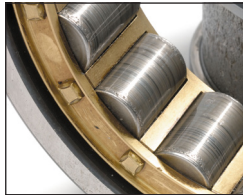


# ANALEX<sup>®</sup>pqL



## PQ<sup>®</sup> Technology Ferrous Debris Monitor Installation and Operation Manual

# ANALEX<sub>pqL</sub>

PQ<sup>®</sup> Technology Ferrous Debris Monitor  
Installation and Operation Manual

MA-K18063-KW Issue 9

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# 1 Introduction

## Key to Symbols



= Caution



= Note – Important information and helpful hints and tips

## For General Enquiries, please contact:

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West Sussex  
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United Kingdom

Tel: +44 1903 731470  
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Web: [www.kittiwake.com](http://www.kittiwake.com)

## Do Not Discard This Manual

The Installation and Operation Manual is a functional part of the ANALEXpqL product and must be kept for future reference.



Please retain all original packaging for shipping purposes. Kittiwake will not be liable for damage to returned goods resulting from inadequate packaging.

This manual covers the Kittiwake ANALEXpqL Ferrous Debris Monitor. The instrument provides the most accurate means of detecting and measuring ferrous wear debris in lubricating oils, hydraulic oils and greases. The rugged, compact and stable monitor delivers retrievable data quickly and simply, ensuring fast, accurate and consistent management of lubricating oil samples.

Unrestricted by particle size or distribution, combined with speed and ease of use, the ANALEXpqL is an extremely effective laboratory based screening tool for multiple samples prior to further analysis by ICP or XRF.

Condition monitoring of machinery lubricants is an established method of predicting and avoiding impending machinery breakdown. Worn components can be identified early and replaced before any serious damage occurs. Production can be maintained, machinery life extended and the return on capital investment increased.

The ANALEXpqL is not designed to make absolute measurements on debris quantity - it monitors trends. To be significant, the PQ Index must change by at least 10% relative to the previous measurement. Empty bottles/pots and clean oil often give a slightly positive PQ Index. This is normal and will not affect trends as long as they give consistent readings.

## Quick Start



90 → 264 Vac

---

## 1.1 Quick Guide

---

### MEASURE

- Manual**
- ▶ Toggle number of measures for this sample
  - ▶ **Append to File.**  
Add new results to existing results file
  - ▶ **New File.**  
Create a new file for these results
  - ▶ Choose an existing file or type name of new file.  
Press **Go** to commence measure sequence.
  - ▶ **And Again.** Swap sample and repeat test.  
**Print.** Use Kittiwake printer.  
**Transmit.** Transmit via RS-232 or to a USB memory stick.  
**Save & Exit**  
**Exit (no save)**
- 

**Magazine** (Non standard option. Special order only)

---

- Remote**
- ▶ Allows remote control from an external PC
- 

### DATA MANAGER

- Highlight a file in the list
- ▶ **View**
  - ▶ View the file
  - ▶ **Print**  
**Rename**  
**Delete**  
**Transmit**
- 

**Rename** ▶ Type new filename

---

**Delete** ▶ **Single File.**  
Delete highlighted file.  
**All Files.**  
Delete all files.

---

**Transmit** ▶ Transmits file via RS-232 (9-way D type connector) and to a removable drive (USB memory stick) if inserted.

---

---

## TRANSMIT

- ▶ Highlight a file in the list
- ▶ **Selected File.**  
Delete highlighted file.
- ▶ **All Files.**  
Delete all files.
- ▶ Transmits file(s) via RS-232 (9-way D type connector) and to a removable drive (USB memory stick) if inserted.

---

## SET UP

- ▶ **Calibrate**
- ▶ Calibrate instrument using 0PQ and 750PQ standards supplied by Kittiwake
- ▶ Place the correct standard puck on the carousel when instructed. Press **Go**.
- ▶ **Save results**
- ▶ **Cancel**

- 
- ▶ **Set Time & Date**
  - ▶ Use toggles to adjust time and date (ISO standard format)

- 
- ▶ **Align**
  - ▶ Run the Carousel Align Sequence. Note that this sequence is automatically carried out whenever the instrument is switched on.

- 
- ▶ **Options**
  - ▶ See Section 5.4

---

## SHUT DOWN

- ▶ Hold button down for 3 seconds
  - ▶ Are you sure?
  - ▶ Do not remove power until instructed to do so.
-



## 1.2 Certificates

### EC Declaration of Conformity



**Manufacturer:**

Kittiwake Developments Limited  
3-6 Thorgate Road  
Littlehampton  
West Sussex  
BN17 7LU  
United Kingdom

Tel: +44 (0) 1903 731470  
Fax: +44 (0) 1903 731480

Email: sales@kittiwake.com  
Website: www.kittiwake.com

Hereby declares that the following apparatus:

Product Name:	ANALEXpql
Model Number(s):	FG-K17000-KW

Are in conformity with the following Directives and standards:

Electromagnetic Compatibility EMC Directive 2004/108/EC	
EN61326-1: 2006	Electrical equipment for measurement, control and laboratory use – EMC requirements
Low Voltage Directive (LVD) 2006/95/EC	
EN 61010-1: 2001	Safety requirements for electrical equipment for measurement, control and laboratory use. General requirements
EN 61010-2-081: 2002	Particular requirements for automatic and semi-automatic laboratory equipment for analysis and other purposes

**Manufacturers Signature:**

Andrew Baldwin  
Technical Manager, Kittiwake Developments Ltd.

Date: 3<sup>rd</sup> June 2011

## 1.3 Cleaning

If aggressive fluids (e.g. phosphate esters) are being tested, particular care should be taken to avoid contact between the fluid and the ANALEXpQL. It is very important to keep the instrument clean, particularly the platen surface underneath the carousel. Otherwise, a new sample may become contaminated by a previous spilt sample.

To clean, use a damp cloth moistened with a warm detergent solution. Do not use aggressive solvent cleaners as they may damage the surface.

### 1.3.1 Cleaning The Main Enclosure

Lightly wipe the body of the instrument. Do not scrub as this may damage the paint finish.

