ICON RESEARCH

THE DIESEL DOCTOR

Diesel Engine Condition & Performance Monitoring

Portable Solutions for Diesel Engine Condition and Performance Monitoring, Combining Accuracy, Ease of Use and Durability.

THE DIESEL DOCTOR

Version V6 Software

New DK-20

Analyser from Icon Research

DK-20 PORTABLE ANALYSER

DK-20 and DK-20/FV Portable

FEATURES

- All New Compact Instrument
- Proven Reliability and Accuracy
- Cylinder Pressure Only & Cylinder with Fuel Pressure Versions
- Easy to use Full Colour Touchscreen
- Choice of Inductive or Optical Crank Synchronisation
- Easy Carrying in Compact Shoulder Bag
- Designed to Meet the Requirements of Real Marine Users

Portable Doctor Systems

Over a period of 20 years, the Doctor DK series from Icon Research has become a standard for diesel engine monitoring and analysis in the marine industry, as well as many onshore applications, having built its reputation on reliability, accuracy and ease of use.

The new DK-20 is a next generation instrument that builds on the strengths of the earlier products, but incorporates many new features that enable even easier and more accurate measurements. The DK-20 is smaller and lighter than its predecessor and incorporates a large high resolution colour touchscreen behind impact resistant glass. However, a complete set of cylinder measurements can still be taken without having to remove protective gloves.

System Checks

To ensure the reliability of data, measurement integrity is enhanced by a series of system checks prior to readings being taken. For example, the instrument checks that the operator has connected the pressure sensor to the correct cylinder, and checks that engine speed signals are within tolerance. All the operator has to do is press the large GO button.

To protect the investment already made in instruments purchased from Icon Research, all pressure sensors, crank pick-ups and accessories are the same as used with the DK-2. Indeed, the DK-20 can be simply used in place of the DK-2 with no changes to supporting hardware whatsoever. Two versions are available; the DK-20 is a single channel unit for measuring cylinder pressure while the DK-20/FV measures cylinder and fuel pressure simultaneously. Both systems use ***Kistler*** pressure sensors for long term reliability and accuracy. The latest '***Diesel Doctor***', as it is often known, is housed in an extremely rugged plastic case and is fully sealed against moisture and dirt. A complete system, including sensors and cables, fits into a convenient shoulder bag.

Your Investment

The marine industry, like any other, operates in a dynamically changing environment. Particular issues in the marine industry are fuel economy, reduction of emissions and improved uptime, to name but a few. The DK instruments and software from Icon Research continue to adapt to these changes and combine to provide an invaluable tool in helping to address the new challenges in the marine market.

DK-20 TECHNICAL SPECIFICATION

PRESSURE MEASUREMENTS

No. of Channels:	Single channel (DK-20) two channel simultaneous (DK-20/FV)
ICP Interfaces:	2.4mA at 24Vdc nominal
Input Voltage Range:	+/-5V
Connector Type:	TNC
Bias Voltage Check:	25Vdc range for ICP bias voltage
Amplitude Accuracy:	±1% typical

CRANK INPUTS

No of Channels:	2
Modes:	TDC ONLY or DUAL (with Auto-Select)
Connector Type:	6-way milspec
Crank Sensor Types:	Inductive or optical
Crank Sensor Supply Voltage:	24Vdc nominal

RECOMMENDED CYLINDER PRESSURE SENSOR (KPS-1)

Type:	Kistler 7613C, piezoelectric
Nominal Sensitivity:	20mV/bar nominal (calibration certificate supplied)
Indicator Cock Adapter:	Thompson Adapter with tube spanner for disassembly
Operating Temperature:	350ºC at sensor head
Cable:	High temperature cable supplied with sensor, length 1m

RECOMMENDED FUEL PRESSURE SENSOR (KFS-1)

Type:	Kistler 6729A, piezoelectric
Nominal Sensitivity:	2.5mV/bar nominal (calibration certificate supplied)
Mechanical Fitting:	1/2” BSP male adapter (fitted to sensor) to fit standard fuel isolation valves
Operating Temperature:	200ºC at sensor head
Cable:	High temperature cable supplied with sensor, length 1m

DISPLAY

Type:	640 x 480 full colour VGA
Keypad:	Integrated touchscreen (capacitive)
Measurement Start:	Sealed GO button or screen touch

PERFORMANCE

Engine Speed Range:	20 RPM - 3000 RPM
Resolution:	0.1º up to 1820 RPM 0.2º, 1820 RPM to 3000 RPM
Max Sampling Rate:	102.4kHz
Measurement Storage:	Over 200,000 traces

