ALL-TEST *PRO*® ON-LINE II

ALL-TEST *Pro*, LLC

ESA 6
USER GUIDE

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Introduction

The complete information for the ALL-TEST *PRO*® On-Line II (hereinafter ATPOL II) Electrical Signature Analysis (ESA) system is presented in three separate documents. The manuals are:

- ✓ The ATPOL II Software User Manual (this manual, ESA 6).
- ✓ The Electrical Signature Analysis Pattern Recognition Manual.
- ✓ The ATPOL II Power Quality Manual (PSM).

The instrument portion of the ATPOL II ESA system will be covered in the software manuals ESA 6 and PSM.

ATPOL II ESA 6

ATPOL II ESA Version 6 allows the ESA software to be operated with Windows XP®, Windows Vista® and Windows 7®. Several new features along with several modifications requested by the users were added.

This manual covers the recent changes incorporated into the ALL-TEST *PRO* OL upgrade as well as any previous upgrades.

Some of these changes provide for easier operation and interpretation of the ATPOL II ESA software. Some provide additional features and the following section lists these 6 changes:

1. ESA 6 may be used with Windows XP®, Windows Vista® and Windows 7®. The installation has been modified to not require registry in the computer's software library upon installation.
2. ESA 6 can now be run in some foreign languages.
3. Automatic analysis of asynchronous generators has been added.
4. The 'compare' function has been improved so that more than two motors can be compared on screen at one time. See "Compare Functions" section for instructions.
5. The DC current and voltage amplitude calculations have been improved.
6. The bearing cursors can now be moved through the harmonic multiples for a selected bearing. This leads to an increased ability to evaluate bearing indications.
7. Several improvements were made to the file structure handling and other features suggested by our customers/users.

Operator Safety

The use of any ESA device exposes the operator to electrical safety and/or arc flash considerations. Details covering the safety aspects of the data collector will be found in the ATPOL II Power Quality Manual. However, we will discuss a few of the issues here:

- ✓ The instrument, test leads, CTs and clips provided with the instrument are rated at no higher than 600 Vrms. Exceeding this value puts both the operator and the instrument at risk. Special CTs and voltage probes are available that exceed this limit and are available on special order. However, the resolution for ESA decreases with these CTs and PTs.
- ✓ Personal Protective Equipment (PPE) must be worn during the operation of this instrument; this should be in accordance of your company's rules and practices.
- ✓ Follow all safety rules provided by your company, OSHA, MSHA and/or associated safety organization(s) for electrical testing.

Use of the ATPOL II ESA system including all manuals, training and support material, does not exclude the operator from following proper safety practices. By using the ATPOL II software, instrument, manuals, training and support, you agree to hold ALL-TEST *Pro*, LLC and its subsidiaries, partners, employees and sub-contractors harmless.

Introduction to ESA

Motor Current Signature Analysis (MCSA) is a commonly misused term within industry. MCSA refers to the evaluation of current waveforms only, including the demodulation of the current waveform and Fast Fourier Transform (FFT) analysis. Electrical Signature Analysis (ESA) is the term used for the evaluation of the voltage and current waveforms. This provides an increased advantage to diagnostics as power-related, motor related, and load related signals can be quickly filtered. It also provides several unique abilities when related to power quality, DC motor analysis and generator analysis as well as other advantages.

ESA is a system used for analyzing or trending dynamic and energized systems. Proper analysis of ESA results will assist the technician in identifying:

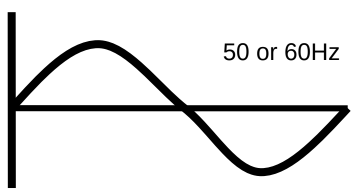
- ✓ Stator winding health
- ✓ Rotor health
- ✓ Air gap and dynamic eccentricity
- ✓ Coupling health, including direct, belted and geared systems
- ✓ Load issues
- ✓ System load and efficiency
- ✓ Power Quality
- ✓ High Resistance or loose connections
- ✓ VFD and/or DC Controller Faults
- ✓ Mechanical Problems in the entire motor system
    - o Unbalance

- o Misalignment
- o Belt Faults
- o Gear Problems
- o Rolling Element Bearing Condition
- o Vane, Blade or Impeller Issues

ESA uses the electric motor as a transducer, allowing the user to evaluate the electrical and mechanical condition from the Motor Control Center (MCC), local disconnect or anywhere that motor current and voltage signals can be accessed safely. For accurate analysis, ESA systems rely upon analysis of demodulated voltage and/or current, which involves the removal of the fundamental frequency (Line Frequency or LF).

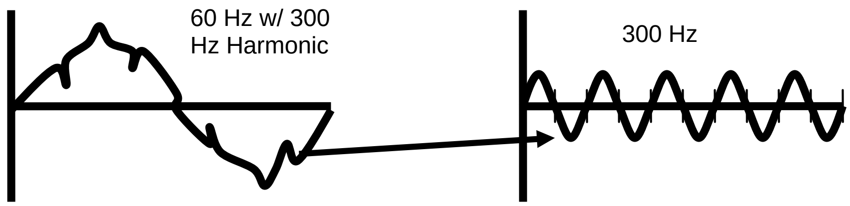
The frequencies found within the LF are used to identify faults. These frequencies are found as ‘ripples’ within the LF caused by incoming power or load-related effects (including motor condition-related).

Figure 1: Line Frequency



The current waveform, shown in Figure 1, is the line frequency (LF) of the system, which is a good or 'perfect' waveform. Any electrical or mechanical faults in the motor system will cause the line current to vary. This causes the LF current waveform to “modulate” at the frequency of the electrical or mechanical fault. The resultant current waveform will appear as shown in Figure 2.

Figure 2: Current Waveform with Electrical or Mechanical Faults



ESA uses the Fast Fourier Transform (FFT) to determine the frequencies of the faults that cause the current.

Figure 3: Fast Fourier Transform (FFT)

How the ATPOL II ESA System Works

The motor current is measured with a Current Transformer (CT) clamped around one of the supply leads located in the Motor Control Center (MCC) or any convenient cable. Voltage is collected using voltage clips and leads connected to the output of a starter, or other convenient test points. On a three phase motor, to obtain the full capabilities of the system, all three phases should be measured using three CTs and three voltage test leads.

The ATPOL II acquires the data in accordance with the data logger instructions. Once acquired, the data is uploaded to a PC where the ATPOL II ESA software provides analysis and reporting.

The ATPOL II system performs the necessary calculations and displays to provide a highly sensitive and selective means of accurately determining electrical and mechanical faults in the motor or any electrical system. The uniquely selected ATPOL II measurements, calculations and displays provide numerous indications to determine the performance and health of the entire electrical/motor system. Indications of the motor system health and performance are contained in the time and frequency data that is provided by the ATPOL II. The ATPOL II system accurately determines the true motor running speed, motor slip frequency, gear mesh speeds, drive train components, gear rotation, and tooth-by-tooth stress distribution, etc.

To identify the various electrical and mechanical frequencies, a FFT is used to convert voltage and current waveforms to the necessary frequency spectra that are displayed on the screen. The peaks in this spectrum correspond to the fault frequencies of the different components in the motor system. For example, in the case of a fan driven by an electric motor through a belt, the spectral peaks correspond to the motor speed, motor slip (pole pass frequency), fan speed and belt speed. If a gear box is used instead of a belt drive, then spectral peaks will appear at the shaft speeds and gear meshing frequencies.

The heights of these spectral peaks will depend on two things: the overall current level to the motor; and the severity of the electrical or mechanical disturbances within the electrical/motor system, sensed by the current. The mechanical disturbances start as torque variations and/or shaft movements, which end up as small changes to the air gap between the rotor and stator or simply changes in the current system. These movements or forces cause small current modulations in the line frequency (carrier) that occurs at specific frequencies related to component condition. For a constant overall speed condition, for example, an increase in the height of the spectral peak at fan speed would indicate deterioration in the mechanical condition of the fan, such as a change in the balance or alignment condition. Worn drive pulley or bad rolling element bearings can be automatically identified. ESA has shown the ability to identify all of the same mechanical faults as Machinery Vibration Analysis (MVA) and provides early warning of potential system mechanical degradation.

When electrical faults in the stator or rotor occur, electrical forces are produced that cause the stator currents to modulate at very specific frequencies. Faults such as loose, broken rotor bars or even high resistant joints in fabricated rotors, or air pockets in cast rotors (casting voids), developing winding shorts, improper rotor position or other faults within the stator or rotor magnetic fields can create very specific patterns that are related to the rotor speed and either the number of rotor bars or stator slots. These faults create very specific patterns and can be easily identified by the presence of these patterns in the current frequency spectrum.

Electrical Signature Analysis also performs a three phase power quality analysis that provides very valuable information about the incoming power. This, not only, identifies developing faults within the electrical/motor system, but also identifies faults from the incoming power.

The ATPOL II acquires a single phase of voltage and current on one channel (V1 and I1) to capture the time and frequency for one phase of the voltage and current. The other two phases are simultaneously collected to determine true power, apparent power, harmonic distortion and/or the presence of any voltage or current unbalances that are detrimental to successful long term operation of the electrical/motor system. From this data power factor and system efficiencies can easily and accurately be determined. This is the optimum combination of data to permit the most efficient use of storage and calculating power in the data collector, while enabling ATPOL II to make the calls necessary to diagnose motor faults.

The ATPOL II software analyzes and displays the acquired data in a variety of forms to assist the user in identifying key performance indices in both the time and frequency domains. Many tools are available in the software to allow the user to adjust the displays and graphs to provide easy and accurate analysis of the collected data. Specific data can be collected and trended for additional analysis capabilities.
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Software Installation

Specifications

The hardware requirements for the ATPOL II system are as follow:

- ✓ Windows XP®, Windows Vista®, Windows 7®.
- ✓ MS Word® 2007.
- ✓ Color printer for reports.
- ✓ Bluetooth® Communications.

Software Description

The ATPOL II software disk contains three software programs, each to be installed separately. ATPOL II can be operated from the TREND®/EMCAT *PRO*® software if already installed. The software can be installed directly from the provided CD or from the PC's desktop. Install the software in the following order:

1. MotorMaster Plus Version 4.0 (US Department of Energy Software) this may already be installed on your system.
2. ATPOL II Power System Manager Module (PSM).
3. ATPOL II ESA Software Module (ESA).

The ATPOL II communicates with a computer using Bluetooth® communications, or a SD memory card. Bluetooth® must be up and operating to communicate and upload the data from the ATPOL II. If Bluetooth® is not installed internally in the computer there are several USB adapters are available. It is recommended to use the supplied Bluetooth® adapter.

ESA data can be loaded directly to an external SD Memory Card and then transported to your computer for storage and analysis. Additional uses of the Memory Card allow for changes in the ATPOL II's Firmware as well as instrument set-ups.

Once ESA 6 is installed, each system can be accessed through TREND™/EMCAT *PRO*® or independently from the computer.

Caution: Software programs such as Palm® OS will lock out your Comm ports and will interfere with the upload/download to your ALL-TEST *PRO*® OL II or ALL-TEST IV *PRO*™.

Installation Instructions

Installing TREND™/EMCAT *PRO*®

Follow all of the instructions included with the TREND™/EMCAT *PRO*® software.

Installing MotorMaster + Version 4.0

1. Place the ATPOL II software and documentation disk in the disk drive.
2. Windows Explorer® should start automatically.
3. Select 'MotorMaster Installation'.
4. Follow the instructions. MotorMaster Plus must be allowed to install into its default directory in the 'C:\Program Files\' directory.

Installing the ATPOL II Power System Manager Module

1. Place the ATPOL II software and documentation disk in the disk drive.
2. Windows Explorer® should start automatically.
3. Select 'ATPOL II Power System Manager Module Installation'.
4. Follow the instructions. ATPOL II Power System Manager Module Installation must be allowed to install into its default directory in the 'C:\' directory.

Installing the ATPOL II ESA 6 Software Module

1. Place the ATPOL II software and documentation disk in the disk drive.
2. Windows Explorer® should start automatically.
3. Select 'ATPOL II ESA Module Installation'.
4. Follow the instructions. ATPOL II ESA Module Installation must be allowed to install into its default directory in the 'C:\ USA32' directory.

Regional and Language Options: The ESA 6 software should work with any setting that uses the Roman alphabet. An effort has been made to accommodate alternate date and number conventions. If you use a setting that seems to not work, please advise us.

The region and language can be set from the Windows® "control panel". Follow the appropriate instructions for your specific Windows® operating system. Use the selected icon from Windows® 7 "control panel".

Establishing Bluetooth® Communications

The ATPOL II uses Bluetooth® wireless communications to communicate with the host computer. This provides both advantages and disadvantages. Eliminating communication cables far exceeds the additional steps required for the initial setup.

If Bluetooth® is enabled on the host computer, the Bluetooth® icon will be in the lower right corner of the desktop (except Windows® 7).

Bluetooth® must be installed before the computer can communicate with the ATPOL II.

Bluetooth® communications can be added to a computer via either the USB port or RS 232 adapters (on older machines). ATPOL II comes with a Bluetooth® USB adapter that has been tested to smoothly connect to the ATPOL II.

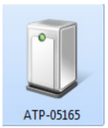
To communicate with the ATPOL II the “Bluetooth® Serial Port” must be enabled. (Disable all other services of Bluetooth®, unless required for other applications, this can be changed later if necessary).

ATPOL II Communications: Bluetooth® Communications Setup

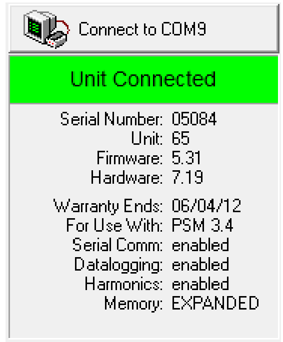
To establish Bluetooth® communications with the ATPOL II refer to your specific computer and operating system instructions.

Establishing Bluetooth® Communications with the ATPOL II

The actual screens and displays will vary depending on which operating system you are using but the basic steps to connect the ATPOL II to the host computer are as follows:



1. Enable Bluetooth® on the host computer.
2. Turn on the ATPOL II instrument.
3. Request that the host computer show Bluetooth® devices.
4. The ATPOL II will be displayed as ATP-xxxxx, (xxxxx is the serial number of the ATPOL II).
5. It is necessary to enter the device code (0000) into the drop down box the first time the ATPOL II is connected to the host computer.
6. When the ATPOL II and the computer are connected, determine which com port is in use.
7. When communications are established with the ATPOL II, open the PSM software. If the communications via Bluetooth® are correct, the box under “connect to unit” of the PSM software will turn green. It will then display that the unit is connected and provide information about the connected ATPOL II.

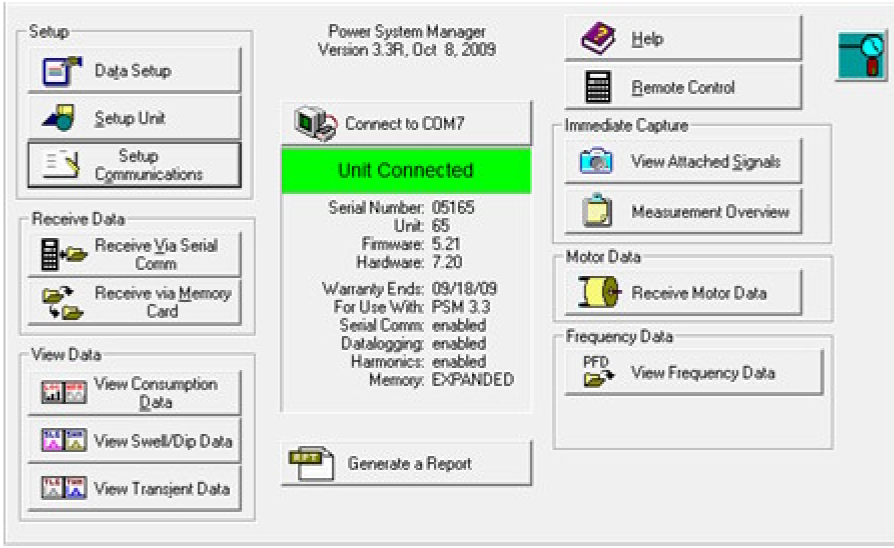


8. If the PSM software fails to connect to the instrument, “No Unit Connected” will appear in red.

9. Click on the “Setup Communication” button, which will bring up, the “Setup Communications” screen.

10. Choose the correct Serial Port that Bluetooth® displayed and verify that the speed is set to 57600. (Consult your operating system manual to determine which COM port the ATPOL II is connected to.)

When the unit is connected the display screen will illuminate green and provide details of the ATPOL II set up.



User Manuals

All associated User Manuals for each software package may be printed directly from the ALL-TEST *PRO*® On-Line II Software Disk. Additional information and technical papers are also available from the disk.

For Additional Information and Technical Support

As part of your purchase of ALL-TEST *Pro* equipment, technical support will be available from 8:30 am to 5:00 pm EST, or special hours by appointment. It is recommended that tech support requests be sent by email to support@alltestpro.com or fax with all pertinent information regarding your request. Updates and additional information will be provided periodically via the ALL-TEST *Pro* e-Newsletter and on the www.alltestpro.com website.

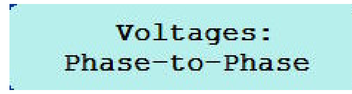
Data Collector and Software Setup and Defaults

For proper ESA data collection, there are several important defaults which should be set in the data collector. There are also several settings within the software that will provide comparable test results with the data interpretation manuals.

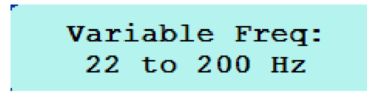
ATPOL II Data Collector Setup/Defaults

For the best results in data collection, the ATPOL II data collector should be set up as follows:

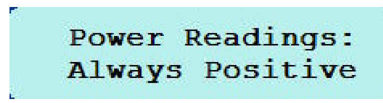
1. Press the ‘Measure Mode’ key. You should see “Voltages” and either “Phase-to-Phase” or “Phase-to-Neutral”. For three phase motors, this should be set to “Phase-to-Phase”. This value can be toggled between the two settings by pressing the ‘No/Reject’ key until it states “Phase-to-Phase” and then press the ‘Yes/Accept’ key.



2. Press the ‘Yes/Accept’ key. Next it will show the Test Frequency for the ATPOL II. For normal three phase motors, set the ATPOL II to “Variable Frequency: 22 to 200 Hz”. If it states some other frequency setting, press the ‘No/Reject’ key until it states “Variable Frequency: 22 to 200 Hz” then press the ‘Yes/Accept’ key.



3. After accepting the frequency range, the tester should display the screen “Power Readings: Always Positive.” Press the ‘No/Reject’ key if it states “Negative Power Readings Allowed”.



Repeatedly pressing the ‘Measure Mode’ key, will allow you to toggle through these three settings to ensure the ATPOL II is set properly.

CAUTION: *DO NOT* change any of the other settings including changing CT or PT ratios in the instrument. These will effect your ESA test results. These should only be used when performing Power Quality Analysis using the instructions provided in the PSM manual.

Changing the other settings will generate non-repeatable and/or erroneous findings.

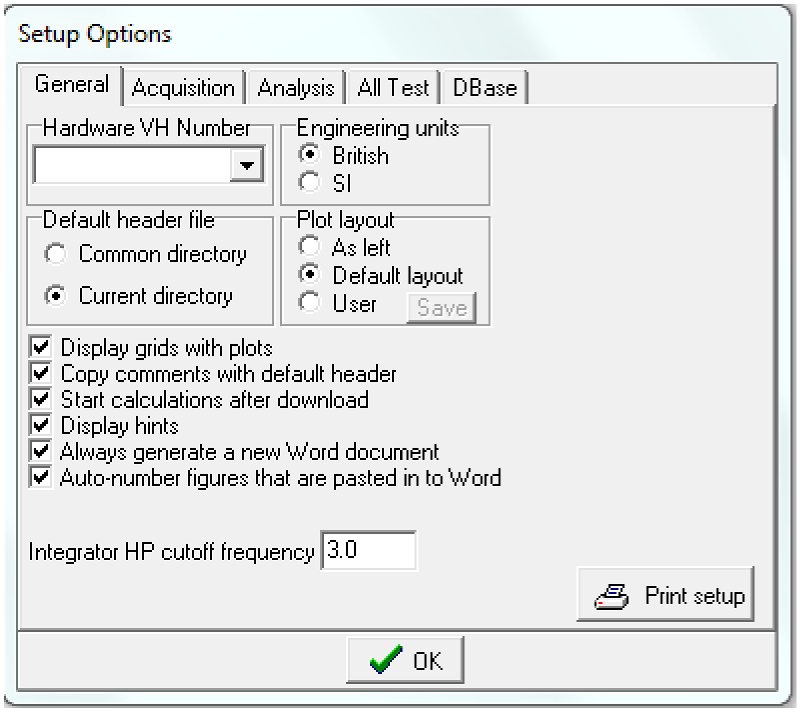
Always verify the ATPOL II setup before any data collection is performed.

ATPOL II Software Setup/Defaults

The ATPOL II software should be set up accordingly.

1. Open ‘File,’ then ‘Setup Options’.
2. Under the ‘General Tab’ verify that all of the boxes are checked.

Figure 4: Setup Screen



Selecting “British” displays motor power in Horsepower and torque in Foot Pounds. Selecting “SI” displays motor power in Kilowatts and torque in Newton Meters.

Note: Not all fill-in blanks or setup options are available on the ATPOL II.

Data Collection Procedure

The ATPOL II system does not require any preset information to perform on-line motor diagnostics. The data file machine operating information (header) can be entered either before or after the motor test data has been collected. The machine information can be added to the header at any time.

Note: The more accurate machine details are provided to the system, the more accurate the automatic analysis will be.

ATPOL II Data Collector System

The ATPOL II is a portable, battery powered, hand-held, stand alone data collector and has internal memory to store twenty motor diagnostic data sets. Additional test data can be stored using the optional SD Memory Card. A 2 GB memory card will store approximately 6000 data sets. The SD Memory Card can also be used to install instrument setups and firmware updates. This combination makes the ATPOL II the most comprehensive portable on-line motor diagnostic system available.

The ATPOL II can be remotely connected to a host computer. Using the internal Bluetooth® device, in this mode, allows unlimited data collection and motor diagnostic capabilities. The ATPOL II system compares and even exceeds most of the features of any other computer based on-line motor diagnostic system.

Combining the ATPOL II with other ALL-TEST *Pro* motor diagnostic tools, creates the most complete and automated motor diagnostic system available at any price. The ALL-TEST *PRO* MD system provides complete detailed reports, specifically identifying any existing and developing faults in the entire motor system, as well as the most comprehensive diagnostic reports about the motor system.

The motor operating data is formatted as a single file and is transferred to the host computer using an *.mtr file of approximately 340 KB. This file contains the detailed information about the data collection such as:

- √ Date and time of the data collection.
- √ ATPOL II system used, serial number, hardware, software and firmware version.
- √ Instrument set-up.
- √ Current probes connected.
- √ Measured volts, current, volt amps, watts current and voltage harmonic distortion and peak values of each phase.
- √ A digitized phase of voltage and current waveforms.

The ATPOL II system requires two accessory software programs to operate.

1. PSM software communicates with the ATPOL II instrument to remotely control the ATPOL II and upload the collected test data.
2. ATPOL 6 software translates the uploaded *.mtr file into the files necessary to display, store, analyze and generate reports about the measured motor system.

The ATPOL II data collector system may include the following, depending on what version was purchased:

- ✓ The ATPOL II data collector instrument.
- ✓ Case and re-charger.
- ✓ Four 0.1 to 100 Amp Clamps.
- ✓ Four 1 to 1,000 Amp Clamps.
- ✓ Four voltage test leads and clips.
- ✓ A custom fitted waterproof instrument case.

The voltage leads are each labeled V1, V2, V3, VN. The current clamps are labeled I1, I2, I3, IN.

The ATPOL II data collector is also a full power analysis instrument. The unit can be used as either a Power Quality Analysis or a Motor Analysis. Each Motor Analysis provides a complete detailed Power Analysis report.

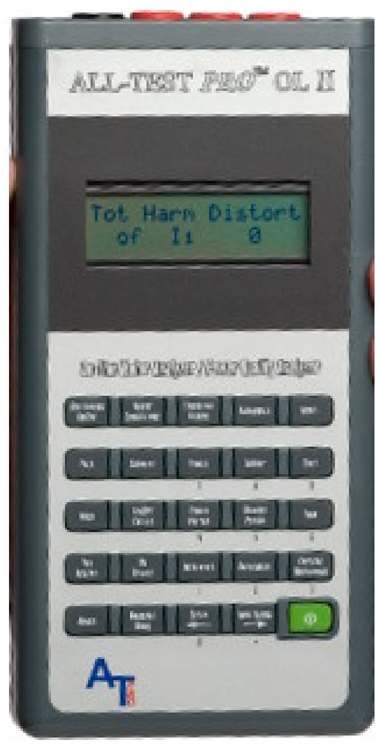
Note: *Do not* use N leads for Motor Analysis. They are for Power Quality Analysis (see the ATPOL II Power Quality Manual located on ESA 6 CD under the Manuals folder).

Electrical Signature Analysis (ESA) provides you with information on the condition of the power supply, phase balance, phase impedance, condition of controls and connections, condition of the stator, rotor, air gap and mechanical condition of the bearings, the driven load, and the process.

Power Analysis provides valuable information about incoming power, inrush, surges, sags, swells, transients, and will also log data events in it’s memory for later review and reporting.

Figure 5 displays the operating keys, which are on the control panel of the ATPOL II data collector. The operating keys are in the same location as when using the PSM remote operating software. These buttons will be referenced during the description of the operation for each function.

Figure 5: ATPOL II



Data Collection

There are two methods of collecting data with the ATPOL II. The first method involves using the data collector as a stand-alone unit. The second method utilizes the instrument, Bluetooth® Communications and laptop computer in order to collect data and upload it directly into the laptop computer.

In both cases, the minimum required data for motor analysis is the instrument Phase A current. It is recommended that you obtain all three phases of both voltage and current for maximum analysis capabilities of three phase motors.

When testing medium voltage equipment (>600Vrms), see the steps on testing medium voltage equipment.

Always verify that the Phase A voltage probe is connected to the same phase as the Phase A current clamp, and that the current clamps are mounted so that the arrows on the current clamps are pointing towards the load.

Select the appropriate current clamps for the application. To reduce the signal to noise ratio it is recommended that the smallest sized current clamps are used. It is unnecessary to make changes to instrument settings, since the ATPOL II current clamp sizes are automatically detected by the instrument.

Figure 6: Connections for Low Voltage

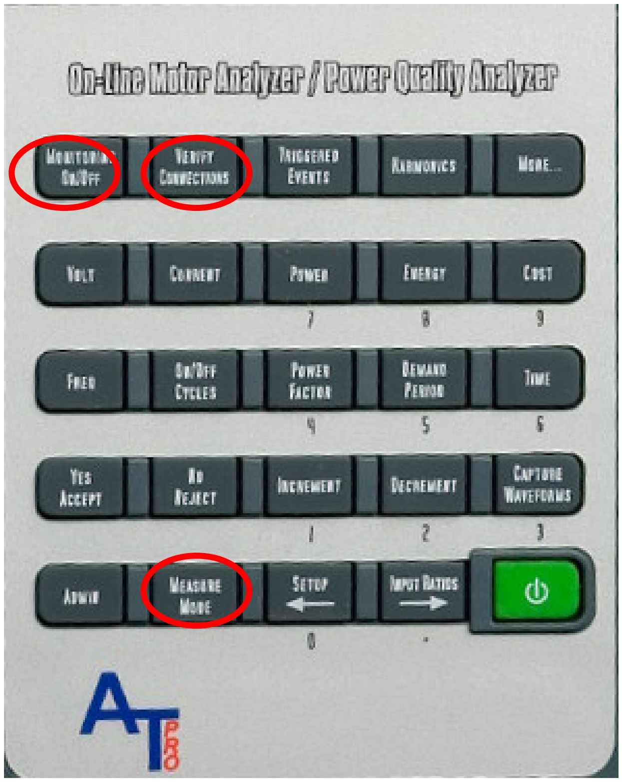
A unique new feature of the ATPOL II is the Patented SureStart™, this feature automatically checks all of the current and voltage connections to verify they are properly connected.

After connections have been verified, press ‘Verify Connections’.

Figure 7

An additional and very useful feature of the ATPOL II is the ability to capture and store a snapshot of both the current and voltage waveforms. By pressing the “Capture Waveforms” button the user will be able to quickly view the integrity of the connections from the remote computer, as well as, provide a quick view of the waveforms.

On Firmware versions 5.32 the voltage and current waveform data are automatically captured with each motor test data set.



Data Collection with the Stand Alone Data Collector Internal Memory

Operating the ATPOL II for motor testing.
(This operation is for ATPOL II systems with Firmware version 5.32 or later, your system may operate slightly differently.)

1. For the best results in data collection, the ATPOL II data collector should be set up as follows:
    a. Using the ‘Measure Mode’ key, press until it states “Voltages:” Press ‘No/Reject’ until it displays “Phase-to-Phase”, then press ‘Yes/Accept’ on the instrument when it displays it’s current setting.

    Voltages:
    Phase-to-Phase

    b. The display will automatically change to “Frequency”. Press the ‘No/Reject’ key until it states “Variable Frequency: 22 to 200 Hz”.

    Variable Freq:
    22 to 200 Hz

    c. The display will automatically change to “Power Readings”. Press the ‘No/Reject’ key until instrument is set to “Always Positive”.

    Power Readings:
    Always Positive

2. For data collection, connect the ATPOL II voltage and current probes to the motor's phase leads (see Figure 6).
    a. Press the 'Verify Connection' this will display …

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SureStartTM
Patent Pending
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    b. Once the connections are verified correctly…
3. Press 'Monitoring ON/OFF'.
    a. Screen will default to "Start Monitoring Power?" Press 'NO/REJECT'

```
Start Monitoring
Power?
```

    b. Screen will Change to Capture Motor Data? Press 'YES/ACCEPT'.

```
Capture
Motor Data?
```

    c. Screen will now change to "Store Motor Test xx?"

```
Store
Motor Test    1?
```

CAUTION: *DO NOT* change any of the other settings; this will affect your ESA test results. These should only be used when performing Power Quality Analysis using the instructions provided in the ATPOL II Power Quality Manual.

Always check the ATPOL II setup before any major data collection is performed.

Data Collection with the Stand Alone Data Collector External Memory

Operating the ATPOL II for motor testing:
(This operation is for ATPOL II systems with Firmware version 5.32 or later, your system may operate slightly different.)

