CHAPTER 6: EMAX CURRENT 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. EMAX Auto is discussed in detail on page 6-18.

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 6-3.

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 test desired. EMAX Auto, Rotor Evaluation, Eccentricity, In-Rush/Start-Up, and Demod are Current Analysis tests. Power is the Power Analysis test and is discussed in Chapter Seven.

   Note: Each test is discussed in detail in the Step-by-step Procedures.
6. Connect the current probes and select the correct current range.
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 tab, located across the top of the History Chart, corresponding to the desired test data.

INTRODUCTION

Current analysis utilizes three-phase simultaneous current measurements to perform rotor bar and eccentricity analysis, in-rush/start-up trending, and high frequency spectrum analysis.

Rotor bar defects result in high temperatures and loss of torque in the motor. By evaluating the amplitude of the pole pass frequency (F_p) sidebands, EMAX indicates broken rotor bars before damage can occur to the stator windings.

Static or dynamic eccentricity results in increased vibration and potential rotor/stator rubbing. Uncorrected, this condition could cause catastrophic failure of the stator windings and/or reduce the life of the bearings. By evaluating the eccentricity frequency and its associated sidebands, EMAX indicates the condition of the air gap.

The most severe electrical and mechanical stresses applied to a motor occur during start-up. As much as seven times the normal full load amperage can be applied during the start-up. By monitoring the in-rush/start-up current, faults or anomalies which are evident under these conditions, but not during normal operation, can be identified. Trending and comparison of the in-rush/start-up time domain signature to the motor's baseline test allows for early indication of rotor or stator degradation and load or operational changes.

High frequency spectrum analysis is used to confirm stator winding defects and perform mechanical fault diagnostics.

GETTING STARTED

Current analysis is performed with the motor circuit energized. A 70% of the rated load, or greater, is recommended (but not required) to maximize the analysis capability of EMAX.

WARNING:

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

There are four AC tests performed by the Current Analysis program: Rotor Evaluation, Eccentricity, In-Rush/Start-Up, and Demod. There are two DC tests performed by the Current Analysis program: DC Current Analysis, DC In-Rush/Start-Up.

The EMAX AC Current test leads consist of three individual iron core current probes and are connected through a 3 BNC to a DB 9 adaptor cable. The EMAX DC Current test leads consist of two individual Hall Effect current probes and are connected through a 3 BNC to a DB 9 adaptor cable. The BNC side of the adaptor is color coded black for Phase 1, blue for Phase 2, and red for Phase 3. The DB9 side of the adaptor cable connects 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. When connecting the two clamp-on current probes to the armature or

field leads of the DC motor, ensure that the arrows on the current probes point in the direction of the current flow through the cables.

The Current Analysis program is started by selecting an asset from the MCEGold Site Navigator and then the Test Selection icon on the toolbar. MCEGold software options are covered in Chapter Three. Detailed testing procedures are covered in the Step-by-Step Testing Procedures section of this chapter.

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: For an AC asset selecting the EMAX Auto  icon on the tool bar automatically runs the Rotor Evaluation, Eccentricity, Power, and Demod tests using either the default or previously saved test settings. For a DC asset selecting the EMAX Auto  icon on the tool bar automatically runs the DC Power and DC Current Analysis 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  on the tool bar.

The Test Selection window is shown in Figure 6-1. 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.

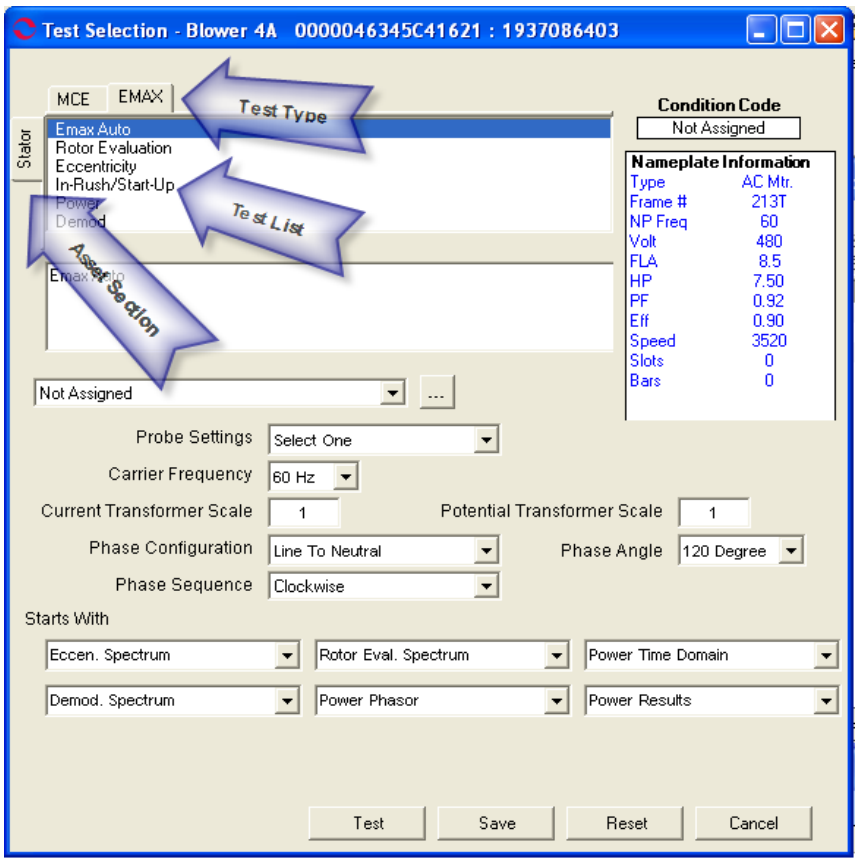


Figure 6-1: EMAX Test Selection Window

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 of the manual shows a screen capture of each test type, by asset type and is followed by a description of the set-up options.

AC Assets

EMAX Auto

The EMAX Auto test set-up selections shown in Figure 6-2 apply to AC Induction, Synchronous, and Wound Rotor assets. Each option is discussed in the Set-up Options section beginning on page 6-13.

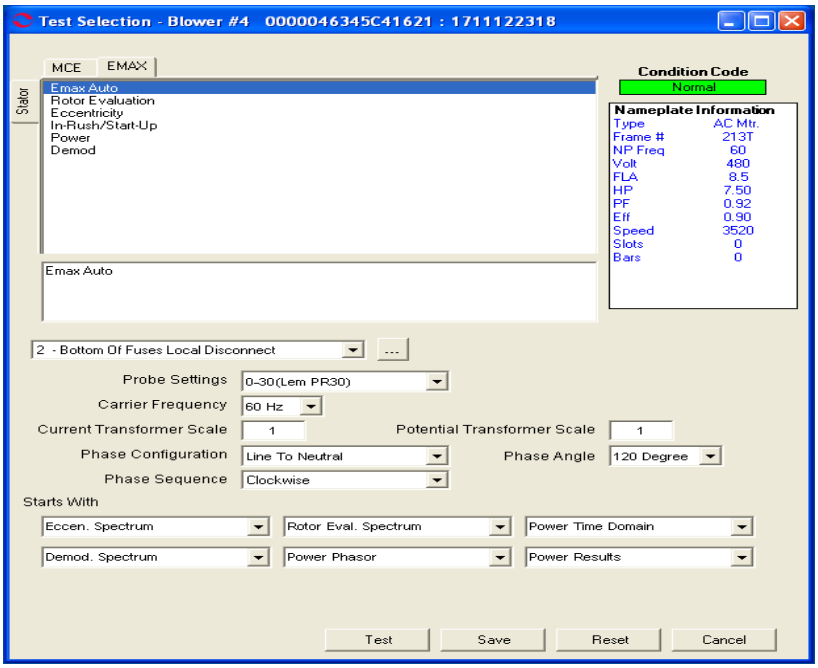


Figure 6-2: Test Set-up Window for AC Assets

Rotor Evaluation

The Rotor Evaluation test set-up selections shown in Figure 6-3 apply to AC Induction, Synchronous, and Wound Rotor assets. Each option is discussed in the Set-up Options section beginning on page 6-13.

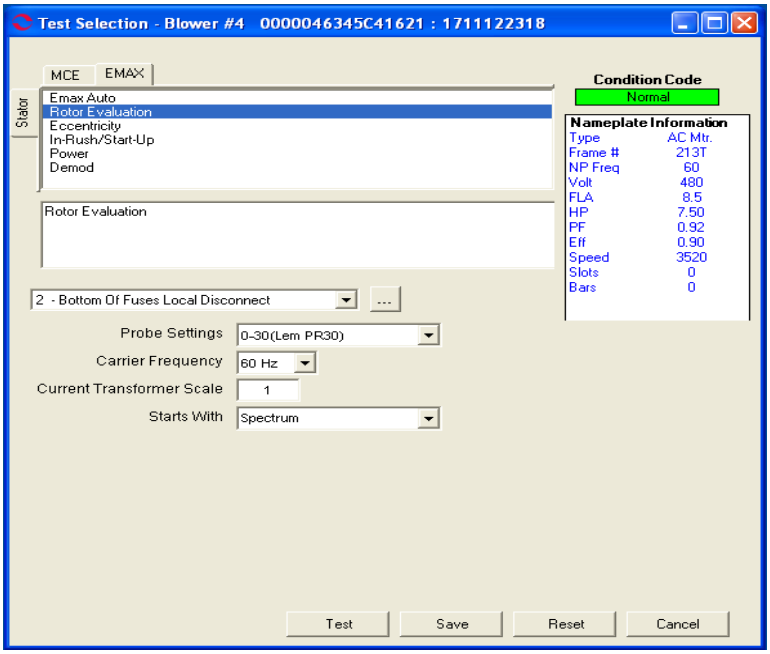


Figure 6-3: Test Set-up Window for Rotor Evaluation

Eccentricity

The Eccentricity test set-up selections shown in Figure 6-4 apply to AC Induction, Synchronous, and Wound Rotor assets. Each option is discussed in the Set-up Options section beginning on page 6-13.

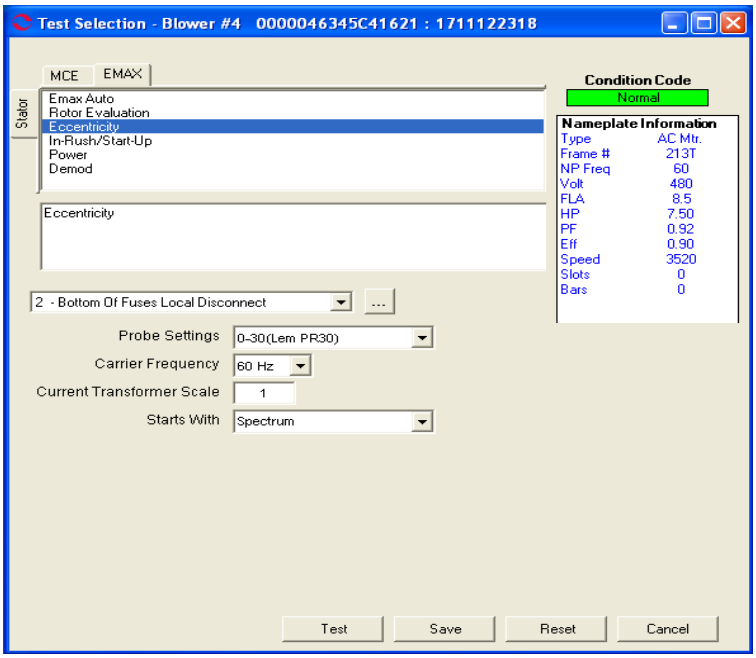


Figure 6-4: Test Set-up Window for Eccentricity

In-Rush/Start-Up

The In-Rush/Start-Up test set-up selections shown in Figure 6-5 apply to AC Induction, Synchronous, and Wound Rotor assets. Each option is discussed in the Set-up Options section beginning on page 6-13.

