference curve for comparison to other cylinder

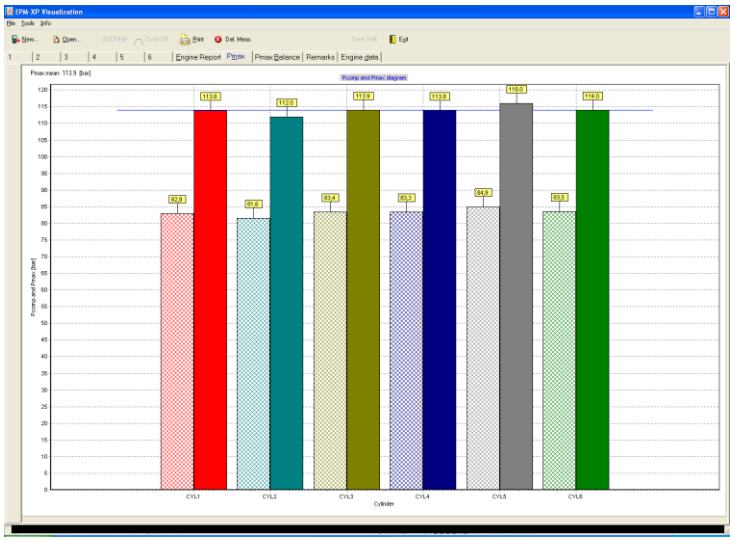
5.4.1.7.4 Shift curve into reference-curve



Note: The reference file can only be compared with measurements at same load.

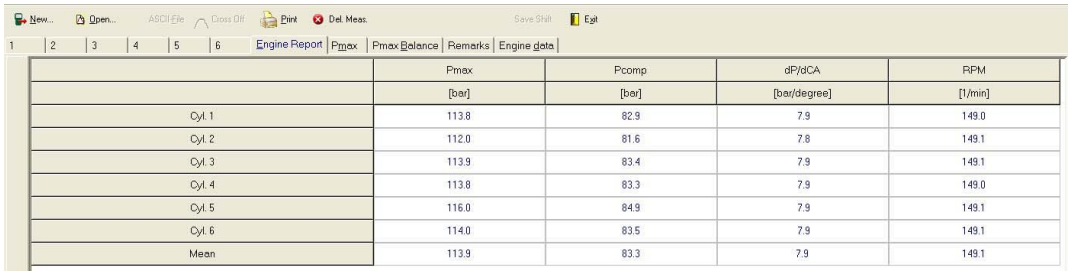


5.4.2 Screen page “Pmax diagram”



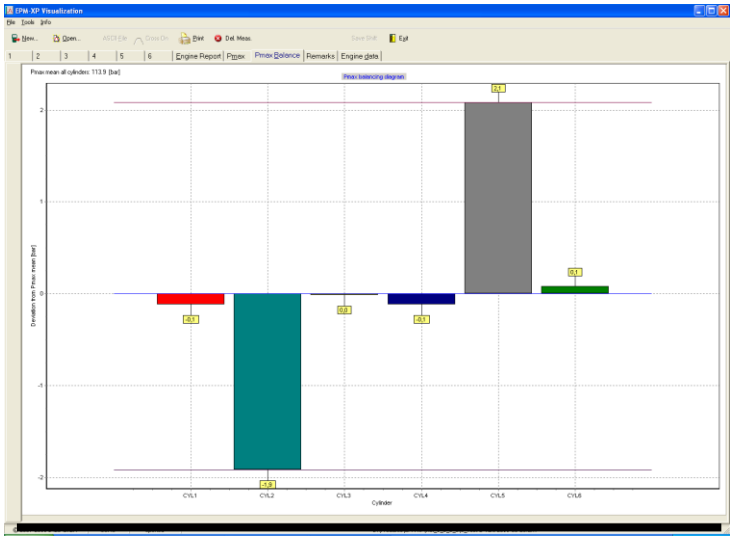
Pmax- and Pcomp values will be displayed.

5.4.3 Screen page “Engine report”



	Pmax	Pcomp	dP/dCA	RPM
	[bar]	[bar]	[bar/degree]	[1/min]
Cyl. 1	113.8	82.9	7.9	149.0
Cyl. 2	112.0	81.6	7.8	149.1
Cyl. 3	113.9	83.4	7.9	149.1
Cyl. 4	113.8	83.3	7.9	149.0
Cyl. 5	116.0	84.9	7.9	149.1
Cyl. 6	114.0	83.5	7.9	149.1
Mean	113.9	83.3	7.9	149.1

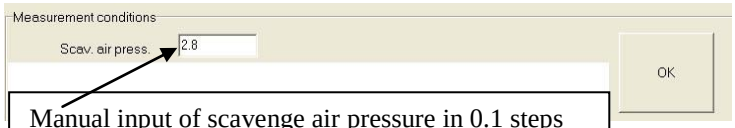
5.4.4 Screen page “Pmax balance”



5.4.5 Screen page “Remarks”

The user can write important remarks into this field and save it.

5.4.6 Screen page “Engine data”



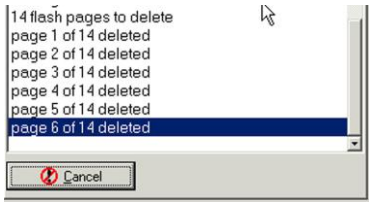
Manual input of scavenge air pressure in 0.1 steps from 0.1 …6.0 bar. For confirmation “OK” must be pressed.

5.5 Delete measurement on CPM 500

CPM 500 must be connected via USB cable to PC

After transferring data to PC the operator has the opportunity to delete all measurements via visualisation software or to override existing data during next measurement on the engine.

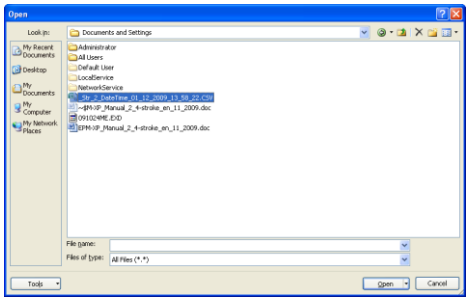
Press **“Delete Measurement”** to delete all measurement at CPM 500.



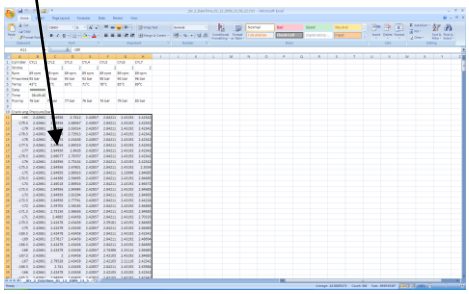
For to delete selected measurements at CPM 500 unit please see also chapter 5.2 !