COMMUNICATIONS

Communications Port:	USB 2.0
Connector Type:	mini-B, sealed

MECHANICAL

Case:	High impact HPX plastic (yellow), press & pull latches, softgrip handle
Dimensions:	30cm x 25cm x 12cm (meets airline carry-on regulations)
Weight:	2.6kg

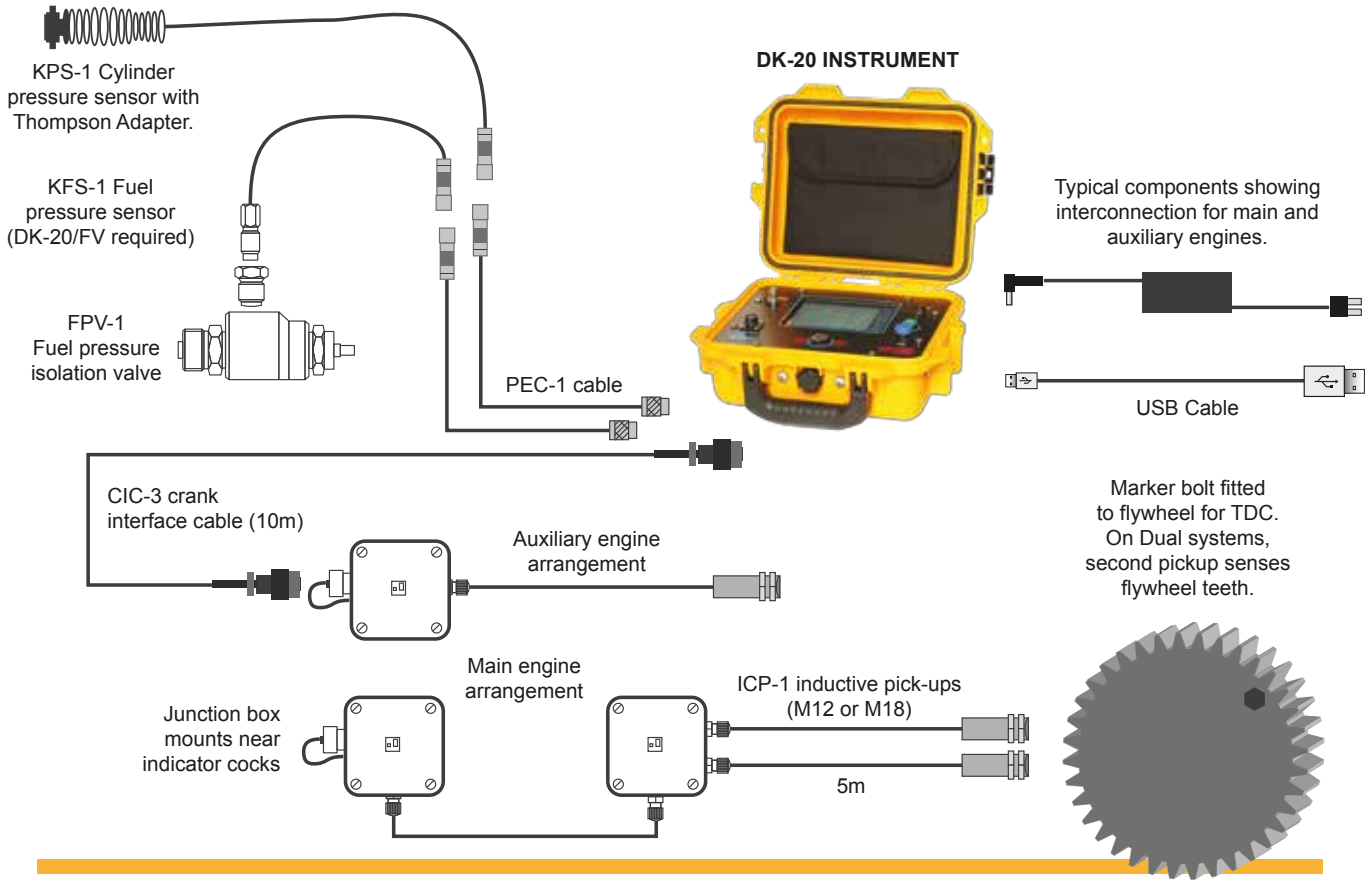
ENVIRONMENTAL

Operating Temperature:	-10ºC to +55ºC
Sealing:	IP66 (IP67 with lid closed)
Compliance:	CE, RoHS

POWER

Power Source:	Internal rechargeable Li-ion battery
Battery Charger (supplied):	9Vdc output rated at 3A, mains input voltage 100-240Vac, 50-60Hz (unit can also be trickle-charged via the USB port)

DK SYSTEM INTERCONNECT



The Doctor instrument is available in two versions, namely the single channel DK-20 for cylinder pressure only measurements, and the two channel DK-20/FV which incorporates a second channel for simultaneous fuel or vibration measurement.