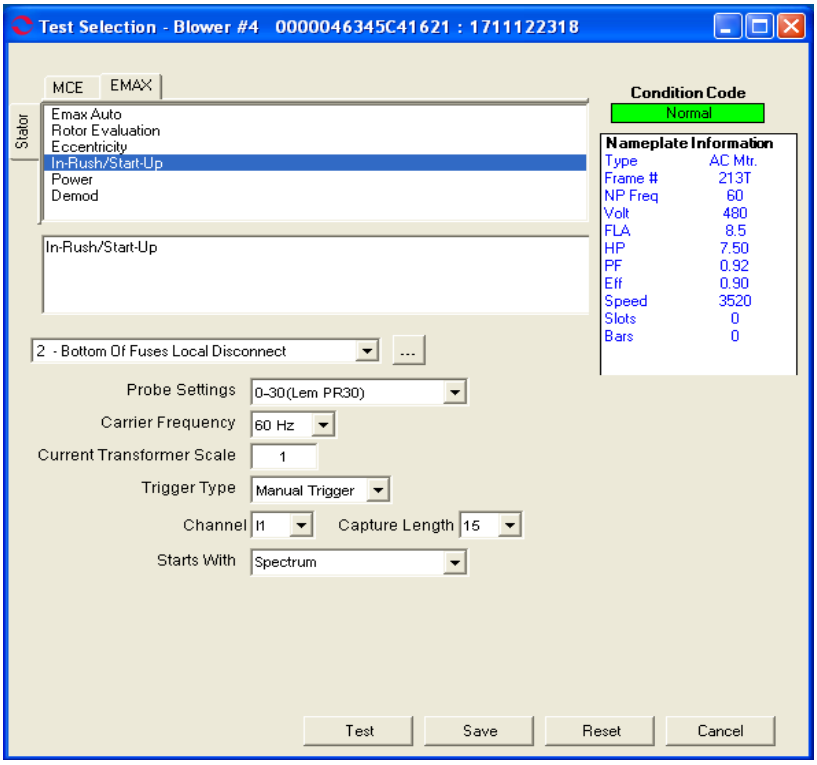


Figure 6-5: Test Set-up Window for In-Rush/Start-Up

Demod

The Demod test set-up selections shown in Figure 6-6 apply to AC Induction, Synchronous, and Wound Rotor assets. Each option is discussed in the Set-up Options section beginning on page 6-13.

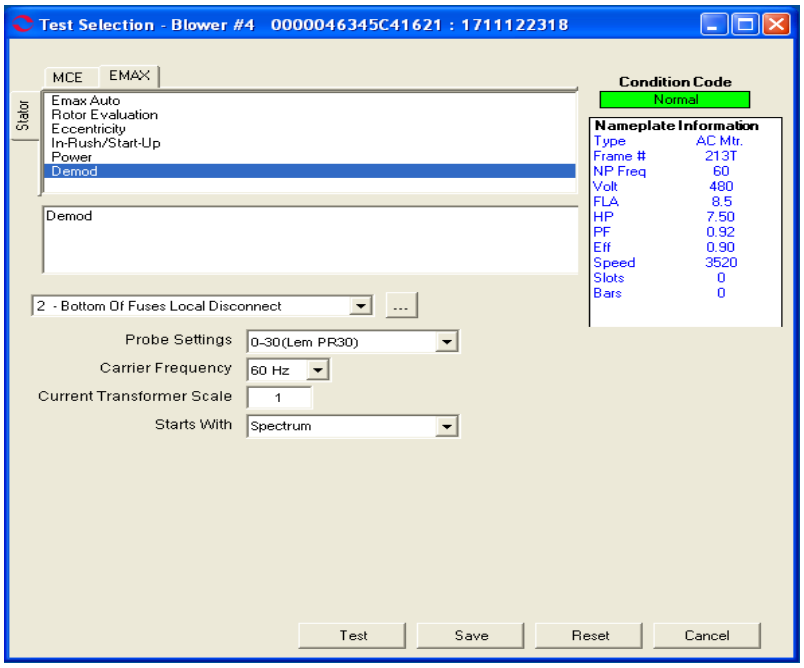


Figure 6-6: Test Set-up Window for Demod

DC Asset

DC EMAX Auto

The DC EMAX Auto test is performed only on the armature section of a DC asset. The DC EMAX Auto test set-up selections shown in Figure 6-7 apply to DC assets. Each option is discussed in the Set-up Options section beginning on page 6-13.

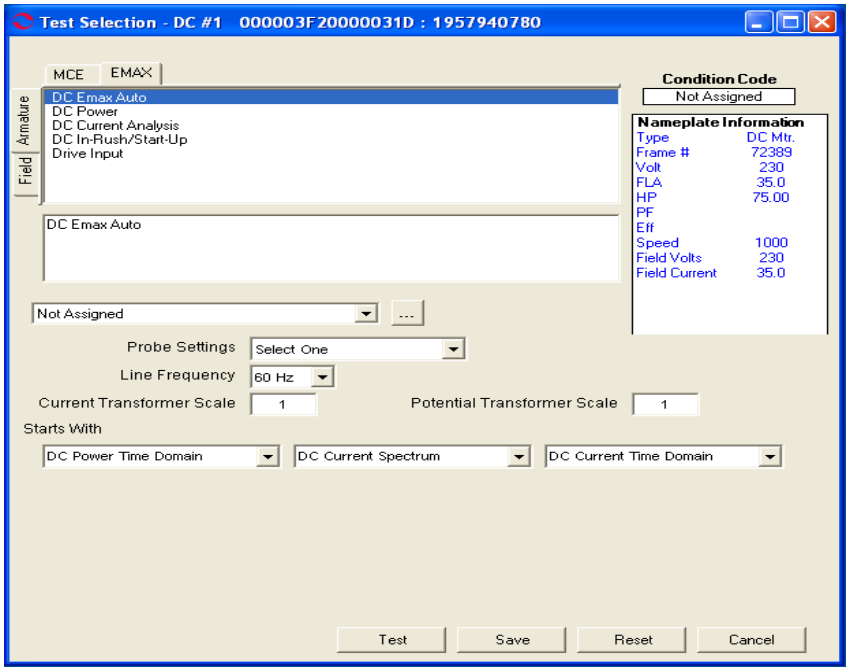


Figure 6-7: Test Set-up for DC Asset DC EMAX Auto

DC Current Analysis

DC Current Analysis is performed only on the armature section of a DC asset. The DC Current Analysis test set-up selections shown in Figure 6-8 apply to DC assets. Each option is discussed in the Set-up Options section beginning on page 6-13.

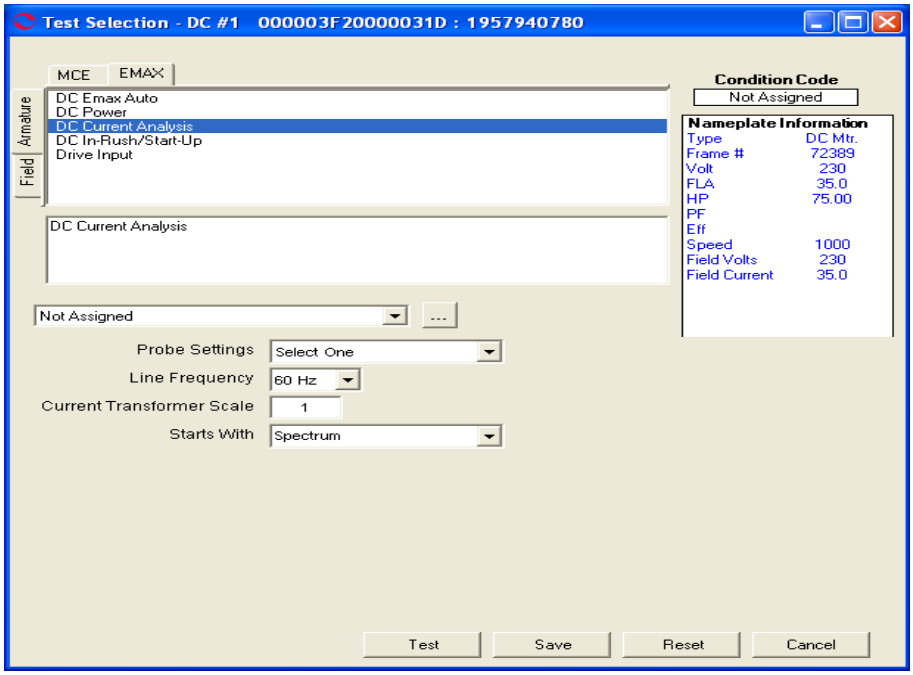


Figure 6-8: Test Set-up for DC Asset - DC Current Analysis

DC In-Rush/Start-Up

DC In-Rush/Start-Up is performed on both the armature and field sections of a DC asset. The DC In-Rush/Start-Up test set-up selections shown in Figure 6-9 apply to DC assets. Each option is discussed in the Set-up Options section beginning on page 6-13.

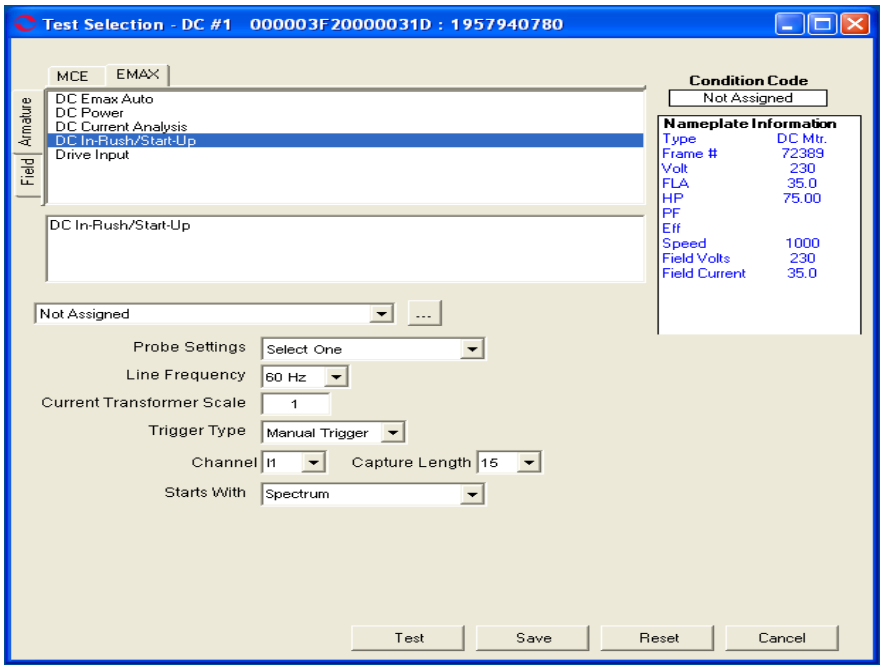


Figure 6-9: Test Set-up for DC Asset - DC In-Rush/Start-Up

Drive Input

Drive Input test is performed only on the armature section of a DC asset. The Drive Input test set-up selections shown in Figure 6-10 apply to DC assets. Each option is discussed in the Set-up Options section beginning on this page.