1. The instrument setup of the ATPOL II when using the memory card is the same as when operating the unit as a stand alone system.

```
Memory Card
Updated
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2. Insert a SD Memory Card in the memory card slot on the side of the ATPOL II. The ATPOL II automatically recognizes the memory card and stores any new data on the card.

Once all data has been collected; go to the section on Uploading Data.

DC Electric Motors

Direct Current (DC) electric motor analysis utilizes a simple concept – form factor analysis or AC ripple. The output of a rectified DC drive leaves an AC ripple at the top of the DC voltage and related current. The armature is actually an AC circuit in that, as the armature turns, current flows through conductors in one direction, then in the other. As a result, for the purposes of DC Electrical Signature Analysis, we will analyze the demodulated AC ripple and resulting voltage and current FFT's. In addition, because there is no 'slip,' there is no CF and the calculated frequencies are what will appear in the signature.

DC Motor Testing Procedure

To view the actual current value, the DC Hall-Effect CT is required. The 0.1 to 100 Amp AC CTs may be used for accurate analysis, as well. However, the AC ripple will be the only component of the current evaluated. The procedure for testing DC motors is as follows.

1. Obtain field and armature nameplate voltage, horsepower, RPM and current values
2. Change the setup frequency on the ATPOL II unit to '60 Hz and DC' (or '50 Hz and DC').
3. Clip the Va voltage probe to the positive armature lead and the Vb lead to the negative armature lead.
4. Place the Ia CT with the CT arrow facing towards the DC drive.
5. Note voltage and current using the appropriate selections on the ATPOL II.
6. Take data following the standard operating procedure for the ATPOL II.

7. Upload data using Upload Procedures. Be sure to select the DC motor selection in the header screen of the ATPOL II software.

Variable Frequency Drive Testing Procedure

Variable Frequency Drives (VFDs) are widely used throughout industry. They are normally self diagnosing and will trip to protect themselves from damage. There are a few potential faults that will not cause an immediate trip, which could be potentially dangerous to the equipment and/or personnel. Therefore, when testing VFDs, some special considerations need to be incorporated.

1. It is recommended to take motor test data on both the input to the VFD and the output of the VFD. This will allow detection of both power quality issues as well as potential internal faults on the input of the drive.
2. Perform a waveform capture on both the voltage and current waveforms for the input and output of the VFD. This allows observation of incoming and outgoing current /voltage waveforms, which can help identify any developing issues.
3. If possible, it is recommended to take the output VFD data at a constant frequency. Continual frequency changes during normal operation may provide inconsistent results.
4. For long term trending, it is recommended that the motor data be taken at the same load and frequency conditions.

Data Collection Using the PSM Software

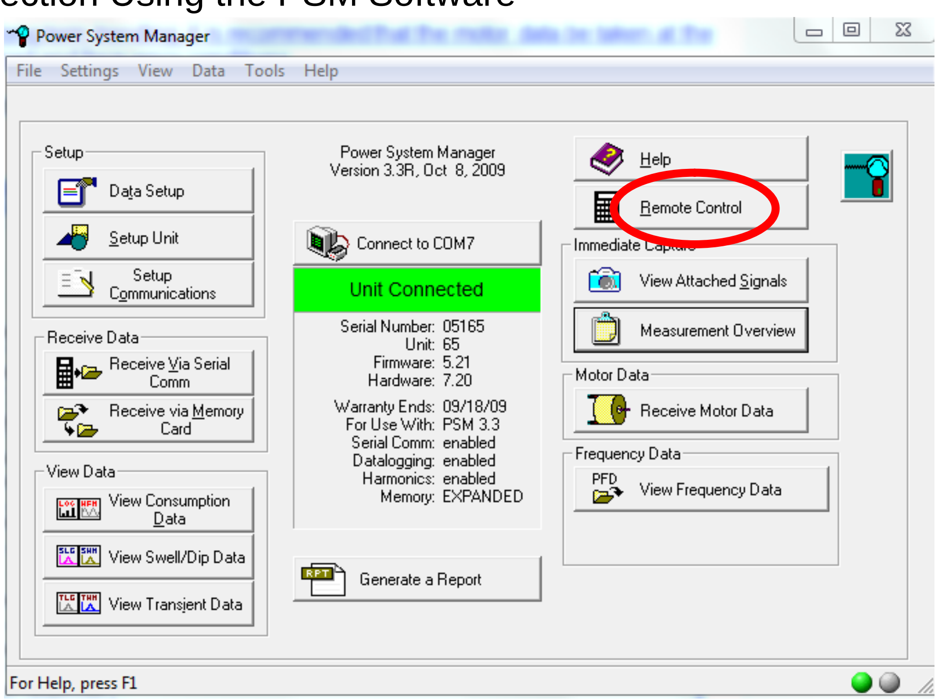


Figure 8: PSM Software

Remote Operation

A unique feature of the ATPOL II system is the ability to connect the ATPOL II to a laptop computer through Bluetooth® Communications. This allows for virtually continuous data capture and the ability to remotely view the voltage and current waveforms.

The procedure is as follows:

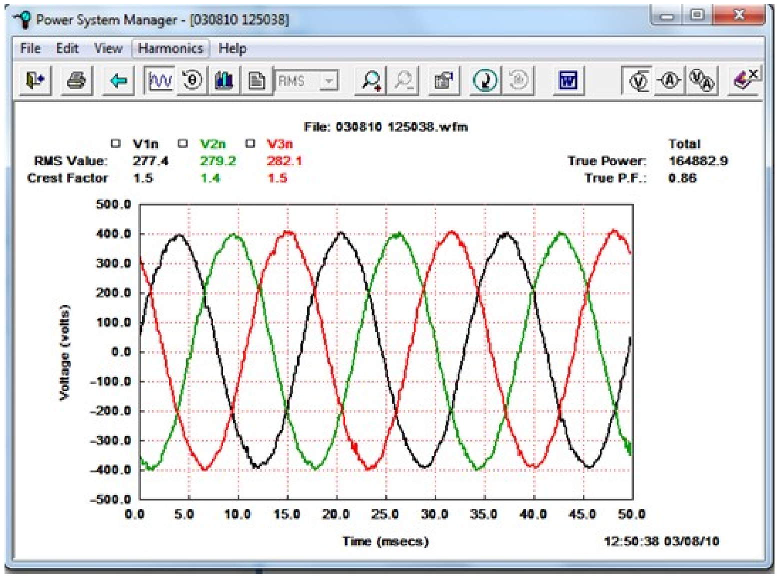
1. Activate PSM software (see software procedure).
2. Select ‘Remote Control’ button (see figure 8).
3. See screen shown in Figure 7: use your computer mouse to “push” appropriate instrument button to perform the data collection procedure. (see Data Collection with the Data Collector).
4. After data collection upload using the Upload Procedure (see Upload Procedure).
5. Repeat steps.

View Attached Signals

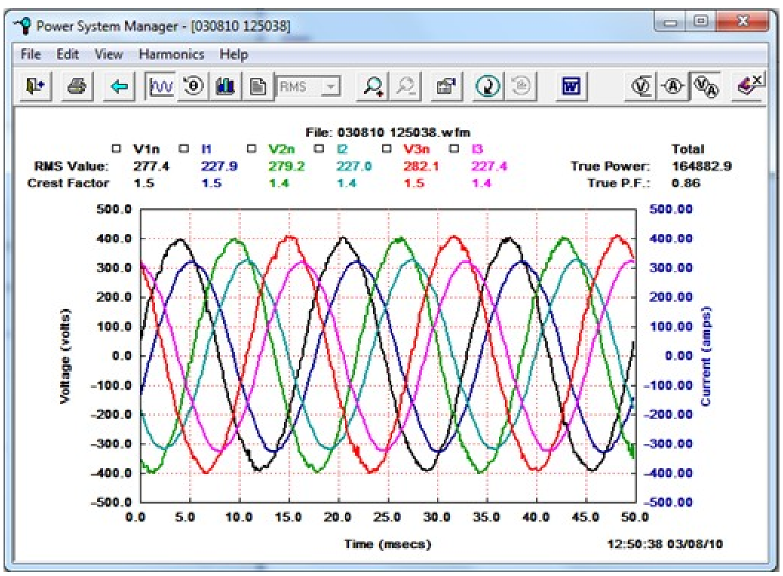
Click the ‘View Attached Signals’ key to verify the connection set-up and/or to view and store the voltage and current waveforms (Figure 8).

Select your choice of Voltage; Current; or Voltage and Current, then select the number of phases and finally click the ‘View’ button.

The viewed waveform display captures the instantaneous waveforms of all three phases of voltage and current. View the voltage and current waveforms provides valuable information regarding the condition of the power supplied to the motor, as well as a verification of the proper instrument voltage and current probe connections.



The waveform capture can display any individual or combination of the three phase voltages or current waveforms. This allows the user to quickly verify that all voltage and current connections are correct. This display is captured and automatically stored during the data collection process.



Viewing the three voltage time waveforms provides visual indication of the condition of the incoming power.

The three waveforms should be sinusoidal and separated by 120°. The voltage waveforms are particularly important when testing the input side of Variable Frequency Drives (VFDs). (*See the section on testing VFD's for further details.)*

Testing Medium Voltage

To test medium voltage machines the ATPOL II may be connected to pre-existing metering CTs and PTs or the ALL-SAFE *PRO*™.

The purpose of this information is to discuss how to use the ATPOL II on medium voltage equipment. However, it must be understood that the ATPOL II instrument is rated for a maximum steady-state input of 600 Vrms between phases and from phase to neutral. Equipment above 600 Vrms (ie: 2300 and 4160 V in the USA) clearly exceed this limit and should not be tested by direction connection of the ATPOL II.

Indirect Measurement of Medium Voltage Circuits Using CTs and PTs

A simple and safe method of measuring medium voltage circuits is to connect the ATPOL II to previously installed metering instrument transformers. CTs (Current Transformers) provide outputs proportional to the actual line current. PTs (Potential Transformers) provide outputs proportional to the actual line voltage. The ratio between the primary (line) value and the secondary (the CT or PT output) value is usually printed on the CT or PT.

There are several advantages to direct connection of the ATPOL II to the secondary side of the PT/CT: first, it is inherently safer since access to the primary voltage is not required; second, there is no need to de-energize the circuit when making the connections and when removing them. However, it must be considered that there will be some filtering and dampening of fault signals using this method and the detection of motor circuit faults must be considered more severe than when using direct measurement methods. It is recommended that the 0.02 to 5 Amp Current Clamps are used as the output current, which will tend to be in the 5 amp range.

The following steps are recommended, in addition to any safety requirements, to connect the ATPOL II to CTs and PTs:

1. Connect the voltage probes and current probes as shown in the Power Quality manual in the section “Connections to a 3CT / 3PT Metering Circuit” or the section “Connections to a 2CT/2PT Metering Circuit,” depending on what you have available. If you have only 2 CTs available make sure you have the ATPOL II instrument in the “2 Current Mode.” Review the “Phase-Neutral vs. Phase-Phase vs. 2 Current Mode” and “Connections Using 2 Current Approach” sections of the Power Quality manual.

2. The CT or PT ratios can either be set in the ATPOL II directly or in the ESA software**.** **Caution: DO NOT** set at both locators. If not set in the ATPOL II at time of data acquisition, record both the current and voltage ratios for entry into the ATPOL II ESA software for analysis.

3. Proceed with testing.

Using ALL-SAFE *PRO*™

Overview

Once the ALL-SAFE *PRO*™ is installed and proper operation is verified, it is ready for use.

Introduction

ALL-SAFE *PRO*™ comes to you as a kit to be installed in a motor control center or other electrical panel. The standard version is for connection to three-phase circuits without neutral. The ALL-SAFE *PRO*™ -N model (“N model”) is for connection to three-phase circuits with neutral.

ATPOL II has individual inputs for each voltage and current of each phase and neutral. However, the output of ALL-SAFE *PRO*™ is a single large connector. Therefore, a special adapter is required to allow ATPOL II to accept the output of ALL-SAFE *PRO*™.

ALL-SAFE *PRO*™ is intended to be a permanently installed piece of equipment. Installation must follow the instructions exactly and it must in no way be allowed to decrease the safety or effectiveness of the panel that is modified to accept it.

Connecting ATPOL to the ALL-SAFE *PRO*™ Adapter

Introduction

ATPOL II analyzers have individual inputs for each voltage and current of each phase and neutral. However, the output of ALL-SAFE *PRO*™ is a single large connector. Therefore, a special adapter is required to allow ATPOL II to accept the output of ALL-SAFE *PRO*™.

The ALL-SAFE *PRO*™ adapter starts with a large mating connector for the large connector of ALL-SAFE *PRO*™ and ends with individual cables for connections to each of the instrument’s voltage and current inputs. The standard model has connections for voltage and current for three phases. The “N model” also has connections to the neutral voltage and current inputs of ATPOL II.

Connection Procedure

Each cable is labeled at its end. Simply plug each cable into the appropriately labeled jack in ATPOL II.

Software Procedures

There are two parts to the software suite (two modules) for the ATPOL II system. These are the Power System Manager (PSM) software and the Electrical Signature Analysis (ESA) software. The PSM software provides for uploading data from the instrument to the computer and to remotely operate the ATPOL II data collector. The ESA software provides a trending database, automatic analysis and viewing of signatures related to the equipment tested. The PSM system has some additional advanced capabilities that will be covered in the ATPOL II Power Quality manual.

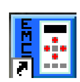
The PSM upload will be covered first, and then the ATPOL II ESA software features, in order to follow the steps normally used in data collection and analysis.

If folders are being developed for data prior to uploading, go to the section on setting up default data in the ATPOL II ESA Software section of this manual, prior to reading the Uploading Data section.

Uploading Data

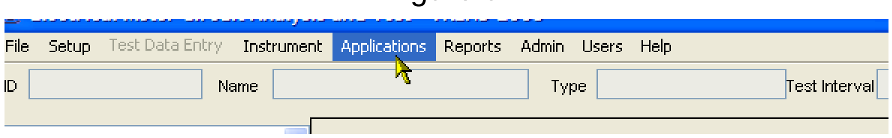
The PSM software can be started by either of the following methods.
Method 1:

1. Start TREND™/EMCAT *PRO*® by selecting the icon on the computer desk top.



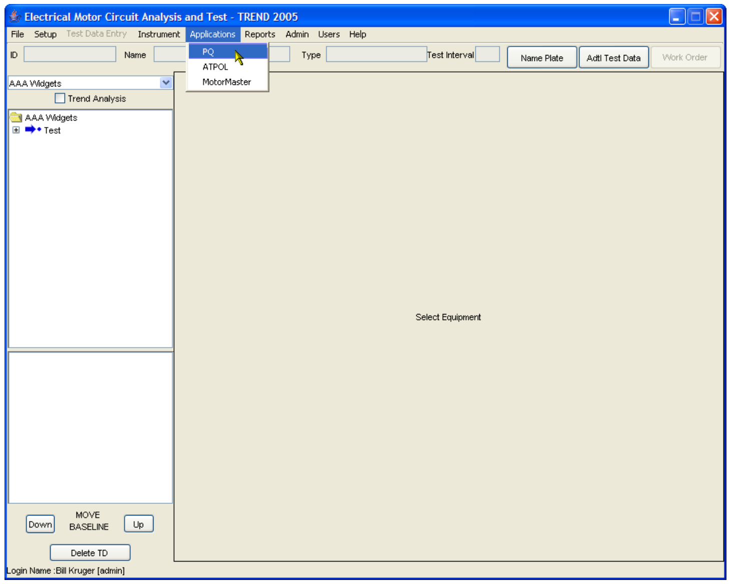
2. Select ‘Applications’ from the TREND™/EMCAT PRO® menu.

Figure 9:



3. Select PQ from the drop-down menu.

Figure 10:

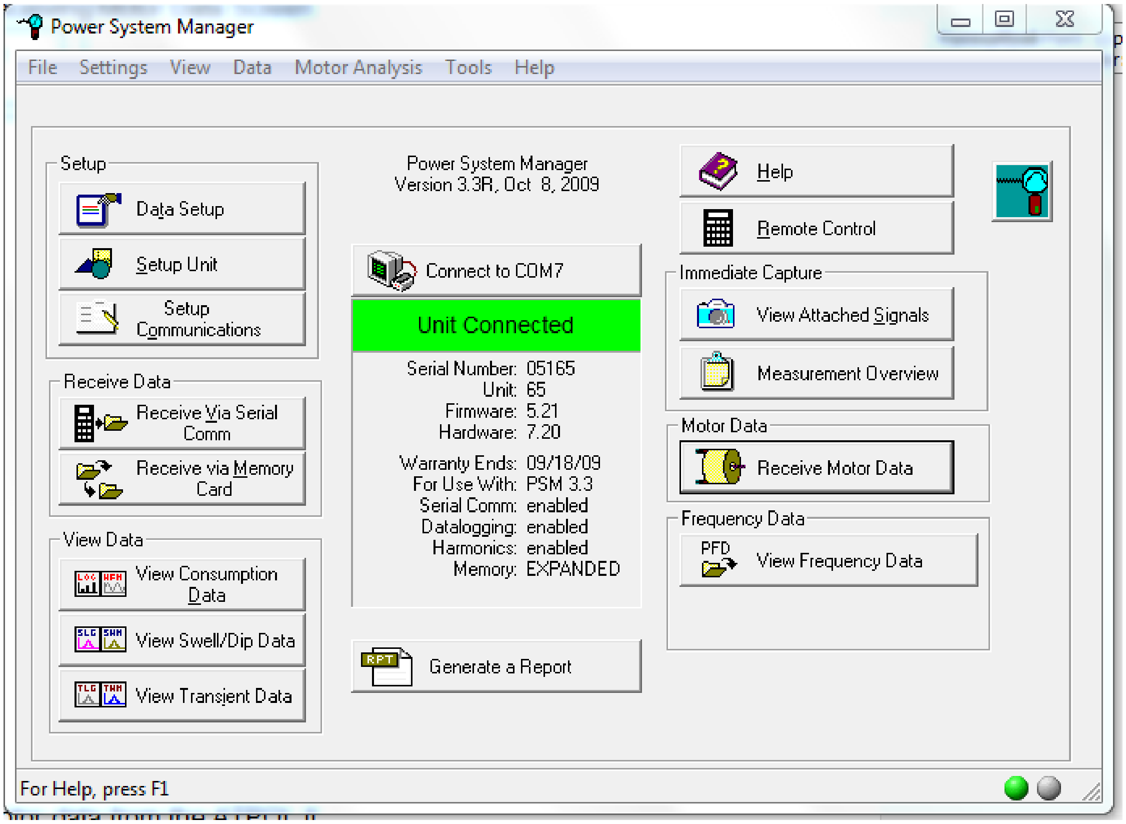


Method 2:

Click on the PSM icon from your desktop.

There are two methods to retrieve data from ATPOL II. Utilizing the Bluetooth® Communication’s link to directly download from the internal memory or by reading the data from the SD Memory Card.

Figure 11: Step1– Select ‘Receive Motor Data’

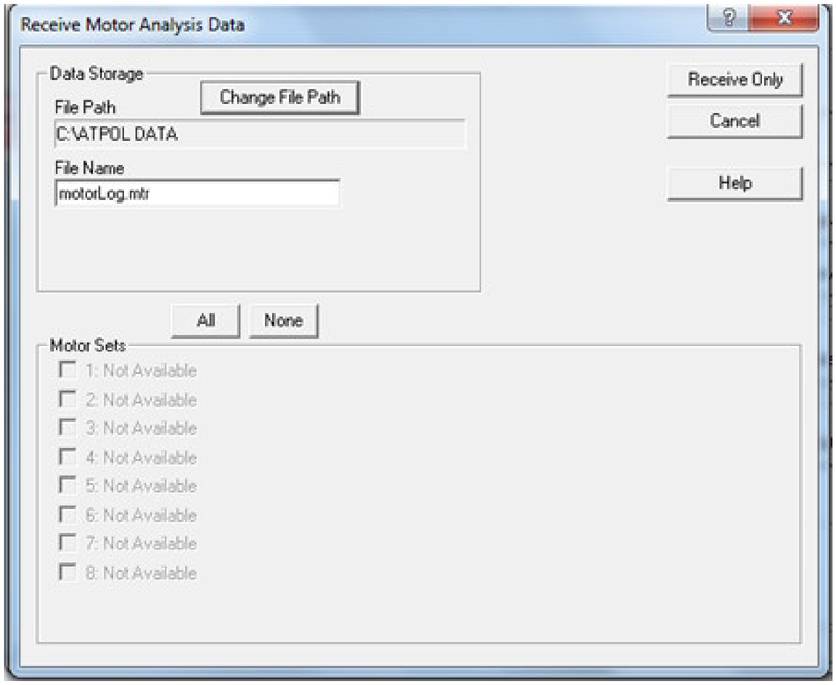


Downloading Data Using Bluetooth®

The additional features, shown in Figure 11, will be addressed in the ATPOL II Power Quality Manual.

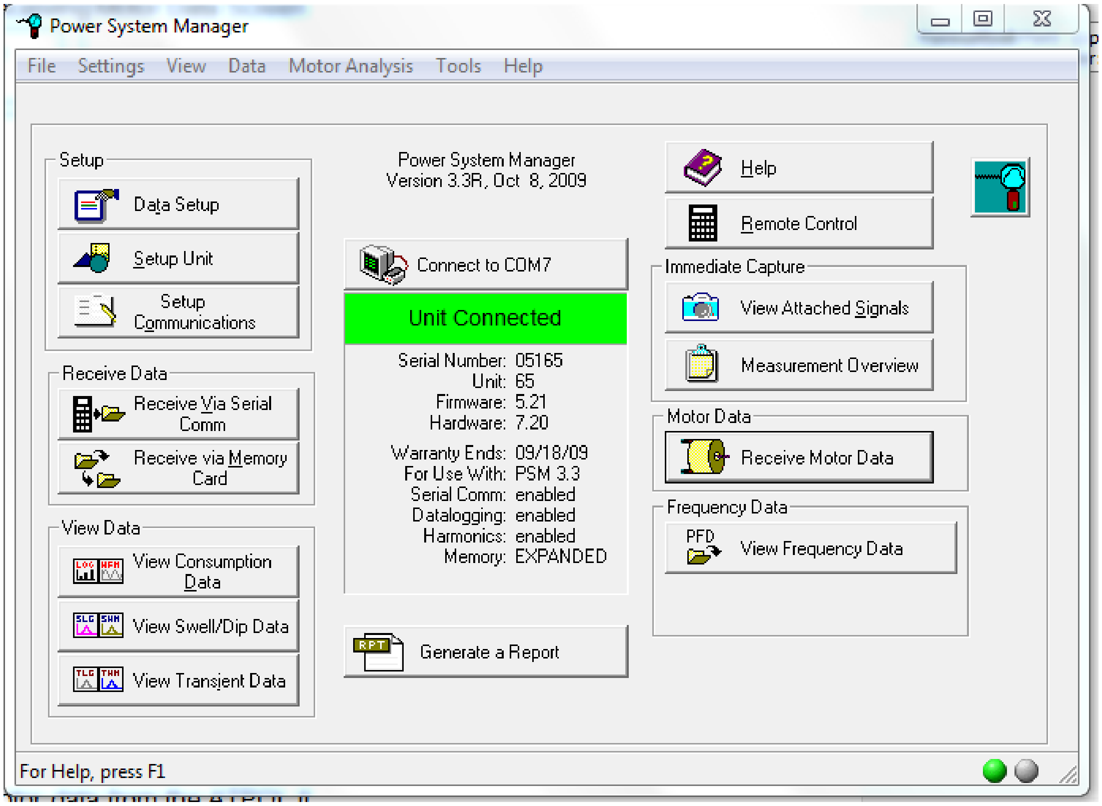
Note: The ATPOL II cannot operate in remote mode and transfer data at the same time. To receive data from the ATPOL II the remote operation must be terminated.

Figure 12: Receiving Motor Data Screen



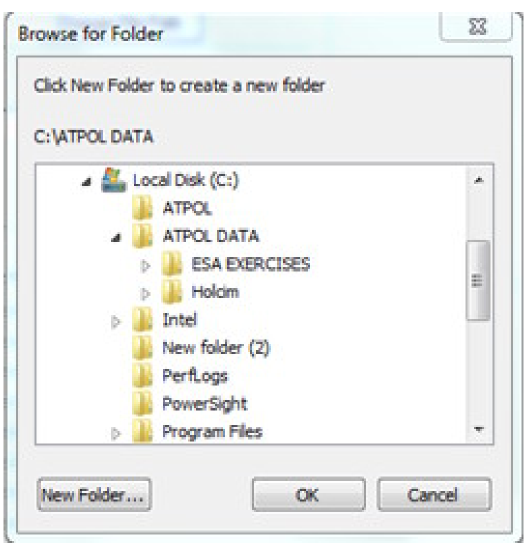
To receive motor data from the ATPOL II, create a data folder on the C: drive (see Note1).

Note 1: The ATPOL II ESA software defaults to the Usa32 folder on the computer's Local Disk: (C:\). It is recommended that the ATPOL II data reside in a separate folder on the local disk (C:\) ATPOL II DATA as a suggested file name. Additional folders and files can be created under the ATPOL DATA folder. These folders can represent Company Names, Plant Names, Plant locations, Equipment ID, Asset Number, etc. This provides the user with the maximum flexibility of the machinery data.



Note 2: The motor name can be changed to anything as long as it follows the Windows® environment rules for naming files, but the '.mtr' extension must be kept. The motor name can also be changed at anytime, since it now a Windows® folder.

Figure 13: Change File Path Screen

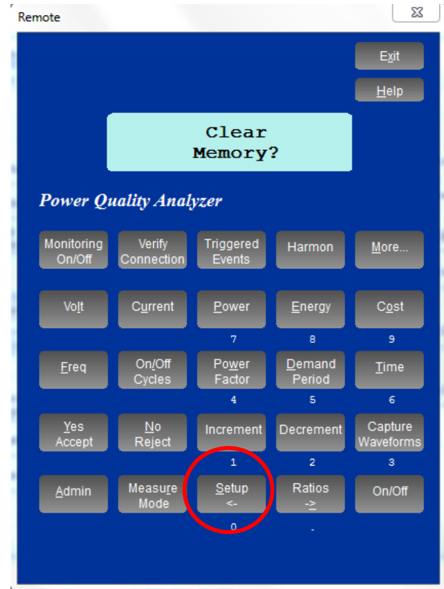


The 'Change File Path' screen (Figure 13) is used for selecting or adding the folders for data that is uploaded.

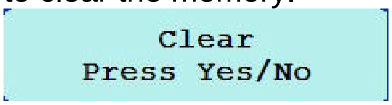
ATPOL II Software Upload

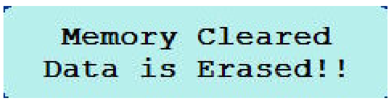
The ATPOL II ESA software expands the file that has been uploaded and allows for a complete analysis and reporting of the condition of the equipment under test. There are additional options required prior to setting up data for analysis. The ATPOL II Software Analysis and reporting section provides the steps for using the full analytical power of the ATPOL II suite.

Clearing the Internal Memory in ATPOL II



