# CHAPTER 7:  EMAX POWER ANALYSIS

EMAX testing may be started by selecting either the Test Selection  or the EMAX Auto  icons on the toolbar.

Selecting the EMAX Auto icon automatically runs the Rotor Evaluation, Eccentricity, Power, and Demod tests. At the completion, after the test results are saved, the Fault Zone Analysis window displays. It uses the existing testing setup values.

Selecting the Test Selection icon allows you to verify and/or change the testing setup values and select which test you want to run. Test Selection is discussed in detail on page 7-3.

## TESTING QUICK START

1.  Connect the EMAX Data Acquisition cable to the PCMCIA DAQ Card in the laptop computer.

2.  Start MCEGold and highlight the motor to be tested on the Site Navigator or WatchList.

3.  Select the Test Selection icon on the toolbar.

4.  Choose EMAX tab on the Test Selection window.

5.  From the Test Selection window select the Power Analysis test. EMAX Auto, Rotor Evaluation, Eccentricity, In-Rush/Start-Up, and Demod are Current Analysis tests and are discussed in Chapter Six.

    Note: Each test is discussed in detail in the Step-by-step Procedures.

6.  Connect the current probes.

7.  Make the appropriate changes in the EMAX Test Setup section. The displayed settings will change depending on the test selected.

8.  Click **Test**. At the end of testing the Test Results window displays test results. Verify the data is valid and save the test data.

## VIEW DATA

1.  Start MCEGold and highlight the motor on the Site Navigator or WatchList.

2.  Select the Test History icon on the toolbar.

3.  Select EMAX from the drop down menu on the History Chart window.

4.  Select the Power tab, located across the top of the History Chart.

# INTRODUCTION

Power analysis utilizes three-phase simultaneous voltage and current measurements to perform power quality analysis.

Power analysis test results may include indications of voltage imbalances, voltage and current spikes, excessive harmonic distortion, and stator faults.

High resistance connections result in *voltage imbalances* and *excessive circulating currents.* These circulating currents cause increased winding temperatures, which lead to insulation damage. By recording phase voltages and calculating a voltage imbalance, EMAX quantifies the severity of the high resistance connections by comparing the voltage imbalance to National Electrical Manufacturers Association (NEMA) standards.

*Voltage and current spikes* can be caused by a number of different events, including starting and stopping of plant loads; use of solid state switching equipment, such as variable frequency drive units; and power distribution system configuration changes. Significant voltage spikes stress the motor's insulation system, eventually resulting in catastrophic insulation failure. EMAX identifies these voltage spikes by calculating the crest factor of the voltage and current signals.

*Harmonics* are primarily caused by the use of solid state switching equipment, such as variable frequency drives and non-linear loads. The presence of these harmonics can result in excessive heating of the insulation in the motor, the distribution system, and the drive itself. EMAX quantifies the severity of the harmonic distortion by comparing the harmonic voltage factor to NEMA standards.

*Stator faults* can be caused by a number of things, including manufacturing defects, insulation breakdown over the life of the motor, excessive vibration, and rotor/stator contact due to severe eccentricity or bearing failure. EMAX calculates an impedance imbalance, which aids in isolating problems between the power distribution system and the stator.

# GETTING STARTED

**WARNING:**

⚠     **FOLLOW ALL ELECTRICAL SAFETY PRECAUTIONS AND PROCEDURES FOR WORKING ON ENERGIZED EQUIPMENT.**

Power analysis is performed with the motor circuit energized. To maximize the effectiveness of EMAX, connect the voltage probes as far down in the power circuit as possible, typically at the "T" lead connections leaving the motor control center.

There are four sizes of current probes and one size of voltage probe. The current probes each have a different size and current rating. When hooking up the current probes to the DB 9 adaptor cable, ensure that the leads are connected to the correct numbered terminal.

The EMAX voltage test leads contain fuses and are color coded black (phase 1), blue (phase 2), red (phase 3), and green (ground). They connect in the space provided on the right side of the tester deck.

When connecting the three clamp-on current probes to each phase of the three phase motor, ensure that the arrows on the current probes point in the direction of the cables leading to the motor.

# TEST SELECTION WINDOW

The Test Selection window section is followed by the Test Window and Step-by-Step testing procedures for AC assets and then DC assets.

Note: Selecting the EMAX Auto [icon] icon on the tool bar automatically runs the Rotor Evaluation, Eccentricity, Power, and Demod tests using either the default or previously saved test settings. At the completion, after the test results are saved, the Fault Zone Analysis window displays.

To open the Test Selection Window highlight an asset on the Site Navigator or WatchList and click the Test Selection icon [icon] on the tool bar.

The Test Selection window is shown in Figure 7-1. The asset name is located on the title bar to the right of the window name. The Test Selection window is used for both MCE and EMAX testing. Test Type is determined by selecting the desired test type tab.

The asset section tabs are found along the left side of the test selection area and are dependent on the asset type. Possible sections are Stator, Armature, and Field Circuits.

- For AC Induction assets, the only option is Stator.
- For AC Synchronous assets, the only option is Stator.
- For Wound Rotor assets, the only option is Stator.
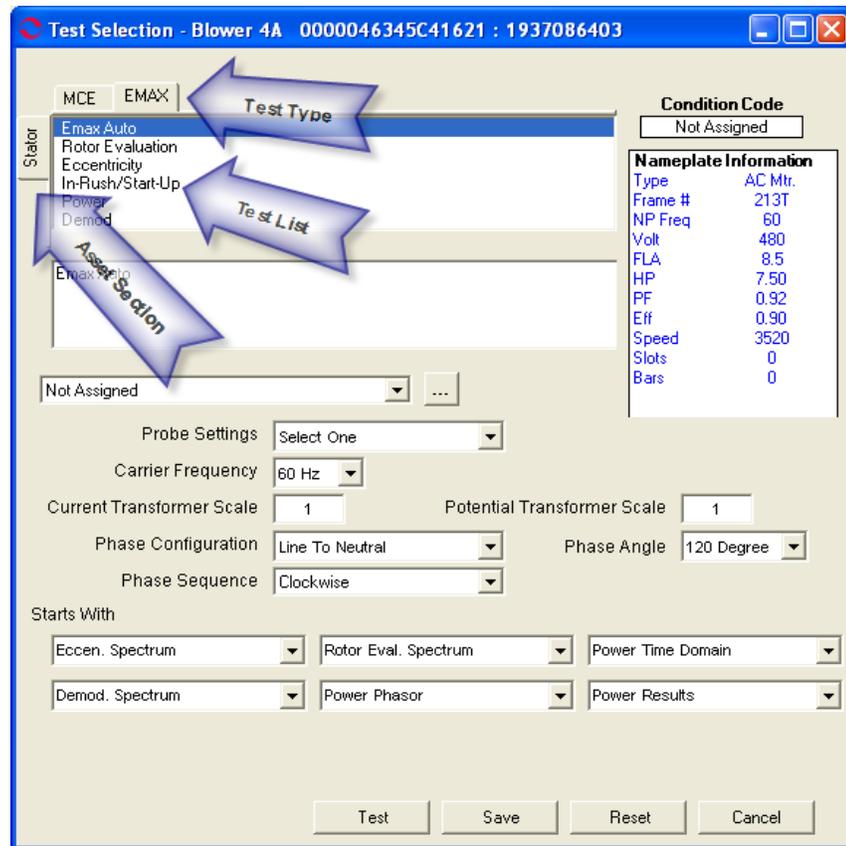- For DC assets, options are Armature and Field Circuit.

**Figure 7-1: EMAX Test Selection Window**

## Test List

The top left section of the window contains a list of test selections for either MCE or EMAX, depending on asset type, test type and asset section tabs selected. When a test is selected, the name of the test is highlighted blue and the test set up area changes to values appropriate for the test selected. The test list possibilities for EMAX testing are:

- EMAX Auto (AC Induction, Wound Rotor, Synchronous)
- Rotor Evaluation (AC Induction, Wound Rotor, Synchronous)
- Eccentricity (AC Induction, Wound Rotor, Synchronous)
- In-Rush/Start-Up (AC Induction, Wound Rotor, Synchronous)
- Power (AC Induction, Wound Rotor, Synchronous)
- Demod (AC Induction, Wound Rotor, Synchronous)
- DC EMAX Auto (DC Armature Circuit)
- DC Power (Armature and Field Circuits)
- DC Current Analysis (DC Armature Circuit)
- DC In-Rush/Start-Up (Armature and Field Circuits
- Drive Input (DC Armature Circuit)

## Asset Information

Asset Information is located on the right side. This area displays the Condition Code and nameplate information of the asset being tested. The information comes from the

nameplate data that was entered when the asset was set up and cannot be edited on this window. Information displayed, depending on asset type, may include: Type, Frame #, NP Frequency, Voltage, FLA, HP, PF, Eff, Speed, Slots, and Bars. Also, Field Volts and Field Current are listed for DC assets.

# Test Setup

The lower half of the window is devoted to test set-up options. The set-up options depend on the asset type and test selected. This section shows a screen capture of the Power Test Selection by asset type and is followed by a description of the set-up options.

## AC Assets

### Power

The Power test set-up selections shown in Figure 7-2 apply to AC Induction, Synchronous, and Wound Rotor assets.



**Figure 7-2: Test Set-up Window for AC Induction Power Test**

### Asset Test Location

To insure consistent trending and assist in trouble shooting, the actual test location should be stored for each test.

Asset Test Location selection is available for all asset types and tests.

The Asset Test Location default is Not Assigned. To assign a test location, click the down arrow and select from the list. If the location is not known, click the browse button [icon]. The Test Location Selection window opens displaying a test location graph for the type of asset selected. See Figure 7-3. Use the graph to determine the location, then click the down arrow in the Test Location text box, select the location from the list, and click **OK.**
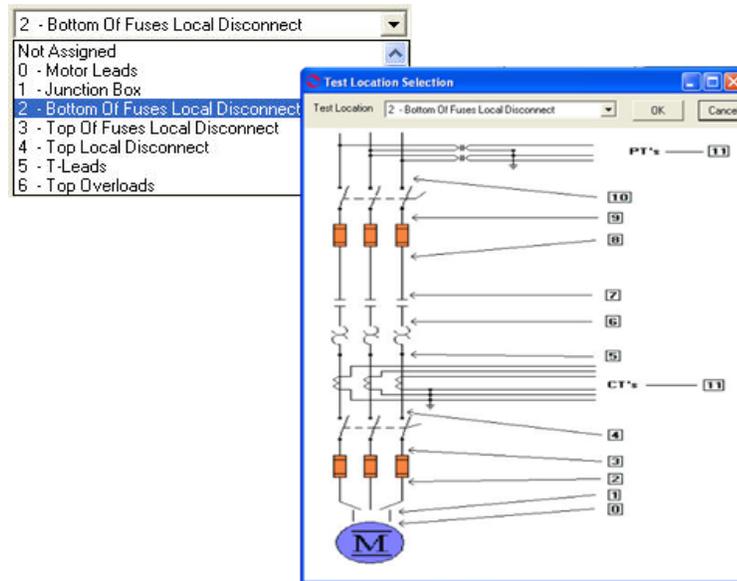


**Figure 7-3: Asset Test Location**
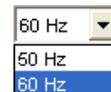
### Probe Settings
Probe Settings selection is available for all asset types and tests. This is a required field.