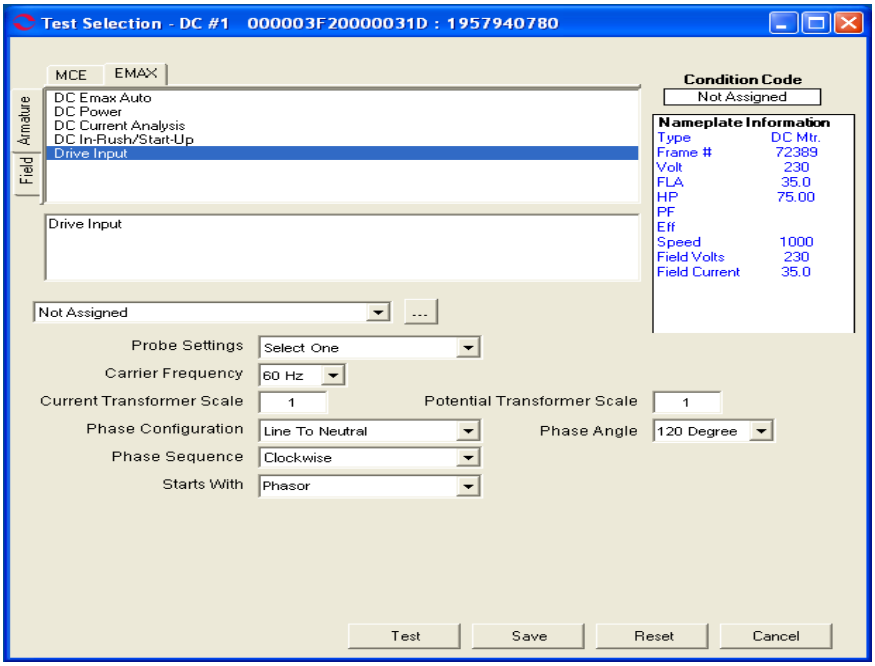


Figure 6-10: Test Set-up for DC Asset - Drive Input

Set-up Options

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 6-11. 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.**

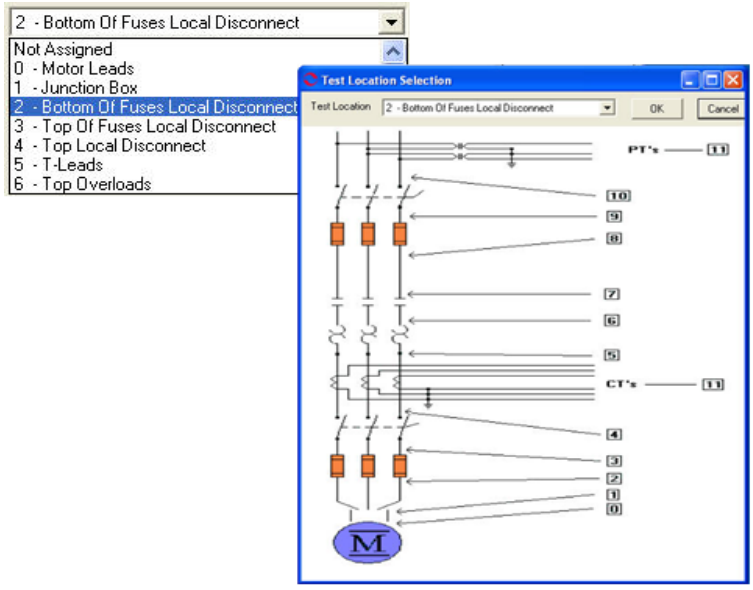
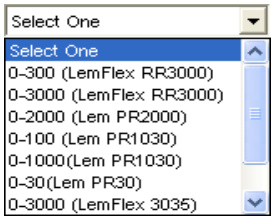


Figure 6-11: Asset Test Location

Probe Settings

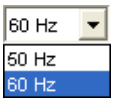
Probe Settings selection is available for all asset types and tests. This is a required field.



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.

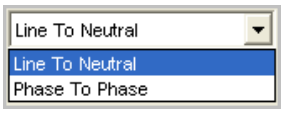
Potential Transformer Scale

This setting is only available for the EMAX Auto test for AC and DC assets, AC Power tests (see Chapter 7), and for the Drive Input test for DC Assets.

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

Phase Configuration

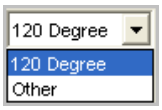
This setting is only available for the EMAX Auto test for AC assets, AC Power tests (see Chapter 7), and Drive Input for DC assets.



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, AC Power tests (see Chapter 7), 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.

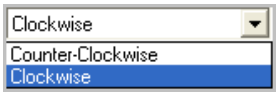
Missing Currents

This setting is only available for the EMAX Auto test for AC assets, AC Power tests (see Chapter 7), and DC Drive Input test when Phase-to-Phase is selected in the Phase Configuration setting.

Select the missing currents from the drop down list. The choices are None, 1, 2, or 3.

Phase Sequence

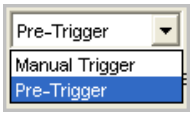
Phase Sequence is only available for the EMAX Auto test for AC assets, AC Power tests (see Chapter 7), and DC Drive Input test for DC assets.



Select the Phase Sequence from the drop down list. The choices are Clockwise and Counter-Clockwise.

Trigger Type (In-Rush/Start-Up only)

For the In-Rush/Start-Up test, use the Trigger Type drop down list to select between Manual Trigger and Pre-Trigger. This option applies to both AC and DC assets. If Pre-Trigger is selected the Pre-Trigger Length and Trigger Factor text boxes appear.



Pre-Trigger Length (In-Rush/Start-Up only)

For the In-Rush/Start-Up test when Pre-Trigger is selected as the trigger type it is necessary to select a pre-trigger length (seconds) from the drop down list.

Trigger Factor (In-Rush/Start-Up only)

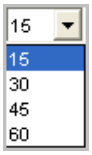
For the In-Rush/Start-Up test when Pre-Trigger is selected as the trigger type it is necessary to select a trigger factor from the drop down list. When the selection is made the software automatically calculates and displays the Trigger Factor on the Test Selection window.

Channel (In-Rush/Start-Up only)

For the In-Rush/Start-Up test, use the Channel drop down list to select between l1, l2, or l3 for AC Assets. For DC Assets there is only one choice, l1. This option applies to both AC and DC assets.

Capture Length (In-Rush/Start-Up only)

For the In-Rush/Start-Up test, use the Capture Length drop down list to select between 15, 30, 45, and 60 seconds capture length. This option applies to both AC and DC assets.



Starts With

EMAX Auto Test

AC Assets. The Starts With section for the EMAX Auto test for AC assets consist of six drop down list boxes. The default selections for an AC Induction asset are shown in Figure 6-12. To change a selection highlight the desired display on the drop down list. The options are shown in Figure 6-13.

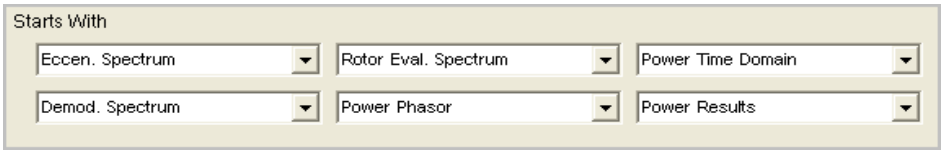


Figure 6-12: Starts With Section for EMAX Auto Test for AC Assets

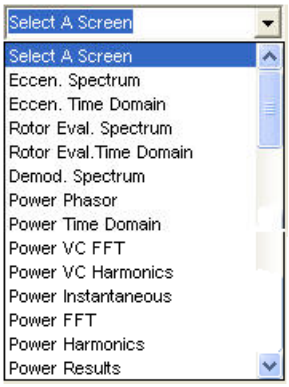


Figure 6-13: Starts With Drop Down List

DC Assets. The Starts With section for the EMAX Auto test for DC assets consist of three drop down list boxes. The default selections for a DC asset are shown in Figure 6-14. The options are: DC Current Spectrum, DC Current Time Domain, and DC Power Time Domain. To change a selection highlight the desired display on the drop down list.

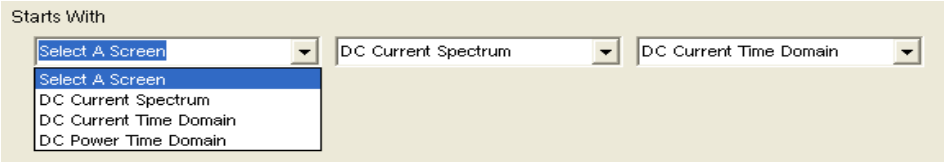


Figure 6-14: Starts With Section for DC EMAX Auto Test for DC Assets

All Other Tests

For all other AC and DC asset tests the Starts With options consist of one drop down list. The options in the list vary according to the test. Figure 6-15 shows the drop down list for an AC Induction asset, Rotor Evaluation test.

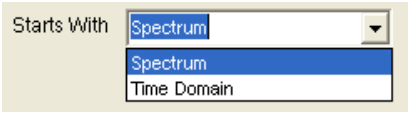


Figure 6-15: Starts With Drop Down List

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 you 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.

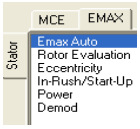
Cancel Button

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 test. This section explains each test by asset type and asset section. The test window is discussed followed by step-by-step testing procedures. Test analysis information begins on page 6-49.

AC Induction Assets



The EMAX tests for an AC Induction asset are EMAX Auto, Rotor Evaluation, Eccentricity, In-Rush/Start-Up, Power, and Demod. Power test is discussed in Chapter 7, EMAX Power Analysis. The remainder are discussed in detail in this section.

EMAX Auto

EMAX Auto test performs a Rotor Evaluation test followed by Eccentricity, Power, and Demod tests, then saves the data and displays the six Test Results windows in the order chosen in the test setup.

EMAX Auto test can be started by clicking the EMAX Auto icon 

on the toolbar or selecting EMAX Auto from the test list in the Test Selection Window. If you select the EMAX Auto icon, the EMAX test begins bypassing the test selection window and displays the Fault Zone Analysis window at the end of testing.

If you need to change the test setup settings or you want to see the graphs of the test results, select the Test Selection icon  on the toolbar.

Step-by-Step EMAX Auto

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 6-16 opens.

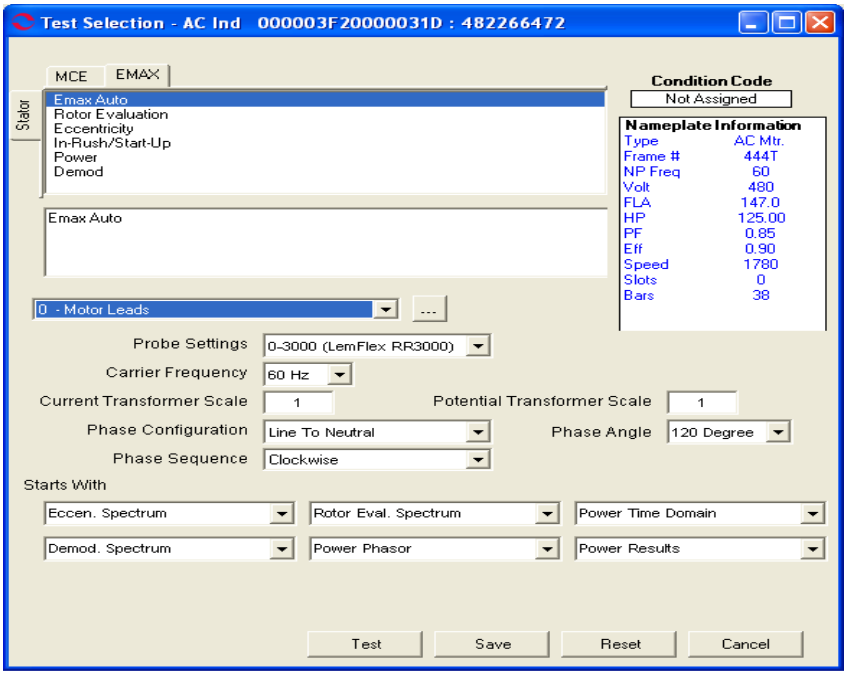


Figure 6-16: EMAX Auto Test Selection Window

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

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

7. Testing begins. A Progress Bar shows the test progress.

8. At the end of testing you will be informed the test data is being saved and the forms loaded. It may take a few minutes depending on the speed of your computer processor. Then the six test results windows chosen during the test setup and an EMAX Auto Test Manager window will open. See Figure 6-17.