5.6 Open *.csv files with Excel

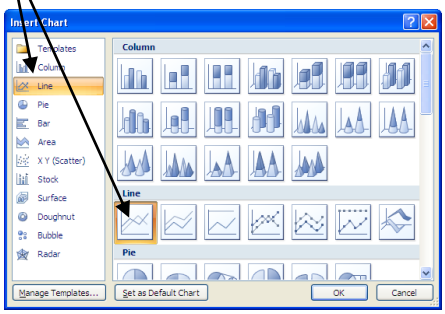
Start Excel program and open selected *.csv file (Microsoft Office Excel Comma Separated Values File)



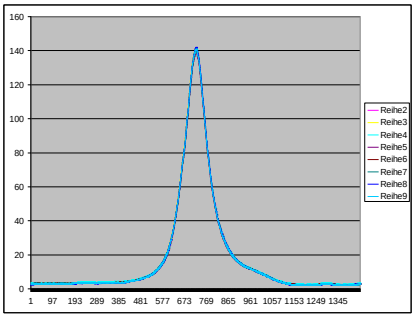
Mark measurement data of cylinder



Select diagram type



Curves can be copied to own report



5.7 620-66-002-00 IPOWER- and IMEP calculation

On two stroke applications the software calculates IPOWER and IMEP automatically. Please check optimum of Pcomp position (according to chapter 5.4.1.4), because it influences the accuracy of IPOWER and IMEP calculation.

On four stroke applications the software shifts the curve automatically to an optimized TDC position for calculating IPOWER and IMEP values of each cylinder. Please see also chapter 5.4.1.6.

5.7.1 Overview of additional functions

For to visible additional power calc. function and trending on Vis-Software the Dongle part no.: 620-66-002-00 must be installed on USB port of PC.

Fig.16: USB Dongle 620-66-002-00

5.7.1.1 Power calculation function

Calculation of MIP and Ipower

Mean indicated pressure:

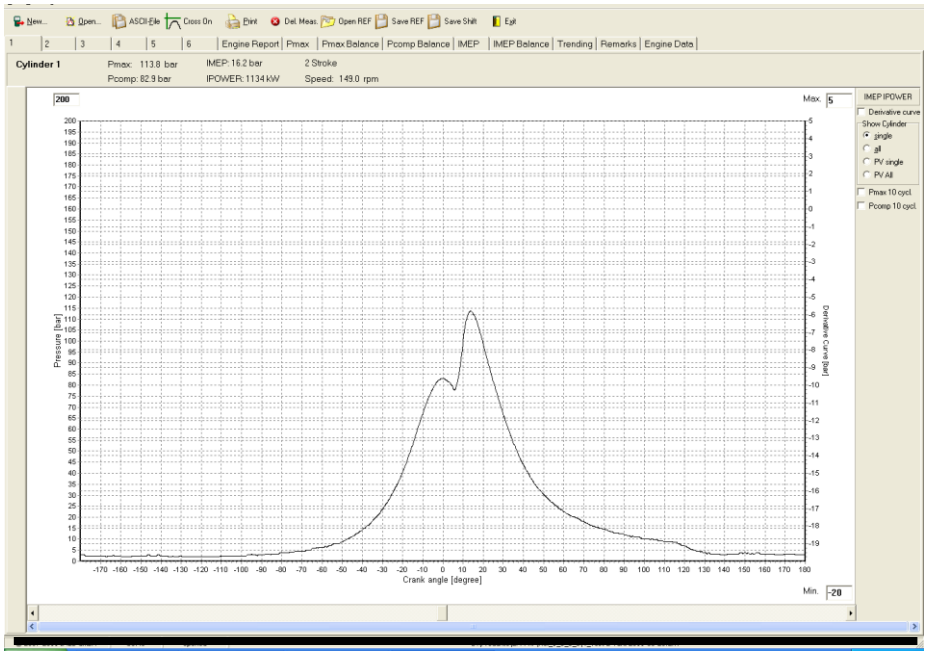
$MIP = (\eta * \pi / n) * \sum pi * [\sin \alpha i + \lambda/2 * \sin (2 \alpha i)]$

with

η: 1 for 2-Stroke, 2 for 4-Stroke
π: Pi (3.14....)
n: Total number of samples per working cycle
pi: Pressure at sample position i
αi: Crank angle at sample position i
λ: Crankshaft radius/conrod length

Mean indicated power:

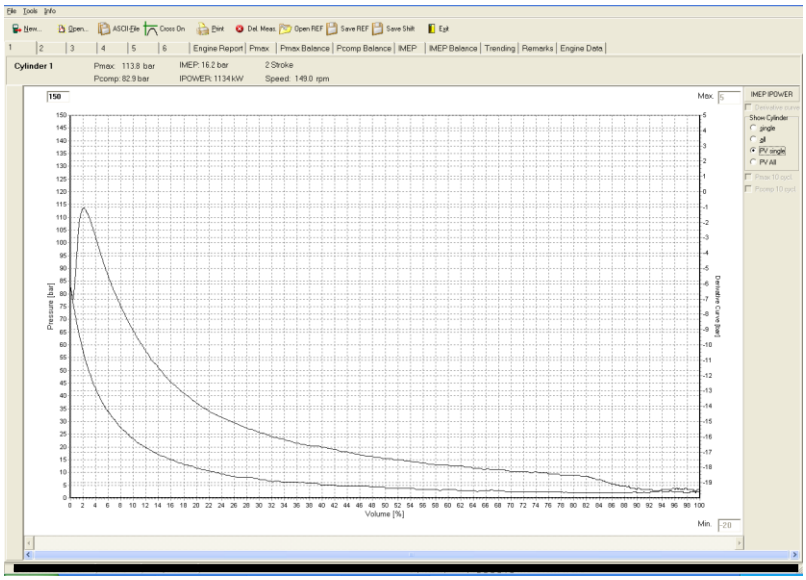
iPower = (cylinder **volume**) x (revolutions per **second**) x (mean indicated power).