The internal memory can be accessed to clear all previous tests and reset the 'Test N Counter' to zero. This can be accomplished by pressing the 'Setup' button eight times and then selecting 'Yes' to clear the memory.





NOTE: Clearing the internal memory of the ATPOL II DOES NOT erase the data located on the SD card, however, it will create a new date/time stamped folder on the SD card where the new data will be stored.

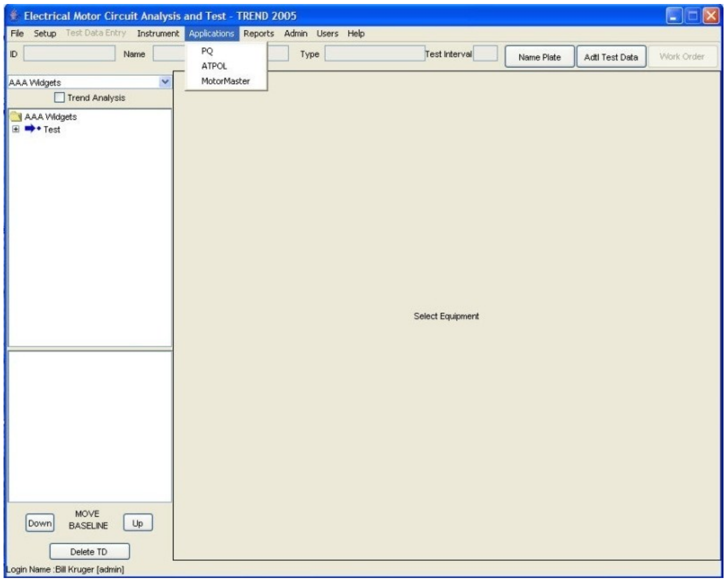
ESA Analysis Software (ESA 6)

Getting Started

To access and analyze the data uploaded from the ATPOL II data collector ESA 6 software can be accessed either from TREND™/EMCAT *PRO*® or directly from the computer desktop.

Figure 14: Open ALL-TEST *PRO* OL 6 (ESA6) from EMCAT *PRO*® Software

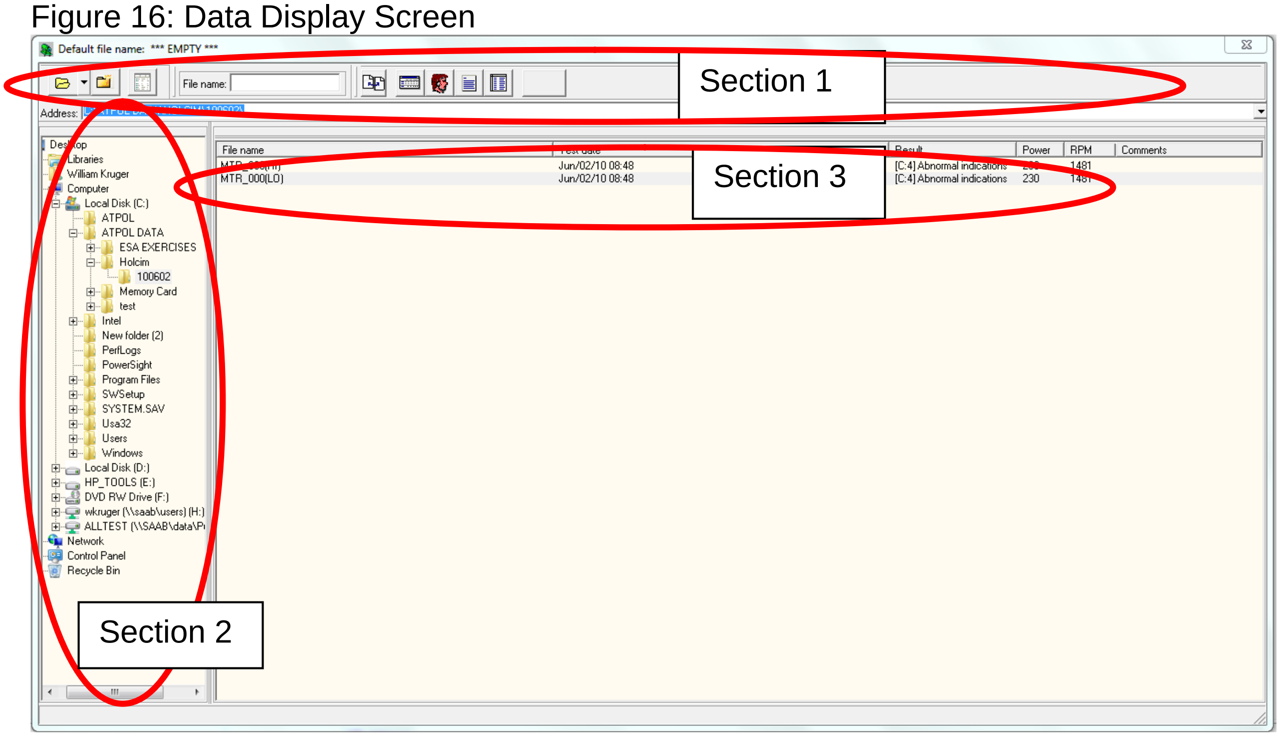
Figure 15: Main Screen – Open File



Data Display Screen

ATPOL II 6 has changed the data display screen to operate similar to Windows Explorer®.

Figure 16: Data Display Screen



The data display screen has 3 sections:

Section 1. Function Bar: Provides the tools to set-up and access the test data collected by the ATPOL II.

Section 2. Folder List: Provides access to the file folders that contain the motor test data.

Section 3. Spectral List: Provides the list of translated spectral data available in the selected machinery folder.

Function Bar: Display/Hide Folder List

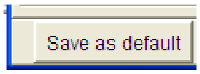
Used to display or hide the 'folder list' in the data display screen, also allows the user to choose which spectral files to display on the display screen.

1. To display 'folder list' place pointer on the icon and press the left mouse button. This will toggle between displaying and hiding the 'folder list'.

2. To choose which spectral data will be displayed in the spectral list place the pointer on the icon. Press the left arrow and select from the drop-down menu.

Open File: Used to access the data files from the location where they have been stored. See 'open file' listed below.

1. Select the folder from the 'folder list' that will be set up with nameplate data.
2. To select the file name left click on the name from the 'file list'. The name should appear in the 'file list' box.
3. The 'Header' button should now be active, press it.
4. Enter header information as outlined in the 'Tour of the Header Screen' section.
5. When finished entering the data into the header screen, press the 'Save as default' button on the header screen. All of the data that is entered into the selected folder will default to this information.

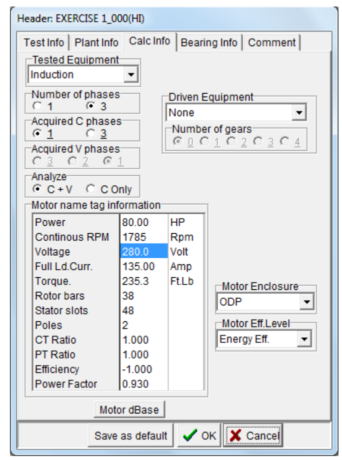


Tour of the Header Screen

Header Screen

The ‘header screen’ is one of the most important screens in the ATPOL II program. Maximum effort should be extended to place as much accurate information in the header as possible. This data provides the software with the individual machine information necessary to provide an accurate analysis of the motor system.

Figure 17

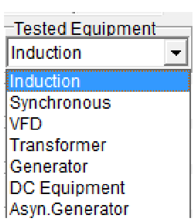


The ‘Header Screen’ provides the ATPOL II ESA software with the information necessary for automatic analysis of the ATPOL II test data. If the correct information is known enter that information into the appropriate header box. If the correct information is not known leave the value as -1.000.

If the same machine is also being tested using the ALL-TEST IV *PRO*™ 2000 motor analyzer and the TREND™/EMCAT *PRO*® software. The machine details from the ATPOL II ESA software can be directly imported into TREND™/EMCAT® software.

Entered values

Tested Equipment: From the drop down menu select the type of equipment to be tested.



This selection sets up the ESA software to identify specific problems associated with particular machine types, as well as, customize the report.

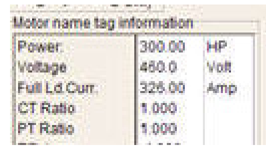
Calc info (see Figure 17).

Some of the information is common to the different machinery types. (See the individual machine for a description of the machine information for each machine type). Information that is common to all machine types will be covered separately.

This selection also customizes the automatic analysis report for the specific machinery type. Samples of these reports are in Appendix 1.

Common Information:

Motor Name Tag Information: This information provides the input to the ATPOL II ESA software for automatic analysis of the motor system. At a minimum, the ATPOL II ESA software requires:



Power: Rated full load power in either HP or KW.
Continuous RPM: Speed in RPM is directly from the nameplate (not measured or estimated speed).
Voltage: Voltage is directly from the nameplate.
Full Ld Curr: Current is directly from the nameplate.
Torque: Torque is automatically calculated from rated power and operating speed.

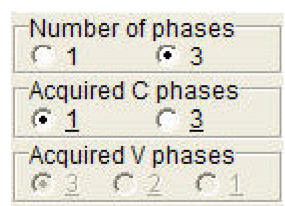
If CTs or PTs are used to gather the motor data, use this entry to record the current or voltage ratios.

CT Ratio: If CTs were used to gather the current data enter the CT ratio of the CT used. Enter “1” if the standard current clamps were used to gather the current data or the current ratio was entered into the instrument during data acquisition.

PT Ratio: If PTs were used to reduce the voltage to a range measurable by the ATPOL II, enter the PT ratio of the PT used. Enter “1” if the standard voltage probes were used to gather the voltage data or if the PT ratio was entered into the instrument during data acquisition.

AC Machines

Induction
Synchronous
VFD
Transformer
Generator



Number of phases: When the data collected is from an AC source, enter “1” or “3” depending on the number of phases of the AC Power applied to the motor.

Acquired C phases: When the data is collected from an AC source always enter “1”, the current and voltage gathered will be from the voltage and current probes connected to the V_1 and I_1 ports, however it is important to connect all of the current and voltage probes for a complete analysis of the motor system.

Acquired V phases: This selection is not available.

Analyze: Select from C +V; C; C + V should always be selected for a more complete analysis of the entire motor system.

Calc Info (See Figure 17). Calculated values

Torque: Is a function in the power and speed of the motor, this value will automatically calculate when the values are filled in for power and continuous speed. These values will be in either Newton Meters, or Inch Pounds; depending whether SI or British units are selected in the options setup.

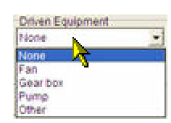
Poles: The number of poles and applied frequency determines the rotational speed of the rotating magnetic field, this is also known as the synchronous speed. The value is calculated when continuous speed is entered. It will vary depending on whether 50 or 60 Hz is selected during the options setup.

Efficiency: The full load efficiency of a motor or generator is the ratio of its total power input and is usually expressed in percentage. Some motors or generators record the design efficiency on the nameplate. The following losses will be included in the efficiency calculations:

1. I^2R loss of rotor.
2. I^2R loss of stator.
3. Core loss.
4. Stray-load losses.
5. Friction and wind-age loss.

Power Factor: The full load power factor is the ratio of true power (Watt) to apparent power (VA). Some motors or generators record the full load power factor on the nameplate. Operating the motor at below-rated power or voltage will reduce the power factor.

Driven Equipment: This screen allows the user to define the type of driven equipment connected to the motor. This provides the menus necessary to easily customize the ESA software for automatic analysis for a variety of driven machines.



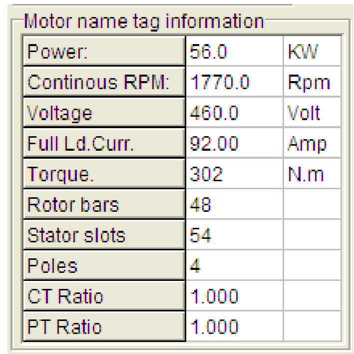
Squirrel Cage Induction Motors

Additional Recommended data:

Some of the electrical and mechanical faults within the AC induction motor appear as spectral peaks around rotor bar (number of rotor bars times rotor speed) or stator slot (number of stator slots times running speed) passing frequencies. If these values are accurately and correctly entered the ESA 6 software will accurately analyze and evaluate these faults.

If these values are not known enter “-1” and the ESA 6 software will attempt to determine the number of rotor bars or stator slots and automatically fill in the value.

Note: If the ATPOL II 6 software determines the number of rotor bars and/or stator slots, it is the analyst’s responsibility to verify these calculated values are correct.



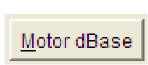
Rotor Bars: The number of bars on a squirrel cage induction motor rotor: if the number of rotor bars is not known, look in the “Motor dbase” (see below) for the selected motor. If the number of rotor bars is still unknown, enter ‘-1’ in the “fill in” box, this prompts the software to determine the number of rotor bars*.

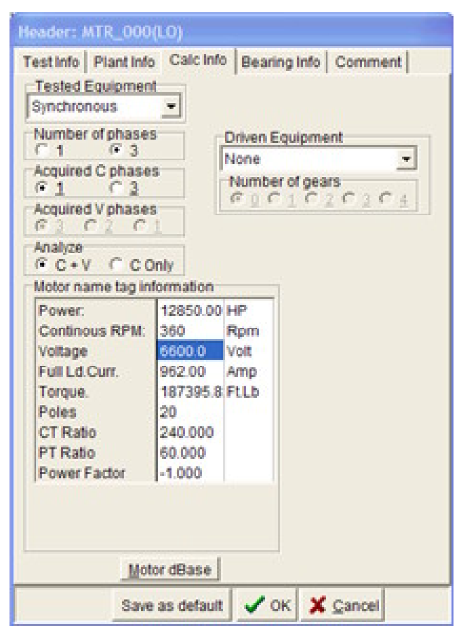
Stator Slots: The number of stator slots in the stator: if the number of stator slots is not known, look in the “Motor dbase” (see below) for the selected motor. If the number of stator slots is still unknown, enter “-1” in the “fill in” box, this prompts the software to determine the number of stator slots*.

*****It is necessary for the analyst to verify that these values are correct***.

Note: The software determines the number of rotor bars and stator slots by looking for peaks spaced at line frequency and/or sidebands spaced at line frequency. The number of rotor bars and stator slots as determined by the ATPOL II ESA software may be correct; however it is up to the analyst to verify the automated analysis.

Motor dBase: If the number of rotor bars and stator slots are unknown the ‘Motor dBase’ provides a library of motors including these values. If, the motor manufacturer and model number is known, the ‘Motor dBase’ provides an extensive database of information including rotor bars and stator slots. To access this information during header setup, press the ‘Motor dBase’ button.





VFD (Variable Frequency Drives)
The header set-up screen for VFDs is similar to the Induction Motor set-up. When testing VFDs some special considerations, need to be incorporated.

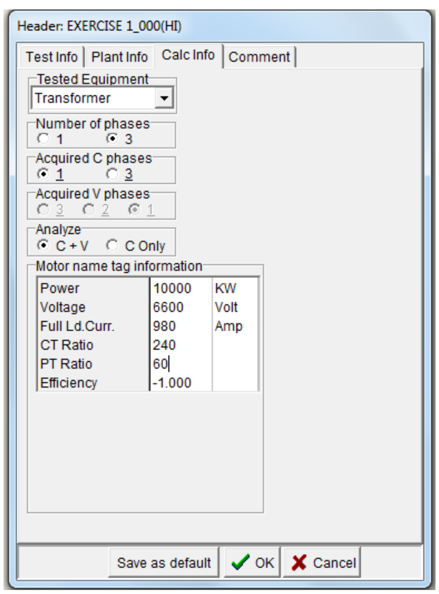
1. When testing VFDs it is recommended to take Motor Test Data at both the input and output of the VFD.
2. Perform a waveform capture on both the voltage and current wave forms for both the input and output of the VFD.
3. If possible, it is recommended to take the output VFD data at a constant frequency. The continual frequency changes that the drive undergoes during normal operation may provide inconsistent results.
4. For long term trending, it is recommended that the motor data be taken at similar load and frequency conditions.

Note: VFDs reduce the supply voltage at lower frequencies; the automatic analysis report will identify a low voltage condition.

Synchronous Motors
The header set-up screen for synchronous motors is similar to induction motors except, synchronous motors do not have rotor bars and they run at the same speed as the rotating magnetic field.

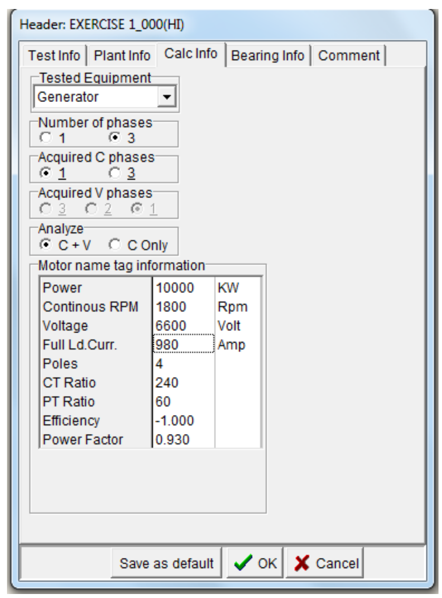
The summary page of the Synchronous Motor Automatic Report is available in Appendix 2.

Transformer



The header set-up screen for transformers is similar to all AC equipment with the exception of rotor bars, stator slots, RPM and number of poles. Additionally there is no driven equipment associated with transformers.

The summary page of Transformer Automatic Report is available in Appendix 3.



Generator
The header set-up screen for generators is similar to synchronous motors but a generator does not have any driven equipment.

The summary page of Generator Automatic Report is available in Appendix 4.

DC Machines
The Header set-up screen for DC machines is considerably different than for AC Machines. Since DC is essentially a single phase power, the numbers of phase sections are eliminated.

An automatic analysis for DC machines requires information regarding the DC Controller.

DC Motor Controller

Full-wave Rectified - The carrier frequency for a full-wave, 3 phase rectified signal, is 6 times line frequency.

Half-Wave Rectified - The carrier frequency for a full-wave, 3 phase rectified signal, is 3 times line frequency.

Motor Name Tag Information

Brush Count – The brush count is the number of rows of brushes on the commutator.

Commutator Bars – The number of commutator segments on the commutator.

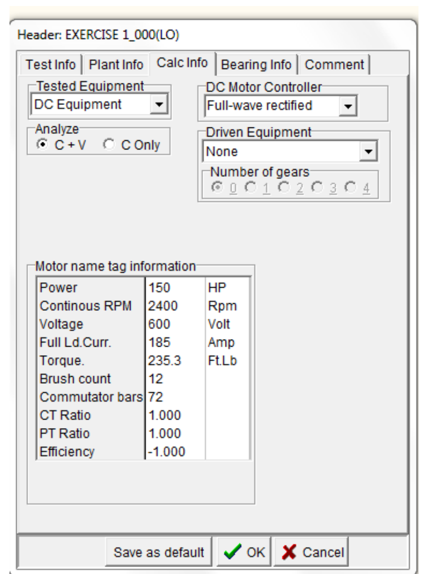
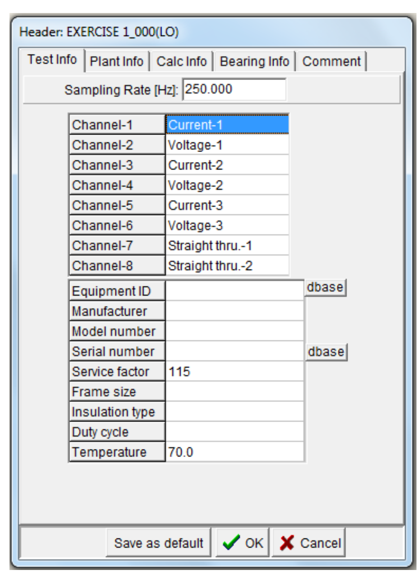


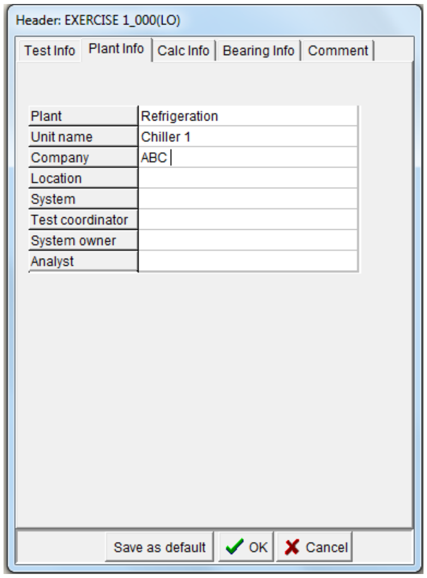
Figure 18: Header 2 Test Info



This screen allows you to enter related motor nameplate information and access it from a database of existing motors (not required). The Channels 1 through 8 are for information only to display where the various data is located.
Channel 1 is the Current for Phase 1; Channel 2 is the Voltage for Phase 1; Channel 3 is Current for Phase 2' Channel 4 is the Voltage for Phase 2; Current 5 is Current for Phase 3; Channel 6 is the Voltage for Phase 3. Channel 7 & 8 will not be used with the ATPOL II.

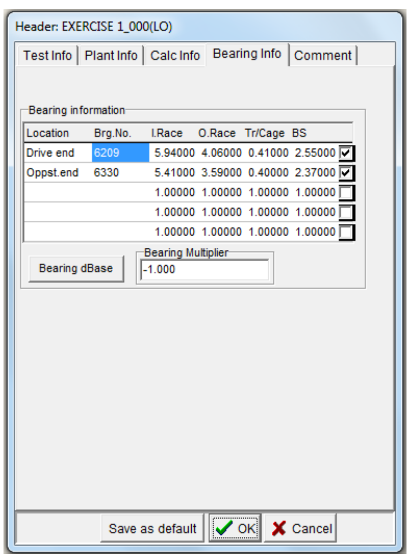
The sampling rate is fixed in the ATPOL II; however it will be different for the 120 Hz vs. 5000 Hz frequency ranges.

Figure 19: Header 3 ‘Plant Info’

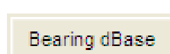


‘Plant Info’ screen allows you to enter specific plant and test data (not required).

Figure 20: Header 4 ‘Bearing Info’

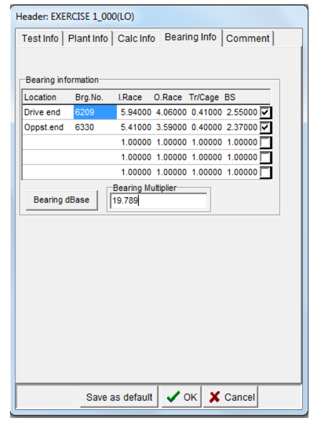