   Note: You may position the windows by grabbing the title bar and dragging them to the desired location or using a command from the Windows menu on the menu bar.

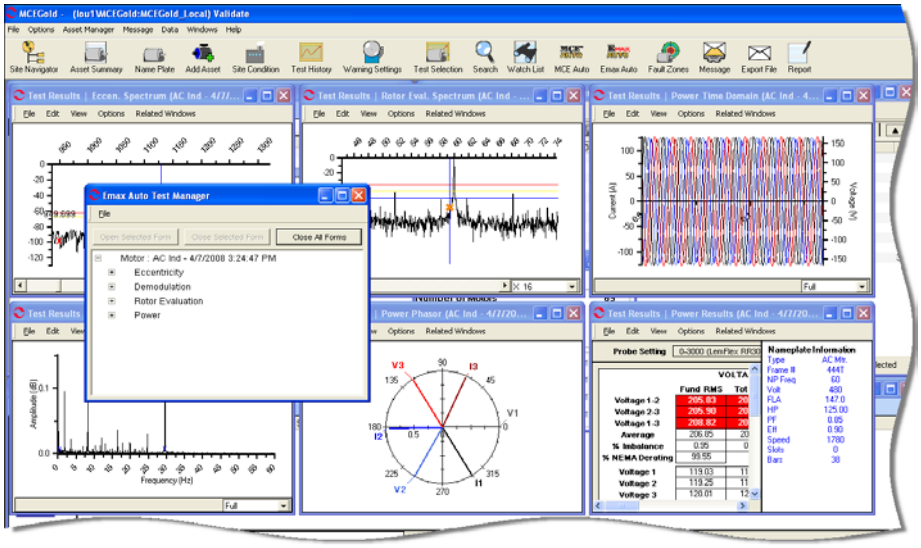


Figure 6-17: EMAX Auto Test Results Windows

9. The EMAX Auto test Manager window shown in Figure 6-18 can be expanded in order to identify which test results are displayed and make changes to the display. Figure 6-19 shows the expanded menu.

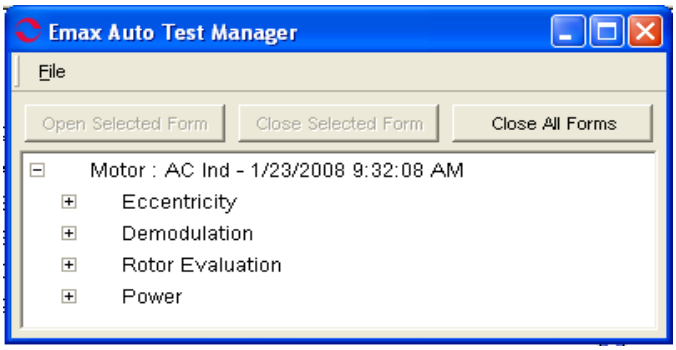


Figure 6-18: EMAX Auto Test Manager Window

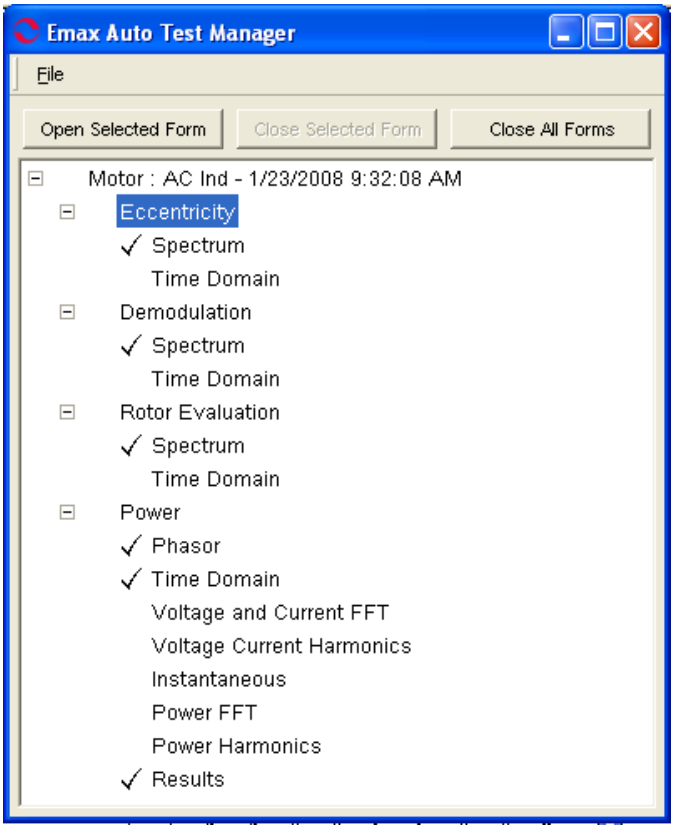


Figure 6-19: EMAX Auto Test Manager Window With Menu Expanded

10. On the expanded EMAX Auto Test Manager menu, a check mark indicates the test results window is displayed. To open a non-displayed window, highlight the desired test results and click **Open Selected Form**.

11. To close a particular test results window, highlight it on the menu and click **Close Selected Form**. The test results window closes.

12. To close all the test results windows, click **Close All Forms**.

13. To close the EMAX Auto Test Manager window select File, Exit or click the Close button in the upper right corner.

14. The test results have been automatically saved and may be viewed using the Test History function.

Rotor Evaluation

Step-by-Step Rotor Evaluation

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 6-20 opens.

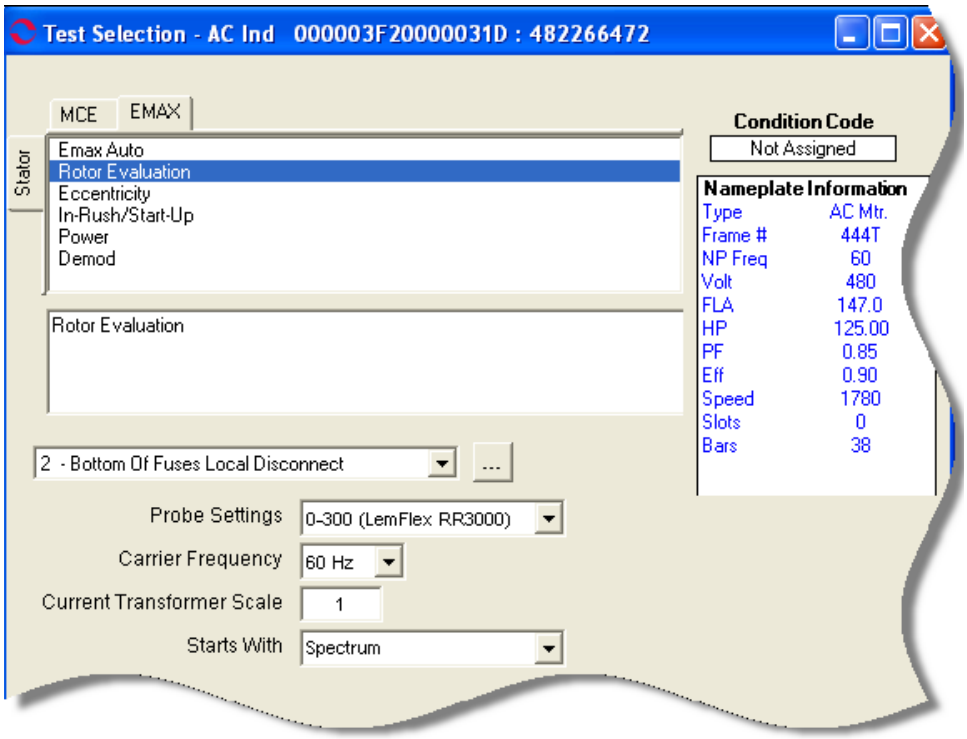


Figure 6-20: Rotor Evaluation Test Selection Window

5. Select EMAX Tab.

6. Select Rotor Evaluation from the test list.

7. Select Asset Test Location. To insure consistent trending and assist in trouble shooting, the actual test location should be stored for each test. 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 6-21. 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.**

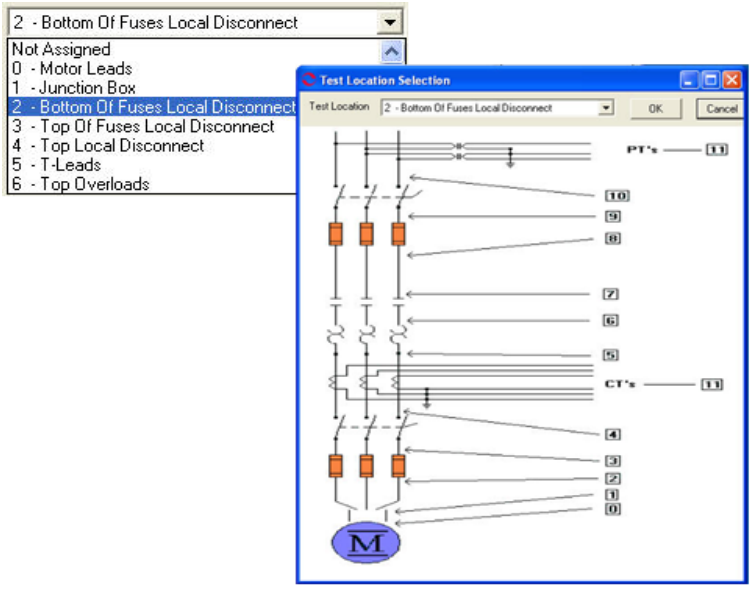


Figure 6-21: Asset Test Location

8. Select the appropriate probes for measuring the current for the asset by clicking on the down arrow to the right of the text box. Highlight the probe from the drop-down list.

9. Select the correct Carrier Frequency by clicking once on the down arrow to the right of the text box. Highlight either 50 Hz or 60 Hz.

10. Enter the correct Current Transformer Scale. Click in the text box and delete the existing number if it is not the correct number, then enter the correct number.

11. Select the Starts With category by clicking once on the down arrow to the right of the text box. Highlight either Spectrum or Time Domain from the drop down list.

12. Click **Save** to save these settings for future testing of this asset. Or click **Reset** to return the original settings. This can only be done if the new settings have not been saved.

13. Connect the current probes to EMAX and the circuit to be measured. Ensure that the arrows on the probes point to the motor.

14. Select the appropriate range on the probes.

15. Click **Test** to begin testing.

16. At the conclusion of testing the Test Results window chosen in step 11 displays the test data.

17. To view the Test Results window for the other graph, select View and the desired graph. A second Test Results window will open.

Note: It is possible to have multiple windows open at the same time. 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.

18. Close the Test Results window by selecting File, Close or clicking the close button in upper right corner.

19. You will be asked if you want to save the changes, click desired answer. The Test Results window closes.

Eccentricity

Step-by-Step Eccentricity

1. Connect the EMAX Data Acquisition cable.

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 6-22 opens.