### 1.3.2 Cleaning The Touchscreen

Any fluids should be removed immediately to avoid staining. Shut down the instrument and lightly wipe the screen with the cloth. Do not scrub hard and wipe only in a horizontal or vertical motion. Never wipe in a circle.

### 1.3.3 Cleaning The Carousel

The carousel may require cleaning during normal use to ensure it is clear of any metal debris or spilt samples. Shut down the instrument, remove the power and only then remove the carousel by firmly pulling it upwards.

Carefully clean the platen base and both sides of the carousel before realigning the location pins and pressing down firmly on the carousel to fully reattach. When correctly positioned, the carousel should not rock at all.



Upon switching on the power, the unit will self-align. **Re-calibrate** before further use since the carousel has been removed. This is critical to ensure accuracy of subsequent measurements.



It is strongly advised to shut down and power off before cleaning. If the carousel is ever removed and replaced without shutting down, ensure that the unit is **Re-Aligned** (see Section 5.4.3) and **Re-Calibrated** (see Section 5.4.1) before re-use.

## 1.4 Calibration, Maintenance & Service

The ANALEXpqL uses proven, patented magnetometry combined with internal microprocessing to indicate metallic particle contamination. The supplied standards should be used for calibration of the instrument at regular intervals and these standards should be returned to Kittiwake for re-calibration as specified on the accompanying certificates.

There are no user serviceable parts in the ANALEXpqL. If required the fuse can be replaced by removing the fuse cover on the rear. Spare fuses are available from Kittiwake Developments Ltd (see Section 3.6).



For continued performance, Kittiwake recommends that the ANALEXpqL is serviced, checked and calibrated regularly by the factory. The recommended re-calibration period is 18 months.

## 1.5 Practical Hints

For best stability, the ANALEXpqL should be left permanently switched on so that the temperature inside the instrument stabilises. Temperature variations are a significant source of error and warm samples should not be left on the sensor.

Do not apply pressure to the top surface of the instrument - this may lead to spurious results and cause damage.

When an oil sample (either in a plastic pot or in a bottle) is in the measurement position, it must be in intimate contact with the sensor coil. The rotating carousel guides the sample across the top surface of the platen to the sensor position. It is important that the sample (or the 750 PQ standard) is a loose fit in the carousel aperture (or adapter). Due to the effects of temperature or spilled material, the sample (or the 750 PQ standard) may cease to be an "easy fit" in the carousel aperture. If it is held tightly in the carousel so that it is no longer in intimate contact with the sensor during a measurement, errors may result.

It is important that sample pots sit correctly on the measurement sensor otherwise major errors may result. The pots supplied by Kittiwake are suitable for PQ measurements. It is essential that all plastic sample pots are individually examined before use and that any pips or projections are removed using a sharp knife. See section 4.4.34.4.2. Sample pots and plastic bottles must only be used once - **NEVER** try to clean and re-use these.

## 1.6 'PQ Index' Versus 'PPM Of Iron'

Users of Spectroscopic Oil Analysis (SOA) methods report their data in parts per million. However, SOA methods are often inaccurate in absolute terms because of the insensitivity of these techniques to large particles and the problem of sample inhomogeneity. SOA is typically most efficient with sample particles <5 microns in size.

Many commercial laboratories are now using both SOA and PQ side by side and the analytical results from the two techniques are often interpreted in the following manner. If the "PQ Index" is less than the "ppm Fe" analysis by SOA, it is likely that all debris is <5 microns in size (this is typical for corrosive wear particles). If the "PQ Index" and the "Fe ppm" by SOA are similar or especially if the PQ Index is higher then it is likely that there will be large particles in the sample. The sample is then examined by microscope to check for the presence of large particles.

## 1.7 How Useful Is Measurement For Iron Only?

The PQ technique responds significantly to ferromagnetic materials such as iron and nickel. There are applications concerning wear in aluminium engines and in white metal bearings where the PQ might not be applicable. However, even for used oil analysis programmes concerning wear in diesel engines (a good example of a "multi-element" application), the PQ technique easily identifies the release of larger particles due to "filter breakthrough".

## 2 Safety Summary

Please ensure you thoroughly read and understand this user manual before attempting to operate the ANALEXpqL.

If the equipment is used in a manner, or for a specific purpose other than that described in this user manual, then any safety protection may be impaired.

- Never use the ANALEXpqL near combustible gases or liquids.
- Never disassemble, repair, or tamper with the ANALEXpqL.
- Ensure that the supply voltage is within the specifications with means of isolation fitted.
- Check all wiring for correct connection before powering the unit.
- The ANALEXpqL, power supply & accessories contain no user serviceable parts. Do not disassemble.
- When handling oil samples, protective gloves and safety goggles should be worn.
- The ANALEXpqL has a rotating carousel. Care should be taken to avoid damage to the equipment or injury to the user.



**Warning!** This equipment has not been approved for use in an explosive atmosphere.



**Caution!** This equipment must be operated by qualified persons only.

### 3 Technical Information

The ANALEXpql is designed for the measurement of oil or grease samples direct from sample bottles or pots.



All values are displayed in PQ units unless otherwise stated.