Select the Probe Settings from the drop down list. It may be necessary to use the scroll bar to see the complete list.

### Carrier Frequency/Line Frequency
Carrier Frequency selection is available for all asset types and tests, except DC EMAX Auto, DC Current Analysis, and DC In-Rush/Start-Up. For those exceptions it is labeled Line Frequency.

Select the Carrier or Line Frequency from the drop down list. The choices are 60 Hz or 50 Hz.

### Current Transformer Scale
Current Transformer Scale is available for all asset types and tests. Place the cursor in the text box, delete the value and enter the new current transformer scale.

**Potential Transformer Scale**

This setting is only available for the EMAX Auto test for AC and DC assets and for the Drive Input test for DC Assets.

Place the cursor in the text box, delete the value and enter the new current potential transformer scale.
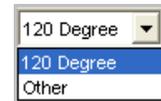
**Phase Configuration**

This setting is only available for the EMAX Auto test for AC assets and Drive Input for DC assets.

Select the Phase configuration from the drop down list. The choices are Line-to-Neutral and Phase-to-Phase.

**Phase Angle**

This setting is only available for the EMAX Auto test for AC assets and DC Drive Input test when Line-to-Neutral is selected in the Phase Configuration setting.

Select the Phase Angle from the drop down list. The choices are 120 degrees or Other.
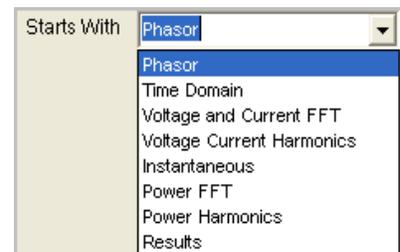
**Phase Sequence**

Phase Sequence is only available for the EMAX Auto test for AC assets and DC Drive Input test for DC assets.
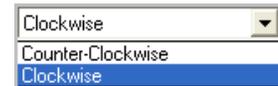
Select the Phase Sequence from the drop down list. The choices are Clockwise and Counter-Clockwise.

**Starts With**

Starts with selects the method of displaying the test results. Additional graphs may be opened from the first one.

**Test Button**

Click **Test** to advance to the test window.

**Save Button**

Click **Save** when the test set-up selections are complete. This saves the settings as default values for that asset for subsequent tests, but is not required. If forget to save and click Test, you will be asked if you want to save your changes.

**Reset Button**

Click **Reset** to set values back to the pre-changed value. Note: If you have clicked the Save button they will not reset and it will be necessary to manually change them back.

**Cancel Button**

Click **Cancel** to close the Test Selection window without saving setup changes or proceeding to the test window. You will be asked if you want to save test setup settings.

## DC Assets

### DC Power

The Power test set-up selections shown in Figure 7-4 apply to DC assets. The DC Power test may be run on both the Armature and Field Circuits.
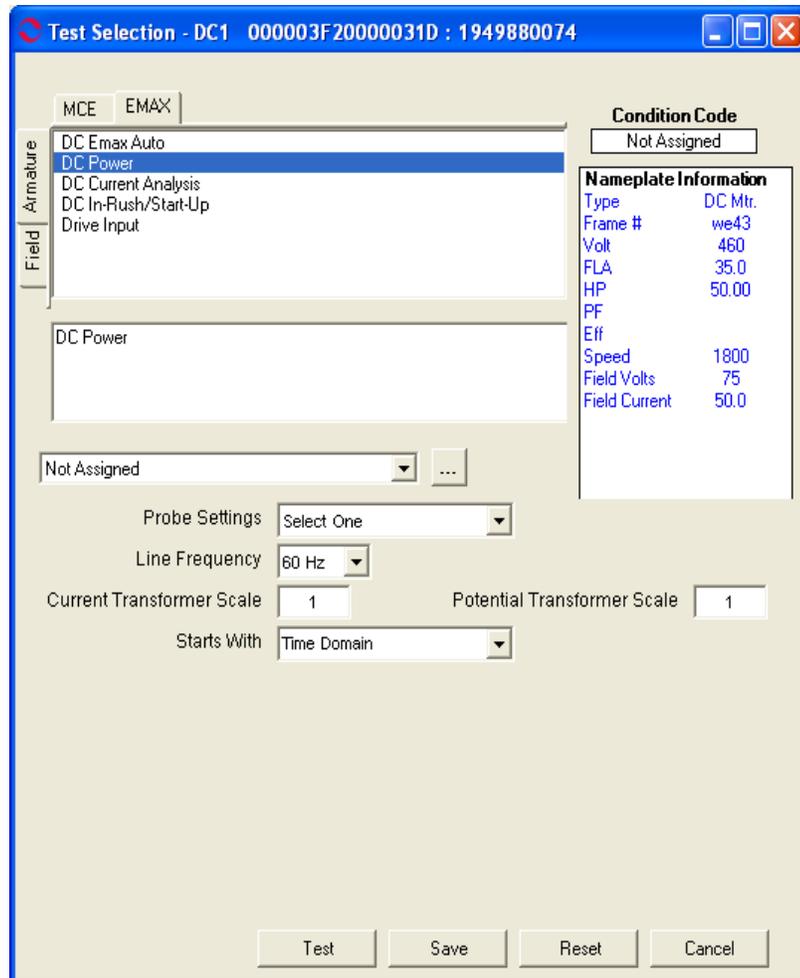


**Figure 7-4: Test Set-up Window for DC Power Test**

**Asset Test Location**

To insure consistent trending and assist in trouble shooting, the actual test location should be stored for each test.

Asset Test Location selection is available for all asset types and tests.

The Asset Test Location default is Not Assigned. To assign a test location, click the down arrow and select from the list. If the location is not known, click the browse button ▫ .

The Test Location Selection window opens displaying a test location graph for the type of asset selected. See Figure 7-5. Use the graph to determine the location, then click the down arrow in the Test Location text box, select the location from the list, and click **OK.**
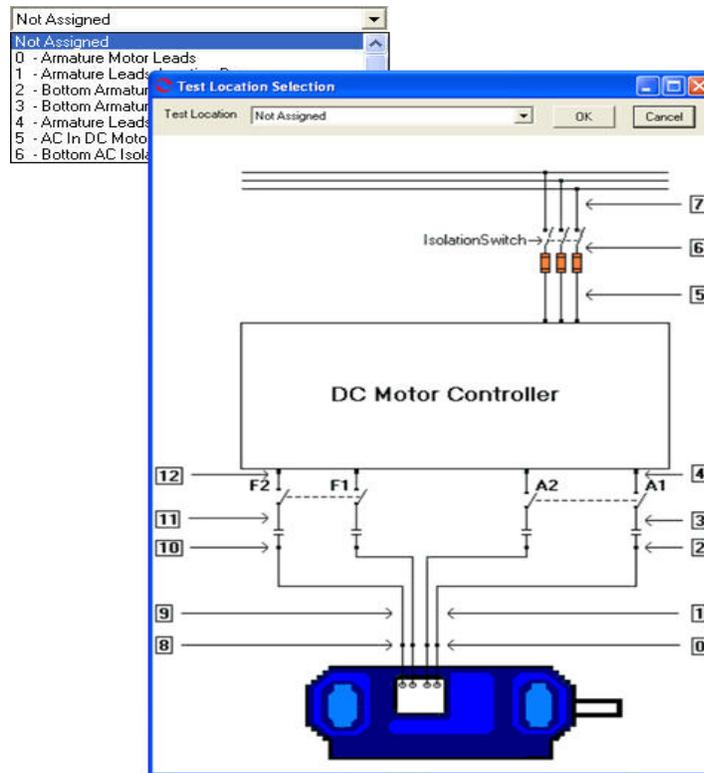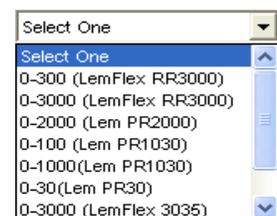


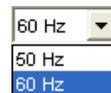**Figure 7-5: DC Asset Test Location**

### Probe Settings

Probe Settings selection is available for all asset types and tests. This is a required field.

Select the Probe Settings from the drop down list. It may be necessary to use the scroll bar to see the complete list.

### Carrier Frequency/Line Frequency

Carrier Frequency selection is available for all asset types and tests, except DC EMAX Auto, DC Current Analysis, and DC In-Rush/Start-Up. For those exceptions it is labeled Line Frequency.

Select the Carrier or Line Frequency from the drop down list. The choices are 60 Hz or 50 Hz.
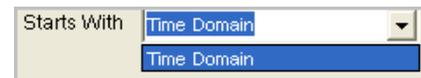
**Current Transformer Scale**

Current Transformer Scale is available for all asset types and tests. Place the cursor in the text box, delete the value and enter the new current transformer scale.

| Current Transformer Scale | 1 |

**Potential Transformer Scale**

This setting is only available for the EMAX Auto test for AC and DC assets and for the Drive Input test for DC Assets.

| Potential Transformer Scale | 1 |

**Starts With**

Starts with selects the method of displaying the test results.The default and only option is Time Domain.

| Starts With | Time Domain |
| | Time Domain |

**Test Button**

Click **Test** to advance to the test window.

**Save Button**

Click **Save** when the test set-up selections are complete. This saves the settings as default values for that asset for subsequent tests, but is not required. If forget to save and click Test, you will be asked if you want to save your changes.

**Reset Button**

Click **Reset** to set values back to the pre-changed value. Note: If you have clicked the Save button they will not reset and it will be necessary to manually change them back.

**Cancel Button**

Click **Cancel** to close the Test Selection window without saving setup changes or proceeding to the test window. You will be asked if you want to save test setup settings.

# TEST WINDOW

Once the asset section and setup parameters are selected, you are ready to run the Power test. This section describes step-by-step procedures by asset type and asset section. Test analysis information begins on page 7-14.