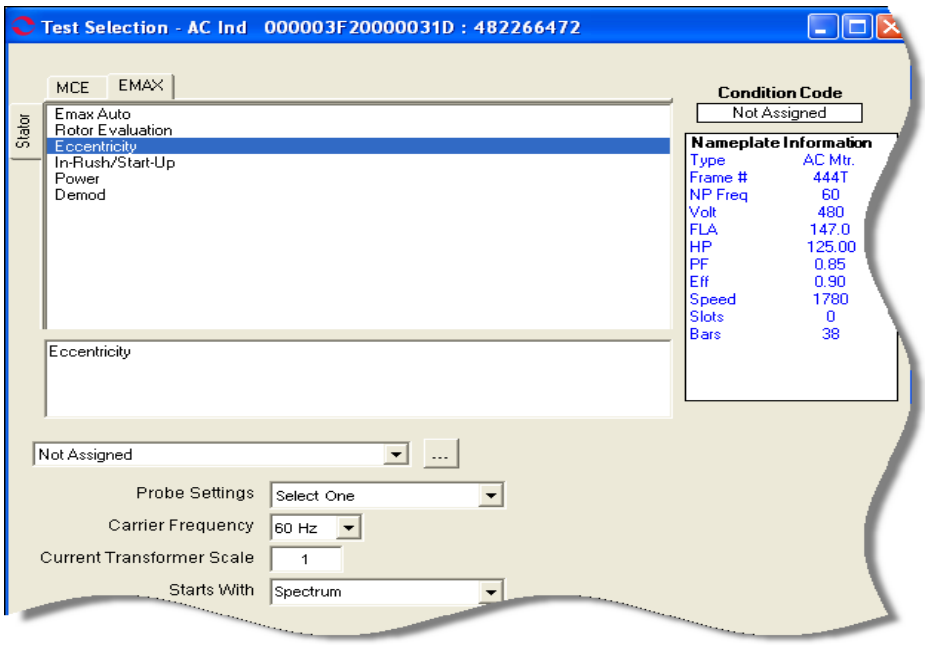


Figure 6-22: Eccentricity Test Selection Window

5. Select the EMAX tab in the Test Type.

6. Select Eccentricity by clicking once on the name in the Test List.

7. Select Asset Test Location. To insure consistent trending and assist in trouble shooting, the actual test location should be stored for each test. 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 6-23. 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.**

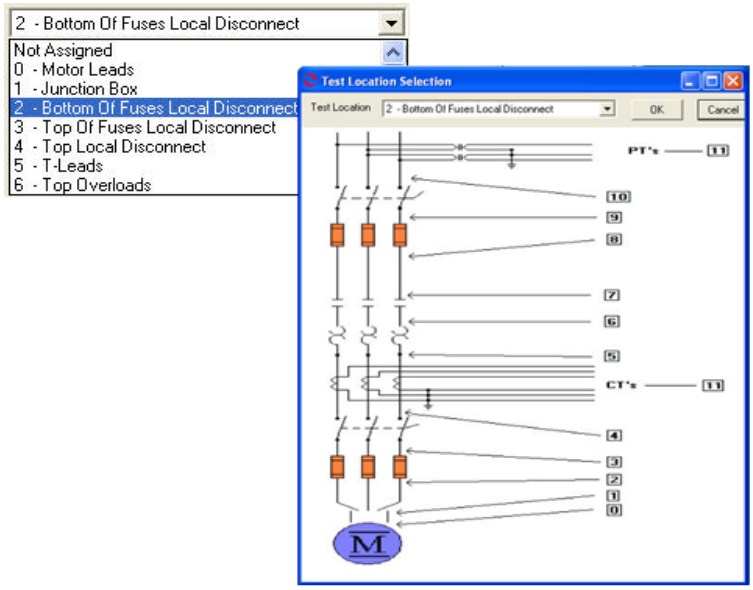


Figure 6-23: Asset Test Location

8. Select the appropriate probes for measuring the current for the asset by clicking on the down arrow to the right of the text box. Highlight the probe from the drop-down list.

9. Select the correct Carrier Frequency by clicking once on the down arrow to the right of the text box. Highlight either 50 Hz or 60 Hz.

10. Enter the correct Current Transformer Scale. Click in the text box and delete the existing number if it is not the correct number, then enter the correct number.

11. Select the Starts With category by clicking once on the down arrow to the right of the text box. Highlight either Spectrum or Time Domain from the drop down list.

12. Click **Save** to save these settings for future testing of this asset. Or click **Reset** to return the original settings. This can only be done if the new settings have not been saved.

13. Connect the current probes to EMAX and the circuit to be measured. Ensure that the arrows on the probes point to the motor.

14. Click **Test** to begin testing. If you have not saved any changes to the setup settings, the system will ask you if you want to save test setup settings at this time.

15. This test only takes two seconds and may not display a progress bar.

16. At the conclusion of testing the Test Results window chosen in Step 11 displays the test data.

17. To view the Test Results window for the other graph, select View and the desired graph. The selected window will open.

Note: It is possible to have multiple windows open at the same time. 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.

18. Close the Test Results windows by selecting File, Close or clicking the close button in upper right corner.

19. You will be asked if you want to save the changes, click desired answer. The Test Results window closes.

In-Rush/Start-Up

NOTE: This test can be performed to monitor load changes if the motor is already running.

Step-by-Step In-Rush/Start-Up

1. Connect the EMAX Data Acquisition cable.

2. Start MCEGold.

3. Highlight the motor being tested in the Site Navigator or Watch List.

4. Select the Test Selection icon on the toolbar. The Test Selection window, shown in Figure 6-24 opens.

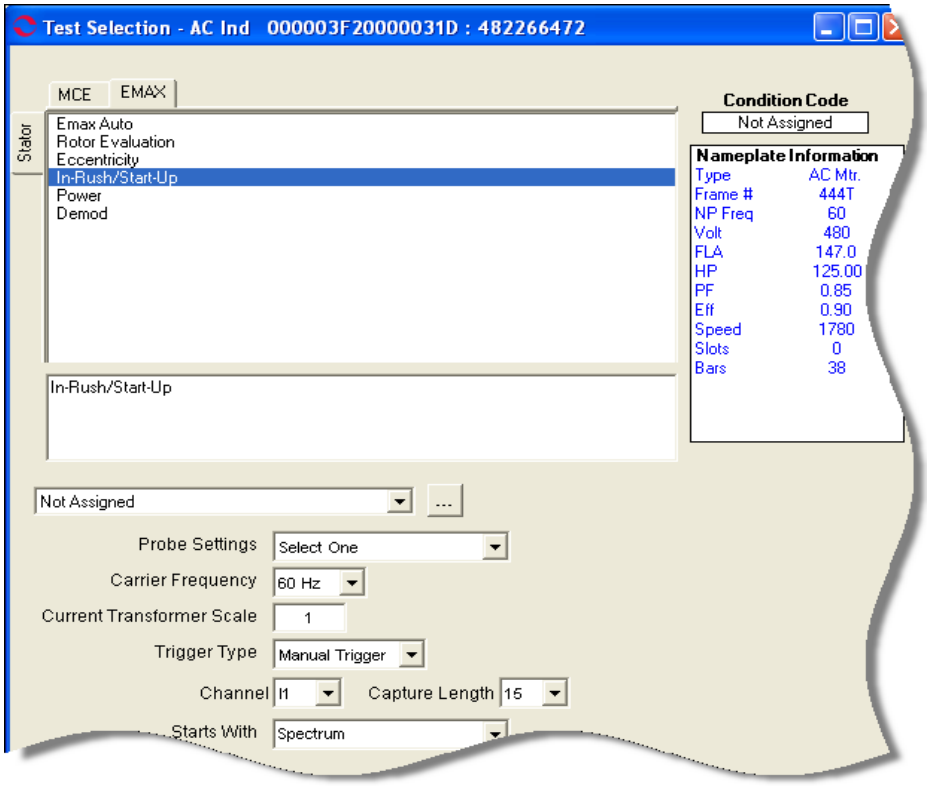


Figure 6-24: In-Rush/Start-Up Test Selection Window

5. Select EMAX tab in the Test Type.

6. Select In-Rush/Start-Up in the Test List, by clicking once on the name.

7. Select Asset Test Location. To insure consistent trending and assist in trouble shooting, the actual test location should be stored for each test. 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 6-25. 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.**

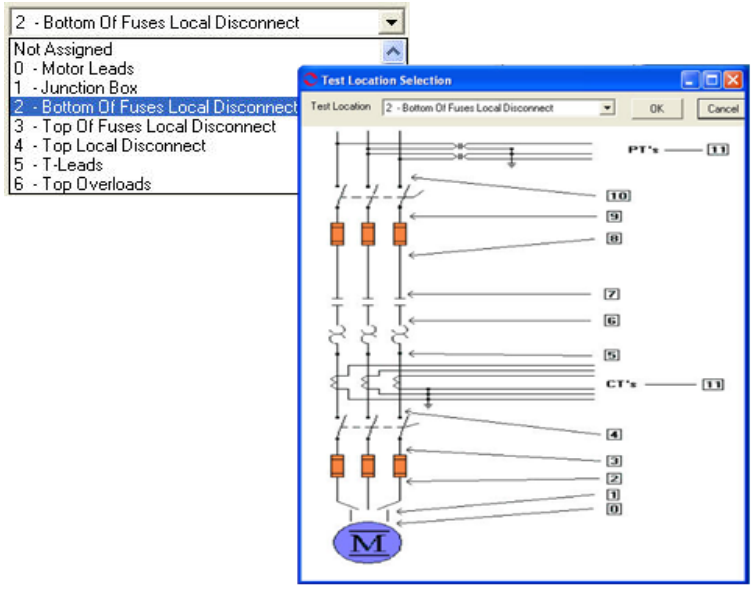


Figure 6-25: Test Location Selection

8. Select the appropriate probes for measuring the current for the asset by clicking on the down arrow to the right of the text box. Highlight the probe from the drop-down list.

9. Select the correct Carrier Frequency by clicking on the down arrow to the right of the text box. Highlight either 50 Hz or 60 Hz.

10. Enter the correct Current Transformer Scale. Click in the text box and delete the existing number if it is not the correct number, then enter the correct number.

11. Select the Trigger Type form the drop down list. The choices are Manual Trigger or Pre-Trigger.

    If Manual Trigger is selected go to step 12.

    If Pre-Trigger is selected it is necessary to select the Pre-Trigger Length by clicking on the down arrow in the Pre-Trigger Length text box to display a list of available seconds. Highlight the desired length.

    Also, if Pre-Trigger is selected it is necessary to select the Trigger Factor by clicking on the down arrow in the Trigger Factor text box to display a list of factors. Highlight the desired factor.

12. Select the Channel. Use the down arrow in the Channel text box to display a list of available channels. Highlight the desired channel.

13. Select the Capture Length. Use the down arrow in the Capture Length text box to display a list of available settings. Highlight the desired length.

14. The Starts With category defaults to Spectrum, the only choice.

15. Click **Save** to save these settings for future testing of this asset. Or click **Reset** to return the original settings. This can only be done if the new settings have not been saved.

16. Connect the current probes to EMAX and the circuit to be measured. Ensure that the arrows on the probes point to the motor.

17. Click **Test** to begin testing. If you have not saved any changes to the setup settings, the system will ask you if you want to save test setup settings at this time.

18. This test only takes two seconds and may not display a progress bar.

19. At the conclusion of testing the In-Rush/Start-Up Spectrum displays test data. This spectrum is discussed in the Analysis section, page 6-63.

20. Close the selected windows by selecting File, Close or clicking the close button in upper right corner.

21. You will be asked if you want to save the changes, click desired answer.

Demod

Demodulation is the process of filtering out the 50/60 Hz carrier frequency and reveals the hidden signals, representing repetitive load variations. These load variations can then be analyzed.