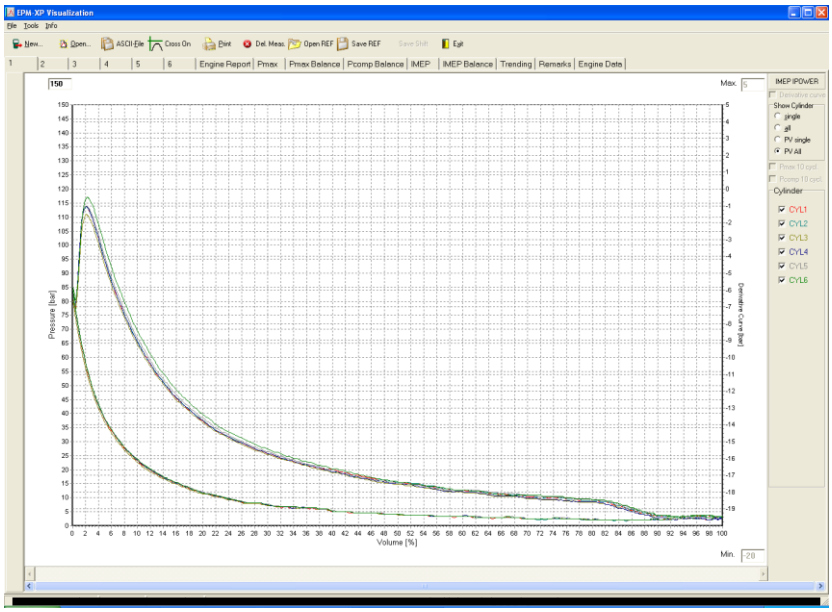
Selection of:
- Derivative curve
- single
- all cylinder
- PV single
-PV all
- Pmax or Pcomp 10 cycles

Remark: For power calculation it is necessary to enter specific engine parameter (bore, stroke and conrod length in mm) at screen page “Engine data”

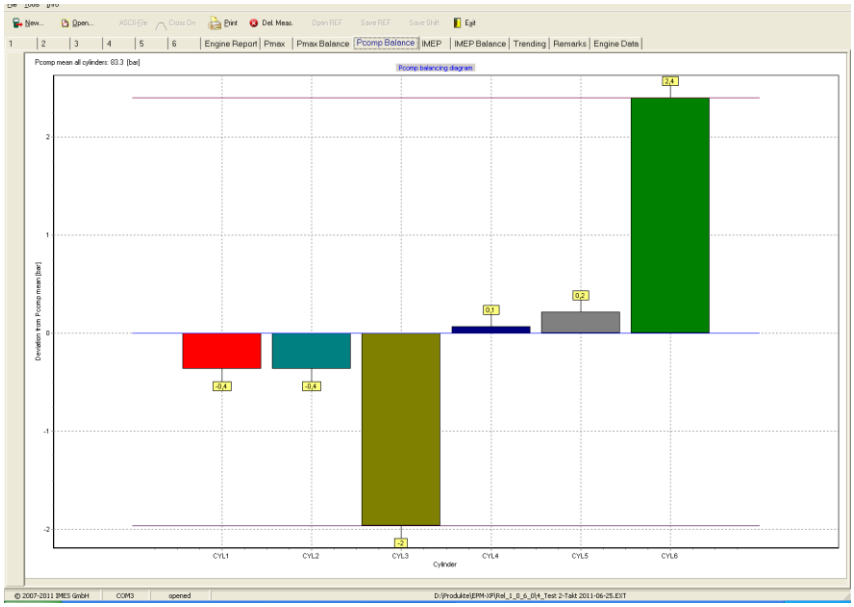
5.7.1.2 Indication of cylinder pressure (single) versus volume



5.7.1.3 Indication of all cylinder pressure (all) versus crank angle

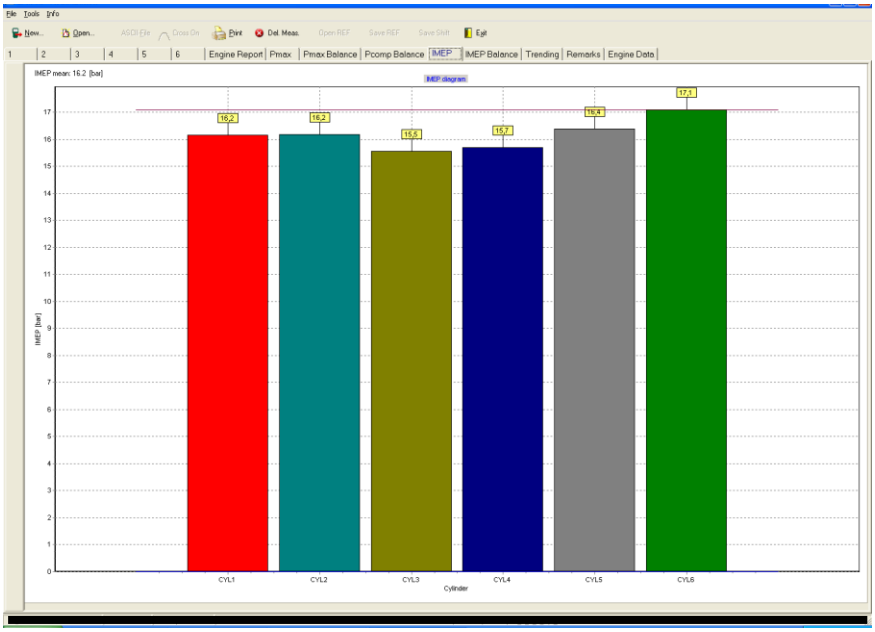


5.7.2 Screen page “Pcomp Balance”

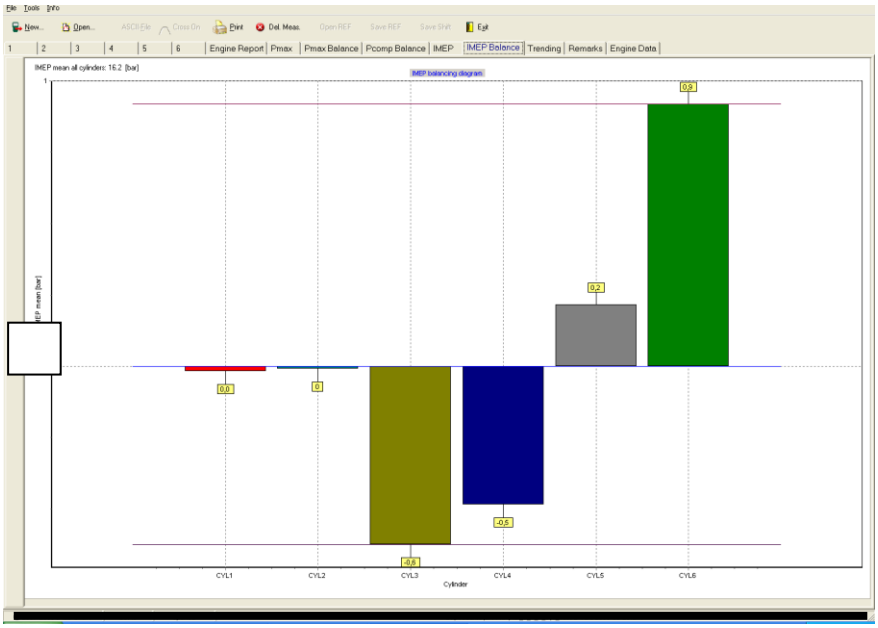


Remark: On 4-stroke engine applications Pcomp Balance will not be displayed!