#### 3.1 Specification

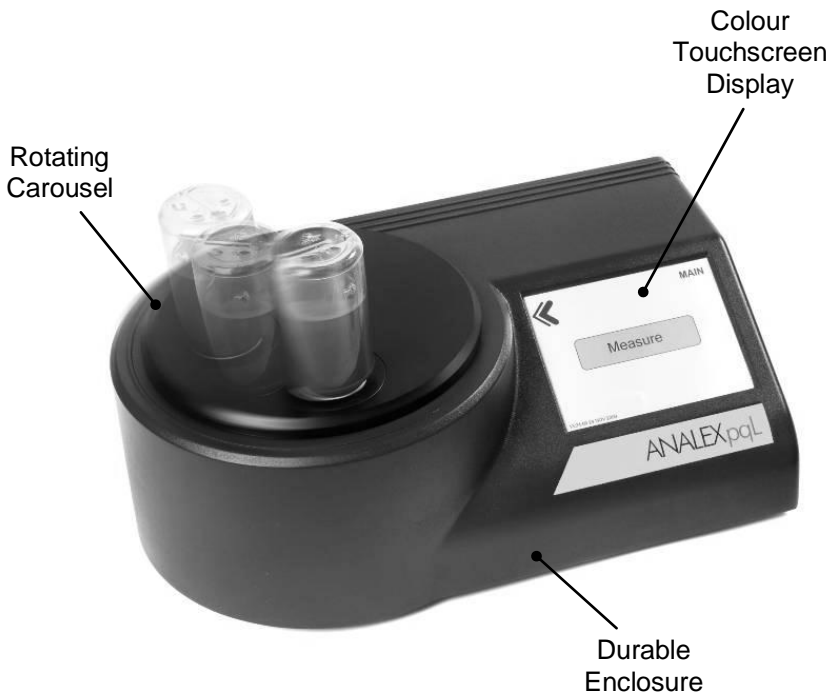
Resolution	1PQ
Measurement Range	0 – 5000PQ
Accuracy †	±4PQ or 1% [whichever is greater]
Repeatability †	±4PQ or 1% [whichever is greater]
Reproducibility ‡	±4PQ or 1% [whichever is greater]
Minimum PQ Detection	1PQ
Cycle Duration	4.2 seconds
Ambient Temperature Limits	Stable temperature between +10°C and +30°C
Environment Required for Optimal Accuracy and Repeatability	Laboratory environment between +20°C and +24°C
Size & Weight	370mm x 230mm x 140mm (3.6kg)
Ingress Protection Rating	IP20
Product Life	In excess of 4 million operations
Fuse Rating	1.6A, 250V, 5x20mm Antisurge Fuse
Supply Voltage Range	24V dc ±10%

† Accuracy compiled at 750PQ. The PQ index of a sample may vary with temperature. The published accuracy, repeatability and reproducibility figures were compiled using the following conditions. Ambient room temperature between +20°C and +24°C. Stable samples held at room temperature and isolated from cold surfaces.

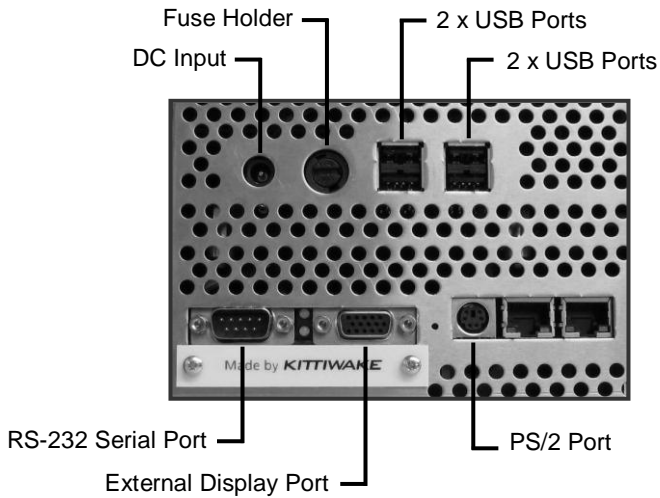
‡ Reproducibility figures are based on averaging a series of 10 consecutive measurements per test sample on each instrument. The instrument was calibrated after every 100 measurements.

## 3.2 Features

- Measures ferrous debris directly from the oil in the sample bottle or from a grease sample placed in the grease sample adapter.
- Large backlit graphical display for clear user prompts and easy viewing of results.
- Colour touchscreen allows easy entry of data via a full alphanumeric keypad.
- Auto zero between each sample.
- Universal power supply allows use with a wide range of supply voltages.



### 3.3 Rear Panel



### 3.4 Adaptors



Pot Adaptor  
(with 5ml sample pot)



Bottle Adaptor  
(with 100ml sample bottle)



## 3.5 Part Numbers

The ANALEXpQL is supplied as shown in Section 3.5.1. Spares and accessories are available as shown in Sections 3.6 and 3.7 respectively.

### 3.5.1 FG-K17000-KW

Description	Notes
ANALEXpQL	Standalone Instrument
User Manual	
0PQ & 750PQ Standards Pack	User Calibration Kit
0PQ 5ml Pot Standard & ANALEXpQL Test Pack	
2m Null Modem Cable	For RS-232 Comms to a PC
5ml Oil/Grease Sample Pots & Lids	
Power Supply and Mains Cable	
100ml Bottle Adaptor (41mm)	
5ml Pot Adaptor	
USB Flash Drive	For Data Storage
Shipping Carton	Retain all original packaging

## 3.6 Spares

In addition to any items listed above, ANALEXpQL spares can be ordered using the following part numbers:

Kittiwake Part No.	Description	Notes
FG-K3-207-KW	100ml Sample Bottles & Lids	Pack of 288
FG-K15004-KW	5ml Sample Pots & Lids	Pack of 100
FG-K15005-KW	5ml Sample Pots & Lids	Pack of 3000
AS-K18525-KW	ANALEXpQL Fuse Pack	3 fuses
FG-K15710-KW	100ml Bottle Adaptor (41mm)	For use with Kittiwake sample bottles

<b>Kittiwake Part No.</b>	<b>Description</b>	<b>Notes</b>
FG-K16062-KW	5ml Pot Adaptor	
FG-K18532-KW	USB Flash Drive	ANALEXpql compatible
FG-K18535-KW	ANALEXpql Shipping Carton Assembly	
FG-K18305-KW	Thermal Paper	20 rolls
FG-K18137-KW	0PQ & 750PQ Standards Pack	
FG-K18351-KW	0PQ 5ml Pot Standard & ANALEXpql Test Pack	
FG-K18538-KW	0PQ & 750PQ Standards Pack - Exchange	Customer to return existing pack
FG-K18539-KW	0PQ 5ml Pot Standard & ANALEXpql Test Pack - Exchange	Customer to return existing pack

### 3.7 Accessories

ANALEXpql accessories can enhance the functionality of the instrument. They can be ordered using the following part numbers:

<b>Kittiwake Part No.</b>	<b>Description</b>	<b>Notes</b>
FG-K18300-KW	Thermal Printer Kit	
FG-K18305-KW	Thermal Paper	20 rolls
FG-K18311-KW	Intelligent Barcode Scanner kit	Use barcode labels to identify samples and enter their codes automatically into the ANALEXpql
BI-K17132	USB to RS-232 Adapter	For PC's without a serial comms port
FG-K18695-KW	Low Range Second Standard (40-60PQ)	
FG-K16065-KW	Slide Adaptor	
Available on request	Robotic handling system	