Step-by-Step Demod

1. Connect the EMAX Data Acquisition cable.

2. Start MCEGold.

3. Highlight the motor being tested in the Site Navigator or Watch List.

4. Select the Test Selection icon on the toolbar. The Test Selection window, shown in Figure 6-26 opens.

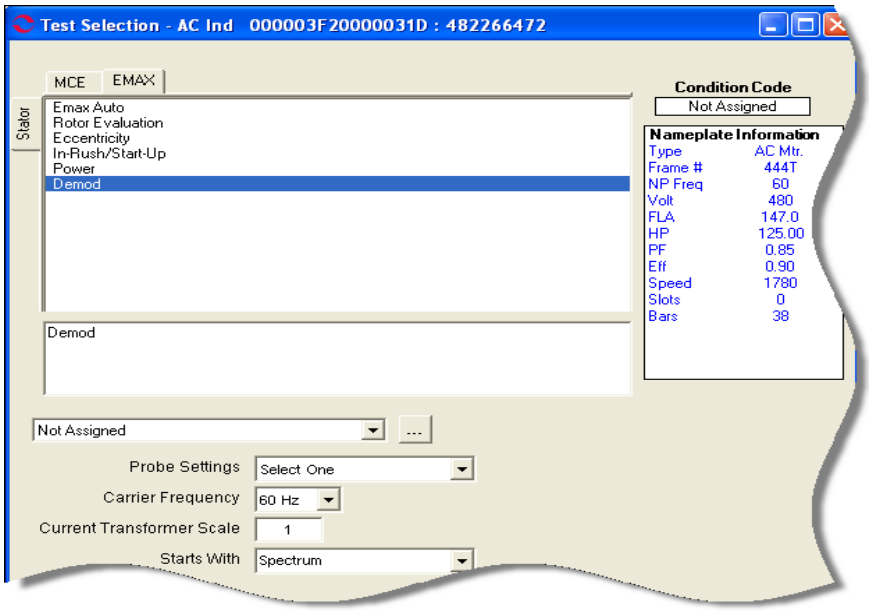


Figure 6-26: Demod Test Selection Window

5. Select EMAX tab in the Test Type.

6. Select Demod in the Test List, by clicking once on the name.

7. Select Asset Test Location. To insure consistent trending and assist in trouble shooting, the actual test location should be stored for each test. 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 6-27 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.**

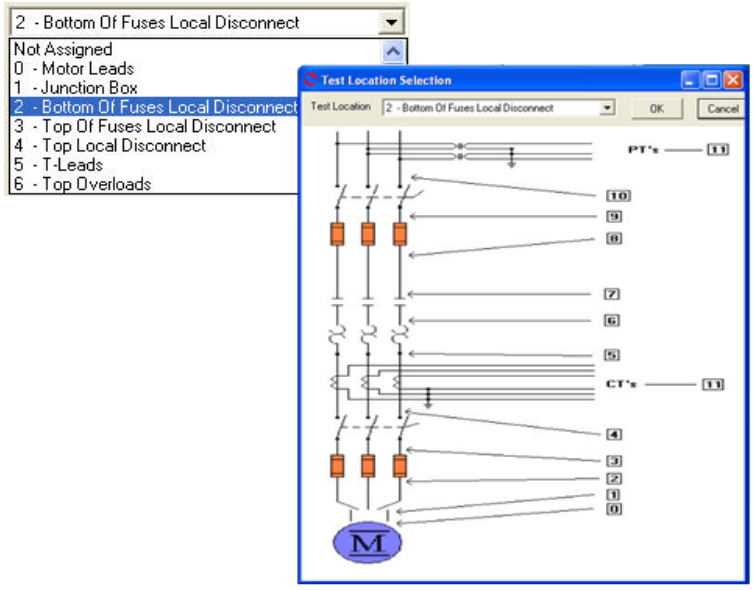


Figure 6-27: Test Location Selection

8. Select the appropriate probes for measuring the current for the asset by clicking on the down arrow to the right of the text box. Highlight the probe from the drop-down list.

9. Select the correct Carrier Frequency by clicking on the down arrow to the right of the text box. Highlight either 50 Hz or 60 Hz.

10. Enter the correct Current Transformer Scale. Click in the text box and delete the existing number if it is not the correct number, then enter the correct number.

11. The Starts With category defaults to Spectrum, the only choice.

12. Click **Save** to save these settings for future testing of this asset. Or click **Reset** to return the original settings. This can only be done if the new settings have not been saved.

13. Connect the current probes to EMAX and the circuit to be measured. Ensure that the arrows on the probes point to the motor.

14. Click **Test** to begin testing. If you have not saved any changes to the setup settings, the system will ask you if you want to save test setup settings at this time.

15. This test only takes two seconds and may not display a progress bar.

16. At the conclusion of testing if the MCEGold software cannot identify the motor speed, the Auto Speed Warning window opens. See Figure 6-28. You may manually check one of the two speed if neither are checked. Select Accept if you agree to an identified speed shown with a check mark or Cancel if you want to search the spectrum for another speed.

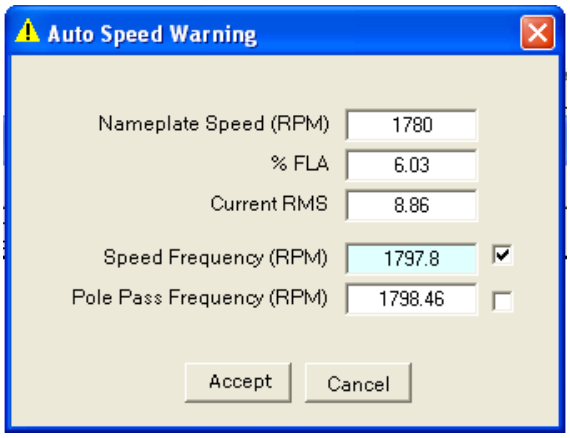


Figure 6-28: Auto Speed Warning Window

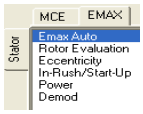
17. The Demod Spectrum window displays test data. This spectrum is discussed in the Analysis section, page 6-69.

18. Close the Test Results window by selecting File, Close or clicking the close button in upper right corner).

19. You will be asked if you want to save the changes, click desired answer. The Test Results window closes.

20. If you selected **Yes**, click **OK** in the Save Status window. If you clicked **No**, the Save Status and Test Results windows close.

AC Synchronous



EMAXAuto

EMAX Auto is the same as EMAX Auto for AC Induction asset. It is discussed on page 6-18.

Rotor Evaluation

The Rotor Evaluation test is the same as Rotor Evaluation test for an AC Induction asset. It is discussed on page 6-20

Eccentricity

The Eccentricity test is the same as Eccentricity test for an AC Induction asset. It is discussed on page 6-23

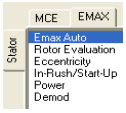
In-Rush/Start-Up

The In-Rush/Start-Up test is the same as In-Rush/Start-Up test for an AC Induction asset. It is discussed on page 6-25.

Demod

The Demod test is the same as Demod test for an AC Induction asset. It is discussed on page 6-28.

AC Wound Rotor



EMAX Auto

EMAX Auto is the same as EMAX Auto for AC Induction asset. It is discussed on page 6-18.

Rotor Evaluation

The Rotor Evaluation test is the same as Rotor Evaluation test for an AC Induction asset. It is discussed on page 6-20.

Eccentricity

The Eccentricity test is the same as Eccentricity test for an AC Induction asset. It is discussed on page 6-23.

In-Rush/Start-Up

The In-Rush/Start-Up test is the same as In-Rush/Start-Up test for an AC Induction asset. It is discussed on page 6-25.

Demod

The Demod test is the same as Demod test for an AC Induction asset. It is discussed on page 6-28.

DC Asset

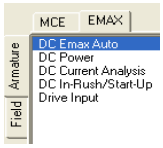
EMAX tests are run on both the Armature and Field sections of a DC asset.

The EMAX tests for the Armature section are DC EMAX Auto, DC Power, DC Current Analysis, DC In-Rush/Start-Up, and Drive Input.

The EMAX tests for the Field section are DC Power and DC In-Rush/Start-Up.

DC Power, which is tested in both the Armature and Field sections is covered in Chapter 7, Power Analysis.

Armature Section Tests



DC EMAX Auto

DC EMAX Auto test can be started by clicking the EMAX Auto icon 

on the toolbar or selecting EMAX Auto from the test list in the Test Selection Window. If you select the EMAX Auto icon, the EMAX test begins bypassing the test selection window and displays the Fault Zone Analysis window at the end of testing.

If you need to change the test setup settings or you want to see the graphs of the test results at the end of testing, select the Test Selection icon  on the toolbar.

Step-by-Step EMAX Auto

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 6-29 opens.

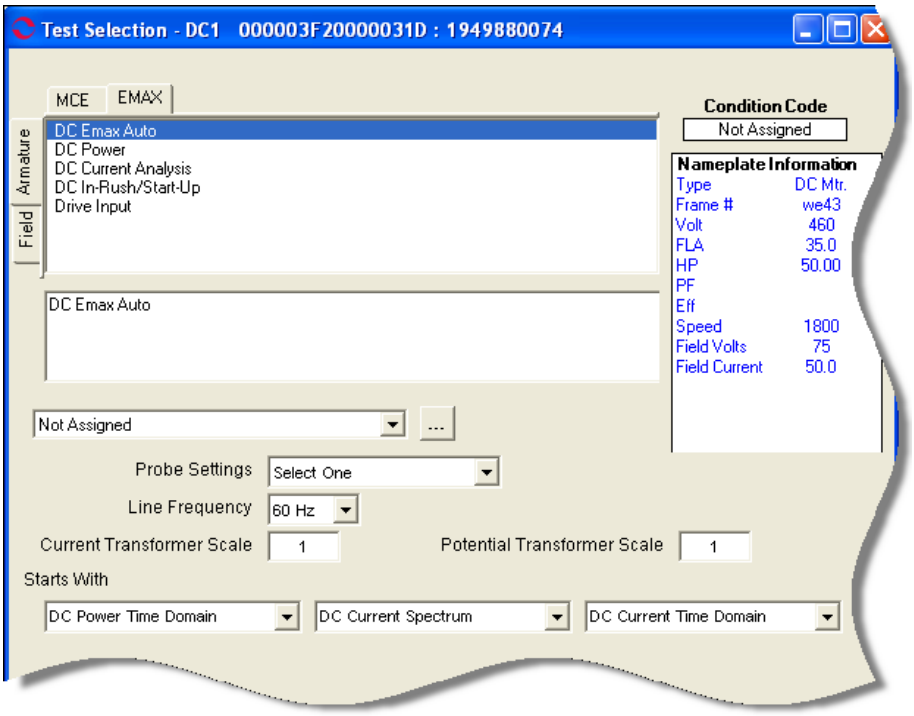


Figure 6-29: DC EMAX Auto Test Selection Window

5. Select EMAX Tab.

6. Select DC EMAX Auto from the test list.

7. Select Asset Test Location. To insure consistent trending and assist in trouble shooting, the actual test location should be stored for each test. 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. 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.** See Figure 6-30.