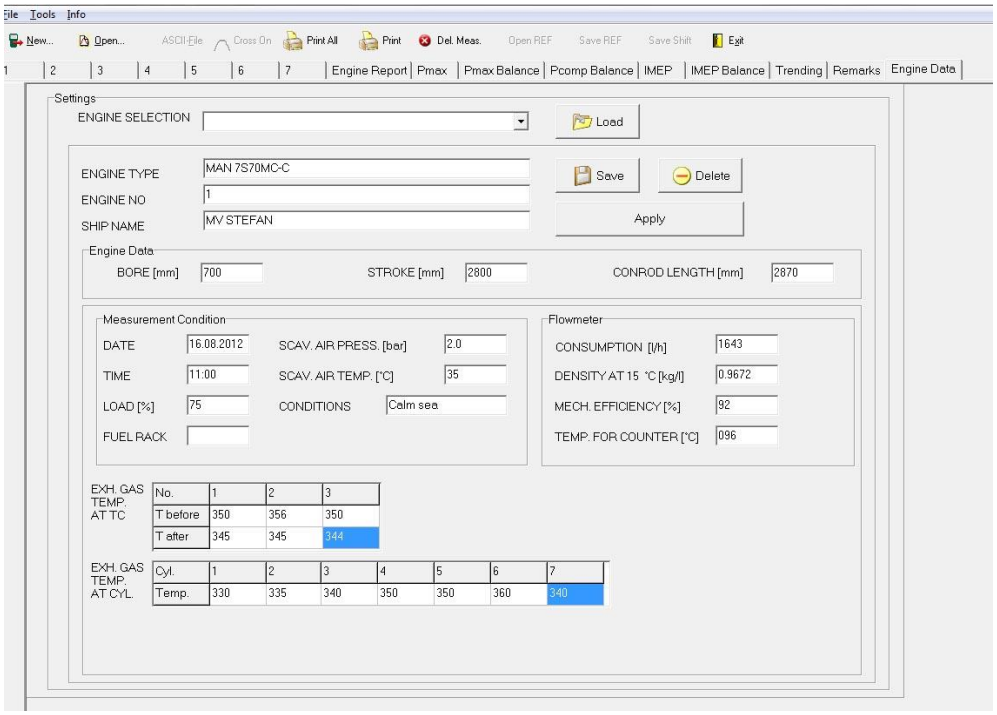
5.7.3 Screen page “IMEP”



5.7.4 Screen page “IMEP balance”



5.7.5 Screen page “Engine data”



Please enter: Shipname, Engine type and Engine no. For power calculation it is necessary to enter specific engine parameter (bore, stroke and conrod length in mm).

Important specific engine data from MAN B&W are stored in the program (Open Engine selection).
For correct values of bore- stroke and con-rod length please see also our list of specific engine data (see Appendix 1).

Also the operator has the possibility to enter measurement conditions for example exhaust gas temperature.

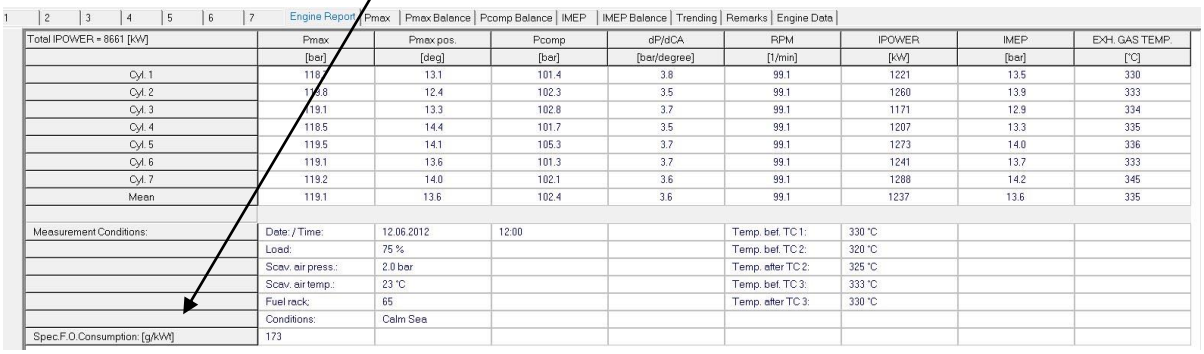
The input of scavenge air pressure influences Pmax and Pcomp values !

For calculation of specific fuel oil consumption [g/kWh] please enter the following data from "Flowmeter":

- Fuel oil consumption in [l/h] in 1h
- Density at 15 °C [kg/l]
- Mechanical Efficiency [%]
- Temperature for counter in [°C]

After entering values of measurement conditions the user must press "Apply" for to display values in "Engine report"