## 4 Starting To Use The ANALEXpqL

### 4.1 Location

- The ANALEXpqL is designed to operate on a flat, level surface such as a workbench or desk.
- The instrument contains a sensitive measuring head that is designed to detect ferrous debris in oil or grease samples. Ensure that the unit has plenty of free space around it (300mm to the sides and 500mm above), and is distant from metal objects, large power cables and electrical machinery etc. Also ensure that there are no other ANALEXpqL instruments, heavy machinery or high power transformers within 2m.
- The ANALEXpqL is very sensitive to changes in temperature. Therefore, locate the unit in a thermally stable environment, avoiding direct heat sources or drafts.
- Site the instrument away from strong magnetic fields, such as near loudspeakers or microwave ovens (these can even affect the instrument through walls).
- Make sure any computers, monitors or other instruments are at least 1m away. Do not operate a mobile phone within 2m of the instrument.
- Metal benches can cause balance problems for the sensing coils. This includes the bench top and/or frame. The same is true for moving metal components such as automatic loaders or door handles.
- Ensure jewellery is at least 20cm away from the instrument whilst measurements are being taken.
- If using the instrument in conjunction with a mechanical sample presenter, consideration should be given to the possibility of the sensor being disturbed by electromagnetic noise or movement of metal components in the mechanism. Such devices have been used successfully in the past but some trials may be necessary to understand how the readings may be affected.



Failure to follow these guidelines will affect the accuracy of the instrument.

## 4.2 How To Ensure Accuracy And Optimum Performance

- Ensure the location meets the requirements in Section 4.1.
- The ANALEXpqL takes approximately 2 hours to reach a stable temperature. For optimum accuracy following power up, wait 2 hours before taking measurements.
- Do not touch sample bottles whilst the unit is measuring - this will affect the result and could knock the carousel out of alignment.
- Keep the carousel and platen base clean at all times. See Section 1.2 (Cleaning).
- Grit, dirt and especially metal particle debris between the bottle and the sensor will affect the reading and cause errors.
- Many printer toners and inks (especially for laser and ink-jet printers) contain elements which could drastically affect the measurement. Use thermal printers if possible. Labels placed on bottle lids or pot bases should be avoided.



### 4.3 Connecting The Power Supply

- a) Connect the cable from the supplied power supply to the rear of the unit.
- b) Plug the mains lead into the power supply and then into a suitable earthed power socket.
- c) Turn on the switch at the power socket.



Never remove the power from the ANALEXpqL before safely shutting down. See Section 5.9.

### 4.4 Sampling And Sample Preparation

The ANALEXpqL can measure metal wear particles in either grease samples or oil samples. Whichever the type, always ensure that a representative sample is taken, using a consistent sampling procedure. This will ensure the most accurate test results and trending data for your machinery.

Bottles, pots, slides or millipore filters can be used to present samples to the instrument. However, measurement of samples within a bottle is the most convenient method. It can provide additional information when compared with samples in pots (see Section 4.4.4), does not require transfer of sample and the same container may be used for PQ measurement and particle counting.

#### 4.4.1 Grease Samples

- Grease samples must be presented in the small 5ml pots provided with the instrument (AS-K15308).
- The grease samples must be flush with the top of the sample pot.
- Place the pot adaptor into the carousel to ensure the sample is centrally located over the measuring head.



Care should be taken to ensure a representative sample is taken. The wear debris from both grease samples and oil samples is very dependant on the sampling point.



For maximum accuracy below 100 PQ with 5ml grease samples, the ANALEXpqL should be re-calibrated prior to measuring. Use the 0 PQ 5ml Pot Standard supplied in kit FG-K18351-KW during calibration.

#### 4.4.2 Oil Samples

- Oil samples may be presented in a standard Kittiwake 100ml sample bottle (FG-K3-207-KW) or small 5ml pot (FG-K15004-KW).
- If using a sample bottle, fill to a depth of at least 40mm.
- Shake the sample before measuring to ensure wear debris is evenly distributed.
- Always use the correct bottle or pot adaptor.
- If using a sample bottle place the sample bottle into the aperture with the lid facing downwards.



Always use the correct adapter, a well homogenized sample and consistent presentation to the instrument in a pot or a bottle with the lid downwards and a geometrically flat lid.



5ml Oil/Grease Sample Pot



100ml Oil Sample Bottle

#### 4.4.3 Using Sample Bottles And Sample Pots

Always use the correct sample adapter in the sample aperture of the measurement carousel for your particular measurement container. This will ensure that the sample is correctly positioned centrally over the measurement sensor. If the sample is not in an exactly central position, erroneous results may occur. Adapters are available for bottles, pots and slides.

Bottles may be measured upright (base down) or in an inverted position (lid down) provided their lids are leak proof. Bottle lids are usually flatter than bottle bases. Metal lids, plastic lids with foil inserts and lids that affect the magnetic field, for example Bakelite lids, should be avoided.

There is an inverse relationship between the measured PQ Index and the distance between the sensor and the sample. Ideally, the sample container should be in intimate contact with the sensor and bottles/pots should therefore have flat bases. Bottles with convex bases or lids should be avoided.

Over-tightening bottle lids may force them to become convex and therefore unsuitable for use.

Likewise, bottles/pots with pips (left over from the moulding process) on the base or lid should be avoided, since this will also affect the PQ Index result. Sample containers should be examined before use and any pips or projections removed using a sharp knife.



Flat base or lid



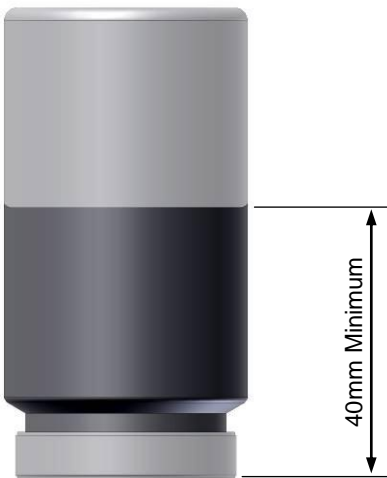
Concave lid or base



Convex lid or base



Pip on lid





#### 4.4.4 Shaken / Settled Samples

It has been shown<sup>1,2</sup> that a PQ Index measurement on a well-shaken sample is independent of the volume of sample in the bottle provided this exceeds a critical depth. The critical depth will vary with the size of bottle and is typically about 10mm (roughly equivalent to 7.5ml of sample) for a standard 35ml or 30mm diameter bottle. A PQ Index obtained using 35ml bottles is about three times greater when compared with the same oil measured using the pot method with just 2ml of sample.