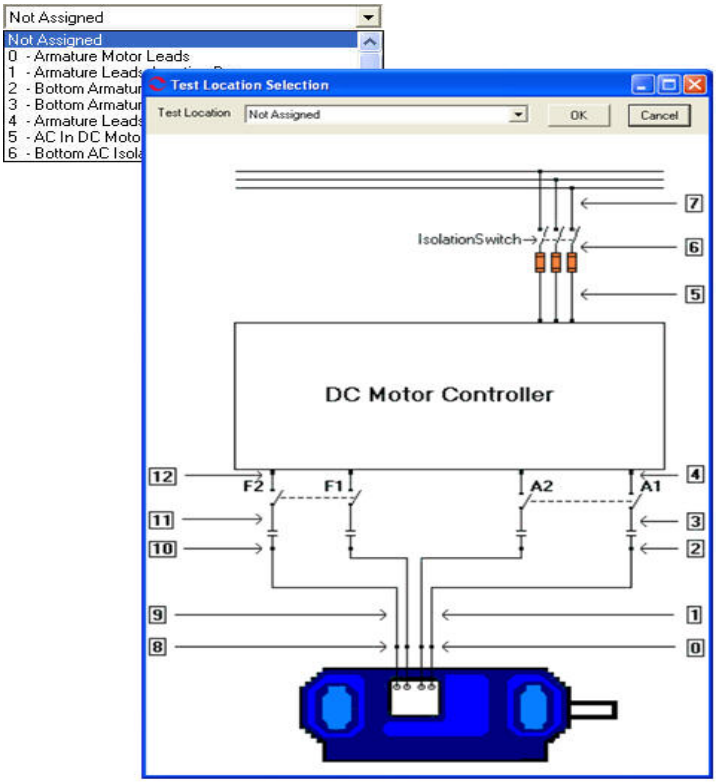
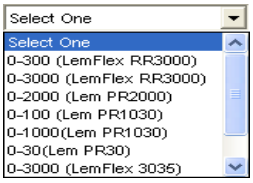
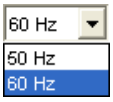


Figure 6-30: DC Asset Test Location

8. Select the Probe Settings from the drop down list, using the scroll bar to see the complete list if necessary.

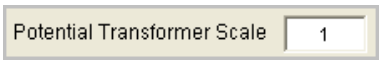


9. Select the Line Frequency from the drop down list. The choices are 60 Hz or 50 Hz.



10. Enter the Current Transformer Scale. Place the cursor in the text box, delete the value and enter the new current transformer scale value.

11. Enter the Potential Transformer Scale. Place the cursor in the text box, delete the value and enter the new potential transformer scale value.



12. Select the Starts With selections by highlighting the desired display on the drop down list. The DC Starts With section is shown in Figure 6-31.

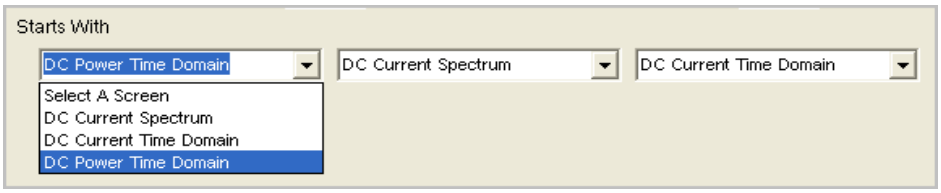


Figure 6-31: Starts With Section for EMAX Auto Test for DC Assets

13. Click **Test**.

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

15. This test only takes two seconds and may not display a progress bar.

16. At the end of testing you will be informed the test data is being saved and the forms loaded. It may take a few minutes depending on the speed of your computer processor. Then the three test results windows chosen during the test setup and an EMAX Auto Test Manager window will open. See Figure 6-32.

    Note: You may position the windows by grabbing the title bar and dragging them to the desired location or using a command from the Windows menu on the menu bar.

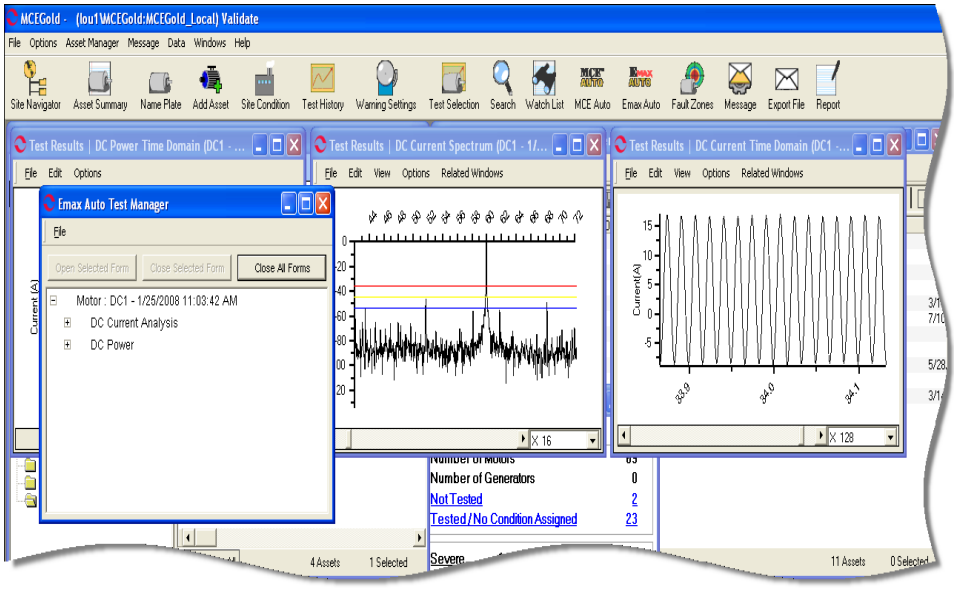


Figure 6-32: EMAX Auto Test Results

17. The EMAX Auto Test Manager window shown in Figure 6-33 can be expanded in order to identify which test results are displayed and make changes to the display. Figure 6-34 shows the expanded menu.

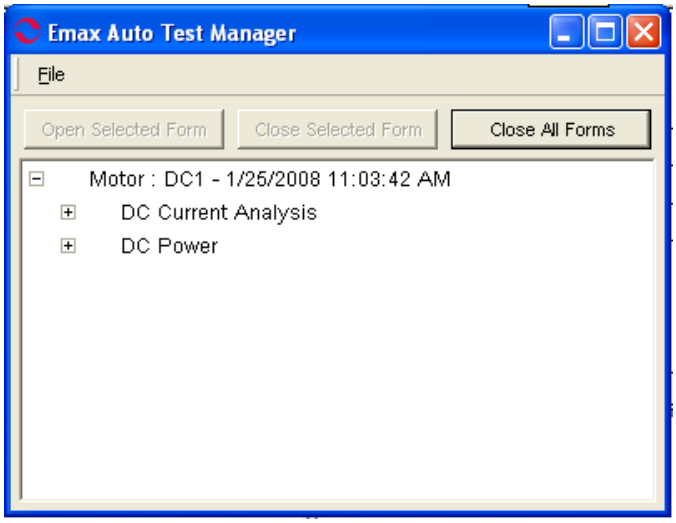


Figure 6-33: DC EMAX Auto Test Manager Window

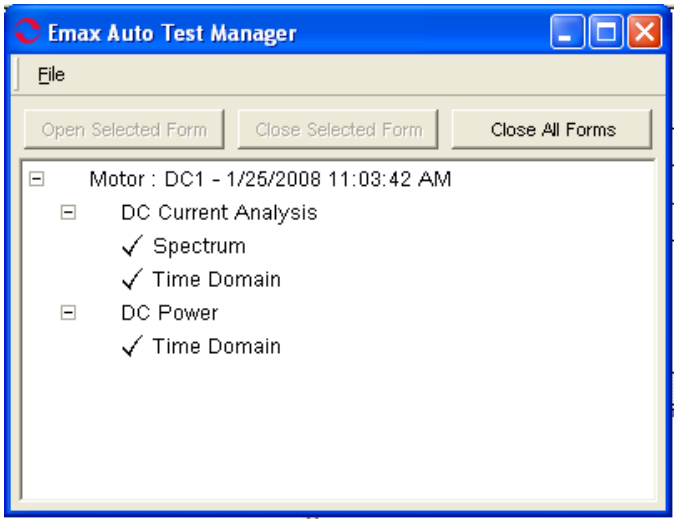


Figure 6-34: DC EMAX Auto Test Manager Window Expanded

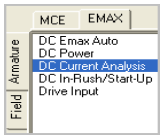
18. On the expanded EMAX Auto Test Manager menu, a check mark indicates the test results window is displayed. To open a non-displayed window, highlight the desired test results and click **Open Selected Form**. The button will not be active until a non-displayed window is highlighted.

19. To close a particular test results window, highlight it on the menu and click **Close Selected Form**. The button will not be active until a displayed window is highlighted. The test results window closes.

20. To close all the test results windows, click **Close All Forms**.

21. To close the EMAX Auto Test Manager window select File, Exit or click the Close button in the upper right corner.

22. The test results have been automatically saved and may be viewed using the Test History function.



DC Current Analysis

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 6-35 opens.

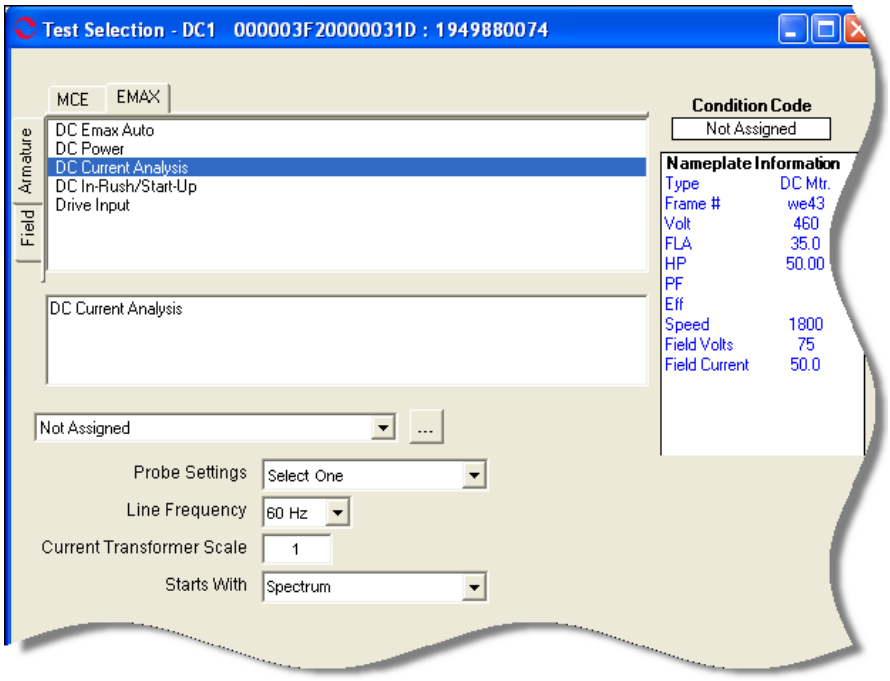


Figure 6-35: DC Current Analysis Test Selection Window

5. Select the EMAX tab from the test type section, the Armature tab (default) from the asset section, and DC Current Analysis from the test list.

6. Select Asset Test Location. To insure consistent trending and assist in trouble shooting, the actual test location should be stored for each test. 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. 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.** See Figure 6-36.

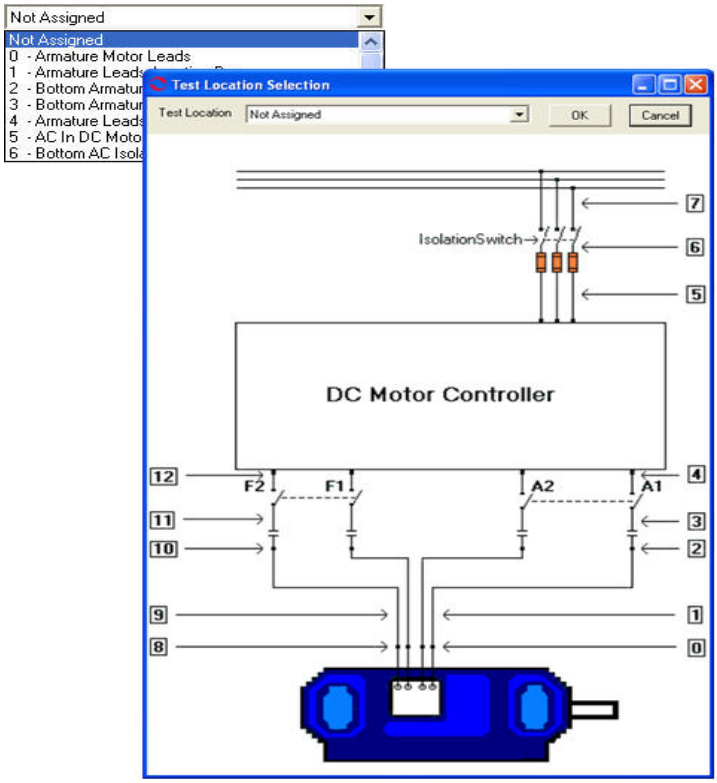
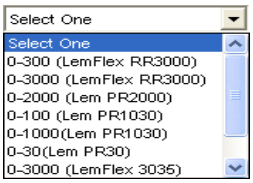
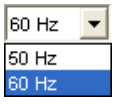


Figure 6-36: DC Asset Test Location

7. Select the Probe Settings from the drop down list, using the scroll bar to see the complete list if necessary.



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



9. Enter the Current Transformer Scale. Place the cursor in the text box, delete the value and enter the new current transformer scale value.