## AC Induction Assets
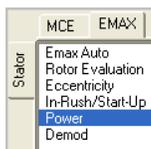
### Step-by-Step Power

1. Connect the EMAX Data Acquisition cable to the DAQ card in the laptop computer.

2. Start MCEGold.

3. Highlight the motor being tested in the Site Navigator or on a WatchList.

4. Select the Test Selection icon on the toolbar. The Test Selection window, shown in Figure 7-6 opens
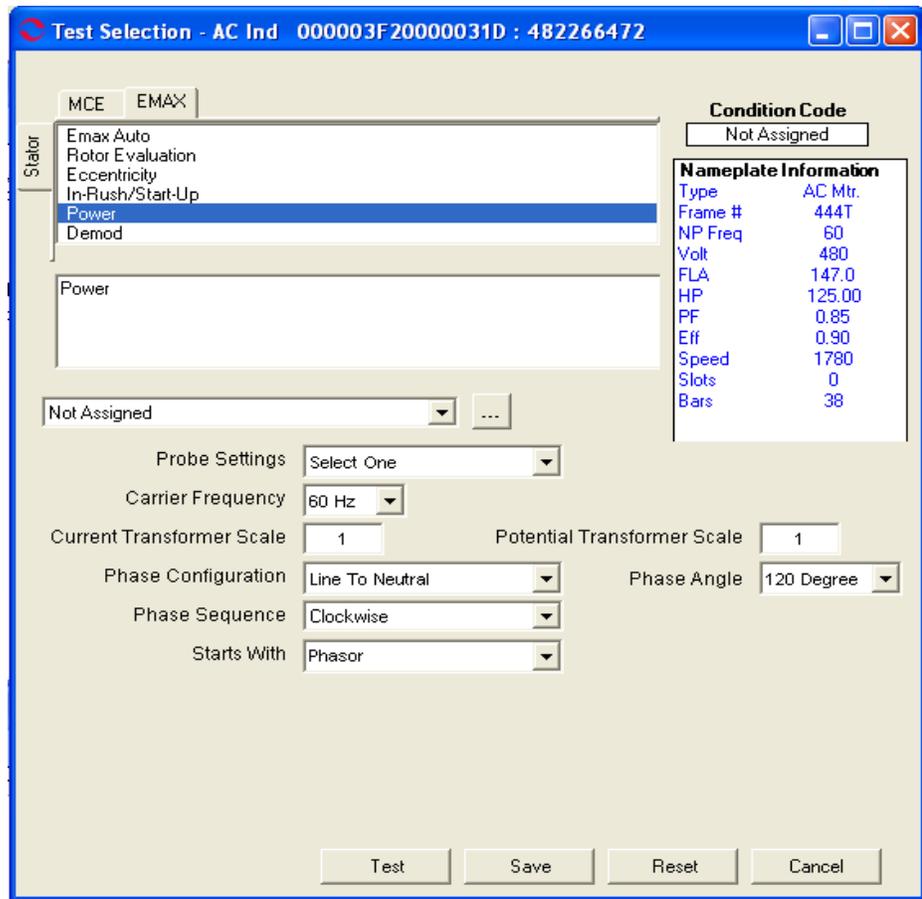
**Figure 7-6: Power Test Selection Window - AC Asset**

5.   Select the EMAX tab.

6.   Select the Power test from the test list.

7.   Make the test set-up selections and click **Test**.

8.   If you have changed the test setup settings, you will be prompted to save the test setup settings. Click **Yes** or **No** as desired.

9.   At the end of testing the test results are displayed in the form chosen in the Starts With section of the Test Selection window. Additional test result graphs may be displayed by choosing View and the graph desired.

Note: You may have multiple windows open. They may be positioned by grabbing the title bar and dragging them to the desired location or using a command from the Windows menu on the menu bar.

10.  To close the Test Results window select File, Close or click the Close button 🗙  in the upper right corner.

11. You will be asked if you want to save the test data. Click the appropriate button. The action is taken. If the test results have been saved they may be viewed using the Test History function on the toolbar.

# AC Synchronous Assets

EMAX Power test for AC synchronous assets is the same as for AC Induction. See page 7-10 for step-by-step testing procedures.
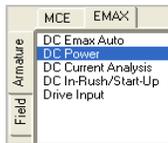
# AC Wound Rotor Assets

EMAX Power test for AC synchronous assets is the same as for AC Induction. See page 7-10 for step-by-step testing procedures.

# DC Assets

## Armature Section

### Step-by-Step DC Power



1. Connect the EMAX Data Acquisition cable to the DAQ card in the laptop computer.

2. Start MCEGold.

3. Highlight the motor being tested in the Site Navigator or on a WatchList.

4. Select the Test Selection icon [icon] on the toolbar. The Test Selection window, shown in Figure 7-7 opens.
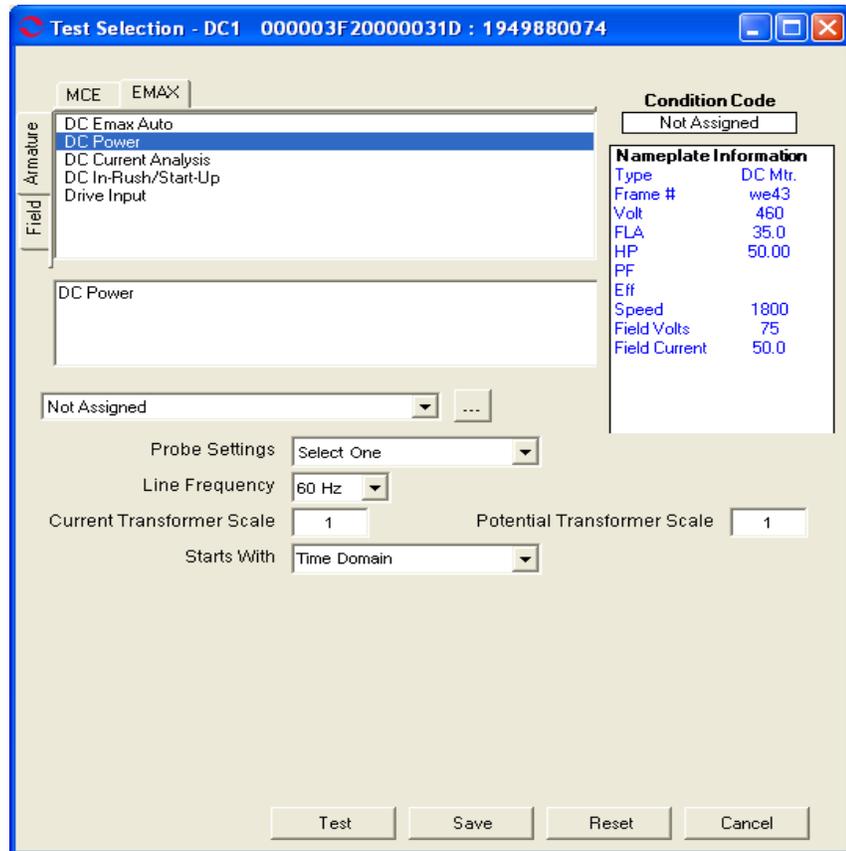
**Figure 7-7: Power Test Selection Window - DC Asset**

5.  Select the EMAX and Armature tabs.

6.  Select the Power test from the test list.

7.  Make the test set-up selections and click **Test**.

8.  If you have changed the test setup settings, you will be prompted to save the test setup settings. Click **Yes** or **No** as desired.

9.  At the end of testing the DC Power Time Domain is displayed.

10. To close the Test Results window select File, Close or click the Close button ☒ in the upper right corner.

11. You will be asked if you want to save the test data. Click the appropriate button. The action is taken. If the test results have been saved they may be viewed using the Test History function on the toolbar.

### Field Section

## Step-by-Step DC Power

The testing procedure for the Field section is the same as for the Armature section. With the exception that you need to select the Field tab in step 5. See Page 7-13.

# ANALYSIS

## AC Assets

The AC EMAX Power test produces a single, user selected, Test Results window at the end of testing. The selection is made during the test set-up, which is discussed on page 7-7, Starts With.
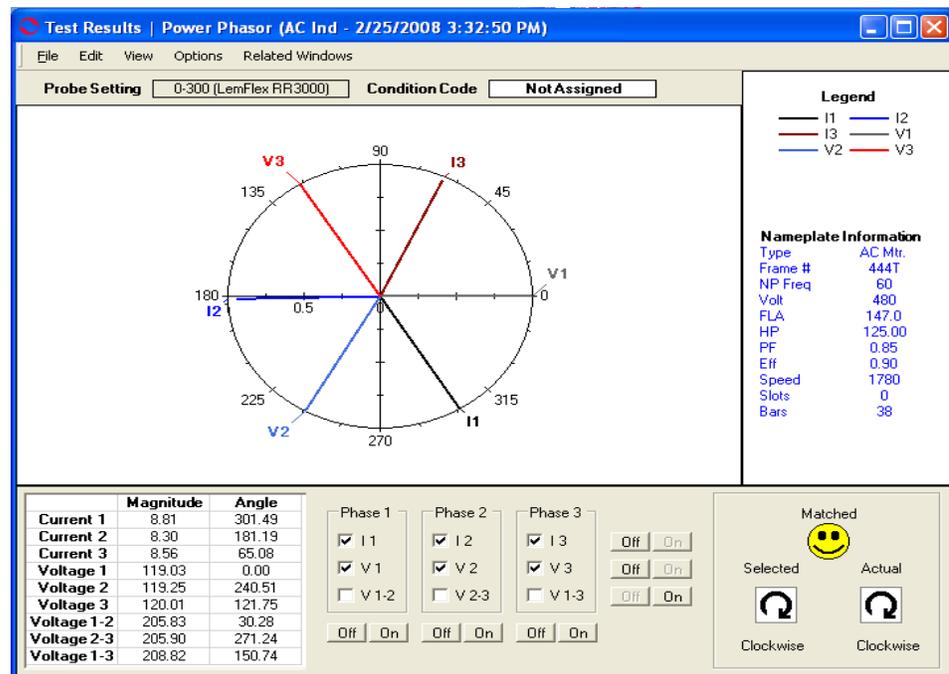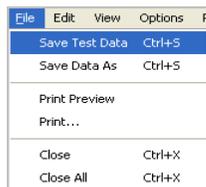
### Power Phasor



**Figure 7-8: Test Results - Power Phasor**

## File Menu

### Save Test Data

Selecting File, Save Test Data saves the test data to the Test History file. When the data is saved a message box informs you "Complete". Click **OK**.

Note: Changes made to the appearance of the graph and data is not saved by using the menu save commands. To save the modified spectrum, use Print Preview. From the Print Preview window you can use File, Export to PDF or Export to HTML.

### Save Data As

Selecting File, Save Data As allows you to save the test data to a location you choose. The Save Data window opens, select a location and enter a file name, click **Save**. The file is saved as an .xls file type.

> Note: Changes made to the appearance of the graph and data is not saved by using the menu save commands. To save the modified spectrum, use Print Preview. From the Print Preview window you can use File, Export to PDF or Export to HTML.

### Print Preview

Selecting File, Print Preview causes the Rotor Evaluation Spectrum to display as it will print. To print, select the print icon, from the Print window verify the printer destination, and click **OK**. To close the Print Preview, select File, Close or click the close button ⊠ in upper right corner.

### Print

Selecting File, Print causes the Print window to open, verify the printer destination, and click **OK**.

### Close

Selecting File, Close closes the Test Results window. If you have not saved the test data you will be asked if you want to save.

### Close All

Selecting File, Close All closes all Test Results windows associated with the Eccentricity test that are open. If you have not saved the test data you will be asked if you want to save.

## Edit

### Create Message (Ctrl+M)

Selecting Edit, Create Message opens the Compose Asset Message window. Use this function to add a message/note to the asset record. The messages/notes can be read using the Message Center. Compose Asset Message and the Message Center are discussed in Chapter 3- MCEGold, Message Center on page 3-4114

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## View

There are seven additional display choices for the Power test results. The initial display is selected during test setup in the Starts With section. You can view additional test results windows by selecting View and desired display. The initial window will remain open, the additional window opens. It is possible to have all windows open at the same time. You can drag them to the desired position on your monitor or use the Related Windows menu to display them.
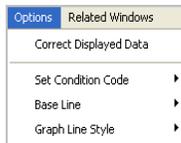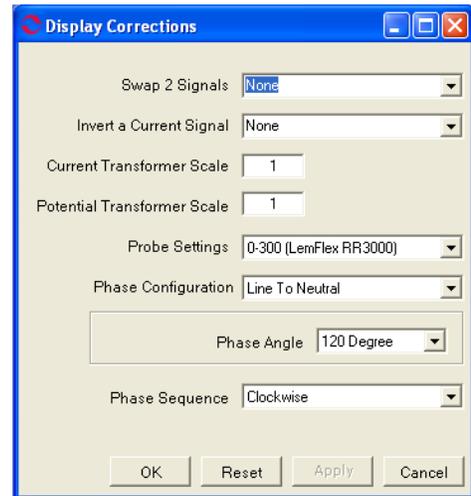
## Options

### Correct Displayed Data

Selecting Options, Correct Displayed Data allows you to make adjustments to the test results. Those adjustments are: Swap 2 Signals, Invert a Current Signal, Current Transformer Scale, Potential Transformer Scale, Probe Setting, Phase Configuration, Phase Angle, and Phase Sequence.