The PQ technique is often employed as a screening device to help decide which samples justify further examination by other analysis methods. Allowing the debris to settle in the bottle before measurement may further increase the magnitude of the PQ readings, but readings on a sample that has been allowed to settle are only semi-quantitative unless the sample volume is controlled.

Some PQ users make a preliminary measurement on a settled bottle followed by a quantitative measurement after shaking the bottle for 30 seconds. If a well-shaken sample bottle is left undisturbed in the PQ carousel, repeat PQ Index readings will be seen to increase with time as debris settles to the bottom of the bottle. A rapid rate of increase is an indication of the presence of large particles in the sample.

1 A. R. Massoudi, M. H. Jones and B. J. Roylance - University College of Swansea. "A Rapid Portable Ferrous Debris Monitor". S.T.L.E. Annual Meeting, Calgary, May 1993.

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2 M. H. Jones and A. R. Massoudi - University College of Swansea. "The TDPQ: a solution to the analysis of large wear particles". INSIGHT Vol 37 No 8 August 1995.

## **5 Operation**

### **5.1 Powering Up The ANALEXpqL**

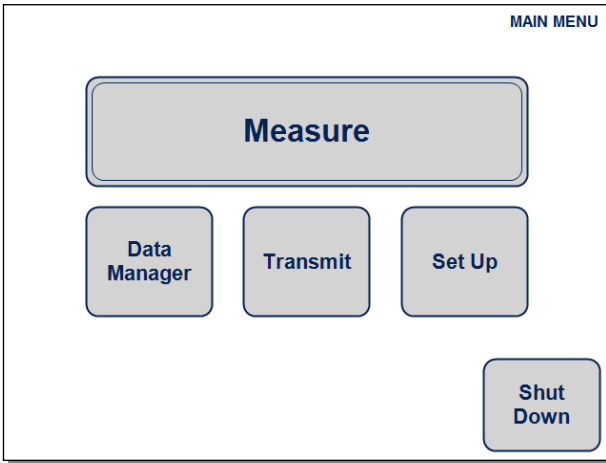
Having switched on the power (see Section 4.3) the ANALEXpqL will initiate its start-up and self-test sequence. This takes about one minute. Once completed, the MAIN MENU will be displayed.

### **5.2 Colour Touchscreen Display**

The touchscreen display provides the user interface. A USB or PS/2 keyboard may be attached if desired to ease data entry. The User Interface is constructed of a simple hierarchy of menu pages. Each page has its name in the top right-hand corner to ease navigation. In the top left-hand corner, there is often a 'back arrow' button to navigate back to the previous page. If the interface is not used for about 2 minutes, it returns to the main menu.

The screen displays results in real time. See Section 5.5.1.2.

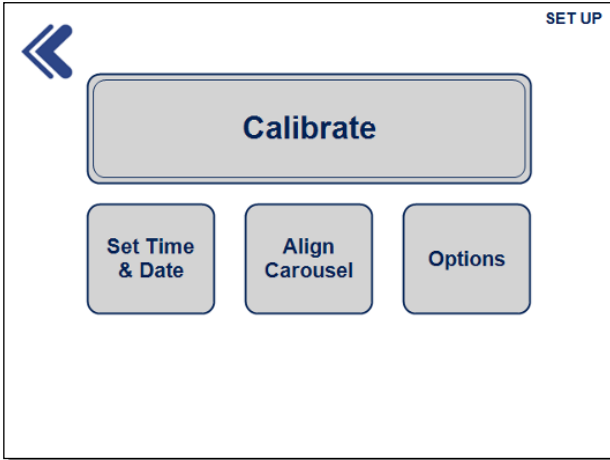
## 5.3 Main Menu



There are 5 options available on the Main Menu:

- a) **Set Up.** Set up the instrument (calibrate, align, set date & time, comms options etc). See Section 5.4.
- b) **Measure.** Taking sample measurements. See Section 5.5.
- c) **Data Manager.** Manage stored data (print, rename, delete etc). See Section 5.6.
- d) **Transmit.** Transmit some or all stored data to an external PC or USB stick. See Section 5.7.
- e) **Shut Down.** Safely shut down the instrument by holding this button for 3 seconds and following the instructions. See Section 5.9.

## 5.4 Set Up



There are 4 options available on the Set Up Menu:

- a) **Calibrate.** Recalibrate the instrument to avoid inaccuracies caused by issues such as temperature drift.
- b) **Set Time & Date.** The time and date will be recorded in every results file so ensure it is correctly set.
- c) **Align Carousel.** The ANALEXpqL has the ability to self align the rotating carousel.
- d) **Options.** There are many user options that can be set up to manage the way results are stored and transmitted. These options can all be set on this page.

### 5.4.1 Calibrate

The Check Standards Pack FG-K18351-KW contains two other small grease standards which may be measured to check whether the ANALEXpqL is in need of re-calibration.

To calibrate, the user should use the supplied 0PQ and 750PQ Standards. There are two 0PQ standards supplied:-

- a) **AS-K18138**. This is found in pack FG-K18137-KW and should be used for calibration prior to measuring using sample bottles.
- b) **AS-K18352-KW**. This is found in pack FG-K18351-KW and should be used for calibration prior to measuring using 5ml sample pots.

The calibration sequence measures the 0PQ and 750PQ Standards and carries out calculations and checks. If the check accuracy is not high enough, the user will be instructed to repeat the calibration. If the check accuracy meets the requirements the user has the option to save or disregard the calibration.



When the ANALEXpqL is first switched on, it should be left to stabilise for at least 2 hours before initially calibrating.



If the ANALEXpqL is relocated, it should be recalibrated.