5.7.6 Screen page "Engine report"

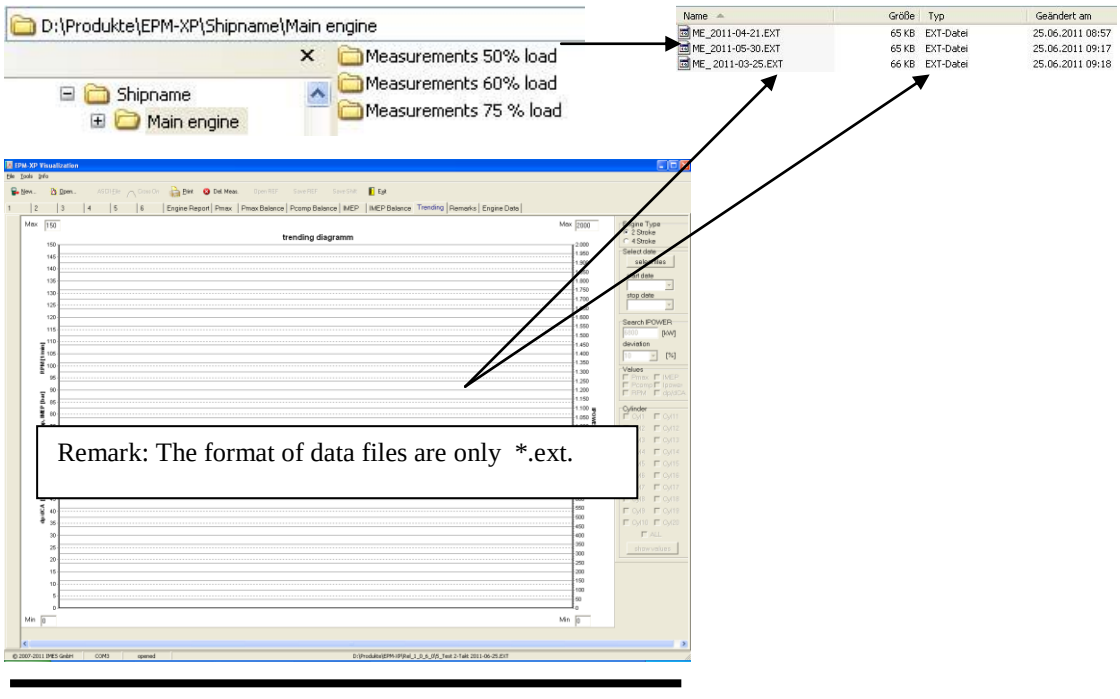


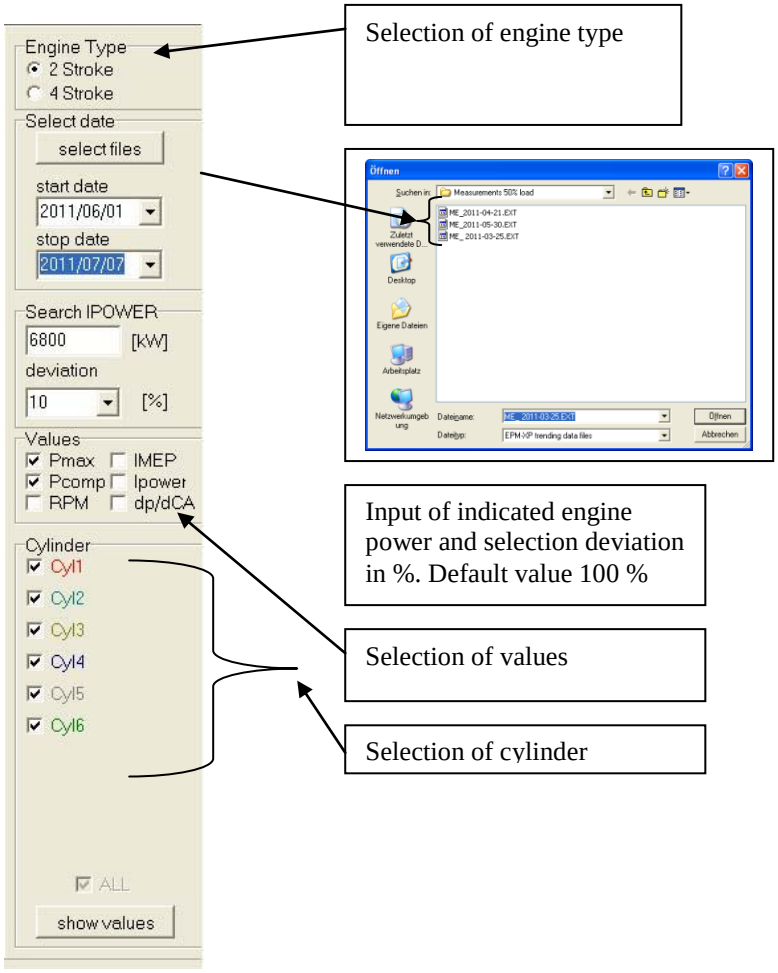
Total IPOWER = 8661 [kW]	Pmax	Pmax pos.	Pcomp	dP/dCA	RPM	IPOWER	IMEP	EXH. GAS TEMP.
	[bar]	[deg]	[bar]	[bar/degree]	[1/min]	[kW]	[bar]	[°C]
Cyl. 1	118	13.1	101.4	3.8	99.1	1221	13.5	330
Cyl. 2	119.8	12.4	102.3	3.5	99.1	1260	13.9	333
Cyl. 3	119.1	13.3	102.8	3.7	99.1	1171	12.9	334
Cyl. 4	118.5	14.4	101.7	3.5	99.1	1207	13.3	335
Cyl. 5	119.5	14.1	105.3	3.7	99.1	1273	14.0	336
Cyl. 6	119.1	13.6	101.3	3.7	99.1	1241	13.7	333
Cyl. 7	119.2	14.0	102.1	3.6	99.1	1288	14.2	345
Mean	119.1	13.6	102.4	3.6	99.1	1237	13.6	335

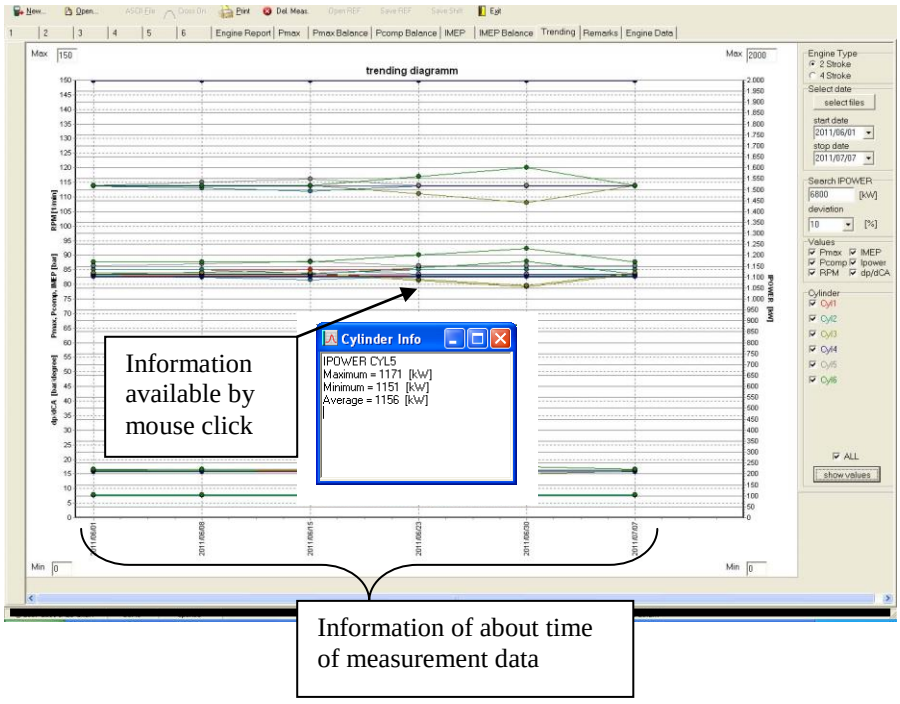
Measurement Conditions:	Date: / Time:	12.06.2012	12:00		Temp. bef. TC 1:	330 °C		
	Load:	75 %			Temp. bef. TC 2:	320 °C		
	Scav. air press.:	2.0 bar			Temp. after TC 2:	325 °C		
	Scav. air temp.:	23 °C			Temp. bef. TC 3:	333 °C		
	Fuel rack:	65			Temp. after TC 3:	330 °C		
	Conditions:	Calm Sea						
Spec.F.O.Consumption: [g/kWh]	173							

5.7.7 Screen page "Trending"

The trending function is a useful tool to compare measurement data at same engine output or load to find deviations in combustion process for preventive maintenance on engine. A max. of 32 measurement data files (*.ext) can monitored with trend function.