Make the desired adjustments and click **OK** to make the changes and close the window or **Apply** to make the changes and leave the window open.

### Set Condition Code

Selecting Options, Set condition Code displays the submenu shown on the right. Click on the desired condition code.

### Baseline

Selecting Options, Baseline displays the Set As Baseline option. This sets the test results as the baseline.

### Graph Line Style

Selecting Options, Graph Line Style displays the option to Show Markers. A check mark indicated the option is active.

## Related windows

Selecting Related Windows, displays functions that control how the open windows are displayed and lists the open windows.

## Display Options

The area below the Phasor diagram contains test result values and options to enhance the phasor display.

The table displays the values for Magnitude and Angle.

The Phase 1, 2, and 3 check boxes control how the data is displayed on the phasor diagram. To control the individual value, click on the box to place or remove a check mark. To control all three values either horizontally or vertically use the Off and On buttons to the left and bottom of the area. The phasor diagram will change as values are turned on or off.

The Phase Sequence area displays the selected phase and the actual phase sequence. When the selected and actual are the same the word Matched is displayed along with a smiley face. When they are not the same the word Unmatched is displayed along with a frowning face.

## Review Phasor

In the phasor diagram the base data for voltage and current is represented in polar form. The default phasor diagram indicates the phase relationship between all three currents and voltages. The purpose of the diagram is to verify proper test connections. Phase-to-phase voltages may be added. The diagram represents 0-360 degrees of electrical rotation. The 0 degree mark is the reference point for phase 1 voltage (V1); 120 degrees for phase 3 voltage (V3); 240 degrees for phase 2 voltage (V2). These reference marks are located on the outside of the circle and are based on a clockwise rotation.

Current lags voltage by an amount determined by the plant power factor. Therefore, phase 1 current (I1) is in the 270-0 degrees quadrant. The reference points for current, I1, I2, and I3 are also shown on the outside of the circle.

Actual voltage and current signals are labeled on the signal line inside the circle.

This display shows a qualitative view of the magnitude difference of each of the signals. To see a quantitative measure of the magnitudes of the different signals, refer to the table below the Phasor Diagram. This table lists magnitude and angle for all 3 phases of voltage and current and all 3 phase-to-phase voltage combinations. This table does not change as the Phasor Diagram changes.

To the right of the table, are nine boxes which control the display of each phase of voltage and current, and combination of phase-to-phase voltage. A check mark in the box indicates that phase display is turned on. Click in the box to toggle on and off. Click the **Off** or **On** buttons to control combination phase-to-phase display.

To the right of the Phase1, 2, and 3 area is the Phase Sequence box. There are three indications in this box: Selected, Matched/Unmatched, and Actual.

- Selected Phase Sequence indicates the default setting for the motor. To change this setting, select Options, Correct Displayed Data. Make your changes in the Display Corrections window and click **OK**.
- Actual Phase Sequence is the true relationship of voltages and currents being tested. Clockwise is phase 1, phase 2, phase 3, left to right. Counter Clockwise is when two phases are reversed.
- When the Selected Phase Sequence and Actual Phase Sequence are the same, the word Matched is placed between the Selected and Actual indications with a "smiley" face. When they are not the same, the word Unmatched appears with a "frowning" face.
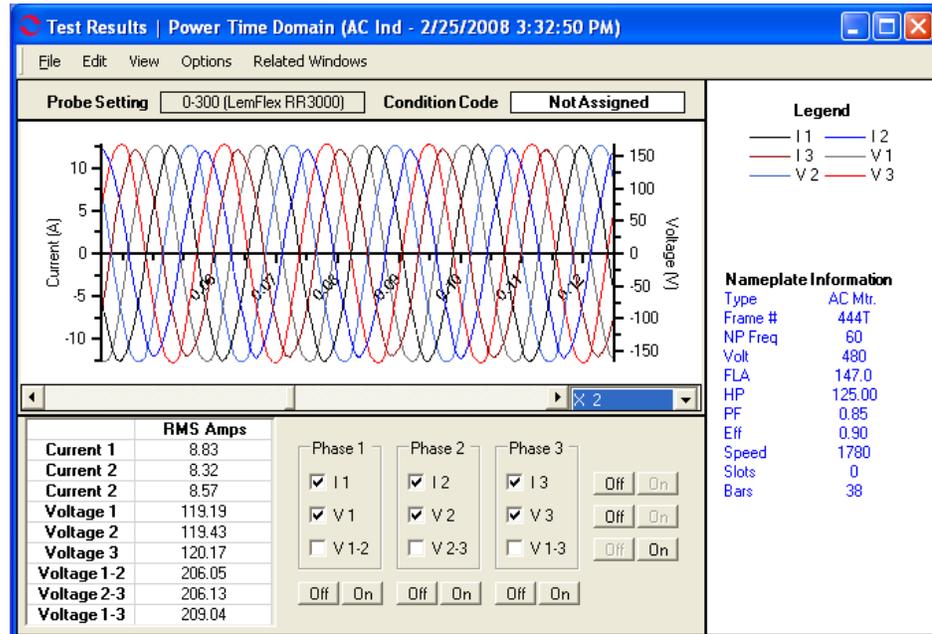
## Power Time Domain



**Figure 7-9: Test Results - Power Time Domain**

The menu options are the same as for the Power Phasor Test Results. See page 7-14.

## Display Options

The area below the Power Time Domain contains test result values and options to enhance the Time Domain display.

### Magnification

The drop down list located to the lower right of the test results graph allows you to increase or decrease the magnification of the graph. Depending on the magnification it may be necessary to use the slider to view the complete results
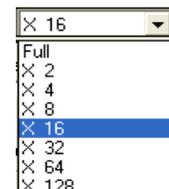


### Table

The table displays the values for RMS Amps.

### Phase Control

The Phase 1, 2, and 3 check boxes control how the data is displayed on the Time Domain. To control the individual value, click on the box to place or remove a check mark. To control all three values either horizontally or vertically use the Off and On buttons to the right and bottom of the area. The phasor diagram will change as values are turned on or off.

## Review Time Domain

The Voltage and Current Time Domain display is reviewed to verify signal validity, proper phase sequence, and general condition. When reviewing the display, ensure all three voltage and current signals are visible.

The default display shows six waveforms - voltage and current for phases 1, 2, and 3. Additionally, phase-to-phase voltages for 1-2, 2-3, and 3-1 can be displayed.

The current scale is in amps (shown vertically on the left side of the display) and the voltage scale is in volts (shown vertically on the right). The voltage and current scales change as necessary to display all of the graphs. Both are referenced to time in seconds (shown horizontally in the middle).

The Voltage and Current Time Domain display shows if any of the following occurred, which invalidates the test data:

- Improper range selected on current probes
- Improper probe connection
- Probes not energized during the test

Verify that the proper ranges were selected on the current probes by looking at the display of the current signals. Flat peaks at the tops of the sine waves indicates that clipping occurred. This happens when the selected range is too low and the current signals overdrive the probes.

Verify that the current probes were energized and voltage and current probes were connected properly. If a phase has a very low amplitude and is extremely erratic, the probes could have been improperly connected or not turned on. An erratic signal can be caused by excessive noise.

Change the zoom factor on the Scale drop-down list box to Full to confirm that the entire signal capture is valid. Analyze the general condition of the voltage and current waveforms by observing the sinewaves for peak to peak variations and non-sinusoidal waveforms.

Voltage and current imbalances cause variations in the peak to peak values. Non-sinusoidal waveforms result from high frequency harmonics riding on the fundamental carrier frequency.

For induction motors verify proper phase sequence by confirming that phase 1 current lags phase 1 voltage. This is shown on the Voltage and Current vs. Time display as the black current crossing the x-axis shortly after the black voltage. Phases 2 (blue) and 3 (red) should look the same with a proper phase sequence.

A second method of verifying the phase sequences are matched is by viewing the Phasor Diagram. Confirm the selected and actual voltage phase sequences are matched as seen by the smiley face. Confirm the selected and actual current phase sequences are matched as seen by the selected I1, I2, and I3 on the outside of the Phasor Diagram lining up in the vicinity with the actual I1, I2, and I3 on the inside.

## Power Voltage and Current FFT

The Power Voltage and Current FFT graph indicates the effect of the voltage and current relationship on the power signal.
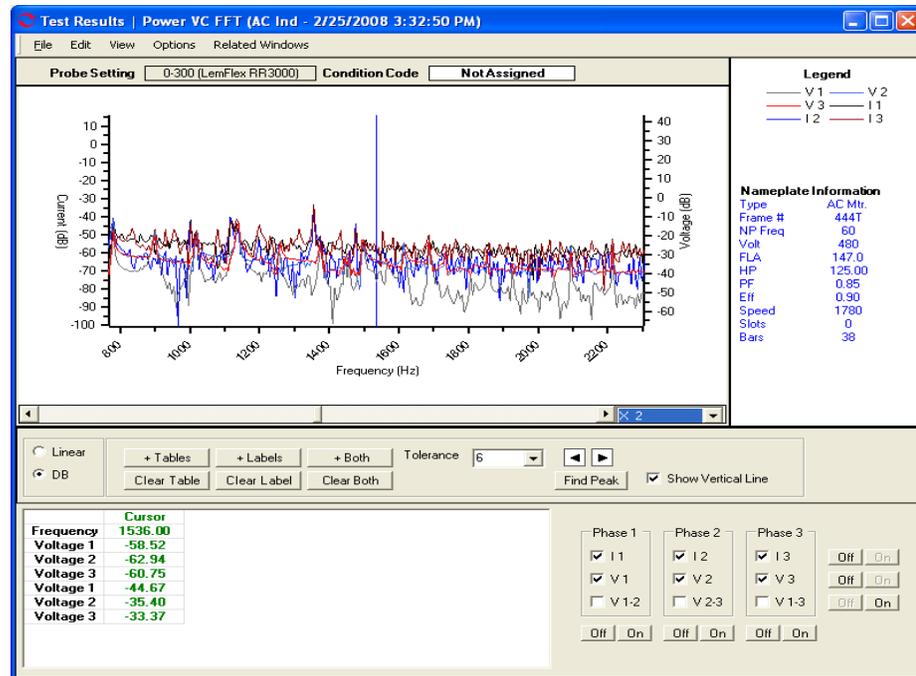


**Figure 7-10: Test Results - Power Voltage and Current FFT**

The menu options are the same as for the Power Phasor Test Results. See page 7-14.

## Display Options

The area below the test results graph contains options to enhance the test data display.

### Magnification

The drop down list located to the lower right of the test results graph allows you to increase or decrease the magnification of the graph. Depending on the magnification it may be necessary to use the slider to view the complete results
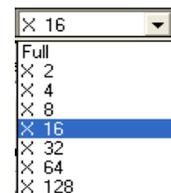
### Linear/Decibel (DB)

The default display for the graph is decibel (dB), which shows the current (dB) and Frequency (Hz). Selecting Linear changes the graph to show the current (A) and Frequency (Hz). The values in the Test Results Table change when a change is made to the linear/decibel display.