For the highest level of accuracy it is recommended that the unit be recalibrated after every 500 measurements or 8 hours, whichever comes first.



If the carousel is ever removed for cleaning, upon replacement the instrument should be re-aligned and then recalibrated.



The 0PQ and 750PQ Standards must be at stable laboratory temperature before calibrating. Do not place them on a cold surface prior to calibration.



For the highest level of accuracy at low PQ levels, a 0PQ standard may be made by the user. Take a clean, unused sample of the specific oil being measured and pour a volume identical to the volume being measured, into an unused sample bottle/pot.



Samples must never be removed or placed whilst the carousel is engaged in a calibration sequence. This will cause misalignment and may damage the motor.

### 5.4.2 Set Time & Date

Select each field individually and set up using the up / down toggle arrows. Alternatives, key in the values using a USB or PS/2 keyboard. Press Save when complete, or use the back arrow to exit without saving.

The date is presented in the dd/mm/yyyy format.

### 5.4.3 Align Carousel

With the carousel in position, select the Align Carousel button to automatically re-align the carousel. It is recommended that re-alignment be carried out every 24 hours.

If the carousel is removed for cleaning, it must be re-aligned upon replacement and the instrument must be recalibrated. It is recommended that the unit be shut down before the carousel is removed, in which case the realignment will occur automatically upon switching on.

### 5.4.4 Options

Results data may be transmitted in a number of formats. The PQ index is always transmitted as a signed 5-digit integer, e.g. +00750. Once all desired options have been selected on this page, press Save. To exit without saving, press Cancel.

#### 5.4.4.1 Default Format

The default format lists all results in standard .csv format as follows:

**BATCH\_ID,hh:mm,dd/mm/yyyy,value1,value2,value3.....valueN**

The “values” detail the PQ Index but may also be prefixed with the Sample ID. This depends on the Sample ID Mode that has been selected (see Section 5.4.4.4). For example:

**BATCH\_ID,hh:mm,dd/mm/yyyy,sample1value1,sample2value2,sample3value3  
.....sampleNvalueN**

#### 5.4.4.2 Custom Format

Alternative formats may be adopted. The custom format lists all results as follows:

```
value1,value2,value3....valueN,
```

[Note the addition of a final comma delimiter which is not present in Default Mode]

The date and headers (Batch ID and the term “PQ”) may also be added when Custom Format is selected, as follows:

```
dd/mm/yyyy,BATCH_ID,PQ,value1,value2,value3....valueN,
```

The field Delimiter may also be changed using the up and down toggle arrows when in Custom Format as follows:

```
dd/mm/yyyy#BATCH_ID#PQ#value1#value2#value3....valueN#
```

Again, the “values” detail the PQ Index but may also be prefixed with the Sample ID. This depends on the Sample ID Mode that has been selected (see Section 5.4.4.4). For example:

```
dd/mm/yyyy#BATCH_ID#PQ#sample1value1#sample2value2#sample3value3  
....sampleNvalueN#
```

#### 5.4.4.3 Auto Transmit PQ Index After Every Measurement

When selected, this feature will transmit every result via RS-232 as soon as the measurement is taken. The PQ index is transmitted as a signed 5-digit integer, e.g. +00750<CR>

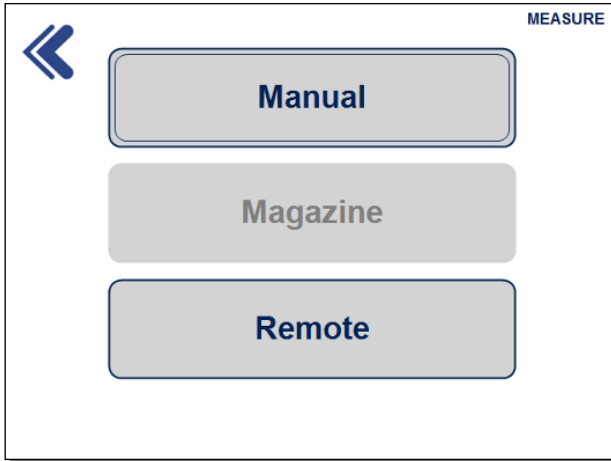
#### 5.4.4.4 Sample ID Mode

There are 3 options - Off, Auto and Manual.

- a) When ‘**Off**’ is selected, no sample ID is appended to each result.
- b) When ‘**Auto**’ is selected, a 3 digit Sample ID is appended to every result. The number starts at 001 for every new file and automatically increments whenever a new sample is measured (using And Again or Append to File).
- c) When ‘**Man**’ (Manual) is selected, the user must add a Sample ID for every sample placed on the carousel. The ID’s may be added using the touchscreen keyboard, a USB or PS/2 keyboard, or the optional USB intelligent barcode scanner kit (FG-K18311-KW).



## 5.5 Measure



There are 2 options available on the Measure Menu (a third is unavailable on the standard instrument):

- a) **Manual.** Manually place samples on the instrument and take measurements. Each sample may be repeatedly measured up to 99 times.
- b) **Magazine** (unavailable).
- c) **Remote.** Operate the ANALEXpqL remotely via a PC with Serial Communication (RS-232). Additional PC applications are not provided for remote control, but the available commands are described in Appendix A.

There is a back arrow at the top left corner which can be pressed to return to the previous screen. This selection is present on many screens.



Samples must never be removed or placed whilst the carousel is engaged in a measure sequence. This will cause misalignment and may damage the motor.

### 5.5.1 Manual Measure

There are 3 options available:

- a) **Append to File.** Select an existing data file and append new results to it. The “Current Results” can also be chosen – these are the most recent results that have been saved.
- b) **New File.** Create a new BATCH ID file to store results. Note that the BATCH ID file name may not include the following characters:  
  \ / : \* ? " < > |
- c) **Measurement(s) per sample.** Choose how many times to measure each sample by using the up and down toggle arrows.

As soon as the “Go” button is selected, the measuring sequence commences.

#### 5.5.1.1 Abort

A measuring sequence can be aborted by pressing the Abort button. All current results up until the abort are still available when the “Current Results” selection is made from the “Append to File” list.