‘Bearing Info’ screen provides the tools necessary to enter Bearing Defect Frequency (BDF) information. The ATPOL II software uses these BDFs to identify pending bearing faults. If the correct bearing information is entered the ATPOL II can identify rolling element bearing faults in either the driver or the driven equipment. Inputting the correct bearing information is important for the ATPOL II software to provide accurate analysis. *If these frequencies are not known, the ATPOL II has an extensive database within the software. To access the database press the ‘Bearing dBase’ button.*



Note: The bearing defect frequencies are a function of the bearing internal geometry. Whereas, bearing numbers are functions of the bearing envelope dimension. Therefore, it is important to know and enter the exact bearing manufacturer as well as the bearing number with all of the prefixes and suffixes.

Bearing Multiplier: If the automatic analysis feature of the ESA 6 software identifies a spectral peak that is a non-integer multiple of running speed, but not one that is identified Bearing Defect Frequencies, it will identify the peak and place as one of the multiplier number in the bearing multiplier box.



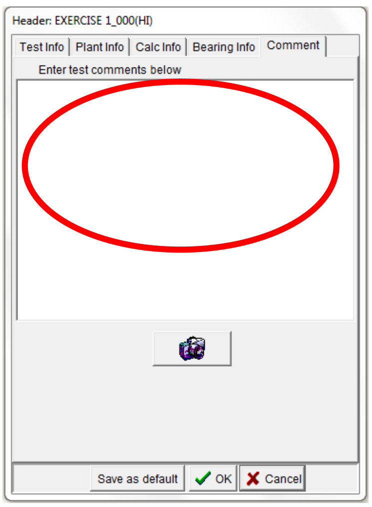


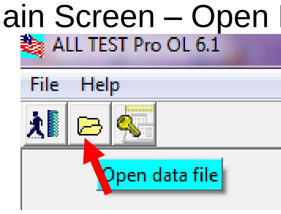
Figure 21: Header 'Comment'

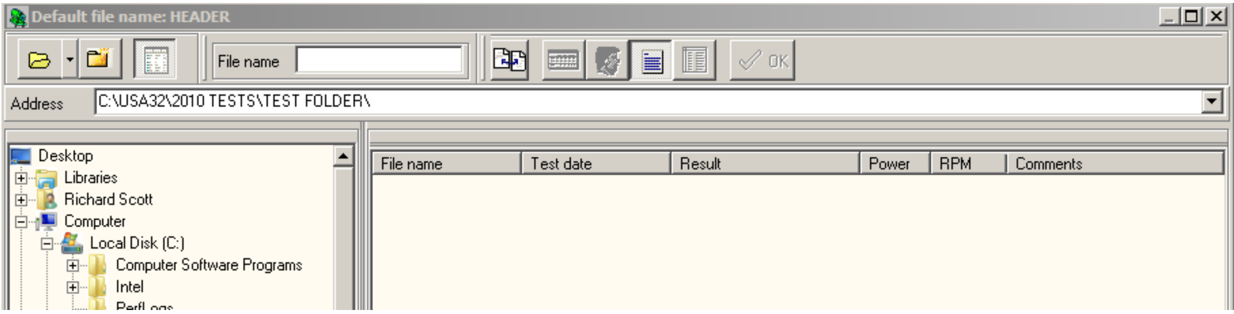
The 'comment' screen allows the analyst to enter additional comments or observations noted during testing. These comments will appear in the 4-page report (See the report's section).

Entering Nameplate Data On New Machines, Before Data Upload

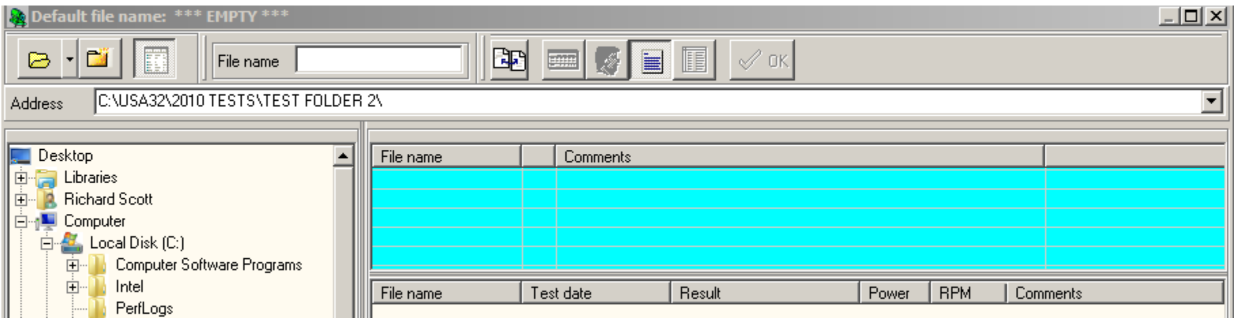
One of the unique features of the ATPOL II system is the ability to gather test data prior to an extensive computer set up operation. However, a machine folder header may be set up before any data has been taken. Setting up the header file before placing test data in the folder will allow the software to automatically populate the header information for any test data subsequently placed in that machine folder.

Main Screen – Open File

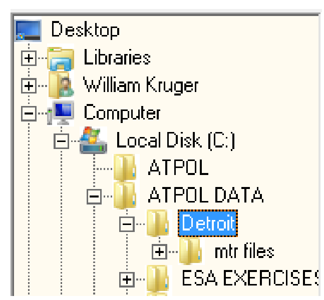




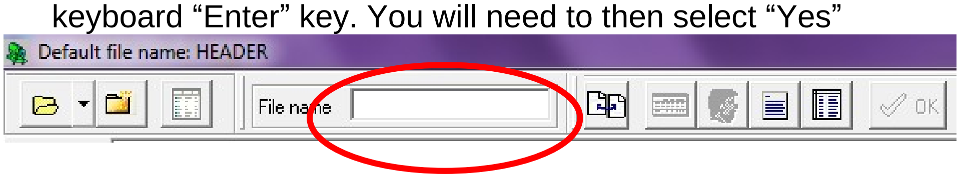
Note: *Before creating a header for an empty folder the "Header information" area of the Open File screen must be visible. This is the light blue area which is directly above spectral list display screen.To display the Header Information screen depress* ***ctrl-alt-A*** *from the Open file screen.*

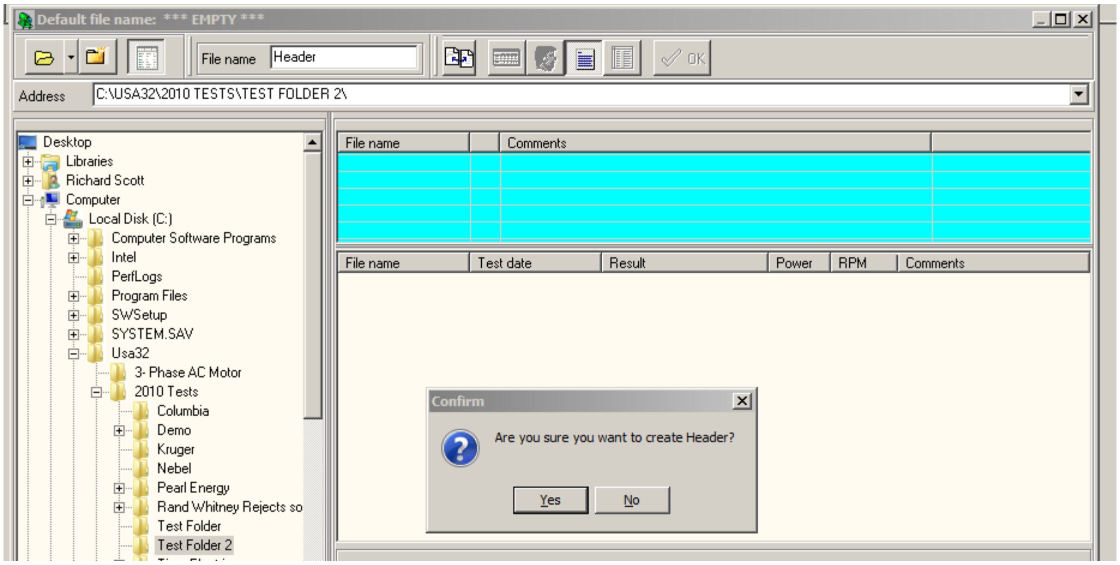


1. Select the folder from the 'Directory List' that will be set up with header nameplate data.

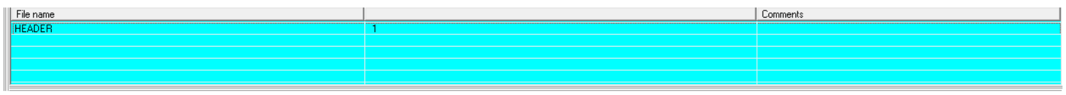


2. In the File Name fill-in box on the menu bar, type header and then press the keyboard "Enter" key. You will need to then select "Yes"

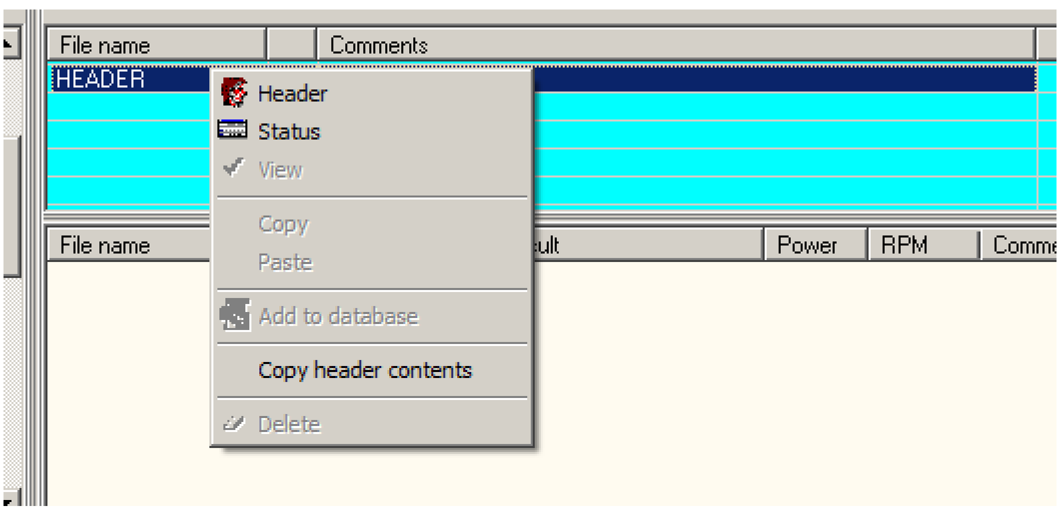




3. The word Header will now appear in the Header information screen.

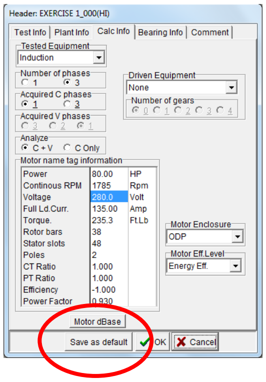


Place cursor on the word “Header” and depress the right mouse button. This will highlight the Header line and then also open up the following dialog box:



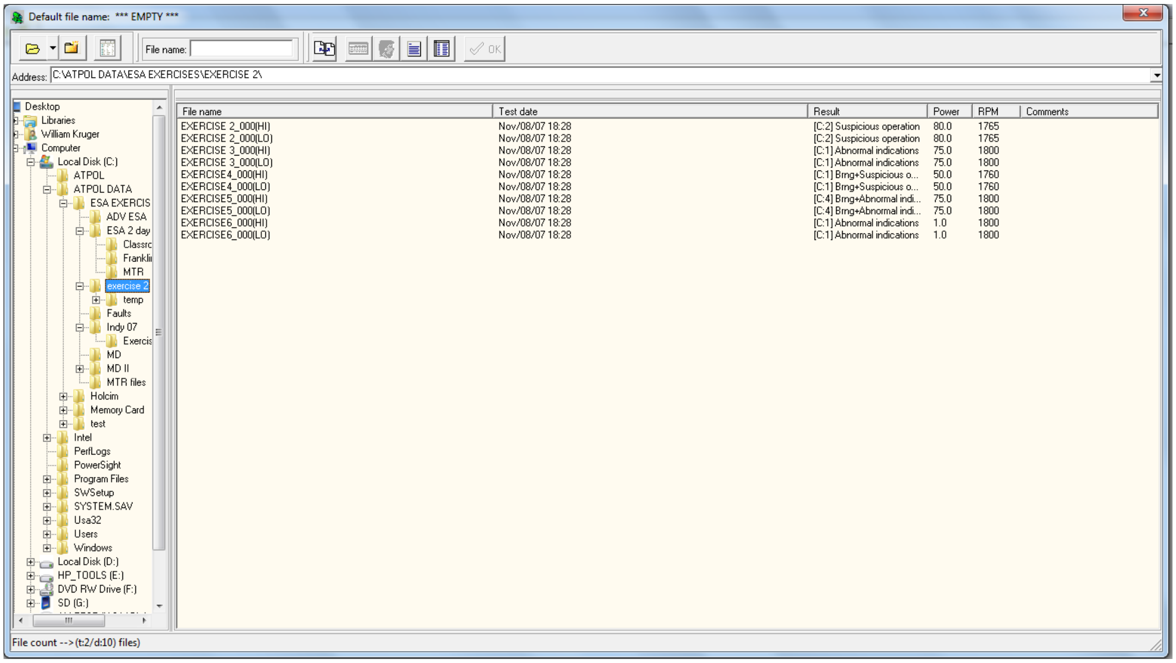
4. Place your mouse on the word “Header” and then click the left mouse button and the Header information screen will appear. Fill in all of the necessary information following the section in the manual for the header screen.

5. When the header information screen is filled in, depress “Save as default.” This will then allow any test data placed in this folder to automatically be populated with the header information.



Open File After Data Upload

Figure 22: Open File/Setup Folder

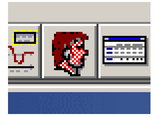


When opening the data file for the first time, select the folder using the ‘Directory List.’ The new data will not appear for about 20 seconds. The software is expanding the files necessary to perform data interpretation.

When the correct data appears, select the associated test result with the ‘(LO)’ in the file name, then click the ‘OK’ button.

The first time that data is opened, select the ‘Header’ button to check data or to enter the nameplate data (see ‘Tour of Header Screen’).

Figure 23: Header Button



The ATPOL II is now prepared for data analysis and reporting.

ATPOL II Data Analysis and Reporting

This section covers the operation of the ATPOL II ESA software. For an understanding of analysis, and advanced analysis procedure, please see the ESA Pattern Recognition Manual. Each spectrum collected by the ATPOL II is displayed in both the low frequency range, up to 120 Hz and high frequency range up to 5000 Hz.

Low Frequency display is selected from the file list by selecting the Motor file with the (LO) after the file name MOTOR_TEST_01_000(LO). The low frequency spectrum is generally used to identify mechanical faults such as unbalance, misalignment and rotor bar issues.

Figure 24: Data Analysis Screen – Low Frequency

Figure 24 shows the low frequency data screen.

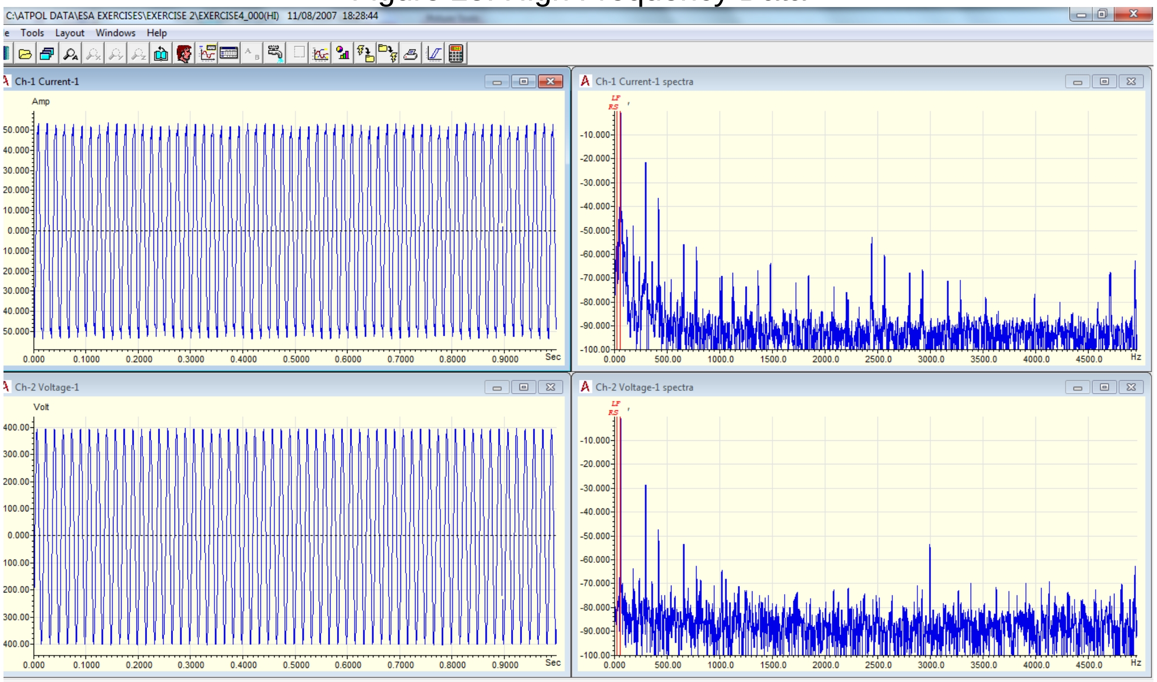
- ✓ The top display is the current waveform over fifty seconds. This shows the torque of the motor across that period of time.

- ✓ The middle display is the line frequency spectrum current peak to 120 Hz and identifies spectral peaks and sidebands, etc. for fault detection.
- ✓ The bottom display is the demodulated current spectrum.

In the above display, the line frequency peak current spectrum is displayed using the log scale and labeled as dB. The Demod spectrum is displayed in the linear scale.

High Frequency display is accessed by selecting the file with the (HI) after the file name MOTOR_TEST_01_000(HI). The High frequency display is generally used to locate and identify electrical and mechanical faults such as static and dynamic eccentricity.

Figure 25: High Frequency Data

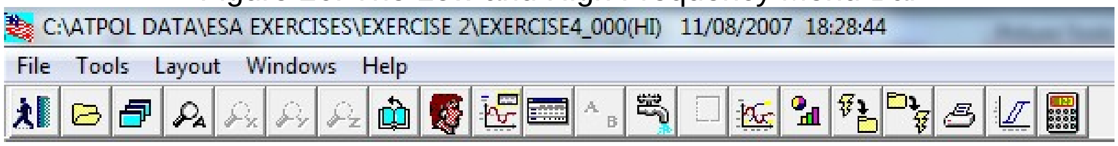


- ✓ Data in the upper left is the input waveform of current over 1 second.
- ✓ Data in the lower left is the input waveform of voltage over 1 second.
- ✓ Data in the upper right is the FFT to 5 kHz of current
- ✓ Data in the lower right is the FFT to 5 kHz of voltage.

The information in Figures 24 and 25 provide the displays necessary to troubleshoot both up and downstream from your test point including the mechanical condition of the equipment.

Figure 26 describes the features of the menu bar for standard analysis.

Figure 26: The Low and High Frequency Menu Bar



The buttons are highlighted as the mouse cursor passes over them. Buttons from left to right are:

- ✓ Close folder
- ✓ Open Folder
- ✓ Single/All Mode
- ✓ Auto Scale
- ✓ X-Axis Zoom
- ✓ Y-Axis Zoom
- ✓ Z-Axis Zoom
- ✓ Previous Page
- ✓ Data File Header (Header)
- ✓ Display Zoom Region
- ✓ Change Trace Plot Status
- ✓ Switch Between Two Traces
- ✓ Waterfall Plot
- ✓ Overlay Two Pages
- ✓ Enter Labels
- ✓ Display Channel Statistics
- ✓ Save Zooms
- ✓ Load Zooms
- ✓ Print
- ✓ Analysis Tools
- ✓ Calculate

The features and functions of the ATPOL II software provide a great deal of flexibility. One of the primary strengths of the ATPOL II ESA software is the ability to automatically analyze different types of machinery using ATPOL II's proprietary algorithms.

The automated analysis features:

- ✓ Automated running speed detection.
- ✓ Automated pole pass frequency detection.
- ✓ Line frequency detection.
- ✓ Number of rotor bars detection.
- ✓ Number of stator slots detection.
- ✓ Automated bearing defect frequencies.

The ATPOL II algorithms are designed to automatically detect the above values based on the collected data. However, these values are calculations and anomalies within the data collection process or signal, which may provide incorrect results. It is up to the analyst to verify all of these values.

DC Motor Analysis and Pattern Recognition

Pattern recognition is similar to the signatures evaluated using vibration analysis.

1. Determine DC motor speed through calculating (voltage/nameplate voltage) times nameplate RPM.
2. View the low frequency data. Note the demodulated current and current values.
    a. Place an RS cursor at the estimated running speed. There may be a peak at the actual value.
    b. Print the spectra.
3. View the high frequency data.
    a. Note the voltage and current waveforms and view for a repeating pattern.
    b. Non-repeating or odd patterns will denote problems with the DC drive.
4. View the voltage and current FFTs.
    a. Zoom in to 1200 Hz.
    b. Place cursor on-line frequency peak (i.e.: 60 Hz) and create harmonic cursors.
    c. Print waveforms.
    d. Place cursor on (number of SCRs time's line frequency) drives frequency and creates harmonic cursors.
    e. Print waveforms.
5. Analyze printed waveforms.

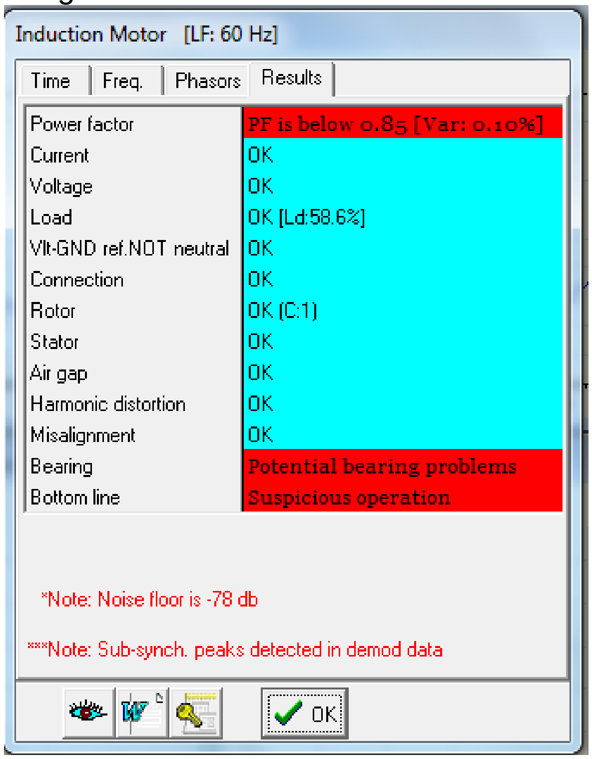
How to interpret the analysis data, as well as known pass/fail values, can be found in the ESA Pattern Recognition Manual.

Automated Analysis and Reporting Feature

One of the most powerful features of the ATPOL II system is its automated analysis and reporting feature. This feature allows users, even with limited knowledge of motor systems to immediately produce answers related to the condition of motor systems.

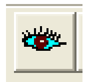
To access the automatic analysis feature of the ATPOL II select the calculator icon from the ATPOL II menu bar.

Figure 27: Press the Calculate Button



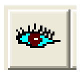
The calculations display defaults to the results screen. This displays any obvious faults that the ATPOL II software identifies.

The calculate screen automatically color codes any areas that exceed pre-determined levels. Red indicates a severe problem and yellow indicates a warning.



The first step after opening the automatic analysis screen is to make the software re-run the data analysis. This is accomplished by using the critical points calculator. This is accessed using the first button to the bottom left of the menu bar.

Selecting the critical point icon prompts the software to re-run the automatic analysis. It also triggers the software to select running speed; line frequency and pole pass frequencies (PPF).
The icons across the bottom menu bar are from left to right:

 Find Critical Points – run analysis.

 Generate MS Word Report – Requires Word 2007®.

 Populate MS Access® Database – Moves associated information into an Access® Database titled 'empdata.mdb' for trending and additional analysis

(See Database and Appendix 5).

Print Report – Generates and prints the 4 page analysis report immediately.

OK – Closes the automatic analysis screen.

A sample report follows on the next four pages:

ALL TEST Pro OL 6 Analysis Results

PERFORMANCE SUMMARY

Bottom Line

________This induction motor is operating normally, no action is required.
__X_____This induction motor exhibits suspicious operation, trending of the motor is warranted.
________This induction motor exhibits abnormal indications, action is warranted, NOW.

Operating normally: There are no problems with the motor.
Abnormal indications: There are current variations, voltage variations and/or overload problems with the motor.
Suspicious operations: There are problems with the motor other than those for current, voltage or load.

Power Factor Commentary

________Power factor exceeds 0.85.
__X_____Power factor is below 0.85, see detailed report.

Exceeds 0.85: Power factor is in normal range.
Below 0.85: Power Factor is below 0.85, this may be the result of running the motor at reduced load.

Current Commentary

__X_____Current variation is within normal limits.
________Current variation is beyond normal limits, see detailed report.

Normal Limits: Phase current deviations are less than 2% and the crest factor is between 1.35 and 1.45 and is generally sinusoidal.
Second Normal Limits: Current unbalance is >2% or crest factor is <1.35 or > 1.45.

Current unbalance may be result of voltage unbalance. (Voltage unbalance can cause current unbalance anywhere from 6 to 10 times more than voltage unbalance.)
Current unbalances without a voltage unbalance indicate a problem in either the motor or the cabling to the motor, these may be winding faults. Verify with MCA

Phase current variations between 2-3% expect localized hot spots.
Phase current variations between 3-5% closely monitor temperature.
Phase current unbalance between 5-10% operation verify current unbalance is the result of voltage unbalance.
Phase current unbalance >10% verify it is the result of voltage unbalance and attempt to correct operation of current unbalance in excess of 10% may cause premature insulation failure.

Crest Factor (CF) If CF is <1.35 or > 1.45 the current wave3 form is distorted. If the current CF follows the voltage CF then the fault is due to incoming power, if the current differs from the voltage CF the fault is in the motor itself.

Voltage Commentary

__X_____Voltage variation is within normal limits.
________Voltage variation is beyond normal limits, see detailed report.
________RMS voltage differs from nameplate by more than 5%.

Normal Limits: The measured phase voltage is balanced within +/-5% and the measured voltage is within 5% of Name Plate Voltage

Voltage Variations are Beyond Normal Limits: NEMA standards recommend that phase voltage unbalance be limited to 1%, because unbalanced phase voltage can create up to 20 times more current unbalance. Current unbalance creates circulating currents which create excessive heat leading to premature winding failure. Motors with voltage unbalance between 1 -5% should be de-rated. The voltage de-rating factor (VDF) is listed in the detailed report. Motors should not be operated with more than 5% voltage unbalance.