Fuel injection sensing can detect issues with injectors while vibration sensing with an accelerometer can detect valve timing within the cylinder. The diagram above shows how the sensors connect to the DK instrument.

Both instruments use single or dual pick-ups to synchronise pressure measurements with crank (and therefore, piston) position. Dual pick-ups are generally used on slow speed direct drive engines (usually 2-stroke) where the speed of the engine can vary during a revolution. One pickup senses the once per rev 'TDC' marker while the second pick-up senses the flywheel teeth, thus minimising the effects of speed variations during each rev. This improves the accuracy of power figures. For medium speed engines (typically auxiliaries that are driving generators), a single 'TDC ONLY' pickup is sufficient.

For reliable long term operation, inductive pick-ups on the crankshaft and flywheel are recommended. These are permanently mounted on the engine with a local junction box (or a combination of boxes on large 2-stroke and V-engines). A CIC-3 cable connects the junction box(es) to the instrument. For service work or a temporary installation, an optical pickup is available for TDC ONLY mode.

Engine details are uploaded into the instrument prior to taking measurements. To take readings at the engine, simply connect the CIC-3 cable to the local junction box and move the pressure sensor from cylinder to cylinder, pressing the GO button once for each cylinder. Key results and a trace are shown on completion. A full set of main engine readings can be made in under 15 minutes.

Results for indicated power are within 2% or better once system setup is complete. The repeatability of the system is within 0.5% or better. Results are available in the instrument immediately after a reading is taken.

After readings are made on all cylinders, they are transferred into the Doctor Analysis Software for full analysis and diagnosis.

DOCTOR V6 SOFTWARE

Summary

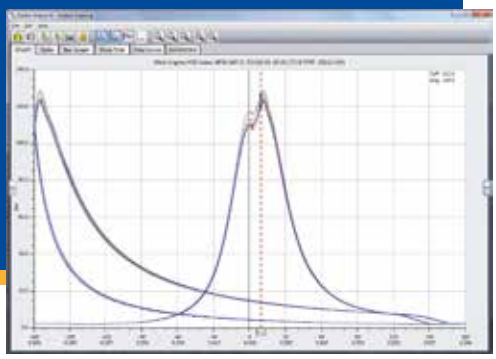
For over 20 years, the Doctor has been helping engineers to manage their engines' condition and maintenance. The latest version V6 has been completely rewritten and is Windows™ XP, 7 and 8 compatible. Version V6 retains many of the standard features that current users are familiar with, but adds many new features for faster and easier engine measurement and diagnosis. Ship operators can easily and efficiently handle single engines up to entire fleets. The performance of similar vessels can be compared to determine where improvements can be made.

The software comes on a self loading USB flash drive and includes a step by step manual, a tutorial, and many useful technical notes. The program can be installed on as many PC's as needed, and is fully network compliant. Data management is straightforward and intuitive using simple drag and drop actions for transferring engine data and measurements. All information is passed using 'logbook' files which can be easily sent from ship to shore using the built in emailing tool. The look and feel of the Doctor has been maintained, with many enhancements to operation and data handling now added.

Getting Started

The programme is intuitive to use, and will automatically start up with a samples library that will let you try out the features of the software. The Doctor Setup Service offered by Icon Research provides you with a logbook customised for your engines so, once the software is installed, no further setup is required.

For users with earlier versions of Doctor software, all data can be transferred into version V6 so all previous engine measurements remain intact.