#### 5.5.1.2 Results

As a measurement sequence takes place, the results are displayed on the touchscreen. The left hand column lists the sample ID if that option has been selected (see Section 5.4.4.4) and the right hand column lists the PQ Index. If the list extends beyond a page, use the page up and page down arrows to view the results.

Following the completion of a sequence of measurements, the user has 5 options:-

- a) **And Again.** Upon selecting this option, the same number of measurements will be taken of the next sample placed on the carousel. Ensure the sample is correctly positioned before pressing the button.
- b) **Print.** Print the displayed results to the optional USB printer. See Section 5.8 for more details of printing to the optional USB printer.
- c) **Transmit.** Transmit some or all stored data to an external PC or USB stick. See Section 5.7.
- d) **Save & Exit.** Save the results and exit to the Measure Menu.
- e) **Exit (No Save).** Select to exit without saving the results. If Appending to File, this selection simply discards the latest set of results.

### 5.5.2 Magazine Measure

This is a non-standard option and available only as a special order.

### 5.5.3 Remote Measure

This feature allows the ANALEXpqL to be operated via a remote PC using RS-232 serial comms. Connect the supplied D-type cable (EL-K18056) to the rear of the ANALEXpqL and to a PC. If the PC does not have a 9-way RS-232 D-Type connector, an optional USB to RS-232 adaptor may be used (BI-K17132).

Run a suitable terminal emulator on the PC (such as 'Tera Term' or 'Hyper Terminal') and set it up as follows:

Bits per second	9600
Data bits	8
Parity	None

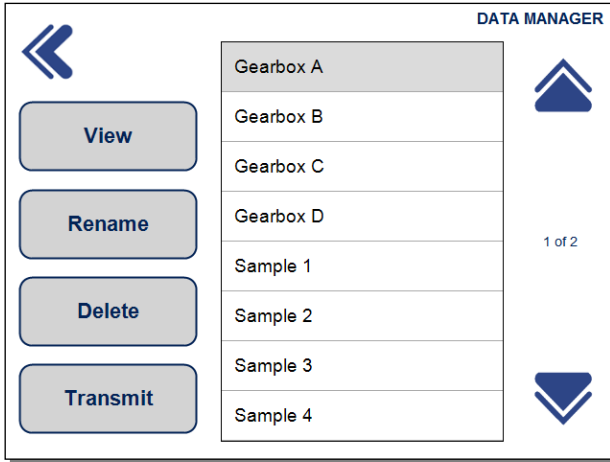
Stop bits	1
Flow control	None

The available commands for remote control are detailed in Appendix A. Note that these must be entered in CAPITAL letters. To exit the Remote Measure mode, press the back arrow.



Samples must never be removed or placed whilst the carousel is engaged in a measure sequence. This will cause misalignment and may damage the motor.

## 5.6 Data Manager

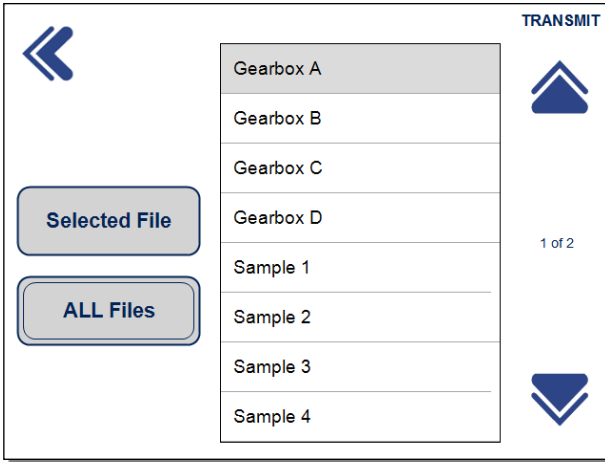


The Data Manager allows the user to manage any stored results file. Press and highlight the desired Batch ID and then select one of 4 options:

- a) **View.** Display the results and allows the user to Print, Rename, Delete or Transmit them. See Section 5.8 for more details of printing to the optional USB printer.
- b) **Rename.** Rename the selected Batch ID. Note that the Batch ID name may not include the following characters:  
 \ / : \* ? " < > |
- c) **Delete.** Delete the selected file or delete ALL files.
- d) **Transmit.** Transmit selected results file via RS-232 and/or USB (whichever is attached). See Section 5.7.

Press the back arrow at any time to return to the Main Menu.

## 5.7 Transmit



The Transmit button allows the user to transmit all stores results files in one go. The option to highlight a single Batch ID and transmit that is also available. Once the transmission has completed, press the “OK” button.

Press the back arrow at any time to return to the Main Menu.

### 5.7.1 Transmitting via Serial RS-232

Connect the supplied D-type cable (EL-K18056) to the rear of the ANALEXpQL and to a PC with a 9-way RS-232 D-Type connector. If the PC does not have this connector, a USB to RS-232 adaptor can be fitted at the PC end. An adaptor, part number BI-K17132, is available from Kittiwake Developments Ltd.

Run a suitable terminal emulator on the PC (such as ‘Tera Term’ or ‘Hyper Terminal’) and set it up as follows:

Bits per second	9600
Data bits	8
Parity	None

Stop bits	1
Flow control	None

If in doubt consult your IT technician. If the D-type cable is connected and the terminal emulator correctly set up, data will be transmitted whenever the

Transmit button is pressed. The transmitted data will be in .csv format by default but this may be modified by the user. See Section 5.4.4.2.

### 5.7.2 Storing On The USB Flash Drive

The ANALEXpQL can store results data onto the supplied USB Flash Drive, or any other USB flash drive formatted as a Removable Drive. The data is all stored in a single text file named as follows:

#### **testresults.dat**

If the USB Flash Drive is connected (leave it for at least 5 seconds once fitted to ensure it is active), data is appended to this file whenever the Transmit button is pressed. The appended data will be in .csv format by default but this may be modified by the user. See Section 5.4.4.2.

## 5.8 Printing

The optional thermal printer (FG-K18300-KW) can be connected to the ANALEXpQL via a USB port. When connected, pressing Print will produce a hard copy of the results. The printer kit contains 1 roll of paper. Additional paper is available. See Section 3.7

## 5.9 Shut Down

From the Main Menu, press and hold the Shut Down button for 3 seconds. If you are sure you want to shut down, when asked Press the “Yes” button. Do not remove the power until instructed to do so.