### + Tables

Clicking the +**Tables** button opens the Add/Edit Cursor Table window. Enter a name in the text box and click **OK**. A column is added to the display. When the cursor is moved to another location you may add an additional column.

**Clear Table**

Clicking the **Clear Table** button removes the column/s added by clicking +Tables.

**+ Labels**

Clicking + **Labels** places a label on the cursor location on the graph. Each time the cursor is moved, click + Labels to place a label on the new location.

**Clear Label**

Clicking **Clear Label** removes the labels placed on the graph by clicking + Labels.

**+ Both**

Clicking + **Both** adds a column on the table and places a label on the graph.

**Clear Both**

Clicking **Clear Both** removes the column/s and label/s on the graph. It does not return the cursor to the original location.

**Tolerance**

Tolerance is a drop down list of values used to limit the cursor movement to within a range.

◀ ▶  **Arrows**

Use the arrow buttons to move the active cursor right or left one increment at a time.

**Find Peak**

When the cursor has been moved, click the **Find Peak** button to cause the cursor to be placed exactly on the peak. The values will change in the appropriate table below the graph.

**Show Vertical Line**

A check mark in the show Vertical Line box causes a vertical line/cursor to display on the graph. The vertical line must show for the + Tables, + Labels, +Both, Find Peak, Start and End buttons to be active.

**Test Value Table**

The cursor position along with the voltages are displayed in the test value table. The values change depending on the selection of linear or decibel display.

**Phase1, 2 and 3**

The Phase 1, 2, and 3 check boxes control how the data is displayed on the Power Voltage Current diagram. To control the individual value, click on the box to place or remove a check mark. To control all three values either horizontally or vertically use the Off and On buttons to the right and bottom of the area. The Power Voltage Current diagram will change as values are turned on or off.

## Review Power Voltage and Current FFT

The default display shows six waveforms - voltage and current for phases 1, 2, and 3. Additionally, phase-to-phase voltages for 1-2, 2-3, and 3-1 can be displayed.

The current scale is in dB (shown vertically on the left side of the display) and the voltage scale is in volts (shown vertically on the right). The voltage and current scales change as

necessary to display the entire graph. Both are referenced to frequency in hertz (shown horizontally).

Below the graph is a table for the frequency, current, and voltage values for each of the parameters. Vertical and horizontal scroll bars are included if needed.

Click anywhere in the graph to show the vertical bar cursor. This causes the values of the displayed parameters at the point where the cursor is located to be displayed in the table below the graph.

The voltage and current FFT graph is used to compare the voltage and current frequency peaks to isolate the source of possible problems to either the power circuit or the motor. Peaks are expected at line frequency and its harmonics for both voltage and current.

If a spike occurs on the current graph that is non-harmonic and does not have a voltage spike associated with it, the probable cause of the spike is the motor. This may be due to eccentricity, bearing defects, mechanical problems, etc.

## Power Voltage and Current Harmonics

The Power Voltage and Current Harmonics graph indicates how the product of voltage and current affects the overall power signal.
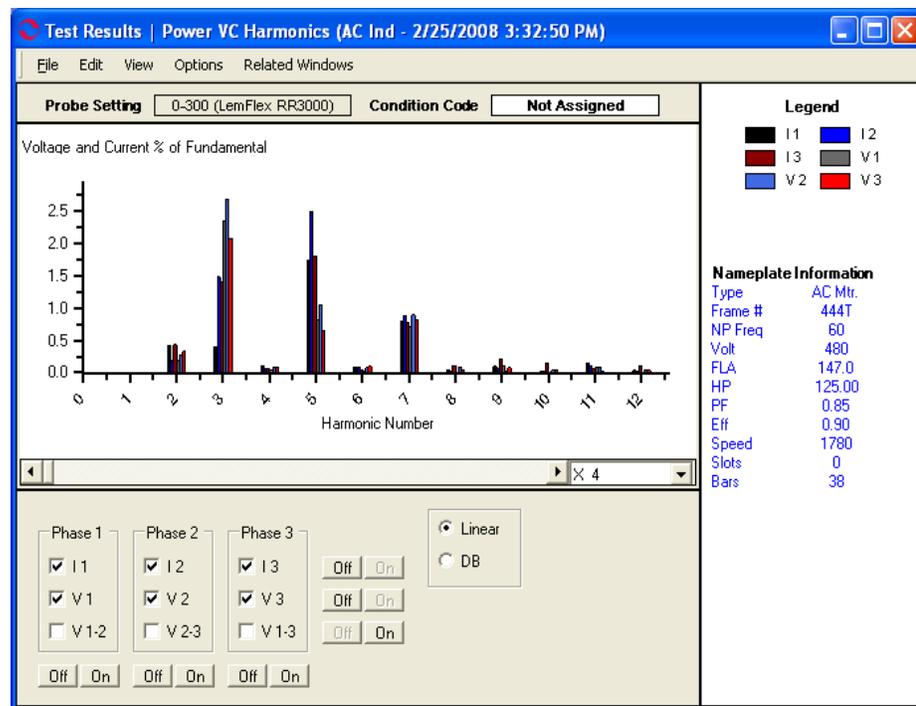


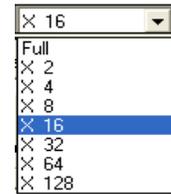**Figure 7-11: Test Results - Power Voltage and Current Harmonics**

The menu options are the same as for the Power Phasor Test Results, except under View there is no Graph Line Style option. See page 7-14.

## Display Options

The area below the test results graph contains options to enhance the test data display.

**Magnification**

The drop down list located to the lower right of the test results graph allows you to increase or decrease the magnification of the graph. Depending on the magnification it may be necessary to use the slider to view the complete results.

**Phase1, 2 and 3**

The Phase 1, 2, and 3 check boxes control how the data is displayed on the Power Voltage Current diagram. To control the individual value, click on the box to place or remove a check mark. To control all three values either horizontally or vertically use the Off and On buttons to the right and bottom of the area. The Power Voltage Current diagram will change as values are turned on or off.

**Linear/Decibel (DB)**

The default display for the graph is Linear which shows the voltage and current % of the fundamental at the harmonic number. Selecting Decibel (dB) shows the voltage and current (dB). The values in the Test Results Table change when a change is made to the linear/decibel display.

## Review Power Voltage and Current Harmonics

Harmonics are measured to determine the influence of nonlinear loads on the power system. Switching devices, such as computer and variable speed drives, are examples of nonlinear loads.

Normally, odd numbered harmonics are of the most concern. Specifically, the fifth harmonic tends to be a primary indicator of variable speed drive influence on the power lines.

Although even numbered harmonics do not oppose the torque in a motor, they still increase the load on the system and can be detrimental if they are present in large quantities.

In general, the THD of the voltage signal should be less than 5%. Problems resulting from excessive harmonics include exceeding transformer limits and overheating electric motors. If excessive voltage harmonics are present, EMAX indicates on the Results page the recommended horsepower derating NEMA standards.

The default display shows six graphical representations, voltage and current for phases 1, 2, and 3 for each harmonic. Additionally, phase-to-phase voltages for 1-2, 2-3, and 3-1 can be displayed.

The voltage and current scales are in percent of fundamental harmonic (both shown vertically on the left side of the display). Both are referenced to the harmonic number (shown horizontally).

Below the graph is a scroll bar which controls the display horizontally. This permits viewing the display out to the 50th harmonic.

### Power Instantaneous

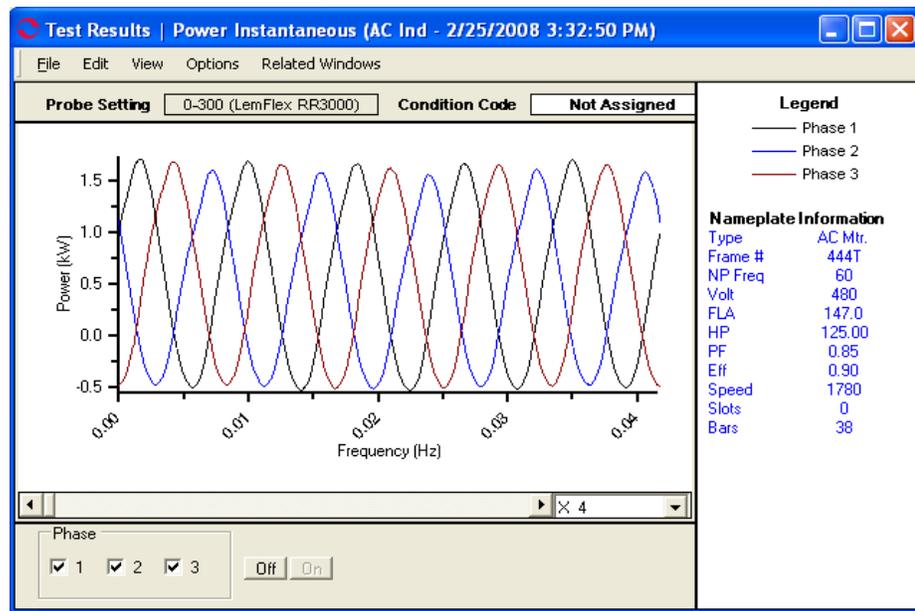The Power Instantaneous graph indicates the effect of the voltage and current relationship on the power signal.

**Figure 7-12: Test Results - Power Instantaneous**

The menu options are the same as for the Power Phasor Test Results. See page 7-14.

## Display Options

The area below the test results graph contains options to enhance the test data display.

### Magnification

The drop down list located to the lower right of the test results graph allows you to increase or decrease the magnification of the graph. Depending on the magnification it may be necessary to use the slider to view the complete results.
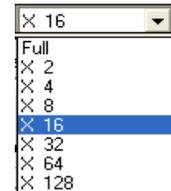
### Phase 1, 2, and 3

The Phase 1, 2, and 3 check boxes control how the data is displayed on the Power Instantaneous diagram. To control the individual display, click on the box to place or remove a check mark. To control all three values use the Off and On buttons to the right of the check boxes. The Power Instantaneous diagram will change as phases are turned on or off.

## Review Power Instantaneous

The Instantaneous Power graph indicates the effect of the voltage and current relationship on the power signal. It also gives a visual representation of the difference in real and reactive power being sent to the motor. This graph is currently included for illustration only and has no influence on signal analysis.

The default display shows three graphical representations - power for phase 1, 2, and 3.

The power scale is in kilowatts (shown vertically on the left side of the display). It changes as necessary to display all of the graph. Power is referenced to time (shown horizontally).
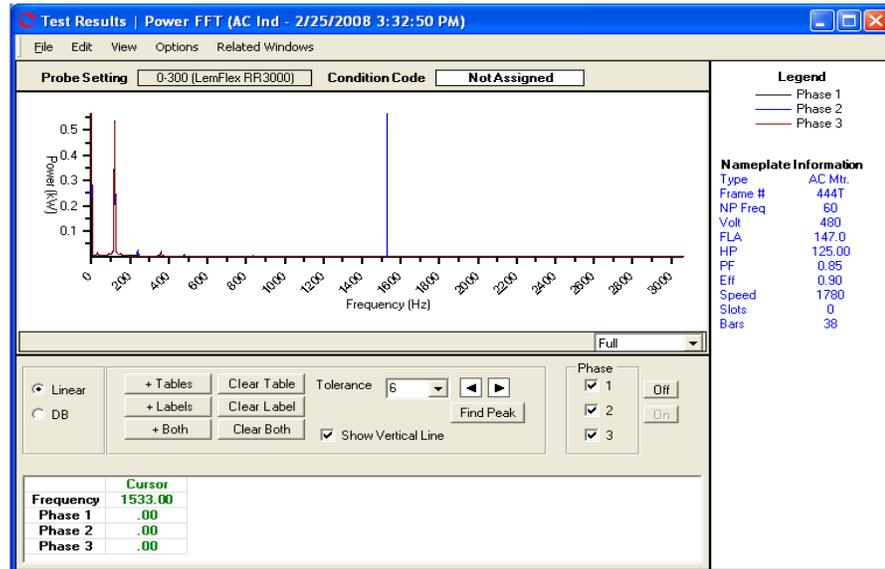
### Power FFT



**Figure 7-13: Test Results - Power FFT**

The menu options are the same as for the Power Phasor Test Results. See page 7-14.