Doctor V6 Features

Compatibility

Windows™ XP, 7 and 8 compatible (32- and 64-bit)

Converts earlier Doctor database formats

Engine Configurations

Supports all engine types (2-stroke, 4-stroke, V or in-line, diesel, dual fuel or gas engines)

Unlimited configurations can be entered and stored

Displays

Trace, bar graph or table of results

Pressure Angle, Pressure Volume, Derivative, Fuel Pressure or Vibration trace combinations

Overlay of any test with any other combination of tests for any engine, or similar engine tests from the same or from different ships

Quick-Smart Zoom with Favourite Zoom stores

Flexible cursor options

MIP, Power and other results calculated automatically

Ability to recalculate results

Notes can be tagged to test or engine

Password locking of key parameters

Data Exchange

Copy or move results, engines, ships etc. between libraries

Fully network compliant

Drag and drop data exchange

Analysis Tools

On screen single click switching between traces, tables, bar graphs and diagnostics

Point and click trace highlight

Sort traces by cylinder or firing order

Compare between multiple engine diagnostic reports

Ignition point markers on traces

ISO normalisation

Propeller curves for 2-stroke engines

Shop/Sea trial comparisons with settable deviation limits

Fleet Analysis

The user can select results from several engines at once. This powerful tool allows comparison of engines on the same ship, on different ships and even between different operators. It is the ideal tool for Fleet Analysis of engines.

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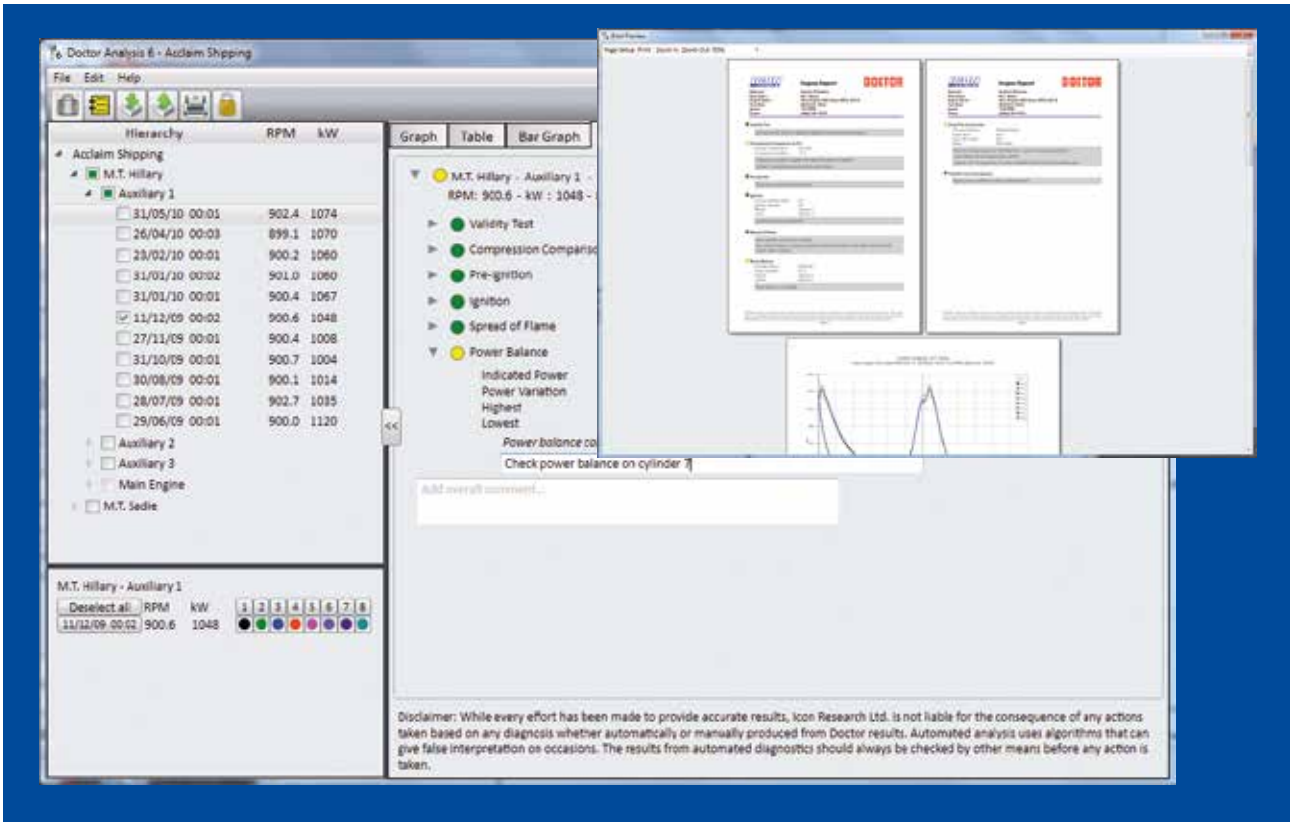
DOCTOR V6 DIAGNOSTICS



Diagnostic Reporter Module

The Diagnostic Reporter Module was introduced in version V5 of the Doctor software. This has now been greatly enhanced in version V6 with additional diagnostic rules and improved ease of use. The Doctor not only provides high accuracy results but it can evaluate them as well. This innovation truly empowers engineers and provides a valuable tool in their engine management portfolio.

