

Digital Pressure Indicator DPI-2



Electronic Engine Indicator

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Description

The Digital Pressure Indicator DPI-2 measures dynamic pressures. It is especially designed to analyze and adjust large 2- and 4-stroke diesel and gas engines in connection with the temperature compensated pressure sensor.

The DPI-2 is a powerful and easy-to-use high quality electronic engine indicator which can be characterized by its long life components. A specially developed measuring procedure allows a high-accuracy level with the measuring results. The results include indicated power, MIP (mean indicated pressure), pressure plots and PV diagrams which can then be used for condition based maintenance (CBM) which can save money and time, basing you service schedules on facts and not time.

The measuring method of the DPI-2 is as follows: The pressure sensor is temporarily connected to the indicator valve. While the measuring series is being recorded, the data can be read off the LC display of the hand-held unit. After that, the data sets are saved to memory and can be transferred to the PC via the serial interface on completion of the measuring series. The data may be depicted and administered with the DPI software.

In order to connect the pressure sensor on the engine to be analyzed it must be equipped with a standard indication valve (Thompson connection). If such a valve is not available, please contact LEUTERT.

The DPI system works independently of the mains voltage. It uses its own integrated power supply.

An optional TDC sensor (4-stroke engine) relates the pressure curve to the crankshaft position. By using the crank angle encoder or incremental encoder on a 2-stroke engine the pressure values are measured in relation to the actual crankshaft angle. When using the optional FI-sensor, the fuel injection pressure is measured also in relation to the crankshaft angle.

All systems can be supplied as permanent installation for vessels or as plug-in version for service engineers.

The DPI-2 is delivered in a tough waterproof carrying case.

Pressure sensor

The DPI system includes the pressure sensor shown in fig. 1 which serves to determine the cylinder pressure in the engine. It is characterized by a high level of precision and rugged design. This type of quartz sensor has passed a trial of non-stop 16,000 hours and is accepted worldwide by all engine manufacturers.



Fig. 1 - Pressure sensor

TDC sensor

The TDC sensor is used on 4-stroke engines to determine the exact position of top dead centre on the cylinders. This is necessary for an accurate power and MIP calculation.



Fig. 2 - TDC sensor

CAE sensor

The CAE sensor is used in combination with a TDC sensor on 2-stroke engines to measure the angular position of the crankshaft and the cylinders for accurate power and MIP calculation.



Fig. 3 - CAE sensor

Incremental encoder

The incremental encoder delivers up to 2,048 pulses to the electronics system, thereby enabling a very precise recording of the engine data, such as the position of the top dead centre, or of the crankshaft angle. Therefore, no additional TDC sensor and CAE sensor is required here.

The incremental encoder is delivered to you with a complete assembly kit for mounting on Wärtsilä RT-flex engines.

The use of the Leutert alpha lubricator connection kit is optional and suitable exclusively for engines equipped with an MAN alpha lubricator system. It enables the use of the incremental encoder already standard installed with the MAN alpha lubricator without impairing its function.



Fig. 4 - Incremental encoder for RT-flex engines

Fuel injection sensor

This sensor is a special pressure sensor for fuel systems of diesel engines. The robust product design withstands humidity and temperature fluctuations, heavy vibration, extreme pressure peaks and electromagnetic interferences for an accurate and reliable performance. The main features are:

- Robust design for use in harsh environments
- Resistant to cavitations, liquid hammer and pressure peaks
- Overload pressure 1.5 times measuring range
- Enclosure stainless steel (AISI 316L)
- Wetted parts stainless steel (AISI 630)
- Pressure ranges from 0 up to 3,000 bar
- All standard output signals: 4 – 20 mA, and voltage outputs
- Self-diagnostic feature
- Temperature compensated
- High vibration stability and high IP protection
- For medium and ambient temperature up to 125°C

The typical application is:

- High pressure fuel injection measurement for use with diesel fuel MFO and HFO



Fig. 5 - Fuel injection sensor

The pressure and the fuel injection sensor are connected to the hand-held data acquisition unit by means of an armored cable.

Hand-held data acquisition unit

The electronic components of the portable DPI hand-held are incorporated in a tough aluminium water resistant body. Figure 6 below shows the hand-held data acquisition unit.