## Display Options

The area below the test results graph contains options to enhance the test data display.

### Magnification

The drop down list located to the lower right of the test results graph allows you to increase or decrease the magnification of the graph. Depending on the magnification it may be necessary to use the slider to view the complete results
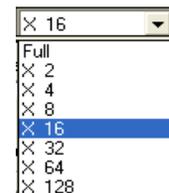


### Linear/Decibel (DB)

The default display for the graph is Linear which shows the Power (KW) and Frequency (Hz). Selecting Decibel (dB) shows the power (dB) and Frequency (Hz).

### + Tables

Clicking the +**Tables** button opens the Add/Edit Cursor Table window. Enter a name in the text box and click **OK**. A column is added to the display. When the cursor is moved to another location you may add an additional column.

### Clear Table

Clicking the **Clear Table** button removes the column/s added by clicking +Tables.

### + Labels

Clicking + **Labels** places a label on the cursor location on the graph. Each time the cursor is moved, click + Labels place a label on the new location.

**Clear Label**
Clicking **Clear Label** removes the labels placed on the graph by clicking + Labels.

**+ Both**
Clicking + **Both** adds a column on the table and places a label on the graph.

**Clear Both**
Clicking **Clear Both** removes the column/s and label/s on the graph. It does not return the cursor to the original location.

**Tolerance**
Tolerance is a drop down list of values used to limit the cursor movement to within a range.

◀ ▶ **Arrows**

Use the arrow buttons to move the active cursor right or left one increment at a time.

**Find Peak**
When the cursor has been moved, click the **Find Peak** button to cause the cursor to be placed exactly on the peak. The values will change in the appropriate table below the graph.

**Show Vertical Line**
A check mark in the show Vertical Line box causes a vertical line/cursor to display on the graph. The vertical line must show for the + Tables, + Labels, +Both, and Find Peak buttons to be active.

**Phase1, 2 and 3**
The Phase 1, 2, and 3 check boxes control how the data is displayed on the Power FFT diagram. To control the individual value, click on the box to place or remove a check mark. To control all three values use the Off and On buttons to the right of the area. The Power FFT diagram and the test value table will change as values are turned on or off.

**Test Value Table**
The cursor position along with the voltages are displayed in the test value table. The values change depending on the selection of linear or decibel display.

## Review Power FFT

The Power FFT graph indicates the effect of the voltage and current relationship on the individual power signal frequencies. This graph is currently included for illustration only and has no influence on signal analysis.

The decibel display shows three waveforms - power for phases 1, 2, and 3.

The power scale is in decibels (shown vertically on the left side of the display). It changes as necessary to display all of the graph. Power is referenced to frequency in hertz (shown horizontally).

Below the graph are the frequency and power values for each of the three parameters. Click anywhere in the graph to show the vertical bar cursor. When you do this, the values

of the displayed parameters at the point where the cursor is located are displayed in the value boxes under the graph.
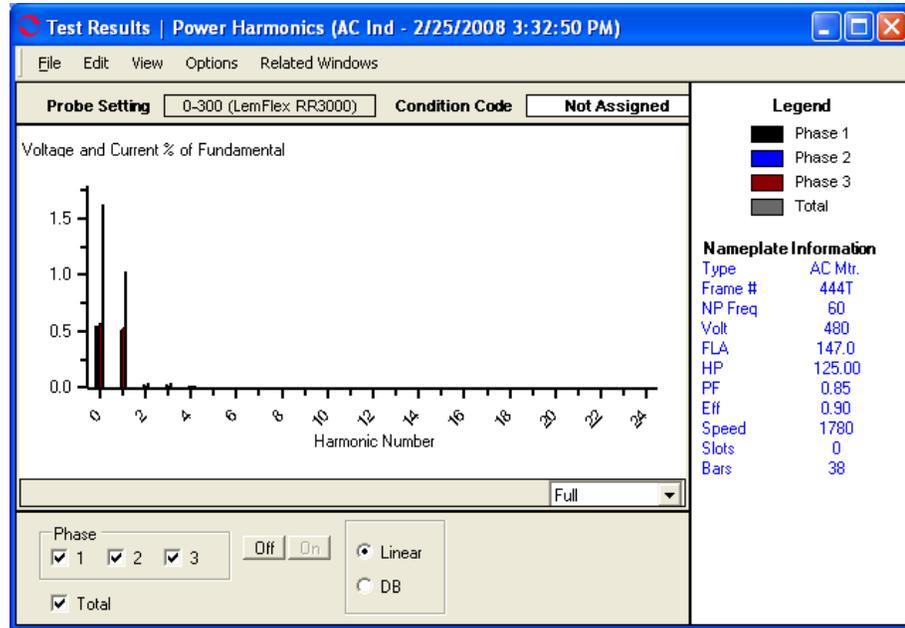
## Power Harmonics



**Figure 7-14: Test Results - Power Harmonics**

The menu options are the same as for the Power Phasor Test Results, except under View there is no Graph Line Style option. See page 7-14.

## Display Options

The area below the test results graph contains options to enhance the test data display.

### Magnification

The drop down list located to the lower right of the test results graph allows you to increase or decrease the magnification of the graph. Depending on the magnification it may be necessary to use the slider to view the complete results
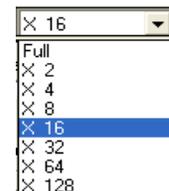


### Phase1, 2 and 3

The Phase 1, 2, and 3 check boxes control how the data is displayed on the Power Harmonics diagram. To control the individual phase, click on the box to place or remove a check mark. To control all three phases use the Off and On buttons to the right of the area. The diagram will change as values are turned on or off.

### Total

The Total option is independent of the Phase 1, 2, and 3 check boxes and is not turned off or on by the Off/On buttons.

**Linear/Decibel (DB)**

The default display for the graph is Linear which shows the Voltage and Current % of Fundamental. Selecting Decibel (dB) shows the Voltage and Current (dB).

## Review Power Harmonics

The Power Harmonics graph indicates how the product of voltage and current affects the overall power signal. This graph is currently included for illustration only and has no influence on signal analysis.

The default display shows four graphical representations of power for phases 1, 2, 3, and the total for each harmonic.

The power scale is in kilowatts (shown vertically on the left side of the display). It changes as necessary to display all of the graph. Power is referenced to the harmonic number (shown horizontally).

At the bottom of the window is a scroll bar which controls the display horizontally. This permits viewing the display out to the 25th harmonic.

## Power Results

The Power Results page displays detailed numeric test data and nameplate information. It is designed to provide a one page summary of an individual test, including warning conditions (caution and alarms). All items on the Results page are included in the Test History. No changes can be made on this page.
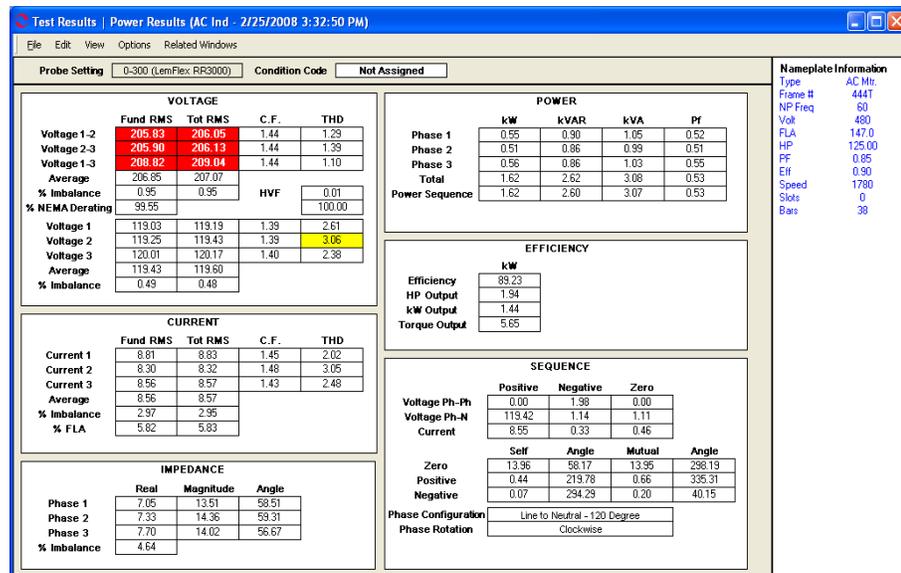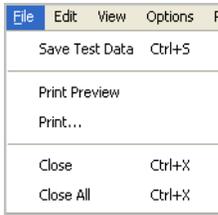


**Figure 7-15: Test Results - Power Results**

## File Menu

### Save Test Data

Selecting File, Save Test Data saves the test data to the Test History file. When the data is saved a message box informs you "Complete". Click **OK**.

> Note: Changes made to the appearance of the graph and data is not saved by using the menu save commands. To save the modified spectrum, use Print Preview. From the Print Preview window you can use File, Export to PDF or Export to HTML.

### Print Preview

Selecting File, Print Preview causes the Test Results to display as it will print. To print, select the print icon, from the Print window verify the printer destination, and click **OK**.

To close the Print Preview, select File, Close or click the close button ❌ in upper right corner.

### Print

Selecting File, Print causes the Print window to open, verify the printer destination, and click **OK**.

### Close

Selecting File, Close closes the Test Results window. If you have not saved the test data you will be asked if you want to save.

### Close All

Selecting File, Close All closes all Test Results windows associated with the Power test that are open. If you have not saved the test data you will be asked if you want to save.

## Edit

### Copy

The Edit, Copy function is used to copy the Results page and paste it in a Detailed Report.

### Create Message (Ctrl+M)

Selecting Edit, Create Message opens the Compose Asset Message window. Use this function to add a message/note to the asset record. The messages/notes can be read using the Message Center. Compose Asset Message and the Message Center are discussed in Chapter 3- MCEGold, Message Center on page 3-43.
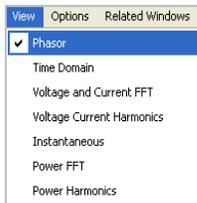
## View

There are seven additional display choices for the Power test results. The initial display is selected during test setup in the Starts With section. You can view additional test results windows by selecting View and desired display. The initial window will remain open, the additional window opens. It is possible to have all windows open at the same time. You can drag them to the desired position on your monitor or use the Related Windows menu to display them.
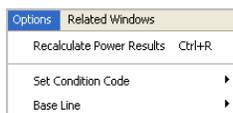
## Options

### Recalculate Power Results

Recalculate Power Results is used when changes have been made to the raw data and/or nameplate information. Selecting this option after changes have been made updates the Power Results display.
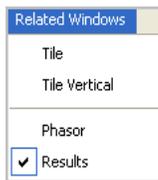
**Set Condition Code**

Selecting Options, Set condition Code displays the submenu shown on the right. Click on the desired condition code.