Engine Type
2 Stroke
4 Stroke
Select date
select files
start date
2011/06/01
stop date
2011/07/07
Search IPOWER
6800
[kW]
deviation
10
[%]
Values
Pmax
IMEP
Pcomp
Ipower
RPM
dp/dCA
Cylinder
Cyl1
Cyl2
Cyl3
Cyl4
Cyl5
Cyl6
ALL
show values
Selection of engine type
Input of indicated engine power and selection deviation in %. Default value 100 %
Selection of values
Selection of cylinder


trending diagramm
Cylinder Info
IPOWER CYL5
Maximum = 1171 [kW]
Minimum = 1151 [kW]
Average = 1156 [kW]
Information available by mouse click
Information of about time of measurement data

6 Accuracy check

The CPM 500 is adjusted at HEINZMANN workshop at different pressure values (0…300 bar)- and temperature values (50°C- 200°C). The values are described at calibration certificate (see fig.13). A calibration certificate will be delivered with each CPM 500 unit.

The CPM 500 has a very stable and long life cylinder pressure sensor type HTT. We emphasize to check calibration values of CPM 500 at pressure calibrator by hydraulic oil once a year.

Kalibrierzertifikat
Calibration certificate

1523-10-0002-0

HEINZMANN®

Temp.	Pressure	p	StdDev	Temp.	Pressure	p	StdDev	Temp.	Pressure	p	StdDev
203.1	0.00bar	3.99	0.012								
201.8	60.00bar	7.19	0.012								
201.3	120.00bar	10.40	0.007								
200.8	180.01bar	13.61	0.007								
200.6	240.00bar	16.81	0.006								
200.9	300.00bar	20.00	0.006								
200.1	0.04bar	4.01	0.005								

Fig.13: Calibration certificate of CPM 500 unit

6.1 Connection of CPM 500 to pressure calibrator

Connect CPM 500 unit with thompson adaptor to pressure calibrator (fig.14).
Please check possible leakage at adaptor by generating pressure.

Fig.14: Connection of CPM 500 to pressure calibrator

Note: The pictured pressure calibrator is an example to generate pressure. At your workshop you can use your standard pressure calibrator.

6.2 Generate pressure at pressure calibrator

We emphasize to check CPM 500 at most frequently measured Pmax-value on engine.

For example pressure values at 0 bar and between 100 bar – and 200 bar.

Fig.15:Example for indication of static pressure by generating pressure at pressure calibrator

Fig.16: Example for indication of static pressure value at CPM 500 display

Fig.17:Example for indication of static pressure by generating pressure at pressure calibrator

Fig.18: Example for indication of static pressure value at CPM 500 display

Checking procedure:

a) Switch – On by pressing operating key “On/Off “ at CPM 500
b) Generate pressure 0 bar at pressure calibrator (fig.15)
c) Press 3 x operating key “2/4“ at EM-XP. The static pressure value will be displayed (fig.16)
d) Generate pressure for example between 100- and 200 bar at pressure calibrator (fig.17)
f) Check displayed pressure (fig.18)
g) Compare generated pressure at pressure calibrator and displayed pressure value at CPM 500.

6.3 Example of displayed CPM 500 values during pressure check

Indicated pressure [bar] at calibrator	**Displayed pressure [bar] at CPM 500**	*Deviation +/-2.5*
0	0	0
100	99	1
200	198	2

Note: The max. acceptable difference between adjusted pressure at pressure calibrator by ambient (20-25°C) temperature and displayed static pressure at CPM 500 is +/- 2.5 bar. By increasing pressure difference we emphasize to send CPM 500 unit to HEINZMANN workshop for new adjustment and calibration.

The accuracy of the CPM 500 unit acc. technical data is +/- 0.5% full scale (0…300 bar) between adjusted temperature range of 50°C- 200 °C.

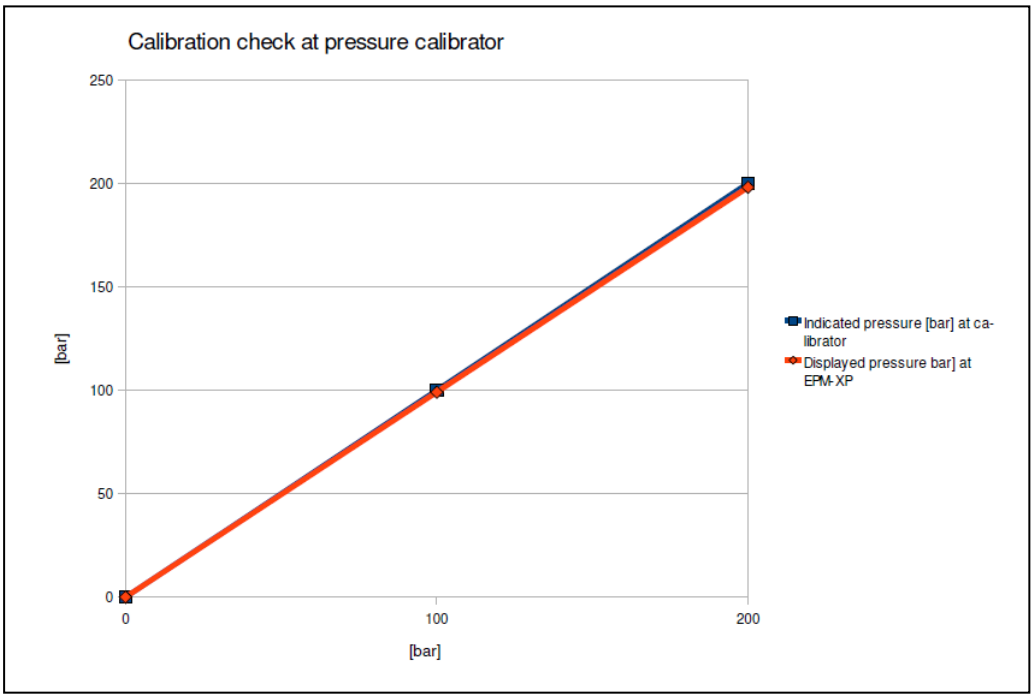


Fig.19: Example of calibration check diagram in Excel program

6.4 Disconnect CPM 500 from pressure calibrator

The thompson adaptor of CPM 500 must be dismounted from adaptor of pressure calibrator. After disconnection the thompson adaptor incl. gas channel of HTT cylinder pressure sensor must be cleaned from oil by using pressurised air.

7 Cleaning

7.1 Periodically cleaning

Clean gas channel of thompson adaptor by compressed air periodically (see fig. 20)

Fig. 20: Periodically cleaning of gas channel

7.2 Cleaning in case of hard deposit

For elimination hard deposit please disconnect sensor from adaptor by using tools with wrench size 19mm and 22 mm (fig.21). Before disconnection of sensor from adaptor spring must be disconnected from adaptor (fig.22).

This procedure should only be done if accuracy of measured values is incorrect!