The ANALEXpQL is not fitted with a switch to help protect the instrument from accidental power down which may cause loss of data or instrument damage.

## 6 Troubleshooting

Symptom	Possible cause	Solution
Results are erratic	Interference from adjacent objects	Make sure the ANALEXpQL is located away from sources of magnetic fields such as heavy machinery, motors, transformers and heavy power cables.
	Unclean instrument	Ensure that there is no external contamination of the sample bottle or grease pot with oil or metal particles. If necessary wipe the bottle or pot with a clean tissue before measuring.
	Changing temperatures	Make sure the sample temperature is stable before measuring. The sensor head is very sensitive to temperature changes.
	Irregular sample positioning	Ensure the carousel is firmly pressed into position.
	Printed labels may contain magnetic iron oxide and carbon black	Remove labels from close to sensor. Use a thermal printer instead of a laser or ink-jet printer.
Results are changing with time	This is a result of particles settling in the sample due to gravity and is normal.	In order to get consistent results always ensure the same sampling routine is followed and that the same time period is used between taking the sample and measuring on the meter. Utilise the rate of change as an indicator of debris particle size in the sample. The faster the change, the larger the particles.
Results are different every time the sample is tested	Poorly mixed sample	Ensure the sample is homogenous and that any ferrous debris is evenly distributed throughout. For highest accuracy, before taking measurements place all samples on a mechanical mixer for more than 30 seconds to ensure a homogeneous mix is attained.
	Interference from adjacent objects	Make sure the ANALEXpQL is located away from sources of magnetic fields such as heavy machinery, motors, transformers and heavy power cables.

Symptom	Possible cause	Solution
Carousel is not aligning	Unclean instrument	Remove the carousel and ensure its underside is clean. Also clean the platen, especially the small alignment sensor near the perimeter.
Carousel is not turning correctly	Unclean instrument	Shut down and remove the carousel and ensure its underside is clean. Also clean the platen. When replacing the carousel, push firmly.
	Carousel pushed down too hard	Before switching on, check the carousel is able to rotate by manually turning it without excessive force. If it is difficult to rotate by hand, remove the carousel again and use less force when replacing it.
Touchscreen is not registering inputs	New hardware has recently been connected	The ANALEXpql takes a few moments to register which hardware has been connected. Wait for 5 seconds and retry input.
	The date and time has been changed	The ANALEXpql takes a few moments to set up the new time and date. Wait for 30 seconds and retry input.
	Instrument has malfunctioned	The only method of shutting down is by removing the power. Ensure the instrument has been in an inoperable state for more than 2 minutes, then remove the power for at least 10 seconds. Restart the instrument.
Calibration keeps failing	Changing temperatures	Ensure the instrument has been left to stabilise for at least 2 hours after being switched on.
		Ensure both standards are at a stable room temperature and have not been resting on a cold surface.
Low Memory Warning appears when pressing Save & Exit from Measure Screen yet there are not many files to delete	Batch ID name contains the following characters which are not permitted: \ / : * ? " < >	Press the BACK button repeatedly until the message disappears and then press Exit (No Save).  Repeat measurements with a suitable Batch ID name that does not contain these characters



Symptom	Possible cause	Solution
RS-232 serial communication is not working	Incorrect cable used	The cable supplied is a Null Modem Cable which is wired differently to a standard serial communications cable. Ensure that the supplied cable is used.
	Incorrect set up	See section 5.7.1
	Commands are not typed using capital letters	All remote messages must be typed using capital letters.
	Commands are not being followed by a carriage return	Press carriage return. NB sometimes the command will not appear on the terminal screen until carriage return is pressed.
Unable to Rename File in Data Manager	The following 2 files cannot be renamed: Z CALIBRATION DATA Z CURVE	-
	Newly entered Batch ID name contains the following characters that are not permitted: \ / : * ? " < > 	Choose a name that does not include these characters

## Appendices

### A. Remote Measure Commands

The following commands are available when in Remote Measure Mode. Each must be entered into the terminal emulator on the remote PC using CAPITAL LETTERS followed by a carriage return. The command typed may not be seen on the screen until carriage return is pressed.

Command	Description
WHO	Return the Serial Number of the ANALEXpQL in the format <b>WHOPQL123456</b> , where the serial number is 123456.
MEAS	Carry out a single measurement and return the result in the format <b>MEAS+VALUE</b> , for example <b>MEAS+00750</b> where the PQ index is 750PQ.
DSPL	Any text string following this command (before pressing carriage return) is displayed on the touchscreen display. For example, command <b>DSPLANALEXpQL</b> will display "ANALEXpQL" on the touchscreen display. A maximum of 4 lines of 20 characters may be displayed.
SETRC	From the Main Menu, enter the Remote Measurement Mode. Use this command rather than pressing the touchscreen "REMOTE" button when running remote software to control the instrument.
EXITRC	Exit the Remote Measurement Mode.
RES	Reset the carousel to its home position. Once complete, <b>RES , OK</b> is returned.
QS	Query Status. Returns any active alarm messages: <b>QS , 01</b> to <b>QS , 09</b> . Else <b>QS , OK</b> is returned.
ALIGN	Realign the carousel. Once complete, <b>ALIGN , OK</b> is returned.
CAL	Place the instrument into the calibration mode ready for further commands.
CAL0PQ	Once in calibration mode, this command commences measurement of the 0PQ Standard. Once complete, <b>CAL0PQ , OK</b> is returned.
CAL750PQ	Once the response <b>CAL0PQ , OK</b> has been received, commence measurement of the 750PQ Standard using this command. <b>CAL750PQ , OK</b> is returned after initial measures are made. The instrument automatically continues to make further accuracy checks using the 750PQ Standard. If the checks are successful <b>CAL , OK</b> is returned and the results are saved. The instrument then exits the CAL mode. If accuracy is unacceptable, <b>CAL , ALInvalid PQ Index</b> is returned. The Calibration is aborted and the instrument exits the CAL mode. With this response, remove the error message from the touchscreen by using the commands <b>EXITRC</b> and then <b>SETRC</b> .



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