**Baseline**

Selecting Options, Baseline displays the Set As Baseline option. This set the test results as the baseline.

## Related Windows

Selecting Related Windows, displays functions that control how the open windows are displayed and lists the open windows.

## Review Power Results

Power Results is designed to provide a one page summary of an individual test, including warning conditions (caution and alarms). All items on the Results page are included in the History Chart.

There are two sections to the Results Page window. On the right is the Nameplate information. The larger section on the left window contains the test results data.

**Voltage**

The top three lines have information for phase-to-phase combinations 1-2, 2-3, and 3-1.

- Fund RMS (in volts) is the RMS value for the fundamental voltage signal.
- Tot RMS voltage (in volts) is the RMS value for the total voltage signal. This includes noise and other non-fundamental components.
- CF (crest factor) is the ratio between peak and RMS phase-to-phase voltages.
- THD (total harmonic distortion; in percent) indicates the RMS value of the signal with the fundamental component removed, expressed as a percentage of the total signal's RMS value.

Average is the average of the three phase-to-phase voltages (in volts).

% Imbalance is the highest measured deviation from the average of the three phase-to-phase voltages, divided by the average voltage, in percent.

% NEMA Derating indicates the recommended percentage of full load for safe operation of the motor based on the horsepower derating factor recommended by the National Electrical Manufacturer's Association standards. This derating factor is based on the percentage of voltage imbalance.

HVF is a ratio between the fundamental and non-fundamental voltage signals.

% NEMA Derating indicates the recommended percentage of full load for safe operation of the motor based on the horsepower derating factor recommended by the NEMA standards. The derating factor is based on HVF.

Next is the information for phase-to-neutral for phases 1, 2, and 3.

- Fund RMS (in volts) is the RMS value for the fundamental voltage signal.
- Tot RMS voltage (in volts) is the RMS value for the total voltage signal. This includes noise and other non-fundamental components.
- CF (crest factor) is the ratio between peak and RMS phase-to-phase voltages.
- THD (total harmonic distortion; in percent) indicates the RMS value of the signal with the fundamental component removed, expressed as a percentage of the total signal's RMS value.

Average is the average of the three phase-to-neutral voltages (in volts).

% Imbalance is the highest measured deviation from the average of the three phase-to-neutral voltages, divided by the average voltage, in percent.

### Current
The top three lines have information for current for phases 1, 2, and 3.

- Fund RMS (in amps) is the RMS value for the fundamental current signal.
- Tot RMS current (in amps) is the RMS value for the total current signal. This includes noise and other non-fundamental components.
- CF (crest factor) is the ratio between peak and RMS currents.
- THD (total harmonic distortion; in percent) indicates the RMS value of the signal with the fundamental component removed, expressed as a percentage of the total signal's RMS value.

Average is the average of the three currents (in amps).

% FLA is the percentage of the nameplate full load amps (FLA) at which the motor is running.

% Imbalance is the highest measured deviation from the average of the three phase currents, divided by the average current, in percent.

### Impedance
There are real and magnitude impedance values (in ohms) for all three phases, along with the angle between each. Real indicates the real component of the impedance triangle. This data is used in the calculations for Impedance Imbalance. Magnitude indicates the apparent component of the impedance triangle.

Impedance Imbalance (in percent) is based on voltage and current, and the phase angle between them. It is used for stator analysis.

### Power
The Power data table displays kilowatts (kW), kilovolt-amps-reactive (kVAR), kilovolt-amps (KVA), and power factor (PF) values for the total signal of each of the three phases.

The Total row contains the sums of kW, kVAR, and KVA and the average power factor respectively.

Power sequence contains the sums of each phase for kW, kVAR, and KVA and the average PF. These values are based on the fundamental signal only

**Efficiency**

Efficiency Calculation is the calculated efficiency of the motor (in percent) at the time of the test.

HP Output, kW Output, and Torque Output are the calculated outputs of the motor at the time of the test.
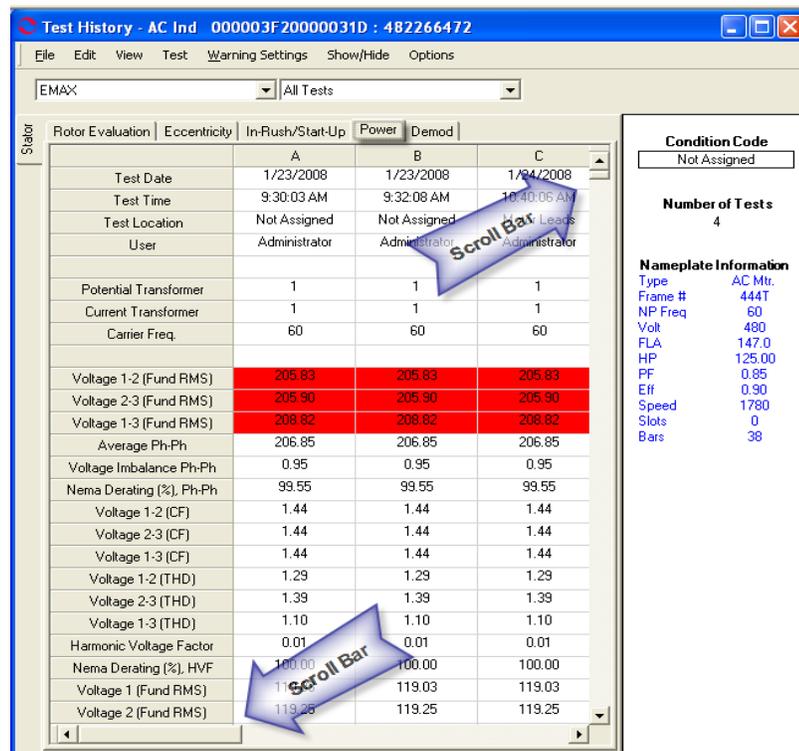
**Sequence**

The Sequence data table displays positive, negative, and zero sequence values for phase-to-phase voltage (in volts), phase-to-neutral voltage (in volts), and current (in amps).

• Positive sequence voltage and current produce aiding torque in the motor.

• Negative sequence voltage and current produce opposing torque in the motor.

• Zero sequence voltage and current produce no affect on torque in the motor. These are monitored for indications of insulation degradation.

## Review Test History

To review the Test History, highlight the asset in the Site Navigator or WatchList and click the Test History icon ⬚ on the toolbar. In the Test History window select EMAX from the drop down list and the Power tab. Locate the test by using the scroll bar at the bottom of the window. Figure 7-16 shows the Test History window for an AC Induction asset, EMAX Power test. Use the Scroll Bars to locate the desired test results. The Test History window menus and functions are discussed in Chapter 3 - MCEGold, page 3-28.



**Figure 7-16: Test History - Power**

There are a number of parameters in the Test History which have Caution and Alarm Warning Levels associated with them. First, look at the parameters with Caution and Alarm setpoints. Then, look at the other parameters which do not have warning levels.

To assist in the analysis process, graphing may be used for visual trending on motors with more than one set of test results.

## Parameters with Warning Levels

**Voltage Line-to-Line** is monitored to indicate if voltage on any phase changes by a given percentage above or below nameplate voltage.

- For example, bad transformer output, single-phasing, or high resistance connections can cause motor operation outside design parameters, resulting in insulation degradation. High voltages cause increased stress to the insulation. Low voltages cause increased currents and overheating of the insulation.

**Voltage Imbalance** is monitored to indicate if the voltage on any phase deviates by a given percentage from the average voltage.

- High resistance connections in the power circuit or inside the motor can cause voltage imbalances, resulting in high negative sequence currents and overheating of the insulation.

**Voltage Crest Factor** is monitored to indicate if any voltage spikes deviate from the RMS voltage value by a given amount.

- Switching devices, VFDs, and load transients are all causes of voltage fluctuations. Severe voltage spikes cause stress to the insulation system.

**Voltage THD** is monitored to indicate if the power signal distortion exceeds a given value.

- VFDs, single-phase loads, and computers are all causes of harmonic distortion, and can result in overheating of the winding insulation.

**Harmonic Factor** (Harmonic Voltage Factor) is also monitored to indicate if the power signal distortion exceeds a given value.

**Current RMS** is monitored to indicate if current on any phase changes by a given percentage above or below nameplate FLA.

- Improper motor applications or excessive loading can result in excessive currents and overheating of the insulation.

**Current Imbalance** is monitored to indicate if current on any phase deviates by a given percentage from the average current.

- High resistance connections in the power circuit or inside the motor can result in current imbalances and overheating of the insulation.

**Current Crest Factor** is monitored to indicate if current spikes deviate from the RMS current value by a given amount.

•   Switching devices, VFDs, and load transients are all causes of current fluctuations. Severe current spikes cause stress to the insulation system.

**Current THD** is monitored to indicate if the power signal distortion exceeds a given value.

•   VFDs, single-phase loads, and computers are all causes of harmonic distortion, and result in overheating of the winding insulation.

**Self Impedance Imbalance** is monitored to indicate if impedance on any phase deviates by a given percentage from the average impedance.

•   Stator winding defects cause inconsistent variations in the phase relationship between voltage and current in each phase leading to motor failure.

# DC Assets

The DC EMAX Power test produces a DC Power Time Domain at the end of testing. The Power Domain window is the same for the Armature and Field sections. See Figure 7-17.
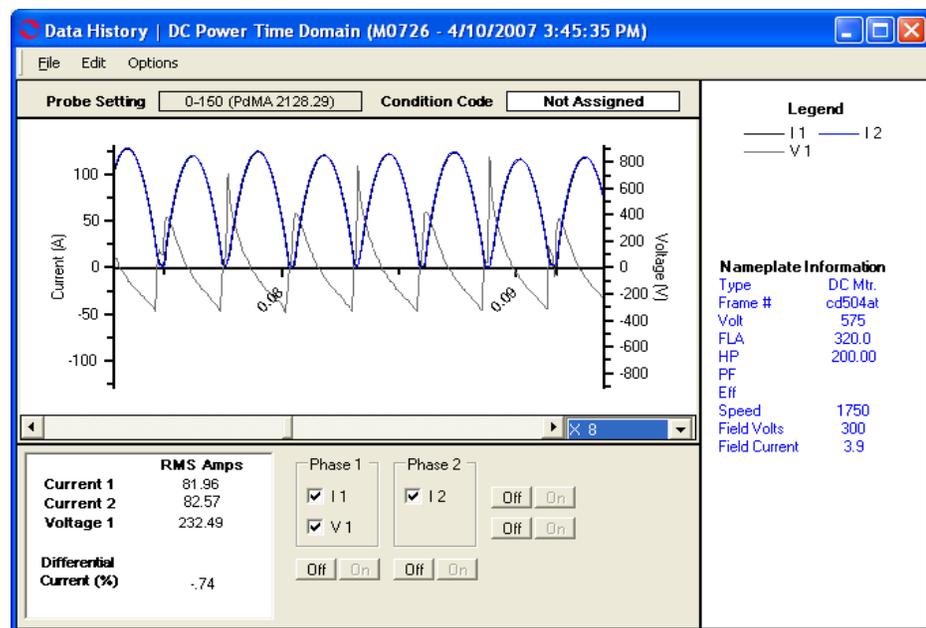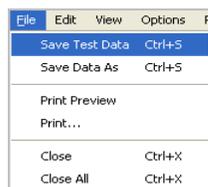
## Power



**Figure 7-17: DC Power Armature Section Results**

## File Menu



### Save Test Data

Selecting File, Save Test Data saves the test data to the Test History file. When the data is saved a message box informs you "Complete". Click **OK**.