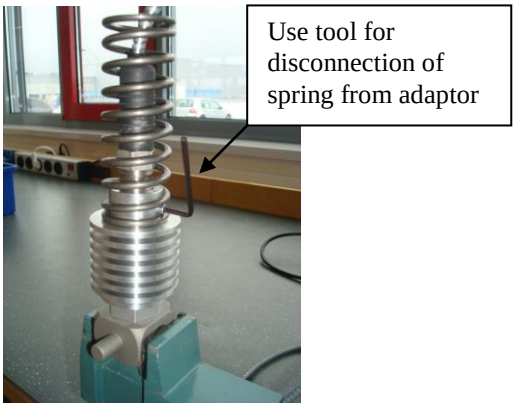


Fig. 21: Disconnection of spring

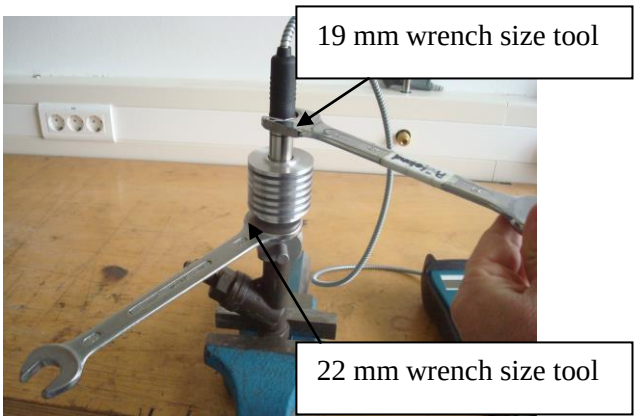


Fig.22: Disconnection of HTT cylinder pressure sensor from adaptor

7.3 Cleaning procedure of adaptor

Please use a drill with 2.5 mm diameter for to clean gas channel of adaptor (fig. 23 and fig. 24)

Fig. 23: Drill 2,5 mm

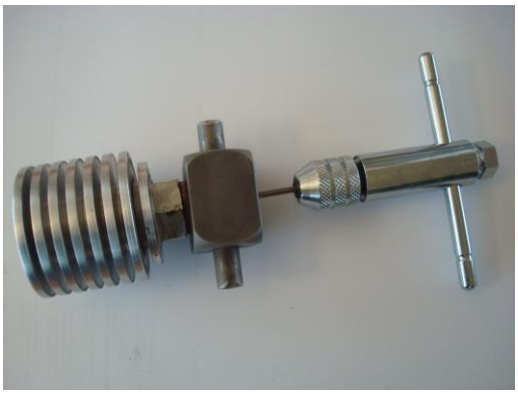


Fig. 24: Drill in case channel for cleaning

Clean gas channel of adaptor with a drill 2.5 mm and clean gas channel of cylinder pressure sensor with special tool.

7.4 Cleaning procedure of cylinder pressure sensor

Please use the special drill tool and clean gas channel of HTT cylinder pressure sensor. (fig. 25 and fig. 26). 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!

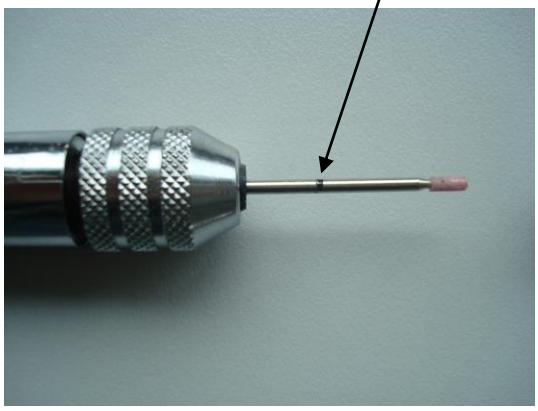
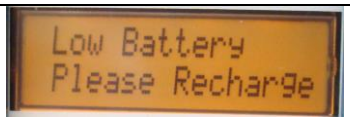
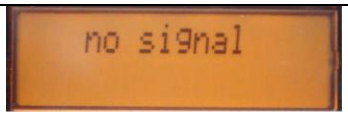


Fig.25: Special drill tool

Fig.26: Special drill tool in gas channel of sensor

8 Basic check for fault finding

Before contacting your local agency or service partner, check the problem guide below.

Problem	Indication at CPM 500	Action
No display indication after switch “On”		Charge battery by connecting to USB port from CPM 500 to PC
Low battery after full charging *If the battery status is low and charging process finished after 5-10 minutes then the user can charge battery manually 90 min. **		Connection to USB port of PC Press 2 s both arrows  at CPM 500 
Over temperature indication *Indication after temperature of measuring cell > 300 °C*		Disconnect sensor from indicator cock and wait 5-10 minutes
High offset		Sensor is defect. Please send CPM 500 unit to HEINZMANN workshop
No signal *Engine speed is lower than 10 RPM or Indicator cock is not opened*		Open indicator cock

* If battery of standard NiMh 250 mAh type Ansmann can not be charged or available than operator can use for measurements Alkaline battery 9V for a short time. Please disconnect CPM 500 unit after transferring data to PC!

Note: It is not recommended to use the Forced Charging Mode when the battery charge condition is more than 40%, due to the risk of overcharging. Please see chapter 5.2 for a description how to check the charge state.

Note: Please only use re-chargeable battery E-block type “ANSMANN 250 mAh NiMh” (Fig. 27).