Voltage Differs from Nameplate by more than 5%: Recommended that motors operate within 2% of the name plate voltage; under voltage creates excess current, poor power factor, reduced efficiency and excess heating; over-voltage creates lower efficiency, reduced power factor, saturation of the iron core which creates excess heat.

Load Commentary

__X_____ Load on the motor is consistent with nameplate values.
________ Load on the motor exceeds nameplate values, see detailed report.
________ Load on the motor is less than 25%.

Load is Consistent with Nameplate Values: The load on the motor is less than the nameplate values, including their service factor (SF). If no SF is entered in the header information software assume a SF of 1.15.

Load on the Induction Motor exceeds Nameplate Value: Load on the motor exceeds nameplate value. If SF differs from 1.15 then the software will use the value entered in the header information.

Load on the Induction Motor is less than 25%: If the motor load is below 25% there is insufficient current to make an accurate rotor call.

Phase Connection Commentary

__X_____ Connections are normal.
________ Voltage ground reference is NOT neutral.
________ Loose connection.

Phase Connections are Normal:

Voltage Ground Reference is NOT Neutral:

Loose Connections:

Rotor Commentary

__X_____ Rotor bar health is normal.
________ Rotor bar health is questionable, see detailed report.
________ Load is insufficient to determine rotor bar health, at this time.

Rotor Bar Health is Normal: The squirrel cage induction motor was running at sufficient load and there were no indication of rotor bars degradation.

Rotor Bar Health is Questionable: The squirrel cage induction motor was running at sufficient load and there were indication of rotor bar degradation, review Rotor Bar Analysis section of this manual for further details.

Load is Insufficient to Determine Rotor Bar Health: The squirrel cage motor load was below 25% which is an insufficient load to identify rotor bar degradation.

Stator Commentary

__X______Stator health is normal.
________Stator electrical health is questionable.
________Stator mechanical health is questionable.
________Turn to turn short.

Stator Health is Normal: There are no indications of existing or developing stator mechanical or electrical issues.

Stator Electrical Health is Questionable: There are indications of developing winding shorts or weaknesses in the insulation to ground. ***Verify with MCA.***

Stator Mechanical Health is Questionable: There are indications loose windings or stator iron.

Turn to Turn Short: There are indications of developing or existing turn to turn shorts. ***Verify with MCA.***

Rotor/Stator Air-gap Characteristics

__X______Dynamic or static eccentricity indications do not exist.
________Indications of static eccentricity exist.
________Indications of dynamic eccentricity exist.

Dynamic or Static Eccentricity Indications Do Not Exist: There is no indication of either static or dynamic eccentricity.

Indications of Static Eccentricity Exist: Indications are present that the rotor is not radially centered in the magnetic field. Check the rotor air gaps.

Indications of Dynamic Eccentricity Exist: Indications are present that indicate that either the shaft is not centered in the rotor or the rotor is not concentric. It could be possible that the rotor is thermally sensitive.

Harmonic Distortion Commentary

__X______There is no evidence of harmonic distortion.
________There is evidence of harmonic distortion, see detailed report.

There is No Indication of Harmonic Distortion: Both the current and voltage waveforms are relatively sinusoidal.

There is Evidence of Harmonic Distortion: Either the voltage or the current waveform has evidence of harmonics. View the detailed report in the harmonic distortion report and table below.

Misalignment Indications

________There are no indications of mechanical problems like misalignment or unbalance.
__X______There are indications of mechanical problems like misalignment or unbalance. Perform vibration survey to identify and correct the cause.

There are No Indications of Mechanical Problems like Unbalance or Misalignment: There are no indications of excessive forces at shaft rotating speed.

There are Indications of Mechanical Problems like Misalignment / Unbalance: There **are** indications when forces are present at shaft rotational speeds. These may be caused by any mechanical problem on the rotating system. These faults include unbalance, misalignment, bent shaft, cracked shaft, eccentric rotor of the driven machine, etc

Bearing Commentary

__X______There is no evidence of bearing problem.

________Indications of potential bearing problems, perform vibration survey to verify.

There is No Evidence of Bearing Problem: There are no indications of rolling element bearing faults.

Indications of Potential Bearing Problems: Spectral peaks are present at non-integer multiples of rotating speeds in the high frequency spectrum. View the bearing multiplier in the header to locate the fault. For additional rolling element bearing analysis review the ALL-TEST *Pro*, white paper on Rolling Element Bearing Failures.

INPUT SUMMARY

NAMEPLATE INFORMATION

		Units
Manufacturer	****	
Serial Number	****	
Model Number	****	
Tested Equipment	Induction	
Power	50.00	HP
RPM	1760	Rpm
Poles	4	
Phases:	3	
Voltage	480.0	Volt
Full Load Current	65.00	Amp
Number of rotor bars	40	
Number of stator slots	48	
Torque	149.1	Ft.Lb
CT Ratio	1.000	
PT Ratio	1.000	
Duty Cycle	****	
Service Factor	115	
Frame Size	****	
Insulation Type	****	
Ambient Temperature	70.0	F°
Motor efficiency	-1.000	
Power factor	-1.000	

Description:

Detailed Calculations

LEGENDS:

Impedance	= Complex Impedance = vi/ci
CF	= Crest Factor = (waveform peak)/(waveform rms)
CFC	= Carrier Frequency Content = 10^(x/20)/frms, %
THDF	= Transformer Harmonic De-rating Factor = sqrt(2)/CF, %
VDF	= Voltage De-rating Factor = 100 - (voltage unbalance, %)^2, %
Se, fund	= Location of pole pass frequency fundamental, Hz
Se, harm	= Number of pole pass frequency harmonics
Level	= Sum of spectral amplitudes of pole pass frequency fundamentals and harmonics
Slip %	= SRSS sum of slip and harmonic "levels" divided by RMS level of RMS DEMOD spectra between 0 and 65 Hz.
Upper sb	= dB level of upper slip sideband of power line peak
Lower sb	= dB level of lower slip sideband of power line peak
Rotor bar health	= Estimate of the percent of broken or cracked rotor bars
Thd	= Total harmonic distortion
+Ve	= Positive sequence harmonic
-Ve	= Negative sequence harmonic
Zero	= Zero sequence harmonic
RB Hlt Index	= Rotor bar health index

Running Speed = 29.685 Hz / 1781 Rpm
Pole pass frequency = 1.256 Hz
Load = 58.6 %

Time			
	RMS	**Peak**	**CF**
Current 1	37.560	54.023	1.438
Current 2	38.590	55.346	1.434
Current 3	36.980	54.387	1.471
Average	37.710	54.585	1.448
% dev	2.3	1.4	1.6

THDF = 97.7

Time			
	RMS	**Peak**	**CF**
Voltage 1	478.400	693.330	1.449
Voltage 2	478.700	692.130	1.446
Voltage 3	477.900	684.150	1.432
Average	478.330	689.870	1.442
% dev	0.1	0.8	0.7

DF = 100.0

			App. Power	**Real Power**	**Reac. Power**
	Power factor	**Impedance**	**kVA**	**kW**	**kVARS**
Phase 1	0.767	12.737	10.363	7.953	6.644
Phase 2	0.755	12.405	10.639	8.033	6.976
Phase 3	0.749	12.923	10.229	7.665	6.773
Avg/Total	0.757	12.688	31.231	23.651	20.393
% dev	1.3	2.2			

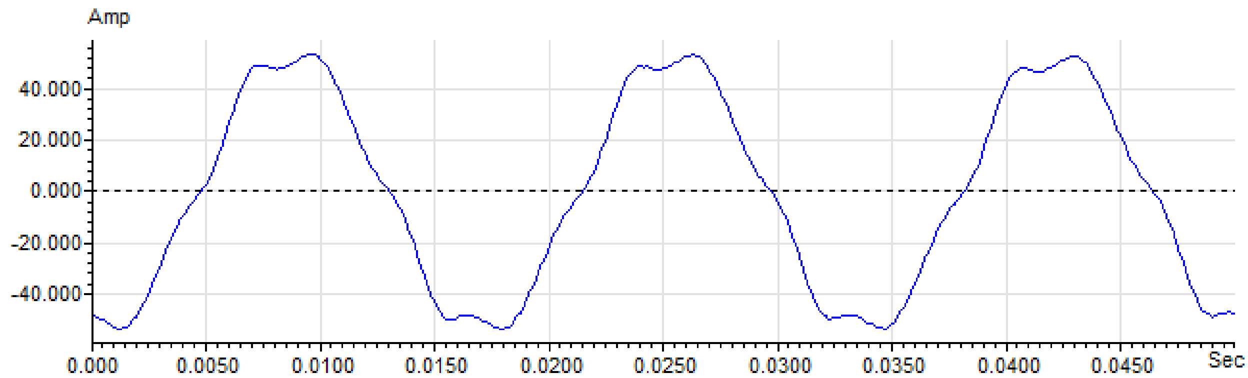
Demand Pwr = 31.70 HP [Load:58.6 %, Motor Eff.:92.6 %, Output Pow.:29.4 Hp, Output Trq.:86.5 Ft.Lb]

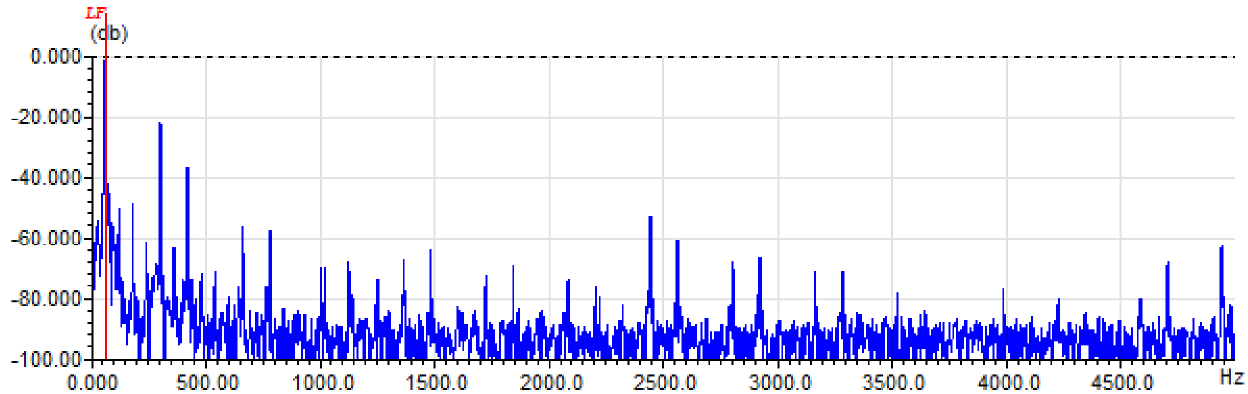
Summary of Rotor Bar Health				Power line dB diff.		RB Hlt Index
	Se, fund	Se, harm	Level %	Upper SB	Lower SB	
Measured	1.256	2	0.0	-78.2	-68.1	0.0336
Severity level	Rotor Condition Assessment			Recommended Corrective Action		
1	Excellent			None		

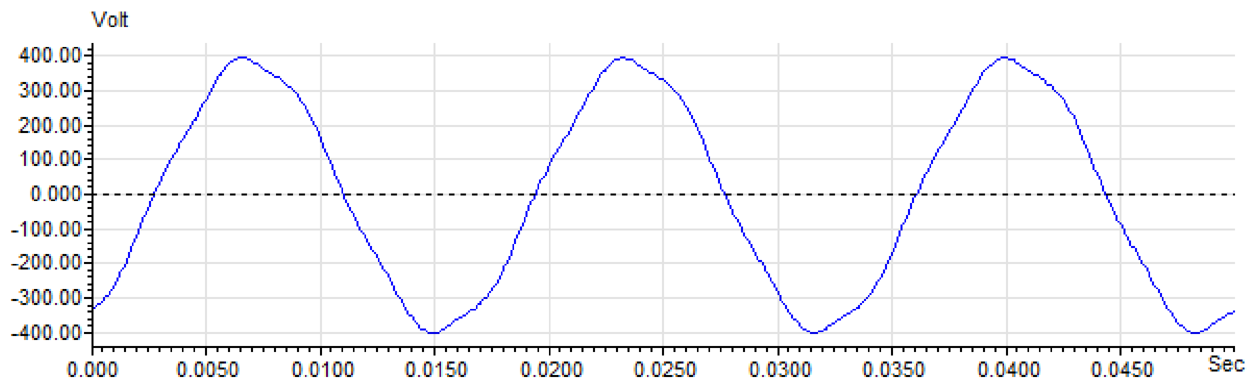
Harmonic Distortion Results:
Voltage input, from 59.998 Hz harmonics

	THD Odd %	THD Even %	+ve%	-ve %	Zero %	THD All %
Current 1	8.804	0.355	1.552	8.663	0.426	8.812
Current 2	***	***	***	***	***	9.000
Current 3	***	***	***	***	***	10.000
Voltage 1	3.890	0.063	0.461	3.862	0.086	3.891
Voltage 2	***	***	***	***	***	4.000
Voltage 3	***	***	***	***	***	4.000

Harmonic distortion table						
Hz	Cur1	Vlt1	Cur2	Vlt2	Cur3	Vlt3
60	37.3	478	***	***	***	***
120	0.1	0	***	***	***	***
180	0.2	0	***	***	***	***
240	0.0	0	***	***	***	***
300	3.3	19	***	***	***	***
360	0.0	0	***	***	***	***
420	0.6	2	***	***	***	***
480	0.0	0	***	***	***	***
540	0.0	0	***	***	***	***
600	0.0	0	***	***	***	***
660	0.1	2	***	***	***	***
720	0.0	0	***	***	***	***


Amp
40.000
20.000
0.000
-20.000
-40.000
0.000
0.0050
0.0100
0.0150
0.0200
0.0250
0.0300
0.0350
0.0400
0.0450
Sec


LF
(db)
0.000
-20.000
-40.000
-60.000
-80.000
-100.00
0.000
500.00
1000.0
1500.0
2000.0
2500.0
3000.0
3500.0
4000.0
4500.0
Hz


Volt
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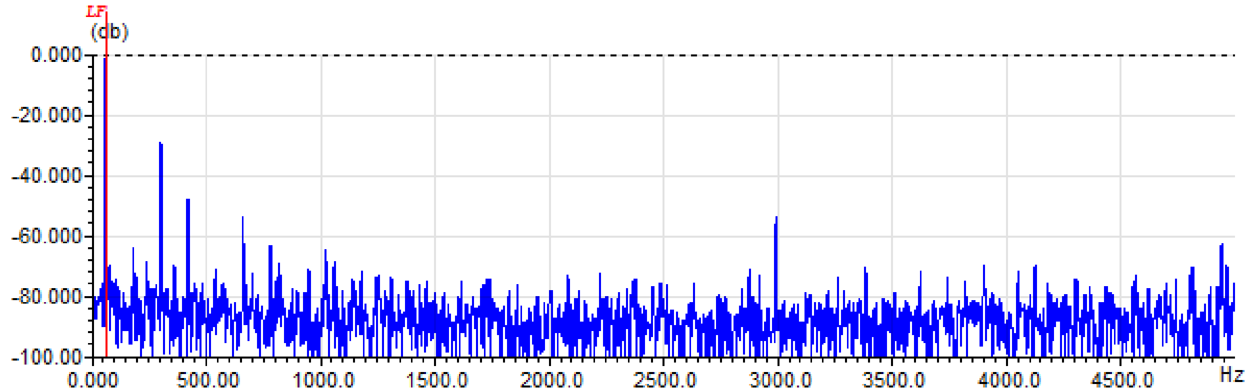
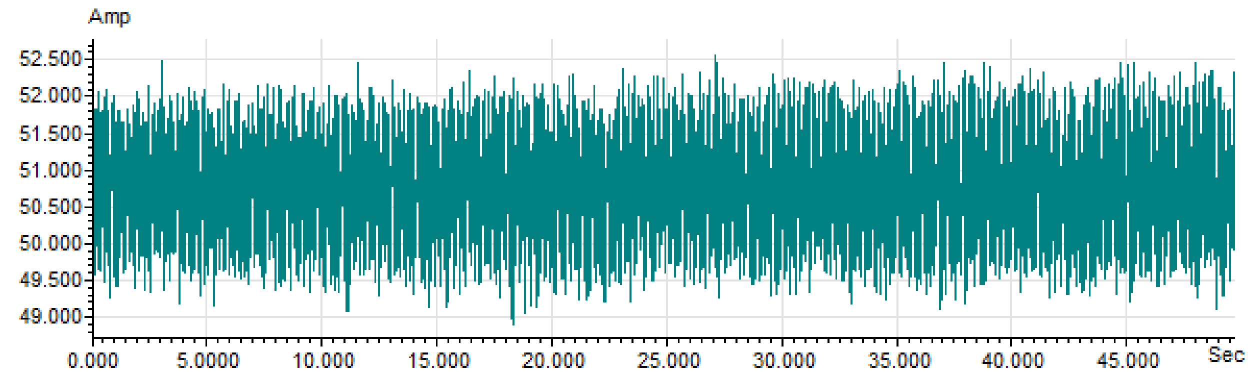
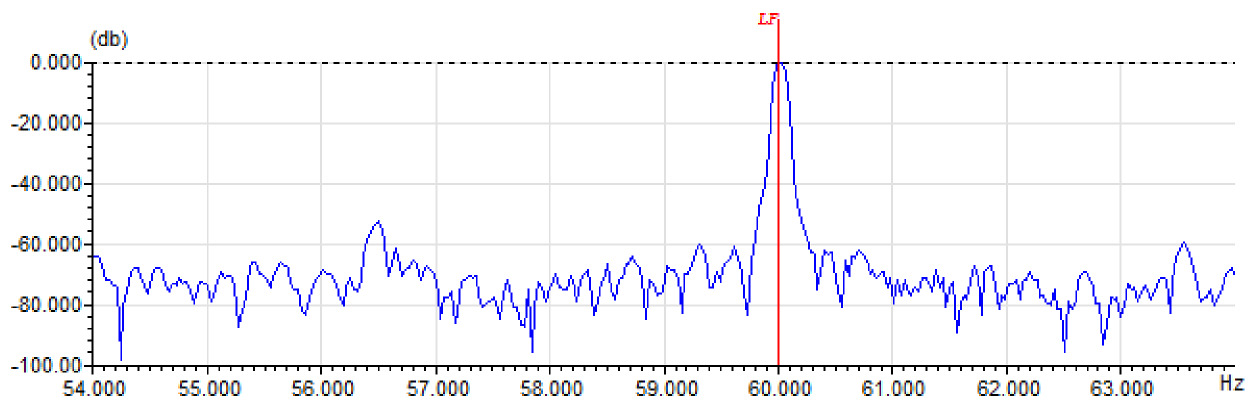
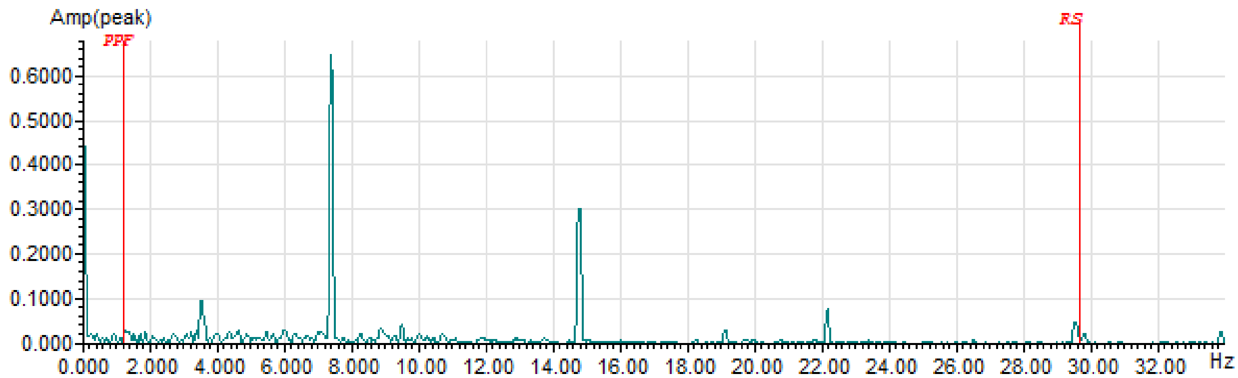
300.00
200.00
100.00
0.000
-100.00
-200.00
-300.00
-400.00
0.000
0.0050
0.0100
0.0150
0.0200
0.0250
0.0300
0.0350
0.0400
0.0450
Sec


LF
(db)
0.000
-20.000
-40.000
-60.000
-80.000
-100.00
0.000
500.00
1000.0
1500.0
2000.0
2500.0
3000.0
3500.0
4000.0
4500.0
Hz


Amp
52.500
52.000
51.500
51.000
50.500
50.000
49.500
49.000
0.000
5.0000
10.000
15.000
20.000
25.000
30.000
35.000
40.000
45.000
Sec


LF
(db)
0.000
-20.000
-40.000
-60.000
-80.000
-100.00
54.000
55.000
56.000
57.000
58.000
59.000
60.000
61.000
62.000
63.000
Hz



Calculate Menu

The ‘calculate menu’ is used to provide the results of the automatic analysis performed on the test data captured by the ATPOL II. It also displays the measured values for the machine under test.

The calculate menu has either 4 or 5 sub-menus. (The bearing sub-menu will be available if bearing data is entered in the header screen.) The sub-menus are:

Results

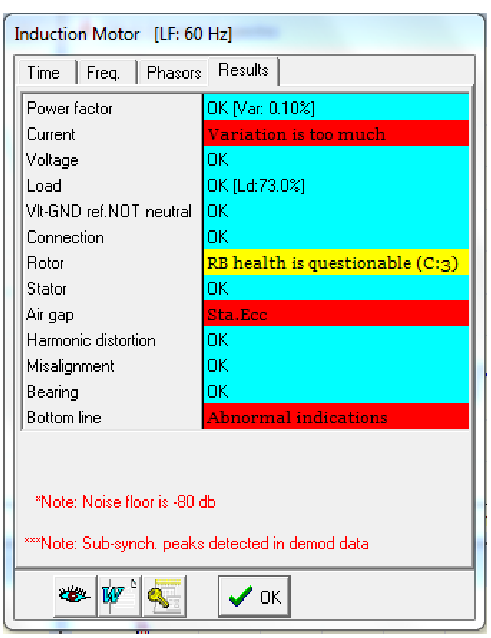
Phasors

Freq.

Time

Bearings (If bearing information is entered in the header file)

Figure 28: Calculate Results Tab



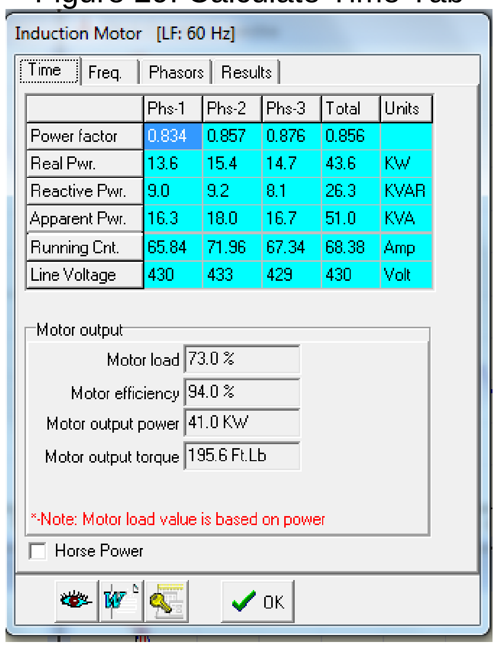
‘Results’ tab

- The ‘Results’ tab presents the analysis results for power factor versus 0.85 and the variation of the power factor during the data acquisition.
- Current unbalance.
- Voltage unbalance and deviation from nameplate value.
- Load % (percent) versus nameplate load.
- Voltage neutral not ground.
- Connection.
- Rotor for rotor bar health.

- Stator.
- Air Gap for static and dynamic eccentricity.
- Harmonic Distortion.
- Misalignment for misalignment or unbalance.
- Bearing to show if potential rolling element bearing damage is expected.
- Bottom Line that shows Normal, Suspicious or Abnormal operation.

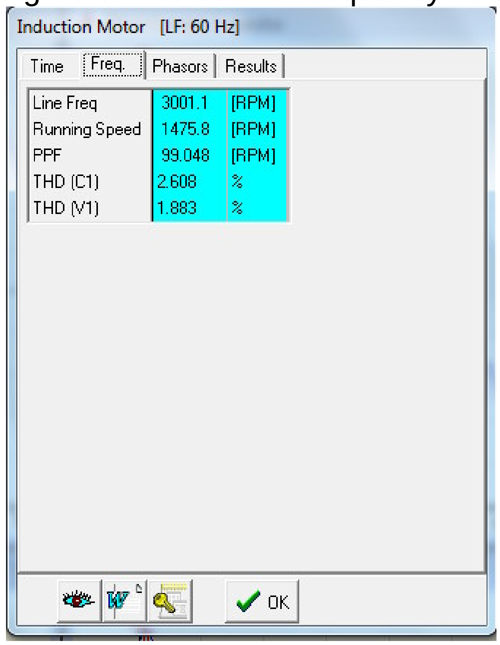
These results will be printed in the Word® report. See the detailed report in a previous section for further interpretation of the results.

Figure 29: Calculate Time Tab



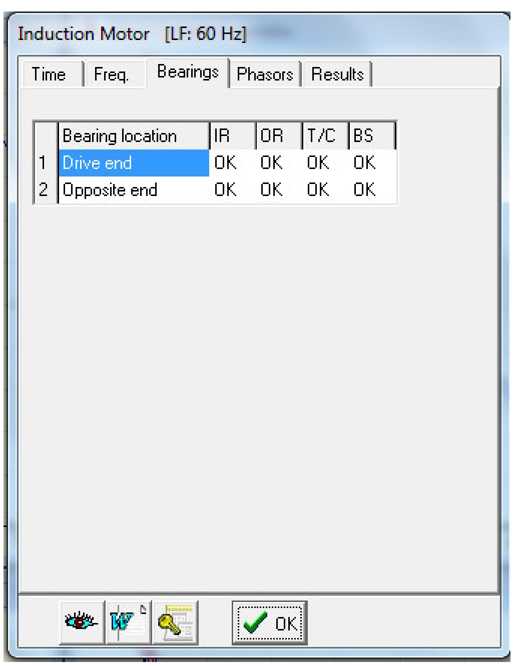
The ‘Time’ tab shows the measured values for the individual phases. It presents the three-phase data for power factor; real, reactive and apparent power; running current; and voltage. These values are displayed as either totals/average. These values can be displayed as either KW or Horsepower.

Figure 30: Calculate Frequency Tab



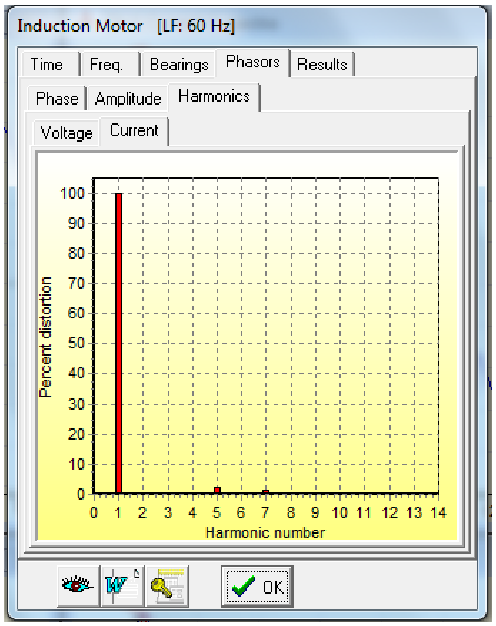
The ‘frequency’ tab presents the data for line frequency, motor running speed, pole pass frequency, and the harmonic distortion for current 1 and voltage 1. This information is used in the automated analysis performed by the software.

Figure 31: The Calculate Bearings Tab



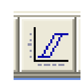
The ‘calculate bearings’ tab presents the bearing multiplier headings (e.g.; BPFI, BPFO, etc) that were used in the analysis if bearing data was entered in the header data field. An ‘x’ in one of the boxes indicates a bearing problem for that specific bearing and multiplier. (To see the actual bearing multipliers, go to the header icon.) A bearing call can also be obtained if peaks present themselves in the spectra, which are possible bearing multiplier-related even if the specific bearings chosen are not the culprit. This can be confirmed by clicking on the ‘header’ icon and checking the ‘bearing’ tab for a number in the middle box. This number will show you the multiplier or harmonic of multiplier that caused the call.

Figure 32: The ‘Calculate Phasors’ Tab



The ‘Calculate Phasors’ tab presents a graphical display of the data for the ‘Phase’ and ‘Amplitude’ for the Phase 1 current and voltage. A graphical presentation is also offered to show the harmonic peak content.

Automated Cursors for Motor Faults

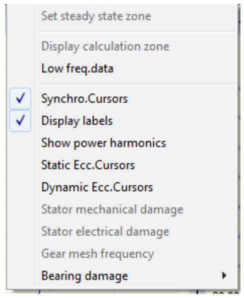


To assist the analyst in confirming the automatic analysis, the software provides automated cursor markers in the high frequency displays. In order to see the automatic cursor display, click on the ‘analysis tools’ button located in the main menu.

From the Low Frequency Display

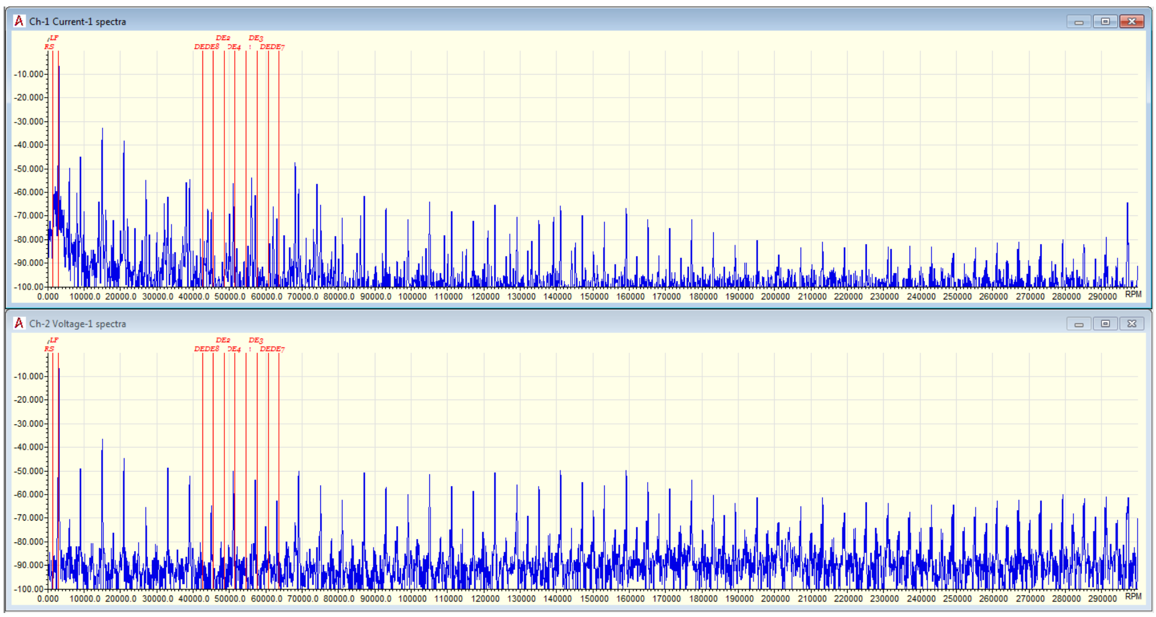
1. Select the high frequency display from the drop down menu. You will then receive a set of choices, as shown in Figure 33. (Sections that are grayed out, means that the machine detail information is necessary to display the automated cursors was not provided in the data file header. *For example in Figure 33, stator mechanical and stator electrical cursors cannot be displayed since the number of stator slots is unknown. The gear mesh frequencies cannot be displayed since none of the gear data was entered*.)