Note: Changes made to the appearance of the graph and data is not saved by using the menu save commands. To save the modified spectrum, use Print Preview. From the Print Preview window you can use File, Export to PDF or Export to HTML.

### Save Data As
Selecting File, Save Data As allows you to save the test data to a location you choose. The Save Data window opens, select a location and enter a file name, click **Save**. The file is saved as an .xls file type.

Note: Changes made to the appearance of the graph and data is not saved by using the menu save commands. To save the modified spectrum, use Print Preview. From the Print Preview window you can use File, Export to PDF or Export to HTML.

### Print Preview
Selecting File, Print Preview causes the Rotor Evaluation Spectrum to display as it will print. To print, select the print icon, from the Print window verify the printer destination, and click **OK**. To close the Print Preview, select File, Close or click the close button 🗙 in upper right corner.

### Print
Selecting File, Print causes the Print window to open, verify the printer destination, and click **OK**.

### Close
Selecting File, Close closes the Test Results window. If you have not saved the test data you will be asked if you want to save.

### Close All
Selecting File, Close All closes all Test Results windows associated with the Eccentricity test that are open. If you have not saved the test data you will be asked if you want to save.
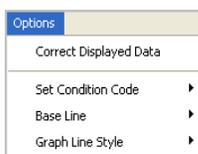
## Edit

### Create Message (Ctrl+M)
Selecting Edit, Create Message opens the Compose Asset Message window. Use this function to add a message/note to the asset record. The messages/notes can be read using the Message Center. Compose Asset Message and the Message Center are discussed in Chapter 3- MCEGold, Message Center on page 3-41.
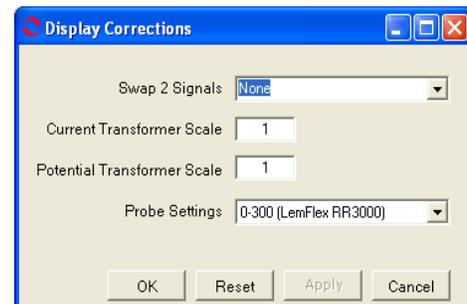
## Options

### Correct Displayed Data
Selecting Options, Correct displayed Data allows you to Swap 2 Signals, change the Current and Potential Transformer Scale and change the Probe Settings.

Make the desired adjustments and click OK to make the changes and close the Display Corrections window or Apply to make the changes and leave the window open.

**Set Condition Code**
Selecting Options, Set condition Code displays the submenu
shown on the right. Click on the desired condition code.

**Baseline**
Selecting Options, Baseline displays the
Set As Baseline option. This sets the test
results as the baseline.

**Graph Line Style**
electing Options, Graph Line Style displays the sub menu
containing options to Show Patterns and Show Markers on the
test results graph. A check mark indicates the option is active.

## Display Options

**Magnification**
The drop down list located to the lower right of the test results graph
allows you to increase or decrease the magnification of the graph.
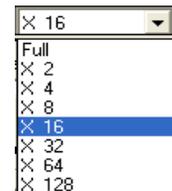
**Phase 1 and Phase 2**
The Phase 1 and Phase 2 areas of the Time Domain
window are used to add or remove lines on the
graph. They may be controlled individually using
the check boxes or in combination using the Off/
On buttons.
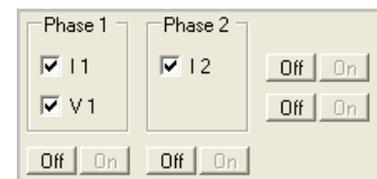
## Review Power Time Domain

To verify the signal capture is valid, review the Time Domain display. When reviewing the
display, ensure all three current signals are visible.

The Time Domain display shows if any of the following occurred, which invalidates the
test data:

- Improper probe selection
- Improper range selected on current probes
- Improper probe connection
- Probes not energized during testing
- Motor speed not constant during testing
- Signal failure at the end of the test

Verify that the proper range was selected on the current probes by looking at the display of
the three current signals. Flat peaks at the tops of the sine waves indicate that clipping
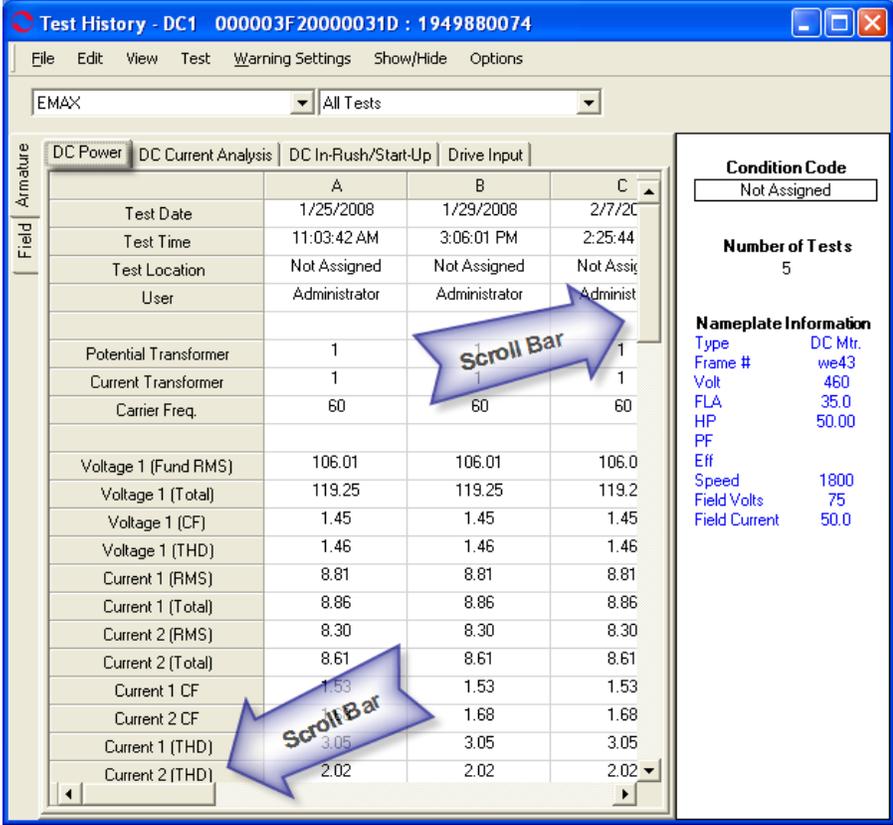
occurred. This happens when the range on the probes is too low and the current signals overdrive the probes.

Verify that the probes were energized and connected properly. If a phase has a very low amplitude and is extremely erratic, the probe could have been improperly connected or not turned on. An erratic signal can also be caused by noise.

Verify that the motor speed was constant during the entire test. Varying peak-to-peak values of current are an indication of load changes. Change the scale of the display to full by selecting full from the scale drop-down list box. Look at the entire waveform and verify that there were no peak-to-peak variations throughout the entire display. The graph may be scrolled by using the arrow keys on the keyboard or the slide bar located above the graph.

## Review the Test History

To review the Test History, highlight the asset in the Site Navigator or WatchList and click the Test History icon on the toolbar. In the Test History window select EMAX from the drop down list and the Power tab. Locate the test by using the scroll bar at the bottom of the window. Figure 7-17 shows the Test History window for an DC asset, EMAX Power test. The Test History window menus and functions are discussed in Chapter 3 - MCEGold, page 3-28.



**Figure 7-18: Test History - EMAX Power DC Asset**

The top four lines on the Test History show the Date and Time the test was taken, Test Location, and User (person performing the test). Next the Potential Transformer, Current Transformer, and Carrier Frequency information is displayed. These are entered during the test setup.

The Condition Code, Number of Tests that have been performed on the motor, and Nameplate information is displayed along the right side of the window.

There are a number of parameters in the Test History which have Caution and Alarm Warning Levels associated with them. First, look at the parameters with Caution and Alarm setpoints. Then, look at the other parameters which do not have warning levels.

### Parameters with Warning Levels

**Voltage (THD)** is taken on the 3-phase line side of an energized DC motor drive. It is the RMS value of the voltage signal with the line frequency removed. A perfect 60 Hz sine wave would have 0% THD. Another way of defining THD is that it is the ratio of the root mean square of the harmonic content to the root mean square value of the fundamental quantity, expressed as a percent of the fundamental. This value is only provided from a Drive Input test for the armature section of a DC motor.

**Current (THD)** is taken on the 3-phase line side of an energized DC motor drive. It is the RMS value of the current signal with the line frequency removed. A perfect 60 Hz sine wave would have 0% THD. Another way of defining THD is that it is the ratio of the root mean square of the harmonic content to the root mean square value of the fundamental quantity, expressed as a percent of the fundamental.

**Differential Current** is the percent difference in current going into and returning from the armature or field windings under test. Increasing differential current due to dropping values of return current may be indicative of increasing leakage current. This value is provided for armature and field sections of a DC motor.

# Warning Settings

Warning levels can be set for each individual asset to indicate problems that exist within that asset or asset circuitry. Warnings can be set at both the Caution and Alarm levels. Caution levels indicate less severe conditions than Alarm levels. Predefined default levels are set in MCEGold by PdMA and may be changed by the user. Based on experience the default values may be changed to be more or less conservative. Test results which exceed the Caution setpoint are shown in yellow and test results which exceed the Alarm setpoint are shown in red.

In addition to providing Caution and Alarm warnings based on a parameter varying from a setpoint, MCEGold can provide warnings based on parameters changing from a baseline reading. Again, test results which exceed the Caution value are shown in yellow and results which exceed the Alarm value are shown in red.

Default warning setpoints are based on testing at the MCC. As you gain experience with the MCE tester, you may choose to narrow the range of acceptable values. The condition of the motor and the importance of its application to your operation or process are other factors that must be considered when setting up the warning levels within MCEGold.

Changing the warning levels will affect all subsequent, as well as all previous tests. Therefore, whenever a warning level is changed, an uneditable message is automatically entered into the motor notes.

Warning levels may be set on the parameters listed below:

> Voltage THD (LL) [>#]
> Current THD [>#]
> Differential Current [>#, Base+-#]

The information inside the brackets describes how the Caution or Alarm level is set; "<" is less than; ">" is greater than; "Base" indicates the baseline value; "+" means baseline plus this value; "-" means baseline minus this value; # is the numeric value for the Caution or Alarm for that parameter.

For the settings which do not reference a baseline, the value obtained will be in Caution or Alarm if it is greater than the numbers entered into the Caution and Alarm boxes for the parameters.

For example, for Fp Amplitude the value obtained will be in Caution or Alarm if it is less than the numbers entered into the Caution and Alarm boxes for the parameters.

A test point without brackets indicates that there is not a default value.

# Change Warning Settings

Warning Settings are changed using the Asset Manager, Warning Settings on the home page. This is discussed in Chapter 3-MCEGold, page 3-3. They may also be changed using the Warning Settings menu on each Test History window. See the Test History information for each test for more information.