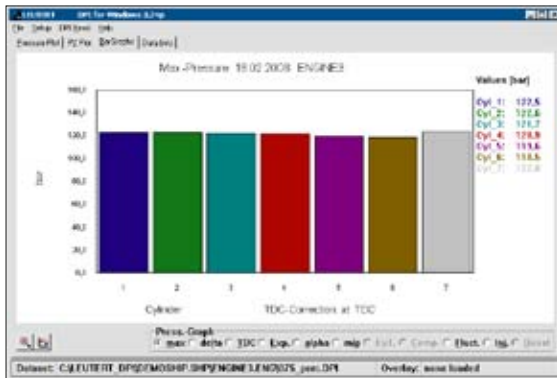
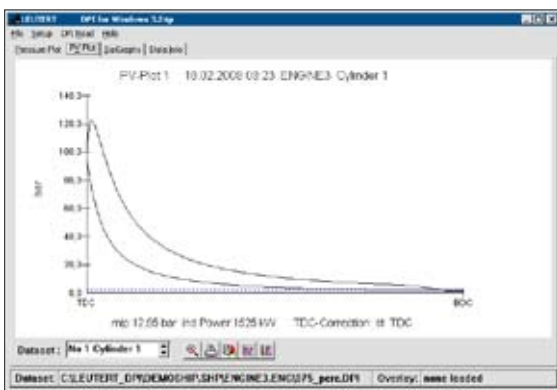
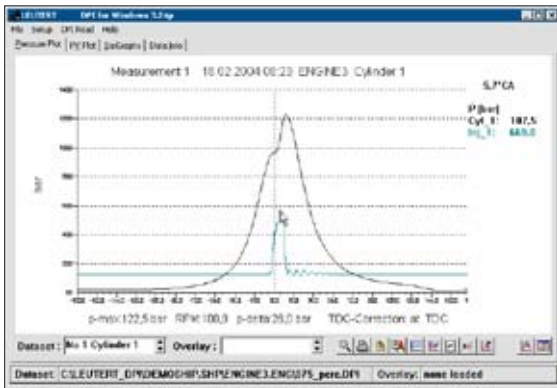
Fig. 6 - Hand-held data acquisition unit

Analyzing software

After measuring the pressure with the hand-held data acquisition unit and the pressure sensor, the measured data may be downloaded to any PC and analyzed with our analyzing software supplied with the DPI system.

Pressure relevant to crankshaft angle, peak pressure and the PV diagram may be displayed as well as the derivative plot. Additionally, the power of each cylinder and the total power of the engine may be calculated, see fig. 7.

Other functions including overlaying of measurements for comparisons and e-mail sending function assist in using the DPI system for CBM.



	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	mean	total
Engine	1	1	1	1	1	1	1	---	---
Cylinder	1	2	3	4	5	6	7	---	---
alpha TDC [°]	9	29.7	103	156	206	99	288	---	---
Time	18.02.2004 18:02:2004	18.02.2004 18:02:2004	18.02.2004 18:02:2004	18.02.2004 18:02:2004	18.02.2004 18:02:2004	18.02.2004 18:02:2004	18.02.2004 18:02:2004	---	---
Power	0W	0W	0W	0W	0W	0W	0W	---	---
Atmosphere	0h	0h	0h	0h	0h	0h	0h	---	---
TDC Correction	at TDC	at TDC	at TDC	at TDC	at TDC	at TDC	at TDC	---	---
Mean Press. [bar]	2,26	2,26	2,26	2,26	2,26	2,26	2,26	---	---
p-max [bar]	650,8	730,1	600,8	5,8	5,9	6,0	299,8	---	---
p-mean [bar]	122,5	122,8	121,7	120,9	119,9	116,5	121,8	121,3	---
p-mean high [bar]	122,1	121,8	121,1	120,7	119,5	115,9	121,8	120,3	---
p-mean low [bar]	122,2	120,8	123,8	120,8	122,1	116,5	120,2	122,8	---
Peak p-mean [bar]	3,8	6,7	2,3	5,7	3,7	3,8	4,3	3,8	---
p-delta [bar]	24,8	28,8	28,2	25,5	25,3	26,1	28,3	27,8	---
alpha p-max [°]	14,8	18,8	18,8	19,8	19,8	19,2	19,8	19,8	---
alpha p-delta [°]	8,0	8,2	8,8	8,7	8,7	8,9	8,8	8,8	---
alpha TDC [°]	8,2	8,5	8,5	8,2	8,2	8,3	8,3	8,3	---

Features

- Menu controlled operation
- Sufficient memory to analyze up to 32 cylinders
- Measurement and display of cylinder pressure in individual cycles or in up to 16 cycles on average
- Storage of motor and measurement parameters
- Selection of various filters
- High sensitivity through 12-bit A/D converter
- Real time clock
- Integrated rechargeable batteries
- Interface for PC (RS 232, adapter for USB)

Technical specifications

- Pressure sensor : 0 – 250 bar
- Fuel inj. sensor : 0 – 2000 bar, 0 – 3000 bar
- Speed range : 35 – 800 rpm for 2-stroke engines
120 – 1400 rpm for 4-stroke engines
- Memory capacity : 9 engines (32 data sets)
- Pressure resolution : 0.07 bar for pressure range
0 – 250 bar
- Accuracy : ± 1.5 % FSO for sensor
temperature 100 – 250 °C
- Battery capacity : 6 hrs
- Battery charger
Input : 100 – 240 V AC, 50 – 60 Hz
- Operating temperature range
Hand-held unit : 0 – 55 °C
Pressure sensor : 0 – 350 °C
- Dimensions
Hand-held unit : 220 mm x 130 mm x 45 mm
Pressure sensor : Ø = 60 mm , L = 210 mm
Carrying case : 470 mm x 365 mm x 146 mm
- Weight
Hand-held unit : 790 g
Pressure sensor : 830 g
Carrying case : 6500 g incl. contents

Fig. 7 - Screenshots of the DPI software