Figure 33: Automated Cursors



From the above figure, select the 'Dynamic Ecc. Cursors' selection from the menu displaying the cursors shown as in Figure 33:

Figure 34: Automated Cursors – Dynamic Eccentricity Example

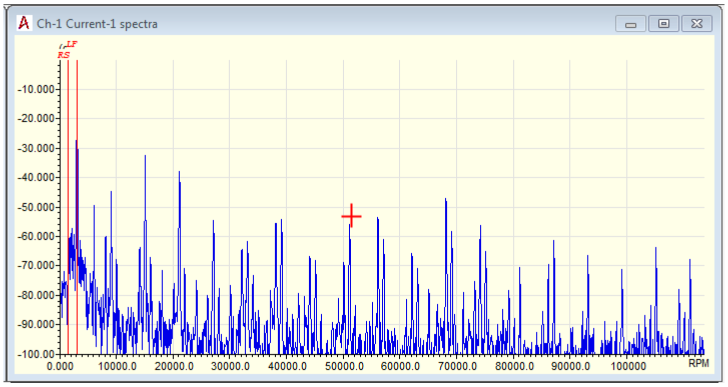


Sideband Cursors

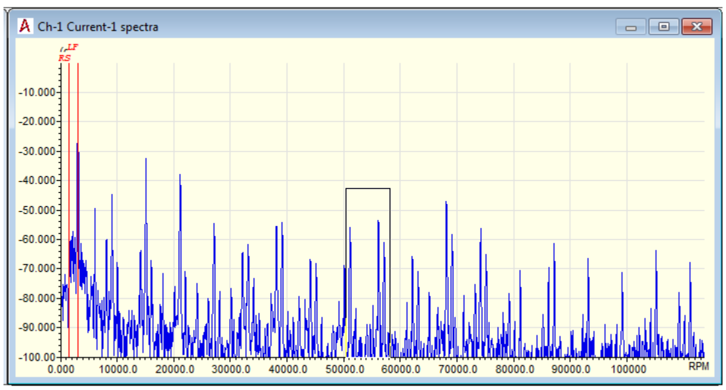
Electrical Signature Analysis (ESA) uses the modulation of the motor current and voltage to identify mechanical and electrical faults within the motor system. The information necessary to identify many of these faults are contained in the sidebands surrounding specific frequencies. The sideband cursor tools allow the analyst to locate and identify these critical sidebands.

To display sideband cursors:

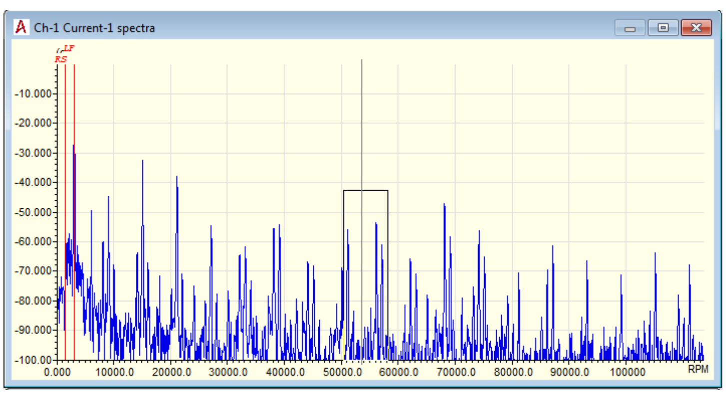
1. Place the mouse pointer to the left of the peak you want to be the center of the sideband pattern. In the figure below is the frequency is 53129 CPM.



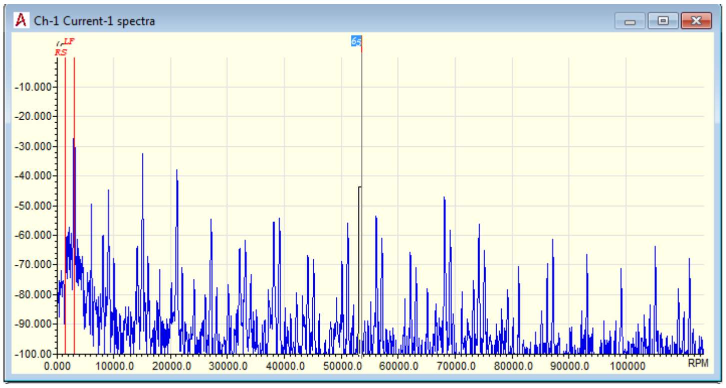
2. Use the mouse to left click, while pressing down, drag and draw a box around the peak to select the center frequency.



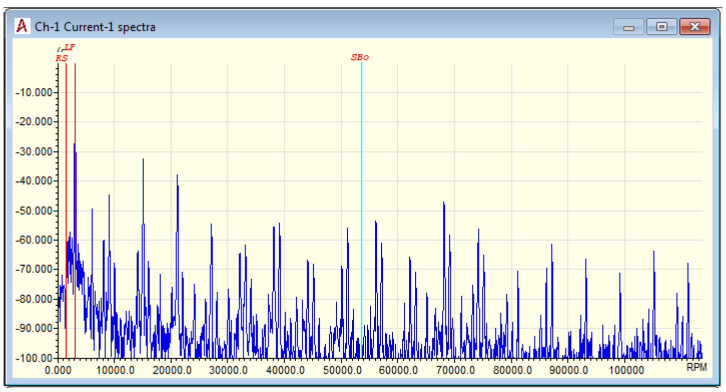
3. Holding down the control key, on the computer keypad, click the right mouse button. A cursor line will appear on the desired peak. (The auto cursor will align on the maximum peak within the selected box. Use the left or right arrow on the computer keypad to position the cursor at the desired frequency).



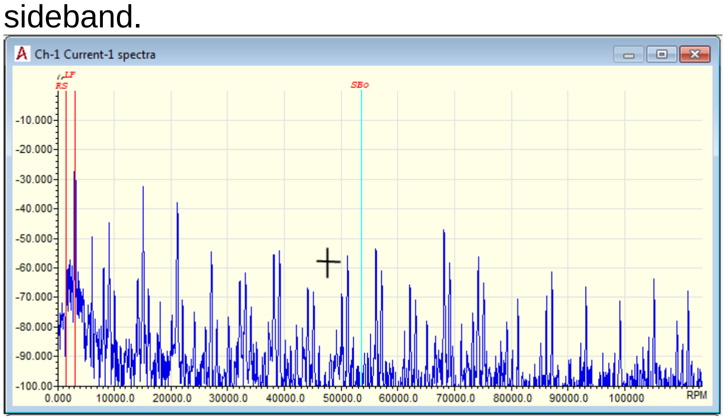
4. Move the mouse pointer to the right of the cursor and double-click the left mouse button.



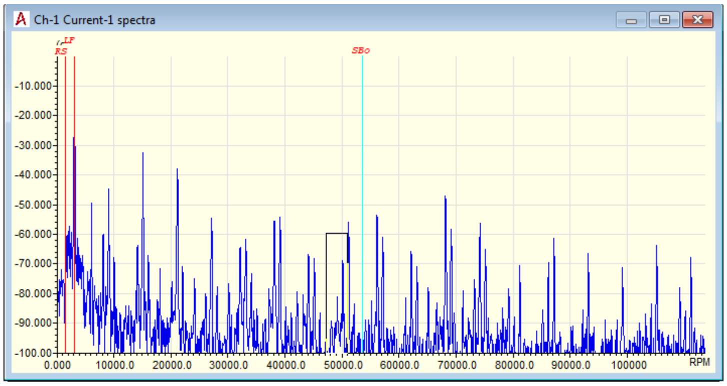
5. A dark blue box will appear at the top of the cursor. Type SB0 [that is, S-B- 0 (the number zero)] and press the enter key.



6. Place the mouse pointer to the left of the peak that you want to indicate as a sideband.



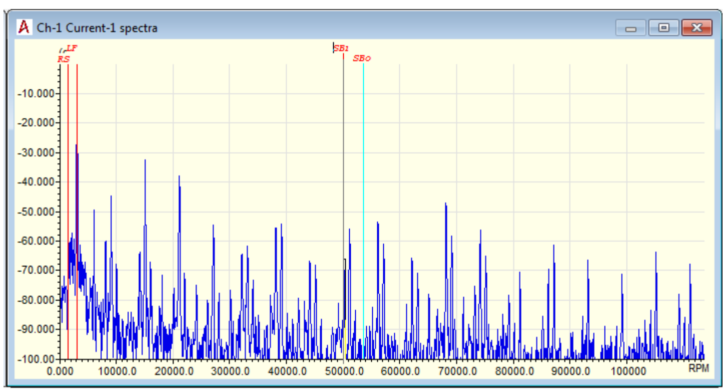
7. Use the mouse with the left button pressed to drag and draw a box around this peak.



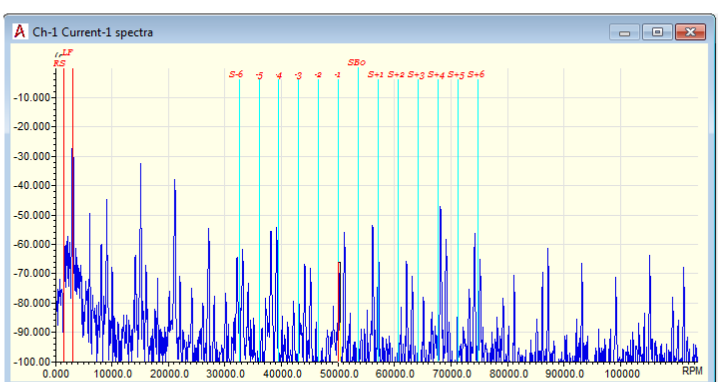
8. Holding down the Control key, click on the right mouse button above the peak.

9. Move the mouse pointer to the right of the cursor and double-click the left mouse button.

10. A dark blue box will appear at the top of the cursor. Type SB1 in this box and press the enter key.



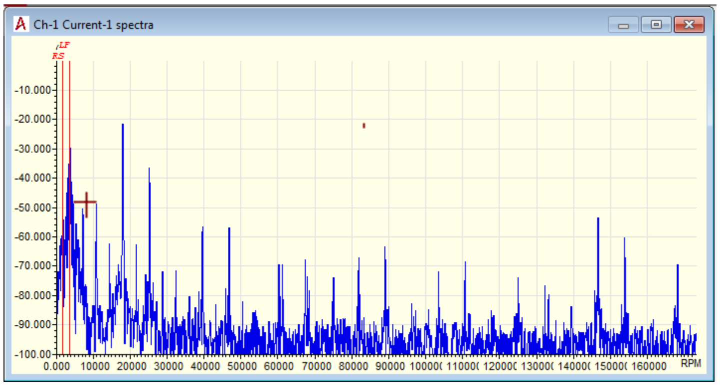
11. The resultant cursors will show as SB0, then S+1, S-1, etc.



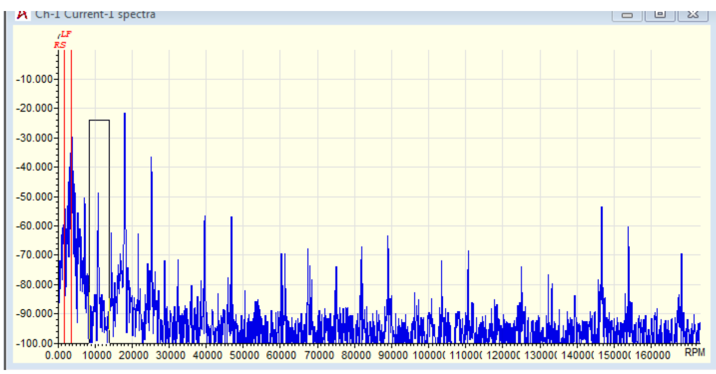
Harmonic Cursors

Some electrical and mechanical faults appear as exact integer multiples of another frequency. Using ‘harmonic cursors’ provides the analyst the ability to determine if the spectral peaks are exact integer multiples (harmonics) of a lower frequency (fundamental). Following are the steps for generating harmonic cursors:

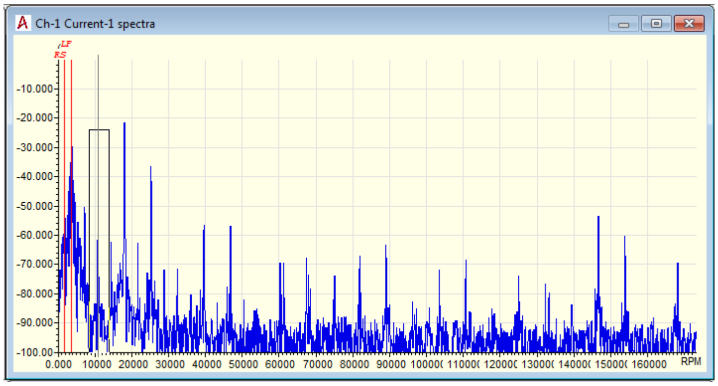
1. Place the mouse pointer to the left of the peak you want to be the fundamental frequency.



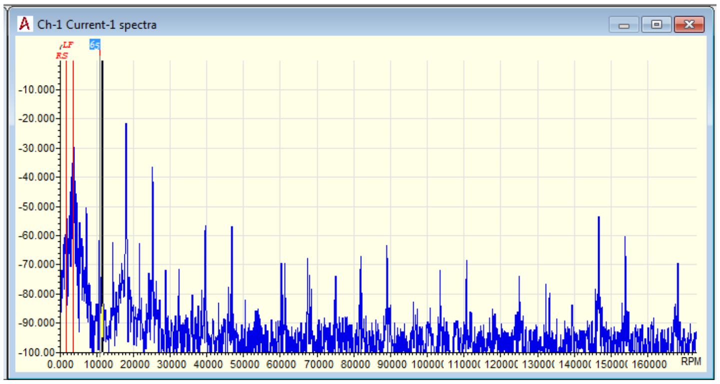
2. Use the mouse, with the left button pressed, to drag and draw a box around the peak to be indicated.



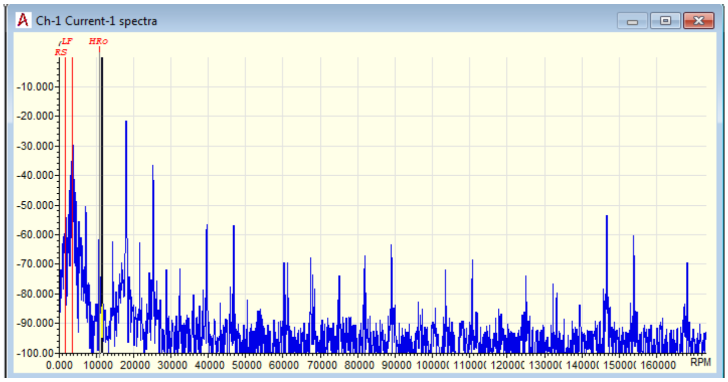
3. Holding down the ‘Control’ key, click on the right mouse button. A cursor will appear on the chosen peak.



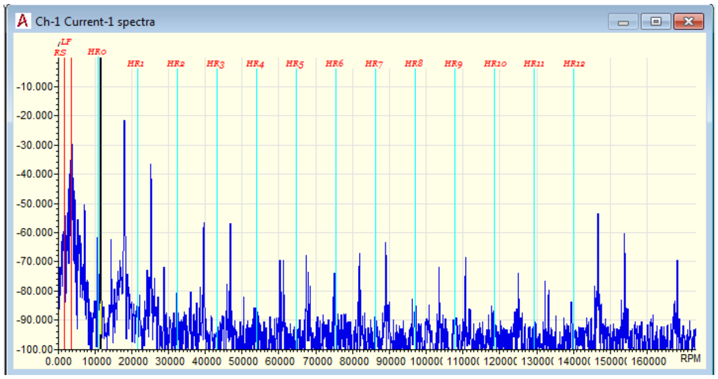
4. Move the mouse pointer to the right of the cursor and double-click the left mouse button.



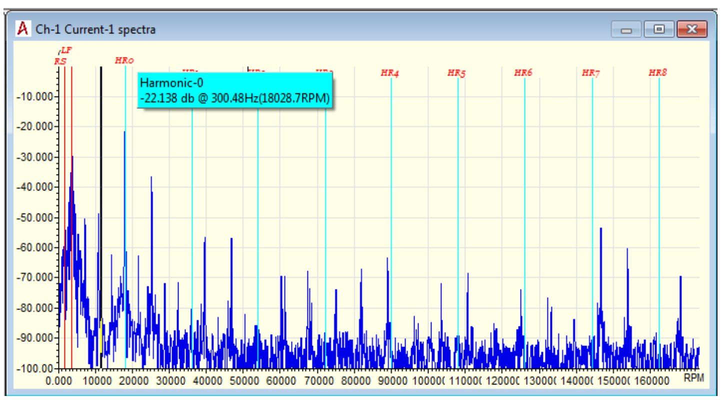
5. A dark box will appear at the top of the cursor. Type HR0 and press the ‘Enter’ key.



6. The resultant cursors will be labeled HR0 through HR12.

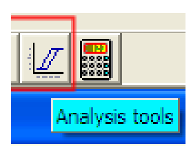


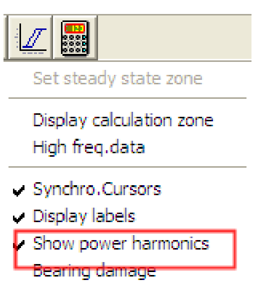
7. To reposition the harmonic markers, position the cursor over any of the harmonic markers and press the left button and hold. Moving the mouse to the left will move all of the harmonic markers to a lower frequency. This allows the analyst to quickly determine if any of the spectral peaks are integer multiples of any other frequency.



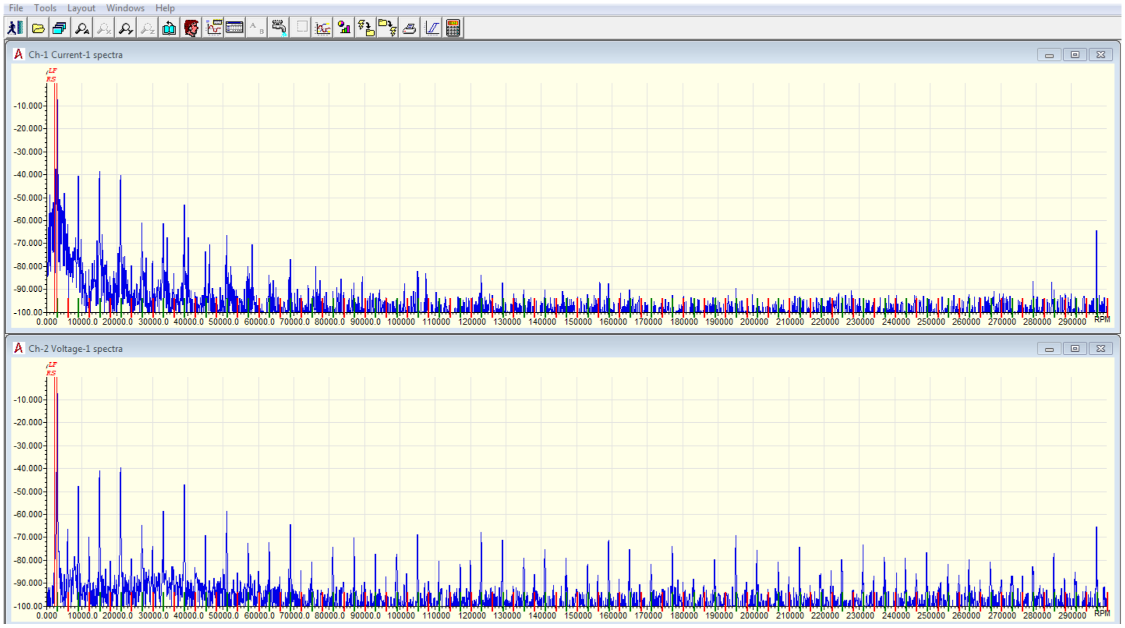
Power Harmonic Cursors

A new set of cursors has been created to aid the user in identifying peaks that result from the line frequency and its harmonics. To activate the ‘power harmonics’ cursor click on the ‘analysis tools’ button.



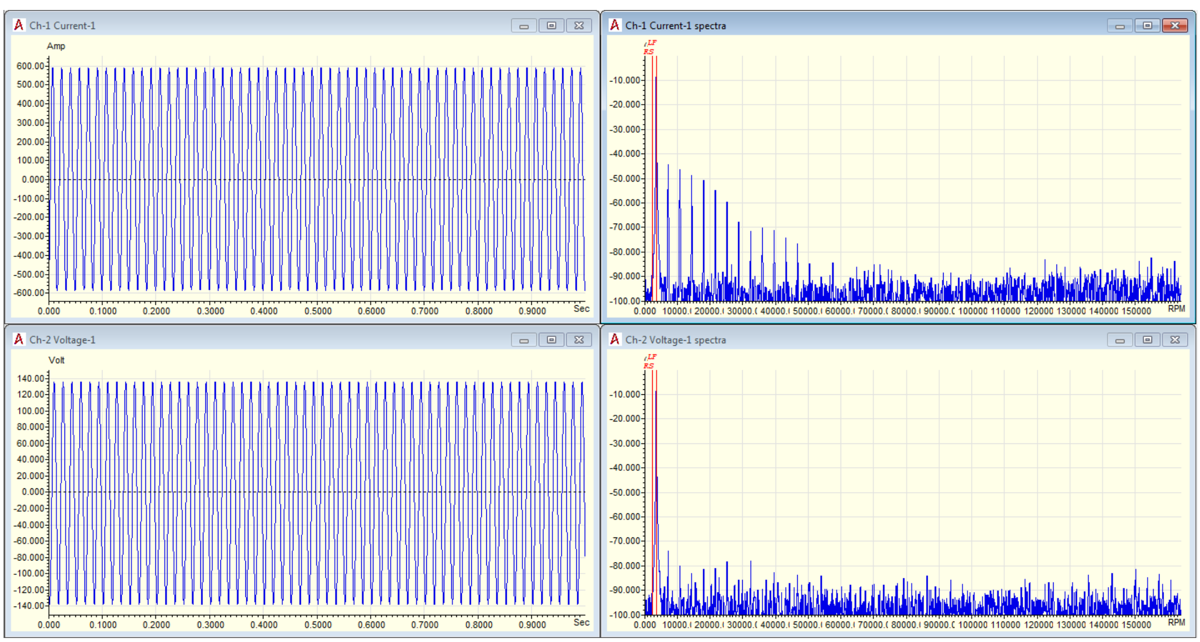


The ‘Show power harmonics’ option is the sixth item down the list. When checked, a set of green and red tick marks appear on the spectra baseline showing where the multiples of line frequency are. These tick marks cover the entire spectrum baseline.



Overlaying Voltage and Current

To determine if the problem within a motor system is load or supply related, it is necessary to compare the voltage to the current spectrum taken at the same time. To assist the analysis ATPOL II provides the ability to overlay one spectrum to another one.



To overlay voltage and current data for a direct comparison:

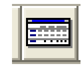
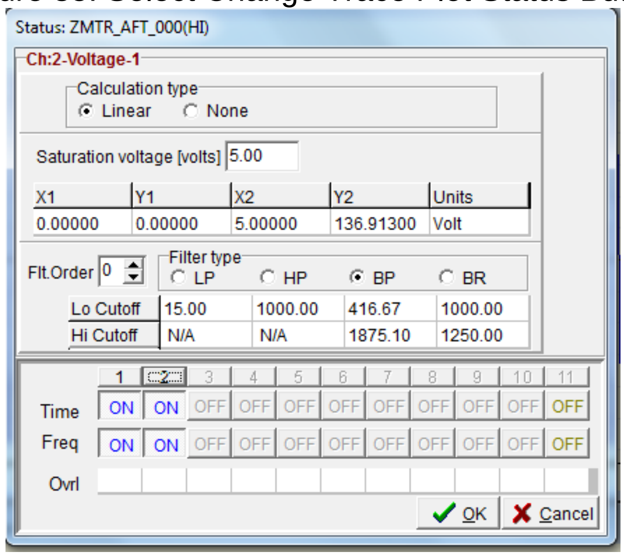
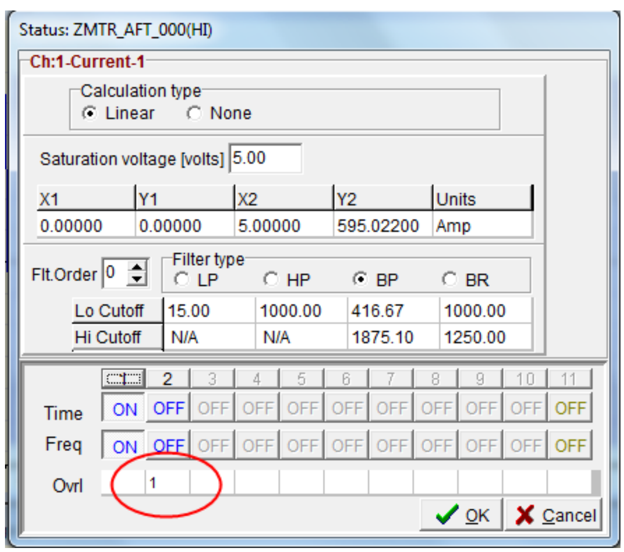
1. From the main menu select ‘change trace plot status’ button. 

Figure 35: Select Change Trace Plot Status Button



Click on the ‘1’ button and drag it down to the box under ‘2’ and next to ‘Ovrl’ (See Figure 35).

Figure 36: Overlay Step 2



Press the ‘OK’ button. You will see a screen similar to Figure 37, which is the overlay from Figure 35.

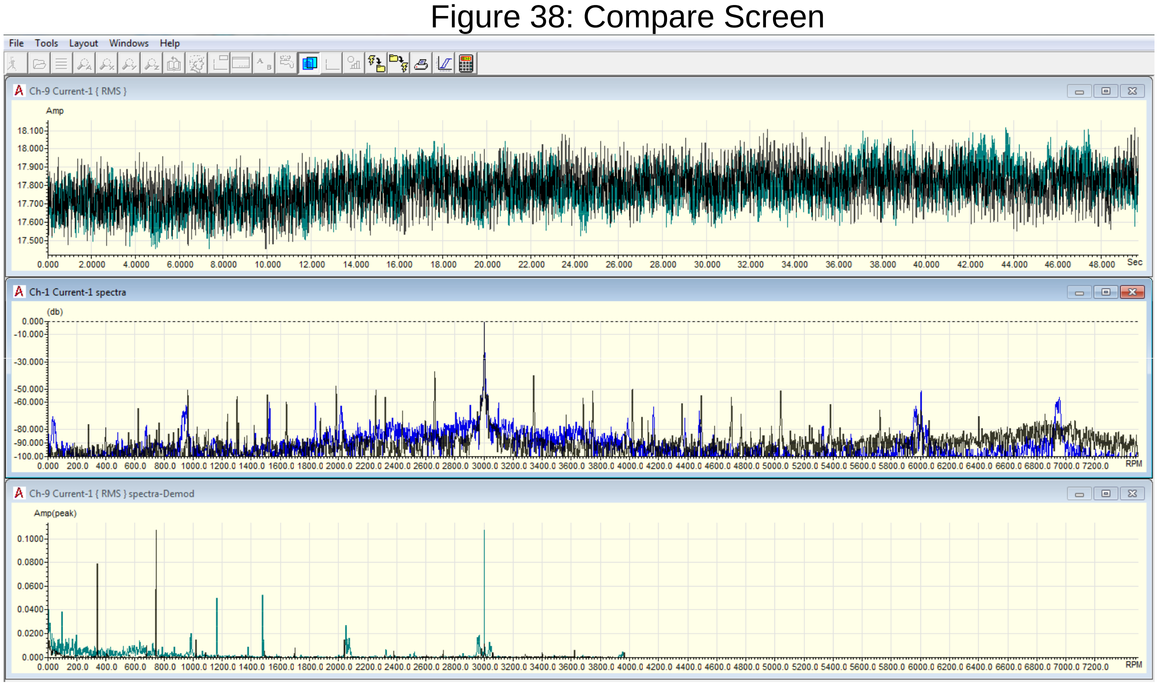
Figure 37: Result of Overlay

All of the functions, including cursors and automated cursors, work in this environment. The same function can also be used in low frequency data.

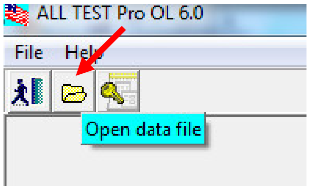
Compare Function

The compare function allows comparison of up to five sets of test data.
To identify condition changes, any two sets of data can be compared using the overlay feature. This allows the analyst the ability to trend conditions or view minute changes as they occur.

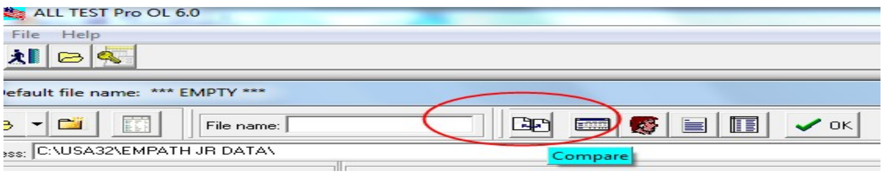
Figure 38: Compare Screen



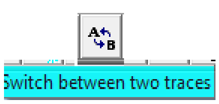
1. On the main screen, click on the ‘Open data file’ button from the menu bar.



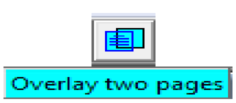
2. From the data file screen click on the ‘Compare’ button to enable the compare feature. This allows the analyst to select up to 5 sets of test data to compare. The compare function only allows for comparison of like data. It is possible to compare up to 5 sets of low frequency data or 5 sets of high frequency data. Data can be compared from different folders.
3.



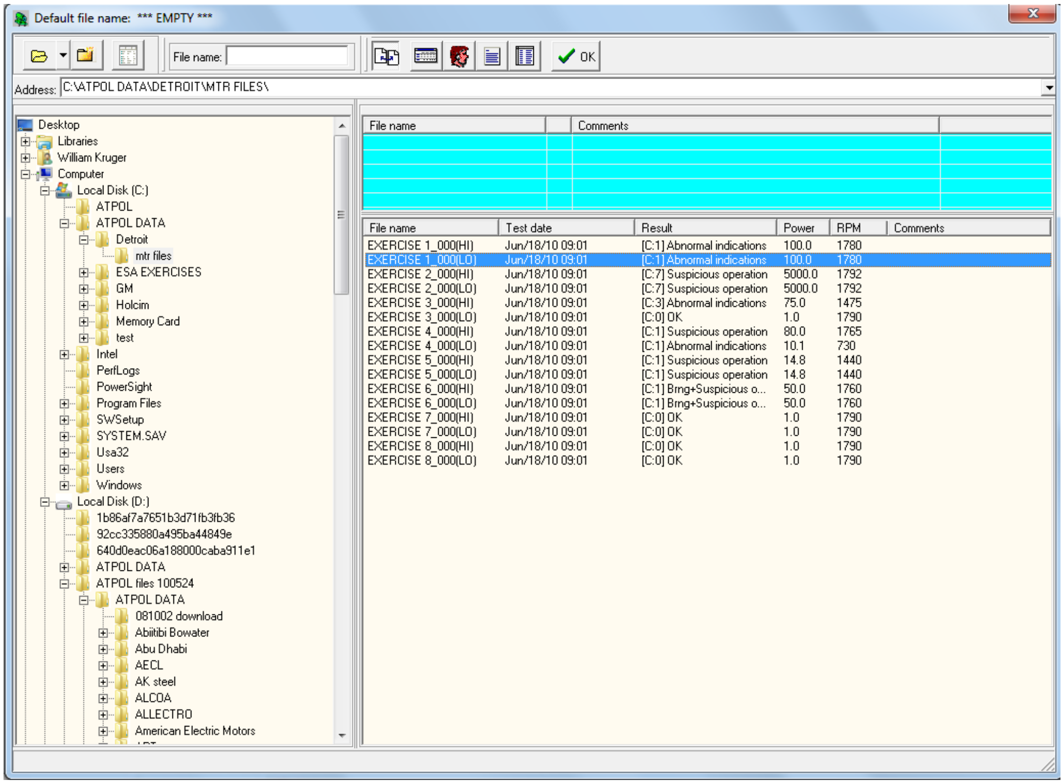
With the compare function selected from the data file screen. Select the first data set to be compared by highlighting the desired data set. Double left click on the highlighted data or press the ‘OK’ button. This will open the data analysis screen. When the compare function is enabled, 2 additional menu buttons will be available on the menu bar.



Switch Trace: Scroll through all data traces that are selected in the comparison screen.



Overlay: Toggles between displaying all selected traces and individual traces. When ‘overlay’ is enabled all of the selected traces will be shown simultaneously. When ‘overlay’ is disabled the individual traces will be displayed and the scaling can be adjusted for more accurate viewing.

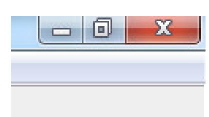


When the first data set is open in the data analysis screen, select up to 4 more data sets for comparison by returning to the data file directory. To select the data highlight the desired data set and either double left click on the highlighted data or press the 'OK' button. As each data set is selected the screen will switch to the data analysis screen. Data sets that are selected for comparisons are grayed out.

4. The individual data sets can be sequentially viewed by pressing the 'switch traces' button. Continue pressing the 'Switch Trace' button to scan through all of the displays. To view all of the data together press the 'Overlay' key.

Press the 'overlay' key to return to the individual data sets. To remove the individual data sets, move the cursor to the 'closed' icon in the upper right hand corner of the display screen.

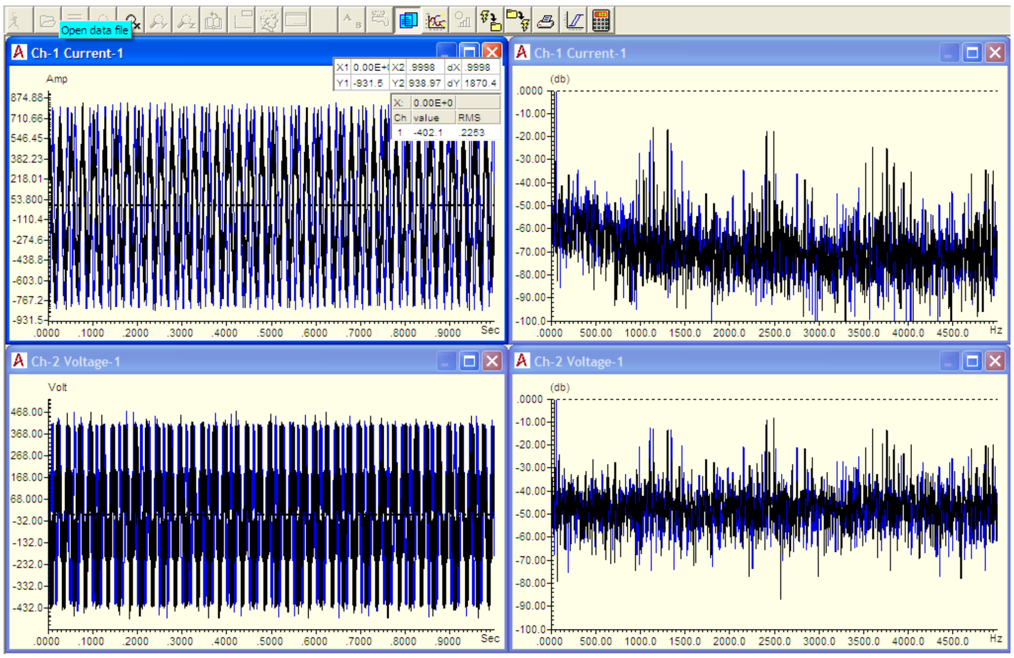
When the last data set has been closed, the screen will return to the open.



Comparative Spectrum

General Reports

There are two methods for including spectral data into reports.



1. **Print:** Using the print function from the ATPOL II menu bar. The report will include all graphs as they are displayed on the screen. It will also include date and time stamp.

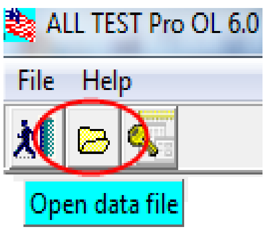
2. **Copy:** Using the copy function, places the data to the clipboard, this also automatically places the data into a MS Word® document. This display only includes the time waveforms and frequency spectrum. Both vertical and horizontal axes are labeled.

To use the print function, close any of the displays that are not going to be included in the report. Place cursors on the spectral peaks of interest and activate any other information to be included in the report. Press the ‘Print’ button from the menu and the display report will print. Included will be the frequency and value for any cursors included.

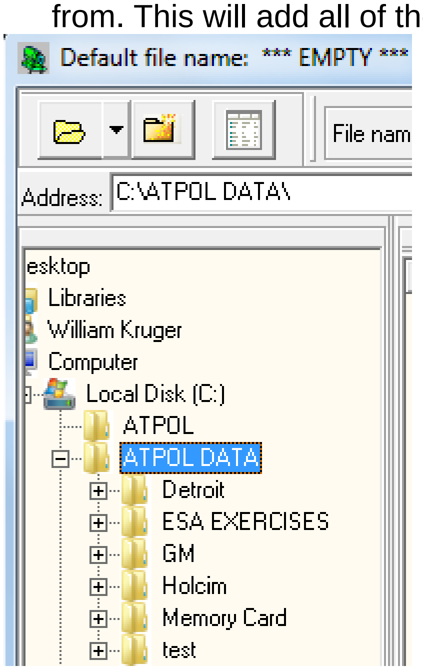
To use the copy function, i.e. data into an MS Word® document, set the ATPOL II data as above, press the ‘control’ and ‘insert’ buttons on the computer keyboard, at the same time. Open the Word® document that the information is going to be inserted. If the information has not been copied to the document, then press ‘control’ and ‘v’ at the same time, it pastes the data into the proper document.

Database Functions

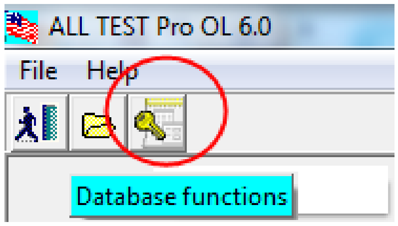
1. See the Technical Bulletin:.APPENDIX 5: TECHINICAL BULLETIN – Search Based on Machine Conditions for how to set up and search for machine condition using Microsoft Access®.
2. The ESA 6 database function allows the user to compare selected data among motors for trending and analysis. The database function tool will extract data from the selected file, placing it in a separate database for further analysis. Data from various files can be combined for statistical analysis. One or a series of filters can be applied to the database to compare selective data between motors, tests or folders to provide a quick analysis of the selected data.
3. To select a file or verify the folder or folders that the data will be selected from, to build or add to your database, open the data file screen.



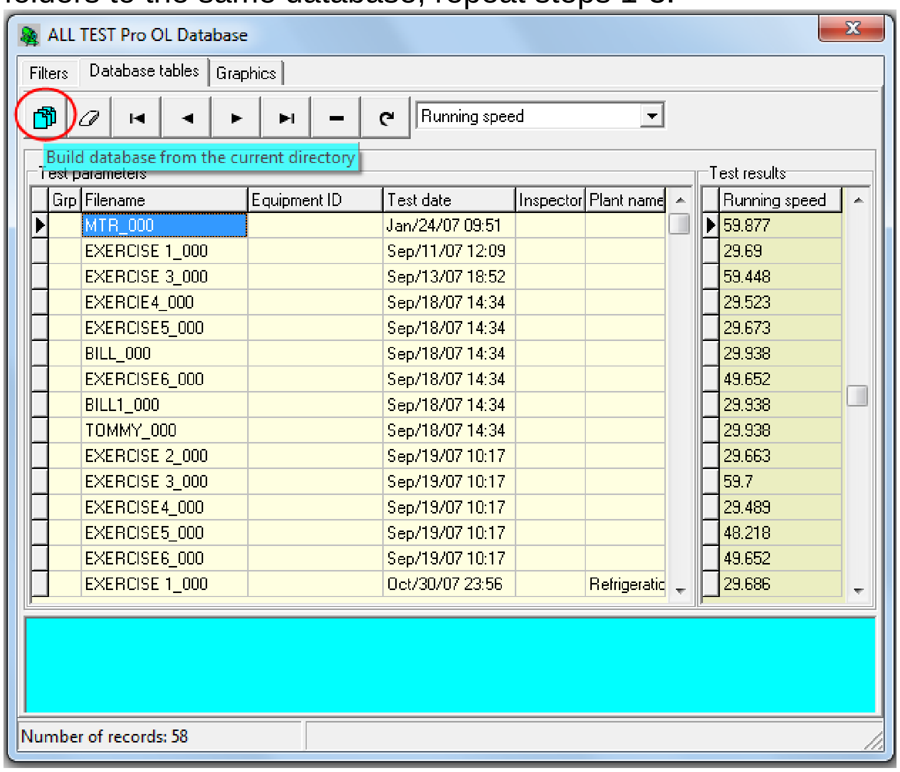
4. From the data file screen highlight the file or folder that the data will be extracted from. This will add all of the desired data to the database.



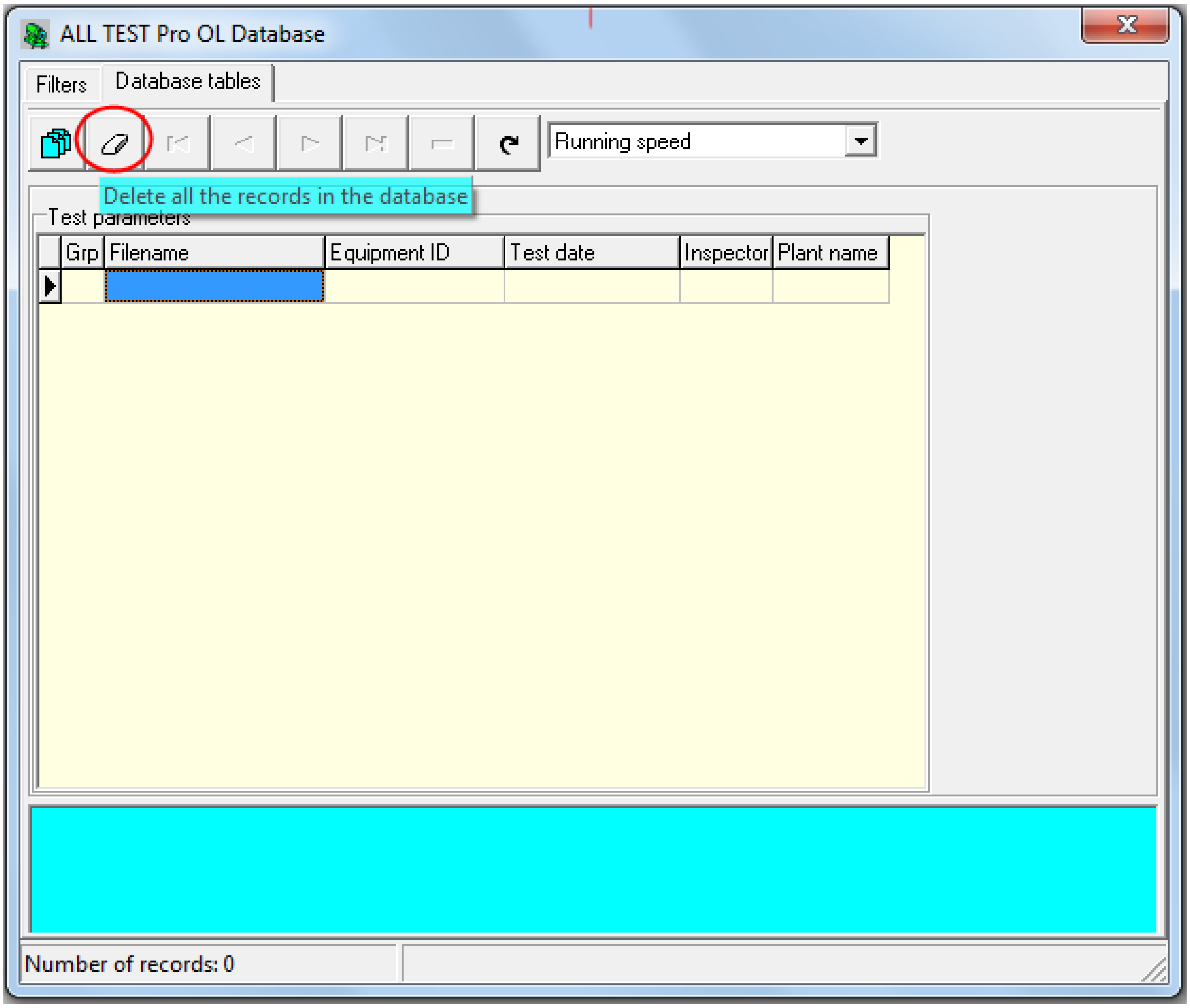
5. When the correct folder or folders are selected enable the database function by selecting the database icon from the main menu.



6. To add the data from the selected folders to the current database select the build database icon from the database menu. This will add desired data from all selected folders or sub-folders highlighted in the file directory. To add data from other folders to the same database, repeat steps 1-3.



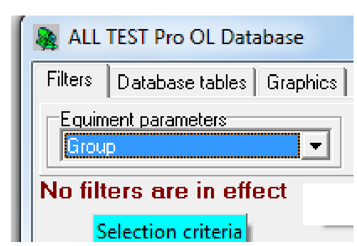
7. To clear all data from the current database press the ‘delete records’ icon. This will remove all of the records currently residing in the database.

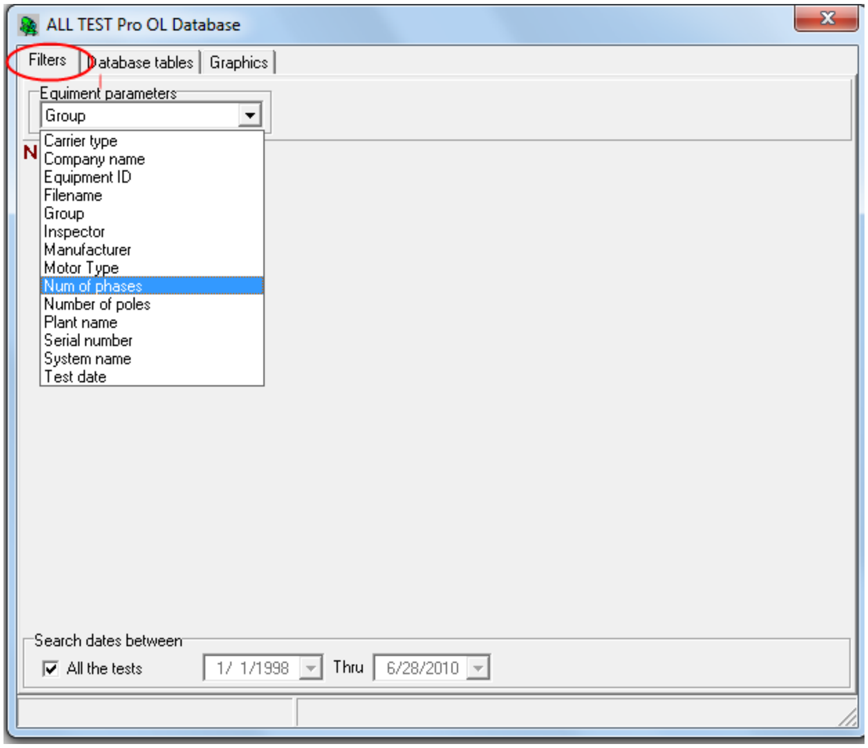


8. To remove a single record from the database, select the record to be deleted and press the 'delete records' button.

9. To refresh the data in the database, press the 'refresh data' icon.

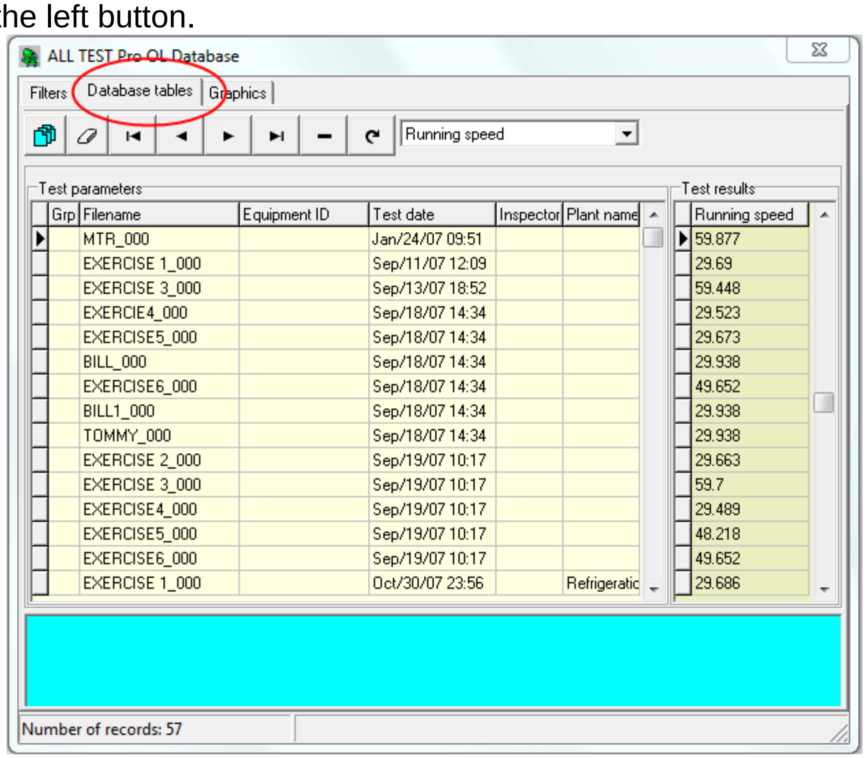
10. To provide further refinement of the search, select one or more of the several filters by selecting multiple filters from the drop down menu.



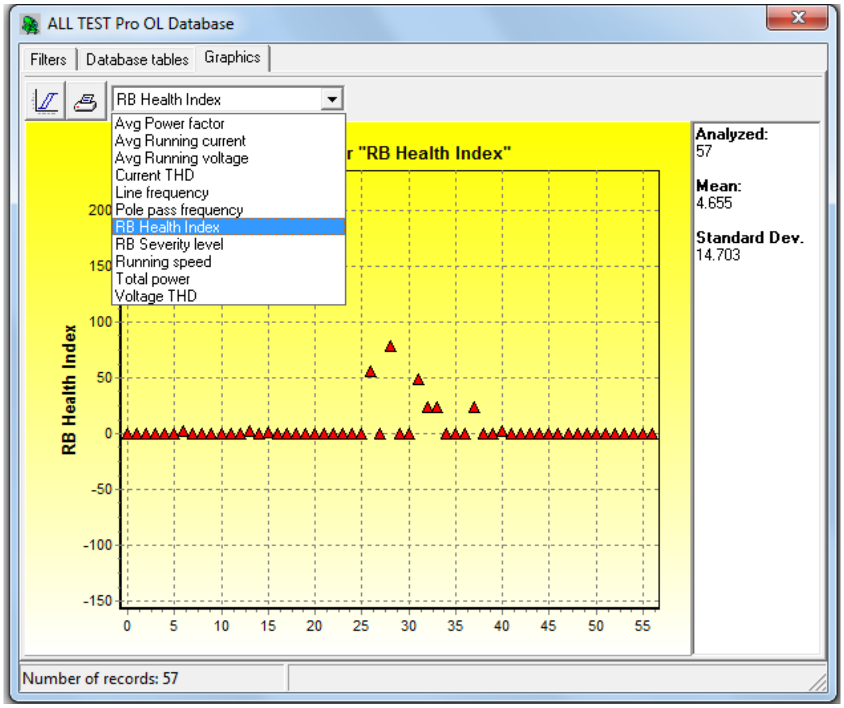


11. Selecting the ‘Filter’s tab will generate a drop down menu that provides a selection of available options to further refine the search from the populated database. Multiple filter selections can be made to provide the analyst with the ability to compare similar operating characteristics with other motors added to the database.

12. To display the list of motors selected in the database, press the ‘database tables’ using the left button.



13. To graphically compare any of the desired measurements, select the measurement from the drop down menu and press the ‘Graphics’ button using the left mouse button.



In the graphics screen, you can select the type of data that you wish to trend. This graph can be copied to another document or printed directly.

Comma Separated Values Function (CSV)

To create files that can transfer ATPOL II files to other programs using the CSV file creation tool:

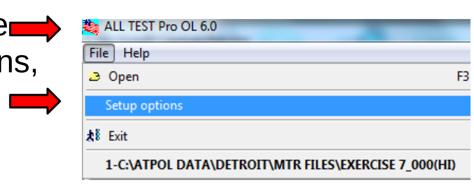
1. Retrieve the data to be transferred, either the ‘Lo’ or ‘Hi’ data set.
2. Make one of the time based data sets active.
3. Click on ‘Layout’ and ‘Create ASCII’ file. The data will be written to a comma separated file that can be retrieved by other programs. The CSV file will be stored in the folder where the data set resides and it will be labeled as ‘Lo’ or ‘Hi’ depending on the data set generated.

Peak List Function

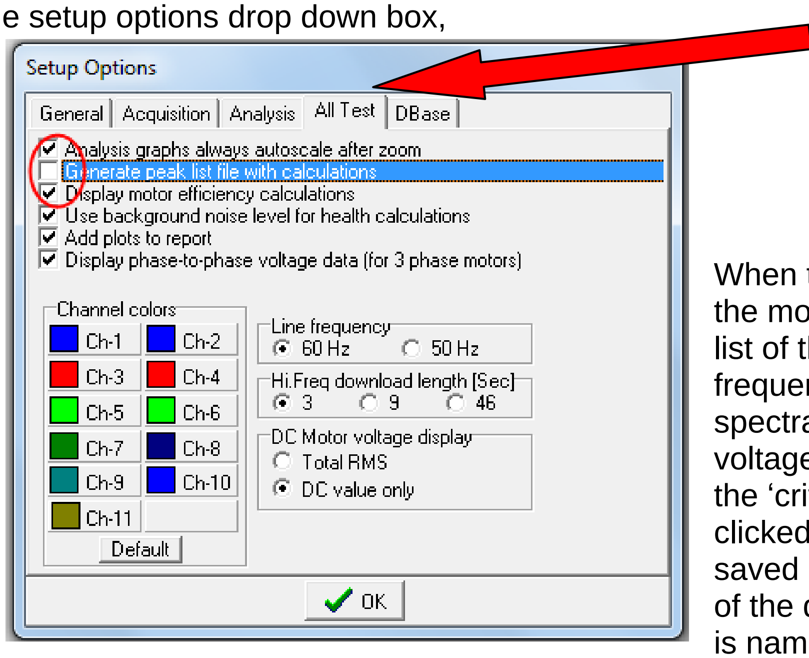