Fig.27: Re-chargeable E-block battery type: Ansmann

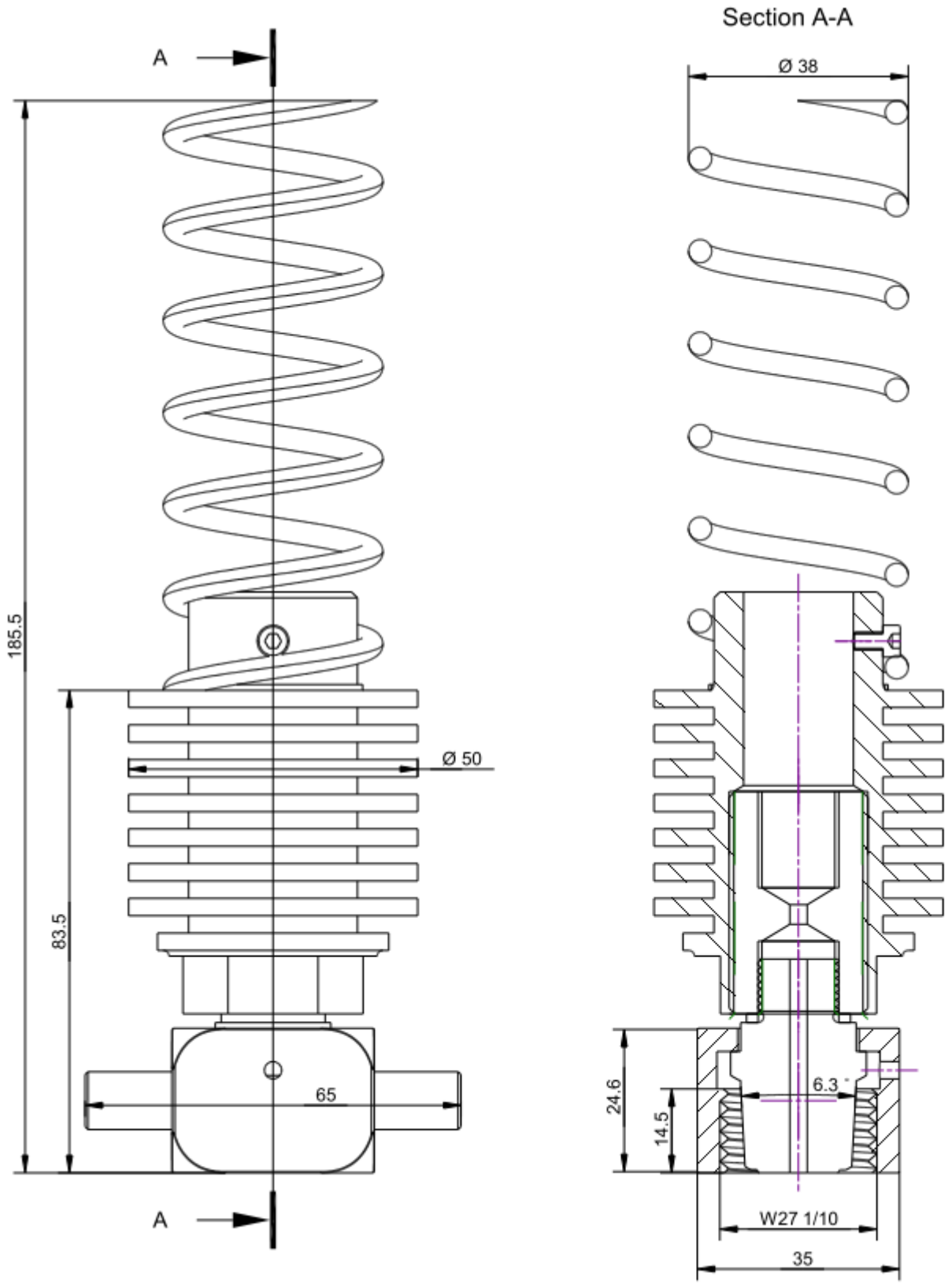
9 Nomenclature

Item	Description
RPM	Engine speed
Pmax	Mean value of maximum pressure [bar]
Cycles	Number of working cycles
dp/ca	Maximum rise of pressure curve [bar/ca]
Pcomp	Compression pressure [bar]

10 Technical data

Measuring range	0…300 bar
Accuracy (CPM 500 incl HTT cylinder pressure sensor)	≤ 0,5 % Full Scale
Max. temperature at measuring cell	300 °C
Storing capacity	20 measurements / engine
Interface	USB
Battery	E-block re-chargeable type ANSMANN 250 mAh NiMh
Dimension	180 x 24 x 52
Weight (incl. battery)	350 g

11 Thomson Adapter



Appendix 1.

The Con-rod length is seldom in the engine manual.
While this data is mostly correct, no responsibility is held for errors.

Engine type	Bore in mm	Stroke in mm	Con-rod in mm
MAN B&W 2-stroke			
L35MC	350	1050	1260
S35MC	350	1400	1600
S35MC	350	1400	1600
S42MC	420	1764	2025
S46MC-C	460	1932	1980
S50MC	500	1910	2190
S50MC-C	500	2000	2050
S60MC	600	2292	2628
S60MC-C	600	2400	2460
S60MC-C8.2	600	2400	2540
L60MC-C	600	2022	2280
S70MC	700	2674	3066
S70MC-C	700	2800	2870
S70MC-C8.2	700	2800	2930
L70MC-C	700	2360	2660
L70MC-C8.2	700	2360	2720
S80MC	800	3056	3504
S80MC-C	800	3200	3280
K80MC-C	800	2300	2920
S90MC-C	900	3188	3270
K90MC-C	900	2300	3159
K98MC	980	2660	3220
K98MC-C	980	2400	3090
K45GUC	450	900	1500
L50MC	500	1620	1950
L55GFCA	550	1380	1958
L60MC	600	1944	2305
L60MCE	600	1944	2041
K62EF	620	1400	2590
L67GFCA	670	1700	2537
L70MCC	700	2268	2730
K74EF	740	1600	2700
L80GFCA	800	1950	2928
L80MC	800	2592	3550

Engine type	Bore in mm	Stroke in mm	Con-rod in mm
MAN B&W 2-stroke			
L80GB	800	1950	2928
K90GB	900	2180	3280
K90GFCA	900	1800	2670
K90MC	900	2550	3505
K98ME	980	2660	3220
S90ME-C	900	3188	3270
Wartsilä Sulzer 2-stroke			
RTA48T-D/-B	480	2000	1860
RT-flex50-D/-B	500	2050	2050
RT-flex58T-D	580	2416	2242
RT-flex68-D	680	2720	2690
RTA82C RT-flex82C	820	2646	2950
RTA82T RT-flex82T	820	3375	3400
RT-flex84T-D	840	3150	3300
RT-flex96C-B	960	2500	2880
RLB66	660	1400	2200
RLA90	900	1900	3000
RLB90	900	1900	3000
RND68	680	1250	2300
RND68M	680	1250	2304
RND76	760	1550	2910
RND76M	760	1550	2430
RND90	900	1550	2880
RND90M	900	1550	2882
RTA48	480	1400	
RTA52U	520	1800	1980
RTA58	580	1700	2600
RTA58T	580	2416	2242
RTA58TB	580	2416	2242
RTflex60	600	2250	2300
RTA62U	620	2150	2360
RTA68TB	680	2720	2690
RTA72U	720	2500	2720
Engine type	**Bore in mm**	**Stroke in mm**	**Con-rod in mm**

Wartsilä Sulzer 2-stroke			
RTA76	760	2200	3250
RTA84	840	2400	2760
RTA84M	840	2900	2480
RTA84T	840	3150	3300
RTA84C	840	2400	2460
RTA96C	960	2500	2880
RT96flex	960	2500	2880
Mitsubishi 2-Stroke			
UEC37LA	370	880	1250
UEC43LS II	430	1500	1600
UEC45LA	450	1350	1619
UEC52LS	520	1850	2159
UEC52LA	520	1600	1928
UEC50LSII	500	1950	2126
UEC60LSII	600	2300	2507
MAN B&W 4-stroke			
40/45	400	450	1045
32/40	320	400	980
28/32	280	320	640
23/30	225	300	650
Caterpillar MaK 4-stroke			
M32	320	480	700
M20	200	300	600
Himsen 4-stroke			
H32/40	320	400	870
H17/28	170	280	540
Deutz 4-stroke			
SBV 6M628	240	280	504
Engine type	**Bore in mm**	**Stroke in mm**	**Con-rod in mm**

Daihatsu			
DK 20	200	300	514
Yanmar			
N21-AL	210	290	530
EY18ALW	180	280	500