The Diagnostic Reporter has been developed using 20 years of experience in diesel engine diagnostics. The analysis results help to point the engineers in the right direction regarding maintenance of their engines. And, when engines are healthy, a report with all green indicators gives a measure of comfort.

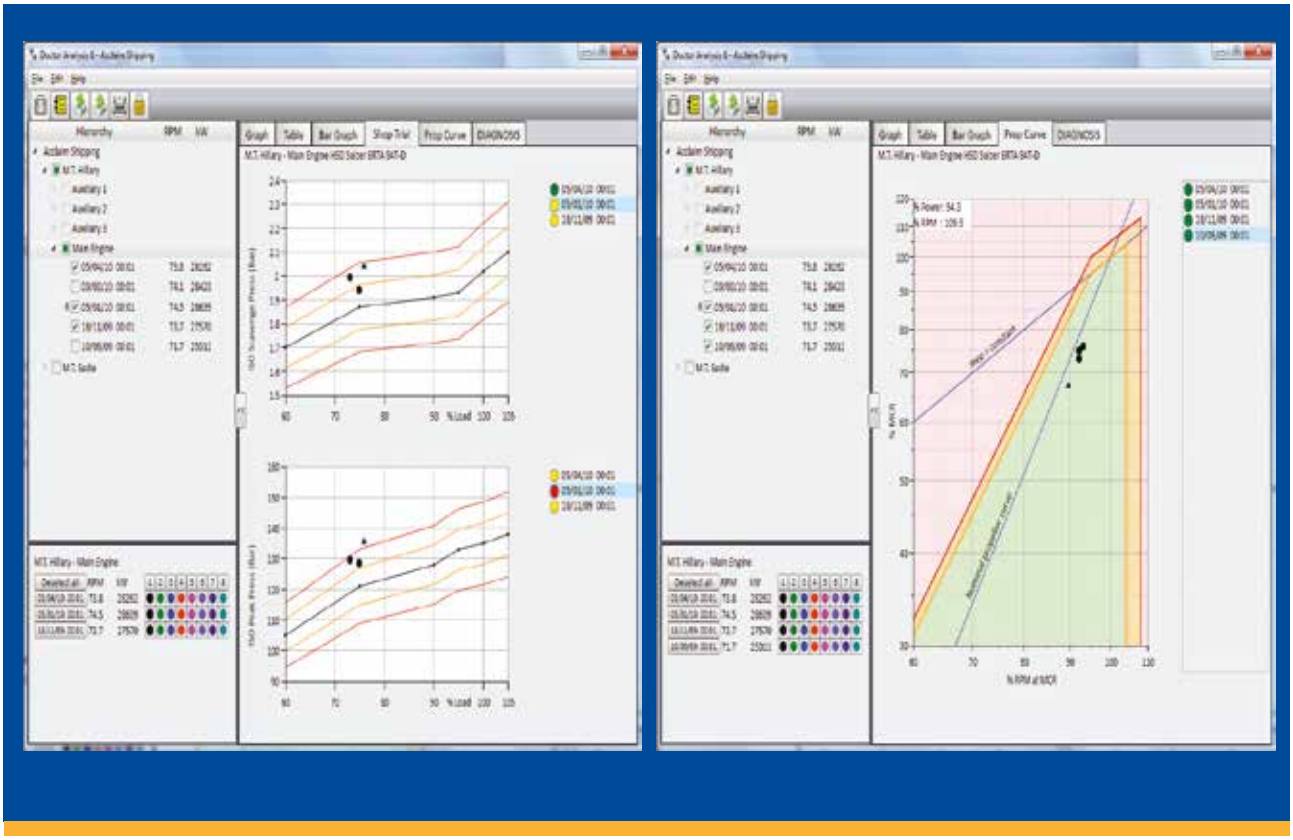
The Diagnostic Reporter uses a six step analysis procedure that has been developed over 20 years to perform an analysis. This process can be carried out manually but requires significant examination of cylinder data. The reporter does the analysis automatically and the results are available in seconds.