The ‘Peak List’ function displays the peaks in the spectra in a text or tabular form.

To create a peak list:

1. Click on File
2. Setup options,



From the setup options drop down box,



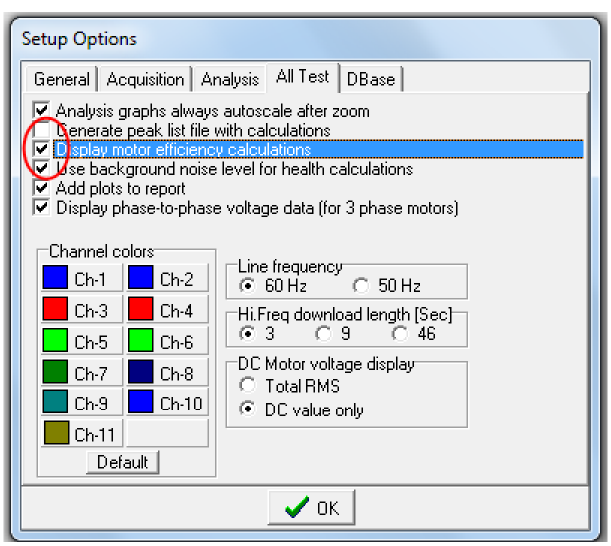
3. Click on All Test tab.
4. Check “Generate peak list with calculations”.

When this box is checked and the motor is analyzed, a peak list of the low and high frequency logarithmic spectra, for both current and voltage, will be created when the ‘critical eye’ button is clicked. The ‘peak list’ is saved in the folder that has all of the data for that motor and is named ABC. Peak list ABC is the name of the motor you are analyzing. This file can be opened, with Microsoft Word® or Notepad®.

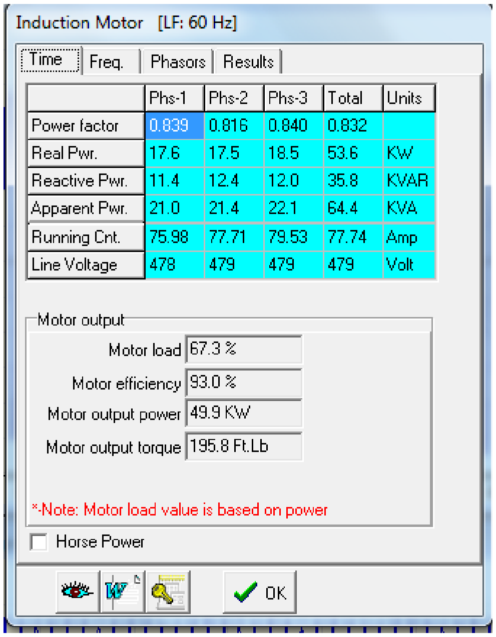
Motor Efficiency Calculation

The Software calculates motor efficiency using the best possible calculation methodology from the data available. If voltage and current data are available, the best calculation will be made based on power consumed and motor speed. If only current data is available, then the efficiency calculation will be based on current and motor speed. In either case the software states which method is used.

To calculate motor efficiency, select ‘Setup Options’ from the file menu (see steps 1 and 2 above). ‘All Test’ tab, and click on the box called ‘Display Motor Efficiency Calculations’.



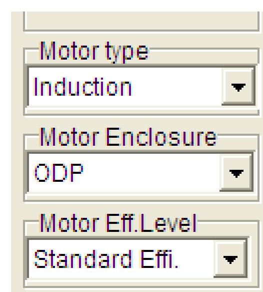
The motor efficiency calculations are displayed on the 'Time' tab of the calculation screen.



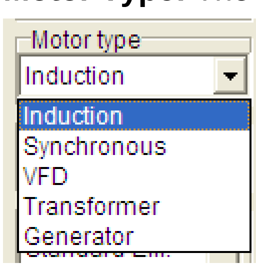
The efficiency calculation is based on the data acquired and on the data entered into the header. The motor efficiency data, as well as, most other data are only as accurate as the header input data. ***(The header data can be changed at any time and does not need to be entered prior to data acquisition.)***

If motor efficiency and power factor data are available, enter them into the header data. When entering these in the header, insert them in the format 0.90 for 90% efficiency or 0.85 for power factor. When one or more of these is not available, place a minus one (-1) in the header entry to indicate that the data is not available and Software will use default data to make the calculations. The default for power factor and efficiency is -1.

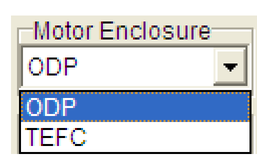
'Motor Type', the 'Motor Enclosure' and the 'Motor Efficiency Level' also effect the efficiency calculations. The defaults for these are "Induction", "*ODP*" (open drip proof) and "Energy Effi".



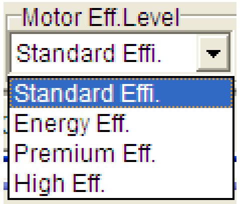
Motor Type: The motor efficiency calculation is performed only if induction motor is selected since the motor efficiency data being referenced (NEMA Standard MG-1) is only valid for induction motors.



Motor Enclosure: Select from two choices. These are: "ODP" (open drip proof) and TEFC (totally enclosed fan cooled).



Motor Efficiency Level: There are four choices: “Standard Efficiency”, “Energy Efficiency”, “Premium Efficiency” and “High Efficiency”.



If the motor is “Premium” or “Energy Efficient”, then this will be indicated on the nameplate. If there is no efficiency indicated on the nameplate, choose “Standard Efficiency” if the motor is over ten years old and choose High Efficiency if the motor is less than ten years old.

Obviously, this ten year choice is arbitrary and if you have better information about the motor design efficiency please use it.

(For a good description of motor efficiency and these terms, please go to the Motor Master + 4.0 manual which are included in the files loaded onto your computer when you install Motor Master + 4.0)

Rotor Bar Analysis

There are seven rotor bar severity levels. These levels are consistent with other published rotor bar severity guides. However, the ATPOL II 6 software uses five separate measurements to determine rotor bar conditions.

SEVERITY LEVELS	CONDITION	RECOMMENDED ACTION
1	Excellent Rotor	No Action Required
2	Good Rotor	No Action Required
3	Indication of slight problems	Continue trending
4	Rotor Bar cracks or high resistance connections	Decrease trending intervals
5	One or two rotor bars are cracked or broken or a high resistance problem is developing	Decrease monitoring intervals, verify with MCA
6	Multiple Rotor Bars are cracked or broken likely	Immediate repair recommended
7	Multiple Rotor bar or end ring faults likely	Immediate repair recommended

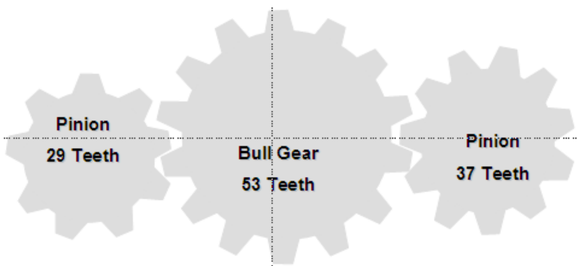
Mechanical Train Analysis

Mechanical train analysis permits the user to enter mechanical train data such as gear ratios or gear teeth; the software will calculate and display where these peaks should appear in the spectral data, based on motor running speed.

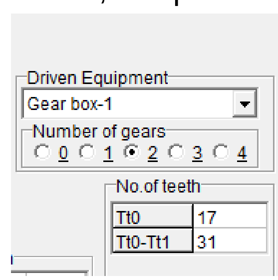
Gear Box Analysis

The gear box analysis feature has been in the software in previous versions. However, the manual did not cover these features. The gear box analysis permits the user to enter gearbox data, such as, gear ratios or gear teeth. The Software will calculate and display where these peaks should appear in the spectral data based on motor running speed. For example, suppose the motor being tested drives a bull gear that drives one or more pinion gears. Knowing the teeth in the bull and pinion gears permits the Software to calculate hunting tooth frequencies, as well as, pinion shaft speeds. Alternately, entering the gear ratios for a gear box permits the Software to calculate shaft speeds in the gear box.

<u>Gear Box 1 Diagram:</u>

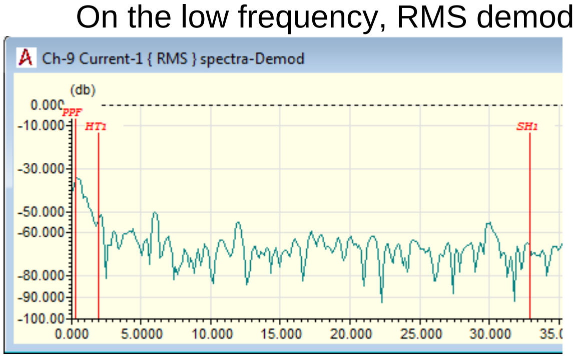


Two examples will be given for use with the sample data for the P1PUMP showing how to use these features. Please bring up the low data set for P1PUMP found in the sample data supplied with the software. The data is in the subfolder basement. This particular motor does not drive a gear box, but since the user has the data, it is possible to show where the peaks would have appeared, if a gear box had been driven by this motor.

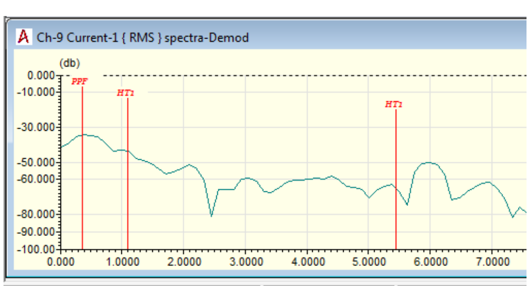


Example 1: Go to the header, click on ‘calc info’ tab. For ‘driven equipment’, go to top right and click on ‘Gear box 1’ and click on ‘2’ for number of gears. For gear teeth put “17” in the top box for Tt0 and put “31” in the second box for Tt0-Tt1. Click ‘OK’.

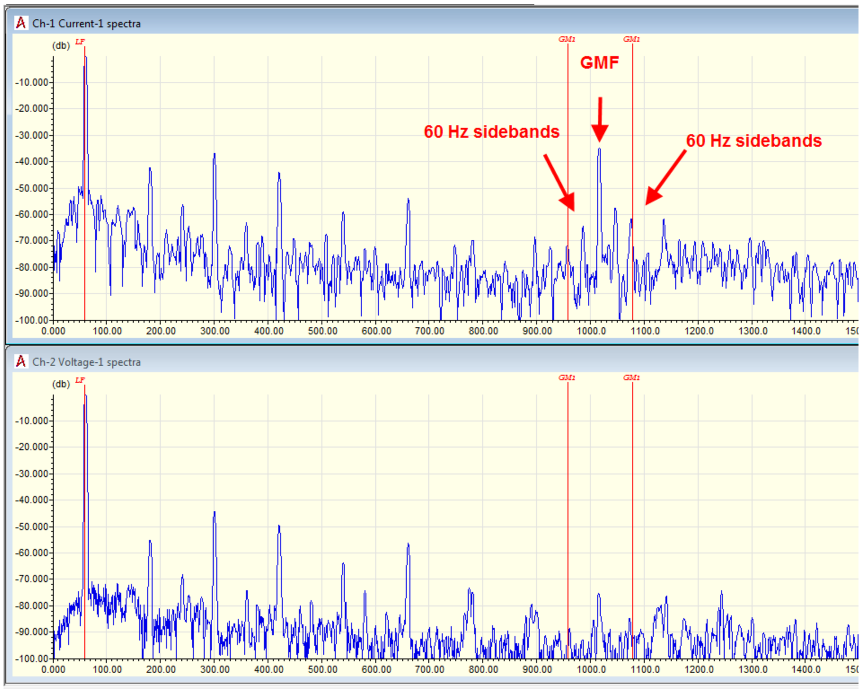
On the low frequency, RMS demod graph, (lower trace) note the new cursor labeled HT1 for hunting tooth frequency. Since “31” and “17” are prime numbers, the only common hunting tooth multiplier will be 1.931.



Example 2: when the gear teeth have a common multiplier, that is, the numbers of gear teeth that are not prime numbers; go back to the header and change Tt0 to “55” and Tt0-Tt1 to “25” and click ‘OK’.

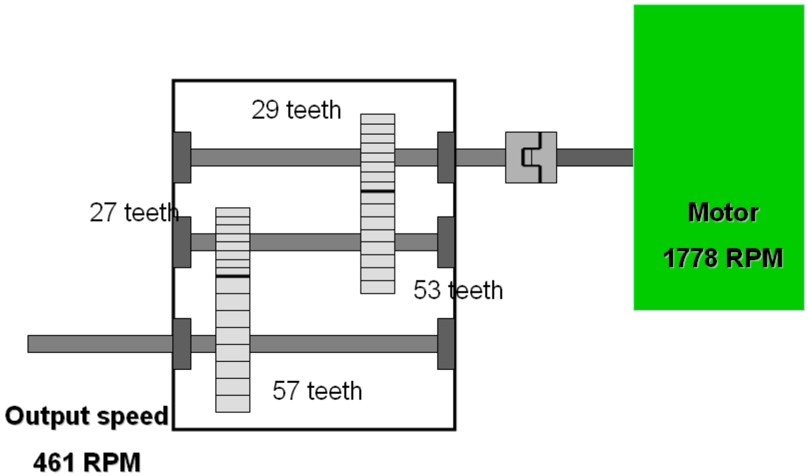


Now there are two hunting tooth cursors labeled HT1, one at 1.085 Hz and one at 5.443 Hz, which is the motor running speed (29.624) divided by the number of teeth (25) times the common multiplier of 5.

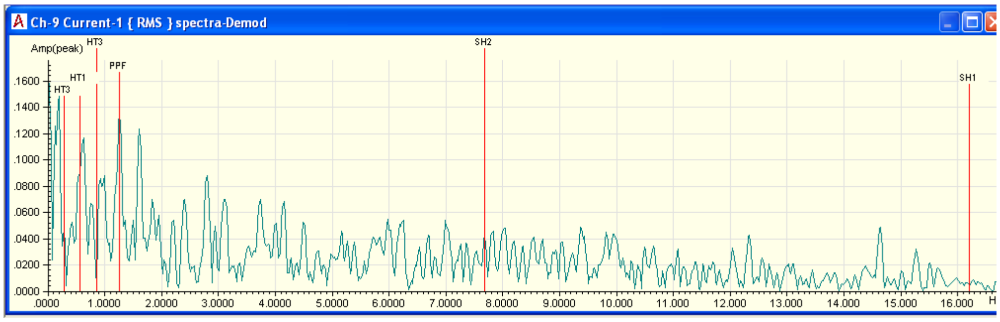


For further gear box analysis, click on the ‘Analysis Tools’ button and change to the high frequency data. Click on the ‘Load Zooms’ button and make the time trace full. Click on the ‘analysis tools’ button and click on ‘Gear Mesh Frequency’. You will see two cursors on the screen for GM1 and GM1, which are the first order gear mesh frequencies calculated by shaft speed, times gear teeth plus and minus line frequency; or 17 x 29.624 = 1017.85 +/- 60 Hz. Just to repeat, this P1PUMP motor is not driving a gear box and so one would not expect to see peaks, where the cursors are calculated in this example.

<u>Gear box 2</u>



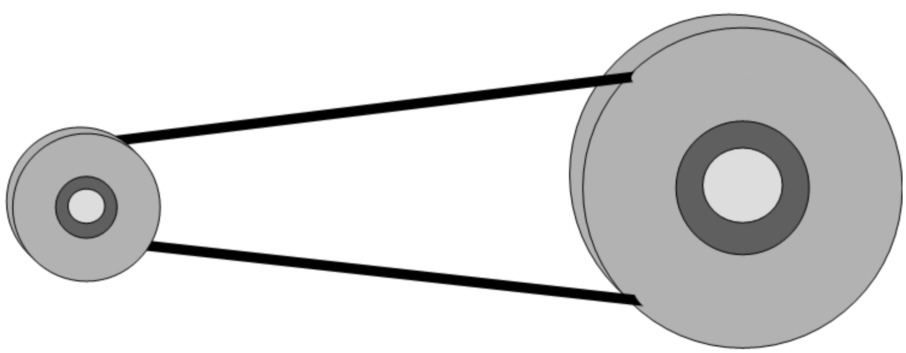
Above shows the configuration for Gear box 2. This represents the traditional speed reduction gear box, where a motor drives a shaft with one gear on it. The driven gear drives a second gear on a second shaft on which there is a third gear, driving a gear on a third shaft, etc. The Software allows for a maximum of 3 shafts and 4 gears for Automated Analysis.



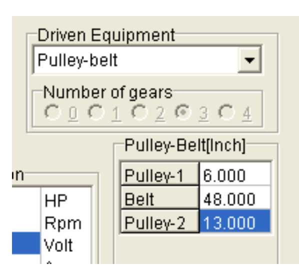
For this example using the P1PUMP data, let teeth 0 = 29, teeth 1 = 53, teeth 2 =27 and teeth 3 = 57, corresponding to gears 1 through 4, respectively. When this data is entered into the header file for the P1PUMP motor data, the resultant cursors on the low frequency, RMS demod spectrum will be S1 = 16.209 Hz, S2 = 7.675 Hz (461 RPM), H1 = 0.559 Hz, H3(1) = 0.284 Hz and H3(2) = 0.893 Hz. H3 (2) occurs since 27 and 57 are both divisible by 3 as well as 1.

In the high frequency data, the shaft speeds S1 and S2 show up as sidebands on the spectral data, then GM1 and GM2 cursors show up for the two gear meshing results +/- 60 Hz.

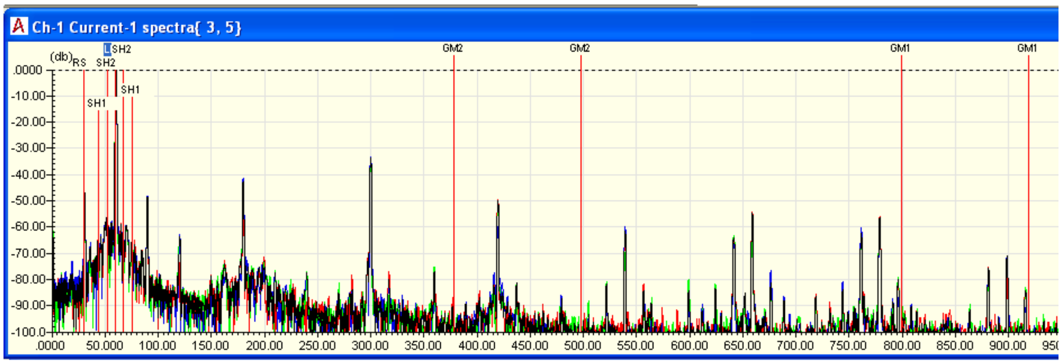
<u>Pulley-belt</u>



For the pulley-belt configuration, see Figure 3. For illustration, use this data in the header for the P1PUMP motor. Let pulley 1 = 6” (Sheave on Motor Shaft), let pulley 2 = 13” (The Driven Sheave) and let the belt length be 48” (Circumference).

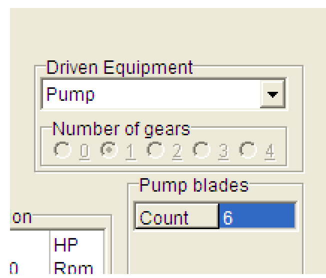


Click ‘OK’ on the header screen, a BLT and PLY cursor will each show up on the low frequency RMS demod spectrum. BLT represents the belt passing peak and is calculated as BLT = 29.624 x π x 6 / 48 = 11.63 Hz. The second pulley shaft speed called PLY equals 29.624 x 6 / 13 = PLY = 13.67 Hz. In the high frequency data, dual cursors for both BLT and PLY are shown since they modulate the 60 Hz line frequency peak.



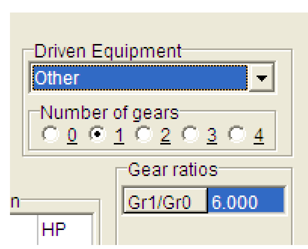
Pump

To configure pumps, enter the number of vanes on the pump (the vanes passing will be shown on the appropriate spectrum). For illustration, enter 6 as the number of vanes. This results in two cursors of the high frequency data. If only 2 vanes are entered, then the BLD cursor will also show up in the low frequency RMS demod spectrum. This will work for fan blades also.



Other

There is a second way to use the gear box calculations. For this example, we will also use the P1PUMP data. Retrieve the low P1PUMP data. Click on the header box. On the ‘Calc Info’ tab, change the driven equipment to “Other”. The drop down box that appears below the “Other” box is the “Gear Ratios” box. Putting ratios instead of teeth in the header will produce shaft speeds for shafts indicated by ratios. For example, if we put in 3 gears with ratios of 5.6, 22 and 12, then the shaft speeds will be GR1 = 5.29 Hz, GR2 = 1.35 Hz and GR3 = 2.47 Hz.



Digital Filtering

Signal filtering allows the analyst to filter out some of the signals which may not be important to the specific analysis being conducted. To use the digital filters that are available with the ESA software, do the following:

1. Go to File / Setup options / Analysis / Filter Status and turn the filters on.
2. On the data where you wish to use the filters, click on the 'Change Trace Plot Status' button. Choose the data channel you want and then click on 'Parameters'.
3. Choose the filter type (see below), the filter order (Flt order) from 1 (lowest) to 7 (highest) and the frequency settings.
4. Click 'OK' and you will see the resultant filtering.

The four filter choices are Low Pass (LP), High Pass (HP), Band Pass (BP), and Band Reject (BR). By definition, choosing LP will pass the low frequency portion and filter out the high frequency portion. For example, suppose you are looking at the high frequency data of current 1, channel 1, from 0 to 5000 Hz and you set the filter to LP, order =7 and cutoff frequency to 3000 Hz. Then the resultant spectrum will be cutoff completely from close to 3000 Hz upwards. The opposite would be true if you had chosen the High Pass filter. In that case all frequencies below 3000 would be reduced.

The Band Pass filter permits you to choose a range of frequencies to pass so that if you chose BP and set the two frequencies to 2000 and 3000 Hz, then very little signal below 2000 or above 3000 would be available. For Band Reject, the opposite would be true. If 2000 and 3000 Hz had been chosen, then frequencies below 2000 and above 3000 would be visible, and almost no signal would show up for the 2000 – 3000 Hz range.

Each channel must be set individually so that if you set channel 1 filters and channels 3 and 5 are superimposed on channel 1, then only channel 1 will be filtered unless you set the channel 3 and 5 filters.

APPENDIX 1: INDUCTION MOTOR - Automatic Analysis Reports

ALL TEST Pro OL 6 Analysis Results

Performance Summary

Bottom Line

__________This induction motor is operating normally, no action is required.
__X_______This induction motor exhibits suspicious operation, trending of the induction motor is warranted.
__________This induction motor exhibits abnormal indications, action is warranted, NOW.

Power Factor Commentary

__________Power factor exceeds 0.85.
__X_______Power factor is below 0.85, see detailed report.

Current Commentary

__X_______Current variation is within normal limits.
__________Current variation is beyond normal limits, see detailed report.

Voltage Commentary

__X_______Voltage variation is within normal limits.
__________Voltage variation is beyond normal limits, see detailed report.
__________RMS voltage differs from nameplate by more than 5%.

Load Commentary

__X_______Load on the induction motor is consistent with nameplate values.
__________Load on the induction motor exceeds nameplate values, see detailed report.
__________Load on the induction motor is less than 25%.

Phase Connection Commentary

__X_______Connections are normal.
__________Voltage ground reference is NOT neutral.
__________Loose connection.

Rotor Commentary

__________Rotor bar health is normal.
__X_______Rotor bar health is questionable, see detailed report.
__________Load is insufficient to determine rotor bar health, at this time.

Stator Commentary

__X_______Stator health is normal.
__________Stator electrical health is questionable.
__________Stator mechanical health is questionable. .
__________Turn to turn short.

Rotor/Stator Air-gap Characteristics

__X_______Dynamic or static eccentricity indications do not exist.
__________ Indications of static eccentricity exists.
__________ Indications of dynamic eccentricity exist.

Harmonic Distortion Commentary

__X_______There is no evidence of harmonic distortion.
__________There is evidence of harmonic distortion, see detailed report.

Misalignment Indications

__X_______There are no indications of mechanical problems like misalignment or unbalance.

_________There are indications of mechanical problems like misalignment / unbalance. Perform vibration survey to identify and correct the cause.

Bearing Commentary

__X______There is no evidence of bearing problem.
_________Indications of potential bearing problems, perform vibration survey to verify.

INPUT SUMMARY

NAMEPLATE INFORMATION

		Units
Manufacturer	****	
Serial Number	****	
Model Number	****	
Tested Equipment	Induction	
Power	5000.00	HP
RPM	1792	Rpm
Poles	4	
Phases:	3	
Voltage	6900.0	Volt
Full Load Current	357.00	Amp
Number of rotor bars	28	
Number of stator slots	60	
Torque	14648.4	Ft.Lb
CT Ratio	1.000	
PT Ratio	58.000	
Duty Cycle	****	
Service Factor	115	
Frame Size	****	
Insulation Type	****	
Ambient Temperature	70.0	F°
Motor efficiency	-1.000	
Power factor	-1.000	

Description:

Detailed Calculations

LEGENDS:

Impedance	= Complex Impedance = vi/ci
CF	= Crest Factor = (waveform peak)/(waveform rms)
CFC	= Carrier Frequency Content = 10^(x/20)/frms, %
THDF	= Transformer Harmonic De-rating Factor = sqrt(2)/CF, %
VDF	= Voltage De-rating Factor = 100 - (voltage unbalance, %)^2, %
Se, fund	= Location of pole pass frequency fundamental, Hz
Se, harm	= Number of pole pass frequency harmonics
Level	= Sum of spectral amplitudes of pole pass frequency fundamentals and harmonics
Slip %	= SRSS sum of slip and harmonic "levels" divided by RMS level of RMS DEMOD spectra between 0 and 65 Hz.
Upper sb	= dB level of upper slip sideband of power line peak
Lower sb	= dB level of lower slip sideband of power line peak
Rotor bar health	= Estimate of the percent of broken or cracked rotor bars
Thd	= Total harmonic distortion

+Ve = Positive sequence harmonic
-Ve = Negative sequence harmonic
Zero = Zero sequence harmonic
RB Hlt Index = Rotor bar health index

Running Speed = 29.934 Hz [1796 RPM]
Pole pass frequency = 0.259 Hz [16 RPM]
Load = 62.5 %

Time			
	RMS	**Peak**	**CF**
Current 1	23600	325.110	1.378
Current 2	240.200	338.210	1.408
Current 3	246.700	348.450	1.412
Average	240.970	337.260	1.399
% dev	2.4	3.6	1.6

THDF = 100.0

Time			
	RMS	**Peak**	**CF**
Voltage 1	7000.600	9035.000	1.291
Voltage 2	7035.400	10023.000	1.425
Voltage 3	7052.800	1008600	1.430
Average	7029.600	9714.700	1.382
% dev	0.4	7.0	6.6

VDF = 99.8

			App. Power	**Real Power**	**Reac. Power**
	Power factor	**Impedance**	**kVA**	**kW**	**kVARS**
Phase 1	0.789	29.664	885.610	698.320	544.670
Phase 2	0.882	29.290	971.030	856.660	457.210
Phase 3	0.794	28.589	1084.600	861.300	659.170
Avg/Total	0.822	29.181	2941.200	2416.300	1661.000
% dev	7.4	2.0			

Demand Pwr = 3238.98 HP [Load:62.5 %, Motor Eff.:96.4 %, Output Pow.:2329.3 KW, Output Trq.:9127.0 Ft.Lb]

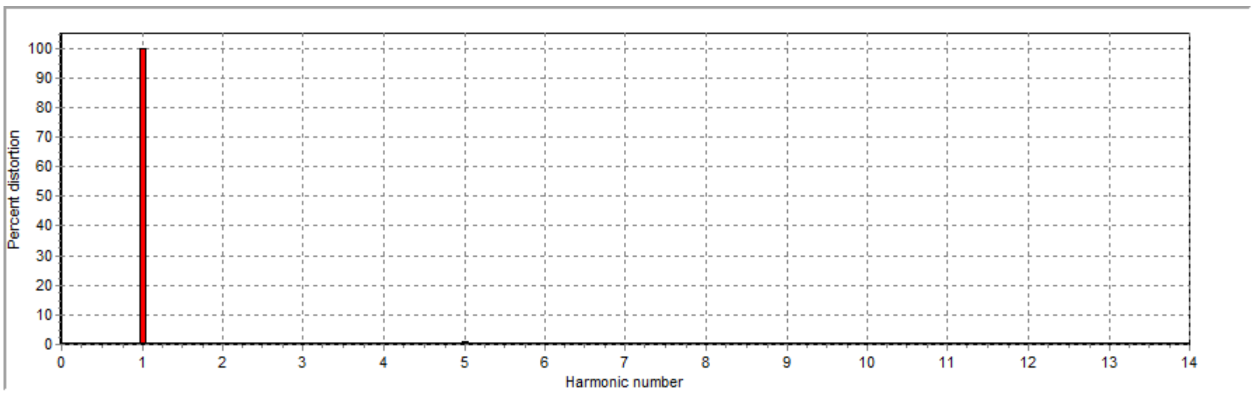
Summary of Rotor Bar Health				**Power line dB diff.**		**RB Hlt Index**
	Se, fund	**Se, harm**	**Level %**	**Upper SB**	**Lower SB**	
Measured	0.259	2	1.7	-35.8	-35.2	2.3916

Severity level	**Rotor Condition Assessment**	**Recommended Corrective Action**
7	Multiple broken rotor bars and end rings very likely. Severe problems throughout	Overhaul or replace ASAP

Harmonic Distortion Results:
Voltage input, from 59.998 Hz harmonics

	THD Odd %	**THD Even %**	**+ve%**	**-ve %**	**Zero %**	**THD All %**
Current 1	1.055	0.060	0.453	0.904	0.307	1.057
Current 2	***	***	***	***	***	0.000
Current 3	***	***	***	***	***	1.000
Voltage 1	0.949	0.037	0.363	0.869	0.125	0.950
Voltage 2	***	***	***	***	***	0.000
Voltage 3	***	***	***	***	***	0.000

Harmonic distortion table						
Hz	**Cur1**	**Vlt1**	**Cur2**	**Vlt2**	**Cur3**	**Vlt3**
60	228.2	6343	***	***	***	***
120	0.1	0	***	***	***	***
180	0.7	7	***	***	***	***
240	0.0	0	***	***	***	***
300	2.1	52	***	***	***	***
360	0.0	0	***	***	***	***
420	1.0	21	***	***	***	***
480	0.0	0	***	***	***	***
540	0.1	2	***	***	***	***
600	0.0	2	***	***	***	***
660	0.2	12	***	***	***	***
720	0.0	2	***	***	***	***



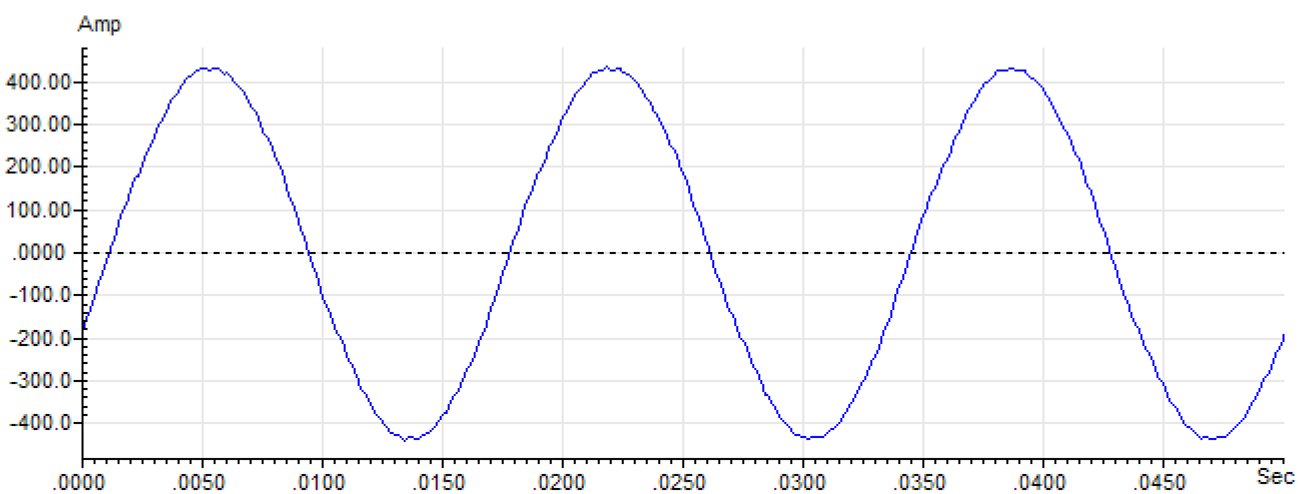


Figure-3 Ch-1 Current-1

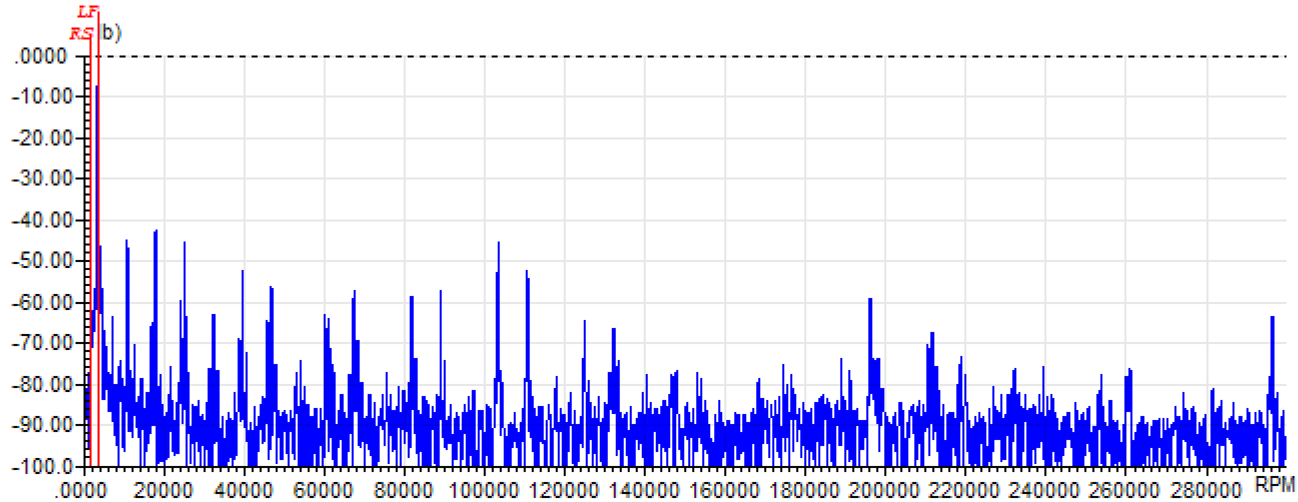


Figure-4 Ch-1 Current-1

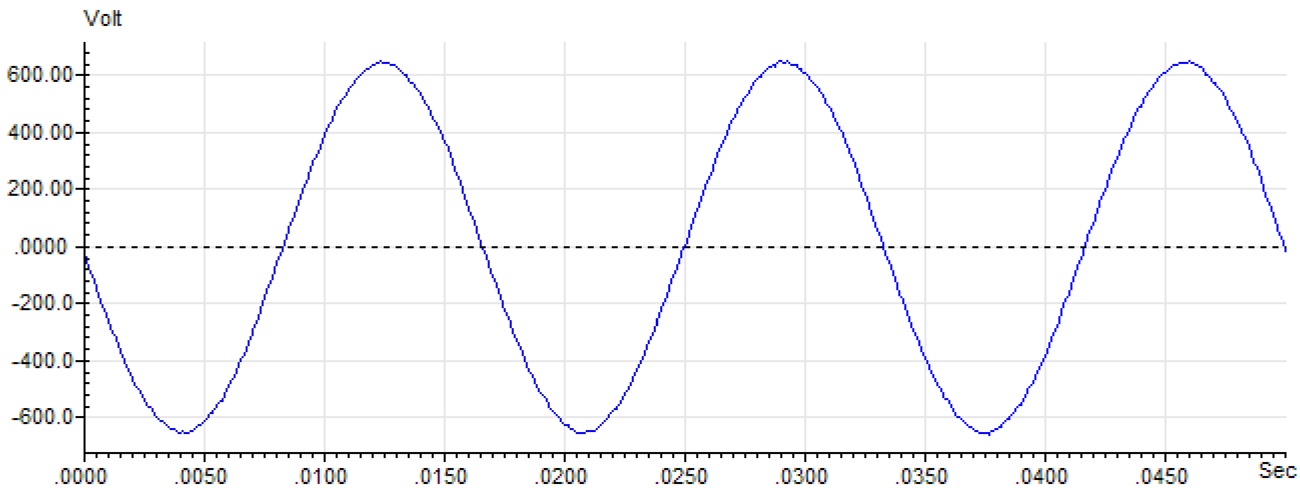


Figure-5 Ch-2 Voltage-1

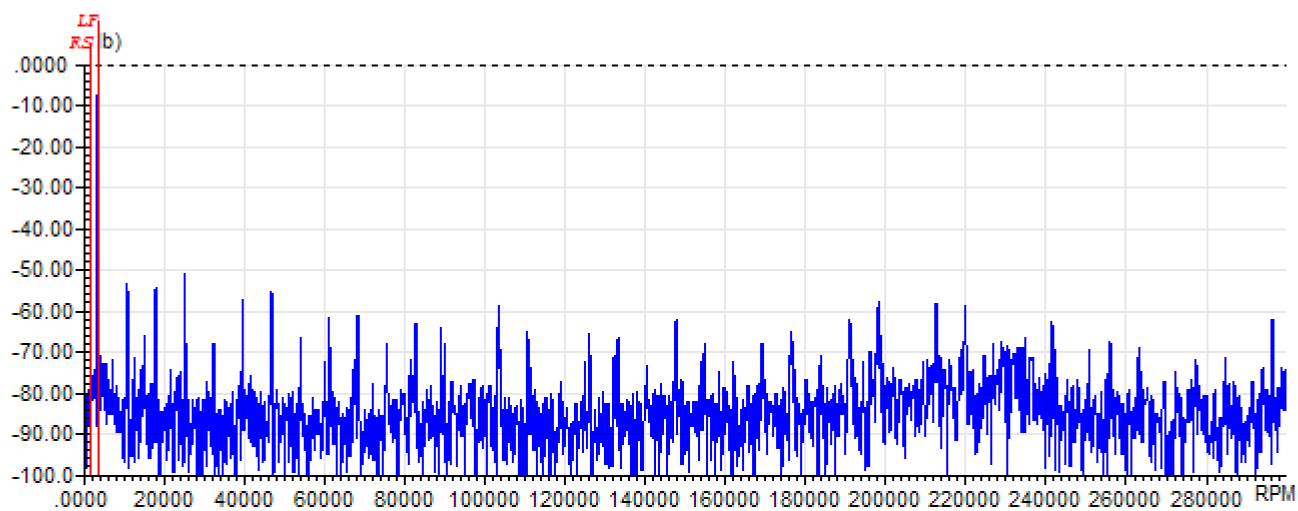


Figure-6 Ch-2 Voltage-1

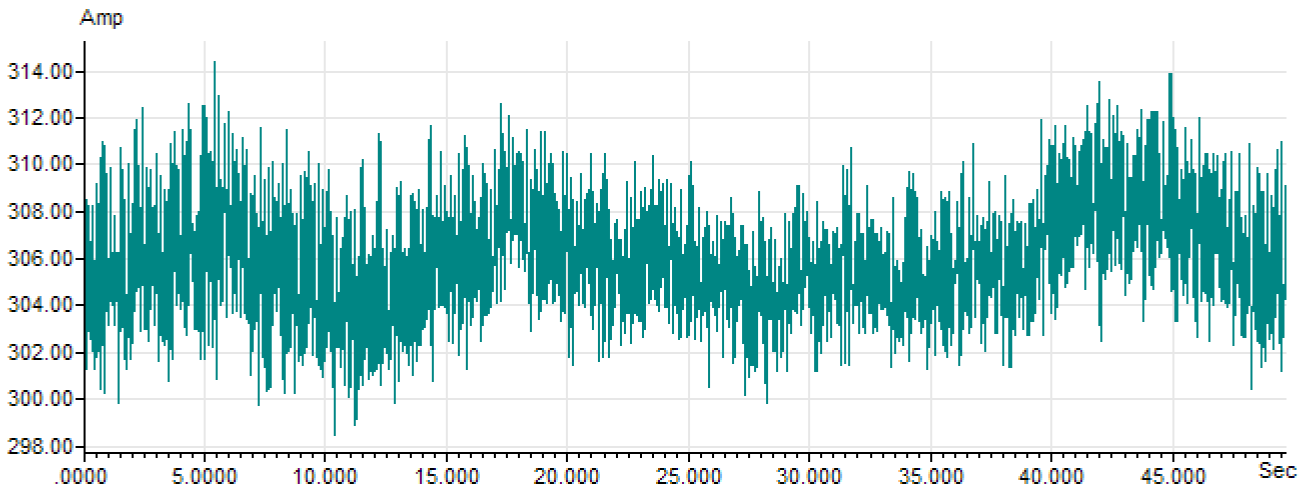


Figure-7 Ch-9 Current-1 {RMS}

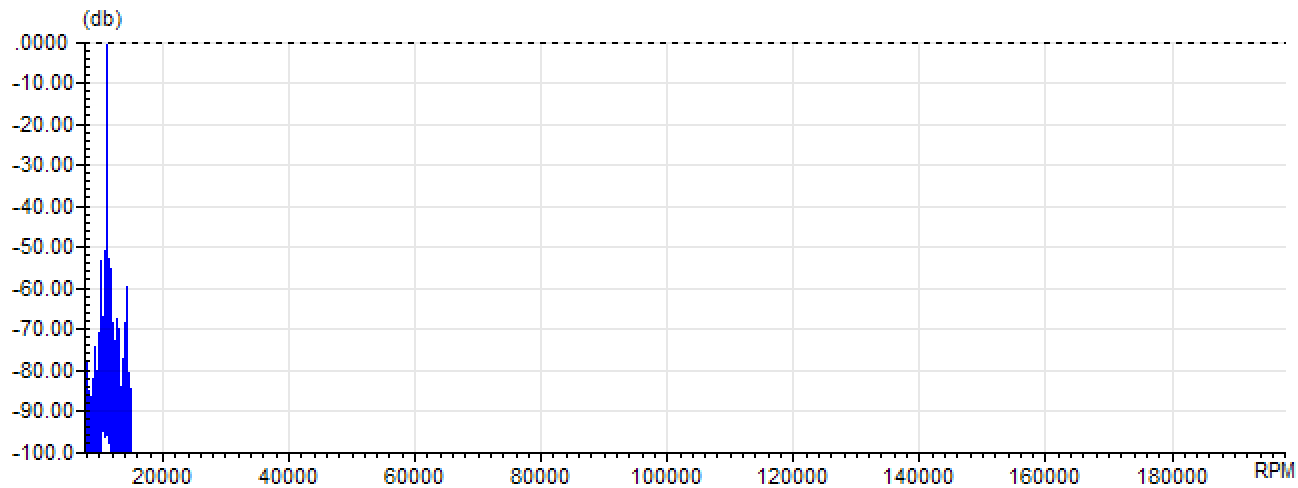


Figure-8 Ch-9 Current-1 {RMS}

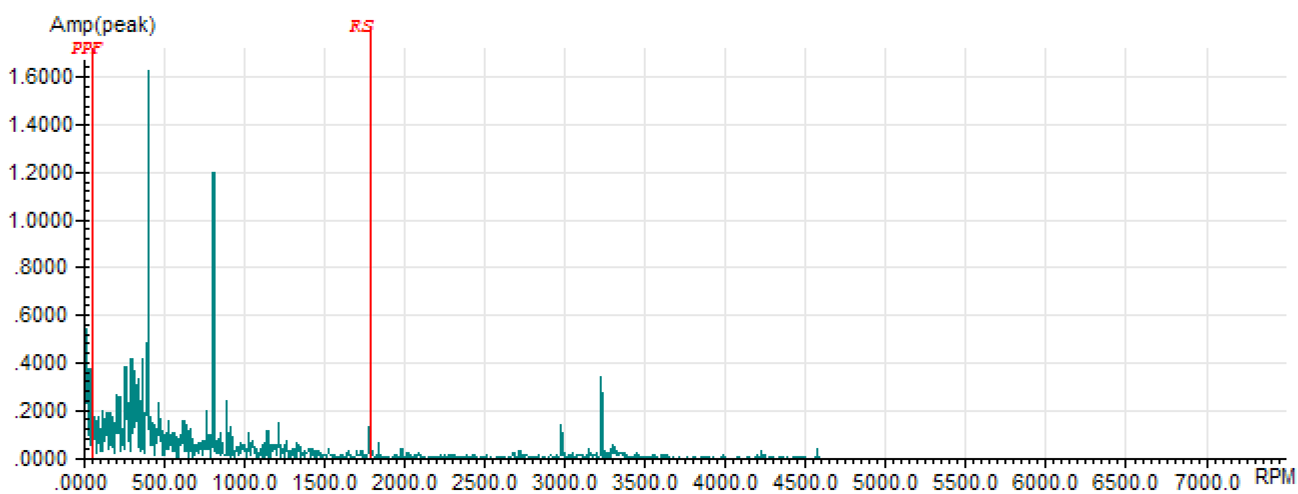


Figure-9 Ch-9 Current-1 {RMS} spectra-Demod

APPENDIX 2: SYNCHRONOUS MOTOR - Automatic Analysis Reports

ALL TEST Pro OL6 Analysis Results
Performance Summary

Bottom Line
________This synchronous motor is operating normally, no action is required.
________This synchronous motor exhibits suspicious operation, trending of the synchronous motor is warranted.
__X_____This synchronous motor exhibits abnormal indications, action is warranted, NOW.

Power Factor Commentary
________Power factor exceeds 0.85.
__X_____Power factor is below 0.85, see detailed report.

Current Commentary
________Current variation is within normal limits.
__X_____Current variation is beyond normal limits, see detailed report.

Voltage Commentary
________Voltage variation is within normal limits.
________Voltage variation is beyond normal limits, see detailed report.
__X_____RMS voltage differs from nameplate by more than 5%.

Load Commentary
________Load on the synchronous motor is consistent with nameplate values.
________Load on the synchronous motor exceeds nameplate values, see detailed report.
__X_____Load on the synchronous motor is less than 25%.

Phase Connection Commentary
__X_____Connections are normal.
________Voltage ground reference is NOT neutral.
________Loose connection.

Harmonic Distortion Commentary
__X_____There is no evidence of harmonic distortion.
________There is evidence of harmonic distortion, see detailed report.

Bearing Commentary
__X_____There is no evidence of bearing problem.
________Indications of potential bearing problems perform vibration survey to verify.

APPENDIX 3: TRANSFORMERS - Automatic Analysis Reports

ALL TEST Pro OL 6 Analysis Results
Performance Summary

Bottom Line

________This transformer is operating normally, no action is required.
________This transformer exhibits suspicious operation, trending of the transformer is warranted.
__X_____This transformer exhibits abnormal indications, action is warranted, NOW.

Power Factor Commentary

________Power factor exceeds 0.85.
__X_____Power factor is below 0.85, see detailed report.

Current Commentary

________Current variation is within normal limits.
__X_____Current variation is beyond normal limits, see detailed report.

Voltage Commentary

________Voltage variation is within normal limits.
________Voltage variation is beyond normal limits, see detailed report.
__X_____RMS voltage differs from nameplate by more than 5%.

Load Commentary

________Load on the transformer is consistent with nameplate values.
________Load on the transformer exceeds nameplate values, see detailed report.
__X_____Load on the transformer is less than 25%.

Phase Connection Commentary

__X_____Connections are normal.
________Voltage ground reference is NOT neutral.
________Loose connection.

Harmonic Distortion Commentary

__X_____There is no evidence of harmonic distortion.
________There is evidence of harmonic distortion, see detailed report.

APPENDIX 4: GENERATORS - Automatic Analysis Reports

ALL TEST Pro OL 6 Analysis Results
Performance Summary

Bottom Line

________This generator is operating normally, no action is required.
________This generator exhibits suspicious operation, trending of the generator is warranted.
__X_____This generator exhibits abnormal indications, action is warranted, NOW.

Power Factor Commentary

________Power factor exceeds 0.85.
__X_____Power factor is below 0.85, see detailed report.

Current Commentary

________Current variation is within normal limits.
__X_____Current variation is beyond normal limits, see detailed report.

Voltage Commentary

________Voltage variation is within normal limits.
________Voltage variation is beyond normal limits, see detailed report.
__X_____RMS voltage differs from nameplate by more than 5%.

Load Commentary

________Load on the generator is consistent with nameplate values.
________Load on the generator exceeds nameplate values, see detailed report.
__X_____Load on the generator is less than 25%.

Phase Connection Commentary

__X_____Connections are normal.
________Voltage ground reference is NOT neutral.
________Loose connection.

Harmonic Distortion Commentary

__X_____There is no evidence of harmonic distortion.
________There is evidence of harmonic distortion, see detailed report.

Bearing Commentary

__X_____There is no evidence of bearing problem.
________Indications of potential bearing problems perform vibration survey to verify.

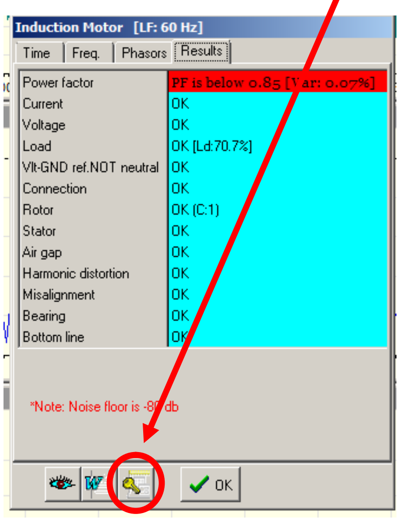
APPENDIX 5: TECHINICAL BULLETIN- Search Based on Machine Condition.

Technical Bulletin 05172010- Release to Distributors & End-Users
ATPOL II ESA Software:
Search Based on Machine Condition

Question: I have multiple machines in multiple buildings and want to be able to search for all machines that exhibit a particular alarm. How do I do this?

Answer: Machine test files (data sets) are stored in Windows file folders and sub-folders. Machine test results and findings can be also stored in a Microsoft Access database. The advantage to storing results and findings in an Access database is the ability to search all machines in that database for any software reported condition, test data (V, I, PF, etc), and user entered information. Such as, search for all machines reporting an eccentricity alarm or search for all motors of a particular Horse Power.

The software comes with an Access database called **EmpDB.MDB** and this is normally located in the C:\Usa32 file folder. Any test can be copied to this file by clicking on the database icon from the ESA Results tab.



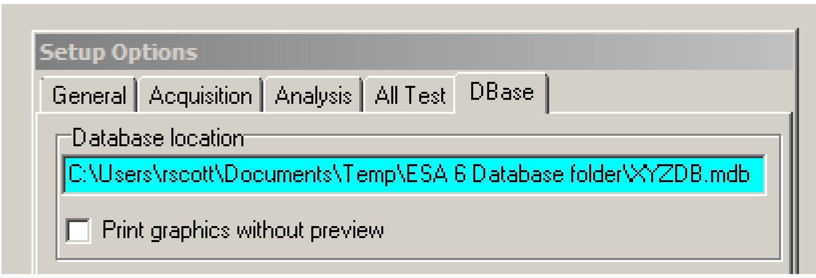
The user can create multiple databases, such as a service company that wants to maintain test results for multiple service customers. However, each database must be set up correctly in order to function with the ESA software.

The easiest way to do this is to duplicate the **EmpDB.MDB** file and then give it a new name. This new database file can also reside outside of the Usa32 file folder.

IMPORTANT: Before making any changes to the original database, make sure to back it up first!

It is very easy to make unintended changes to the database and cause the software to no longer work correctly. Only people with Access training should be working directly with the database using Access.

After the new database has been created then go to the ESA Setup Options menu and make sure to provide the ESA software with the location of the new database.



To view the database, you will need Microsoft Access software which is not provided as part of the ATPOL II software package. Once you have Access installed then you can view the database by exploring to the database file location and then opening it up.

ID	Filename	Test date	Photofile	Plant name	Unit nam	Company	Location n	System na	Coordinator	Owner
8112	2B MOTOR-1_000	2/13/2009 11:15:00 AM		XYZ						
8093	2PHS DAYTON	3/1/2006 11:01:50 AM		common direct						
8095	BLACK GE01	4/15/2005 9:24:42 AM								
8096	CIRC WATER PUMP	11/13/2006 3:12:54 AM		CIRC WATER PL	UNIT # 2	DOHA EAST	DEPS	BOILER #2	VLR	BMB
8094	DAYTON	1/11/2002 12:37:16 PM								

Once open you can view all available fields which include both user entered information and software generated analysis results. These are just a few of the fields that are available for viewing.

NP Torque	NP RPM	CT Ratio	PT Ratio	Rotor bar count	Stator slot count	Brng0 Manufacture
442.4	3560	1	1	42	36	
0.8	1725	0.333	1	30	24	
0.8	1725	1	1	44	36	
9494.5	496	20	66	84	108	SKF

Static Eccentricity	Dynamic Eccentrictiy	Electrical damage	Mechanical damage
Yes	No	No	No
No	No	No	No

Microsoft Access provides many tools for creating searches, reporting results, exporting specific fields, etc. Moreover, **sharing machine results for use in CMMS programs** is easy to do via these Access provided tools.

For more information about this important feature or any other technical questions please contact us via email using support@alltestpro.com or call us at 860-399-4222.

Technical Support and Training

For technical support and training for your Motor Diagnostics program, contact:

Support@alltestpro.com

ALL-TEST *Pro,* LLC
P.O. Box 1139
Old Saybrook, CT 06475

Ph: 860-399-4222
Fax: 860-399-3180

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