Diagnostic Reports include an analysis section where the results of the six steps are summarised, and diagnostic statements are given if problems are identified. Preselected graphs of the results are next, followed by tabular and bar graph data.

Moving between traces, tables, bar graphs and the diagnostics summary can be carried out by single clicks on the computer screen. Notes can be added at each section for further explanation or to suggest remedial work. A report can then be generated in PDF format for assessment by others within the organisation.

The diagnostics function can act as a useful training aid for less experienced engineers and is a valuable tool for pointing experienced technical staff in the direction of possible problem areas. Indeed, the reporter has been known to find issues that even the most experienced engineer could not see from examination of traces and other data.

SEA/SHOP TRIAL AND PROPELLER CURVES



Shop and Sea Trial Comparisons

Doctor V6 software enables ongoing comparisons to be made with measurements taken during Shop and Sea Trials. These can be recalled at the click of a button on the appropriate tab on the computer screen. Measurements can be ISO corrected so that measurements can be taken anywhere in the world for accurate comparisons. MAN and Wartsila ISO correction methods are both included.

Shop and Sea Trial measurement data is entered manually and allowable limits are then defined. A 'traffic light' green-yellow-red warning system is used to indicate if current readings are outside the predetermined limits. A green symbol means that the current measurement is good, and yellow and red provide two levels of warning. A range of scalar values can be compared with shop/sea trial values, plotted against both % Load and RPM. Industry standard formats and terminology have been employed to ensure engineers can quickly understand and interpret data. Shop and sea trial comparison can be analysed by the diagnostic reporter and the results included in the engine report. This procedure is ideal for the typical monthly engine reports produced by vessels.

Propeller Curves

As soon as readings are transferred from the DK instrument, the propeller curve graph can display whether the engine is running in its safe zone or if the engine is being overloaded. This is achieved by a single click on the appropriate tab on the computer screen. The same 'traffic light' system is applied to indicate the status compared with predetermined limits. The graphical output is in a standard format that is easily understood by technical staff.

The propeller curve is used for 2-stroke main engines. Observing that the engine is operating in the green zone is once again a comfort factor that the engine is not being inadvertently overloaded.

Propeller curve comparisons are included in the engine report.

SERVICE AND SUPPORT

Installation and Commissioning

The Doctor DK system has been designed to make installation as straightforward as possible. To save on expensive installation and commissioning costs, we encourage our customers to carry out installation work using their own staff, supported as necessary by Icon Research's in-house engineers. The large majority of Doctor systems are 'crew install' and this approach has proven to be very successful over many years. Comprehensive installation and troubleshooting guides are available. Installation and commissioning services can be arranged through Icon Research with agents located world wide who can supply these services.

Doctor Setup Service

To ensure quick and accurate setup of your Doctor system, Icon Research offer a Doctor Setup Service. Here's how it works:

1. Icon Research provide a simple form that is completed by the customer which contains details of the engines on the vessel. The form is then returned to Icon.
2. When the Doctor system is shipped, Icon Research provide a customised logbook for the vessel on a USB flash drive. Once the Doctor software is installed on a local computer, the logbook is simply 'dragged and dropped' into the software and the system is ready to go.
3. The vessel takes the first set of readings and sends the results via email to Icon Research using a simple auto email facility in the software. Icon Research check the results and carry out TDC offset adjustment (in software) to take account of the positioning of the crank pick-ups on the shaft.
4. Icon Research email the corrected file back to the vessel resulting in setup/commissioning completion. This option is the most cost effective and fastest way to set up a Doctor system. There is no need to wait for a convenient port or short sailing for an engineer to attend the vessel. The corrected logbook file is emailed back to the vessel within a couple of days of the initial readings being taken. If any major problems with the engines are found, these will be detailed in the reply message. This service is included irrespective of whether the Doctor Setup service is used.

Training

Training Courses: Although many marine engineers have seen 'cards' and are used to interpreting them, the Doctor offers much higher resolution and detail. Icon Research training courses cover a simple 6 step analysis method that covers all major engine problems and gives a structured approach to analysis. Courses can be arranged at locations to suit the customer.

Lifelong Support

When you purchase a Doctor system from Icon Research, you can look forward to ongoing support that has set the standard within the marine industry. Icon Research is renowned for its responsiveness and willingness to assist customers, many of whom we have been working with for almost 20 years. Should any operational problems be encountered, telephone support is available during office hours (GMT) and email queries are normally answered within 24 hours.

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