10. Select the Starts With selections by highlighting the desired display on the drop down list. The DC Starts With section is shown in Figure 6-37.

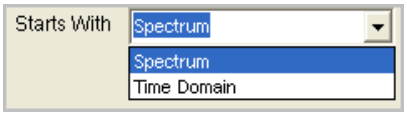


Figure 6-37: Starts With Selection for DC Asset

11. Click **Test**.

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

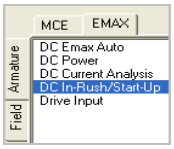
13. This test only takes two seconds and may not display a progress bar.

14. When testing is complete the Test Results window selected in step 10 opens.

15. To close the window used the File, Close menu or click the Close button in the upper right corner.

16. You will be asked if you want to save the test data? Click the desired button.

DC In-Rush/Start-Up



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 6-38 opens.

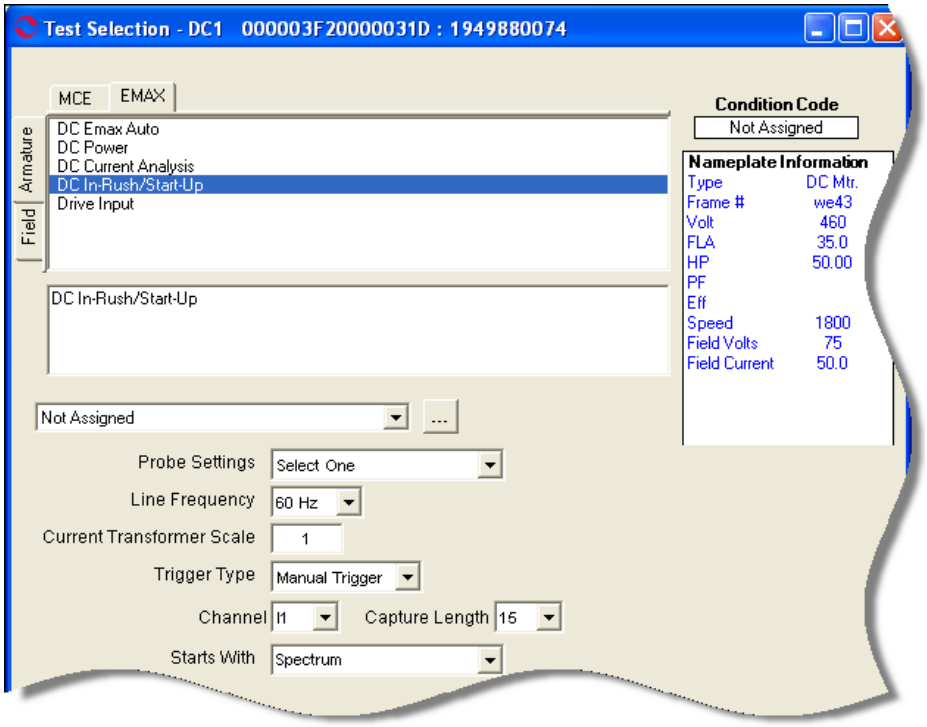


Figure 6-38: DC In-Rush/Start-Up Test Selection Window

5. Select the EMAX tab from the test type section, the Armature tab (default) from the asset section, and DC In-Rush/Start-Up from the test list.

6. Select Asset Test Location. To insure consistent trending and assist in trouble shooting, the actual test location should be stored for each test. 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. 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.** See Figure 6-39.

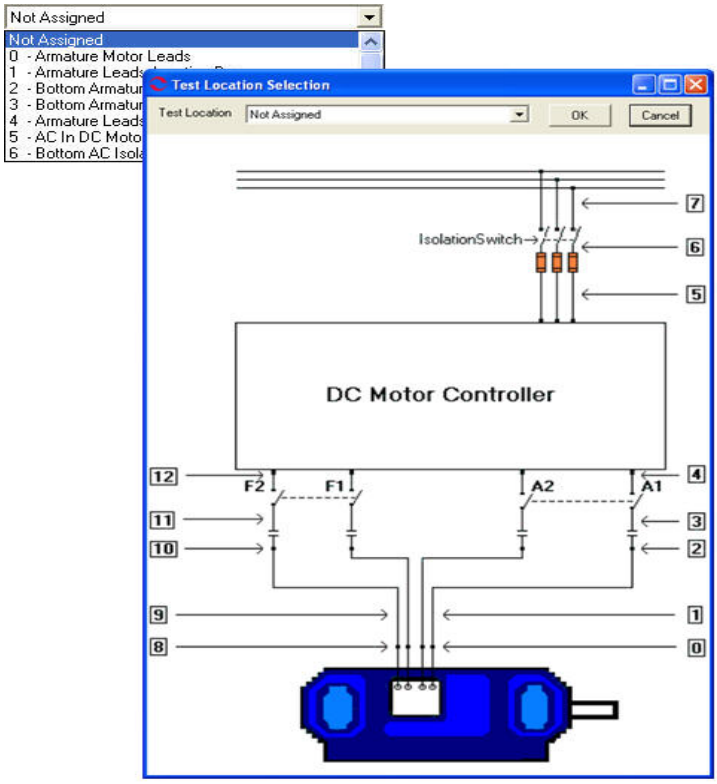
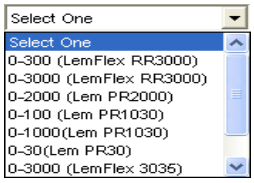
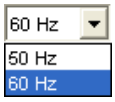


Figure 6-39: DC Asset Test Location

7. Select the Probe Settings from the drop down list, using the scroll bar to see the complete list if necessary.

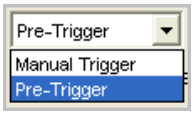


8. Select the Line Frequency from the drop down list. The choices are 60 Hz or 50 Hz.



9. Enter the Current Transformer Scale. Place the cursor in the text box, delete the value and enter the new current transformer scale value.

10. Select the Trigger Type form the drop down list. The choices are Manual Trigger (default) or Pre-Trigger.If Manual Trigger is selected go to step 12.



If Pre-Trigger is selected it is necessary to select the Pre-Trigger Length by clicking on the down arrow in the Pre-Trigger Length text box to display a list of available seconds. Highlight the desired length.

Also, if Pre-Trigger is selected it is necessary to select the Trigger Factor by clicking on the down arrow in the Trigger Factor text box to display a list of factors. Highlight the desired factor. See Figure 6-40. When the selection is made the software automatically calculates and displays the Trigger Factor on the Test Selection window. See Figure 6-41.

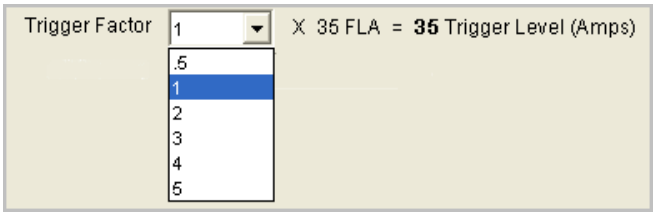
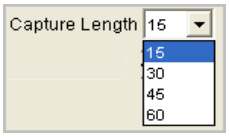


Figure 6-40: Trigger Factor Before Adjustment

Figure 6-41: Trigger Factor After Adjustment

11. Select the Channel. Use the down arrow in the Channel text box to display a list of available channels. Highlight the desired channel.

12. Select the Capture Length. Use the down arrow in the Capture Length text box to display a list of available settings. Highlight the desired length.



13. The Starts With category defaults to Spectrum, the only choice.

14. Click **Save** to save these settings for future testing of this asset. Or click **Reset** to return the original settings. This can only be done if the new settings have not been saved.

15. Connect the current probes to EMAX and the circuit to be measured. Ensure that the arrows on the probes point to the motor.

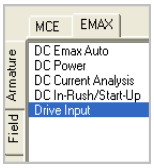
16. Click **Test** to begin testing. If you have not saved any changes to the setup settings, the system will ask you if you want to save test setup settings at this time.

17. This test only takes two seconds and may not display a progress bar.

18. At the conclusion of testing, the In-Rush/Start-Up Spectrum displays test data. This spectrum is discussed in the Analysis section, page 6-80.

19. Close the Test Results window by selecting File, Close or clicking the close button in upper right corner.

20. You will be asked if you want to save the changes, click desired answer. The Test Results window closes.



Drive Input

Step-by-Step Drive Input

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 6-42 opens.

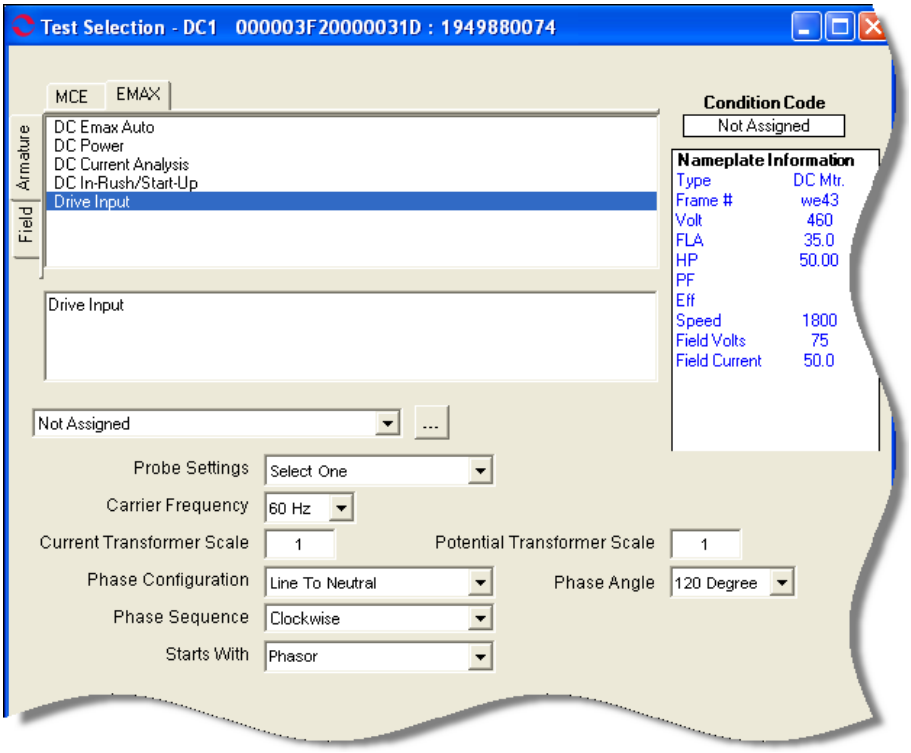


Figure 6-42: Drive Input Test Selection Window

5. Select the EMAX tab from the test type section, the Armature tab (default) from the asset section, and Drive Input from the test list.

6. Select Asset Test Location. To insure consistent trending and assist in trouble shooting, the actual test location should be stored for each test. 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. 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.** See Figure 6-43.

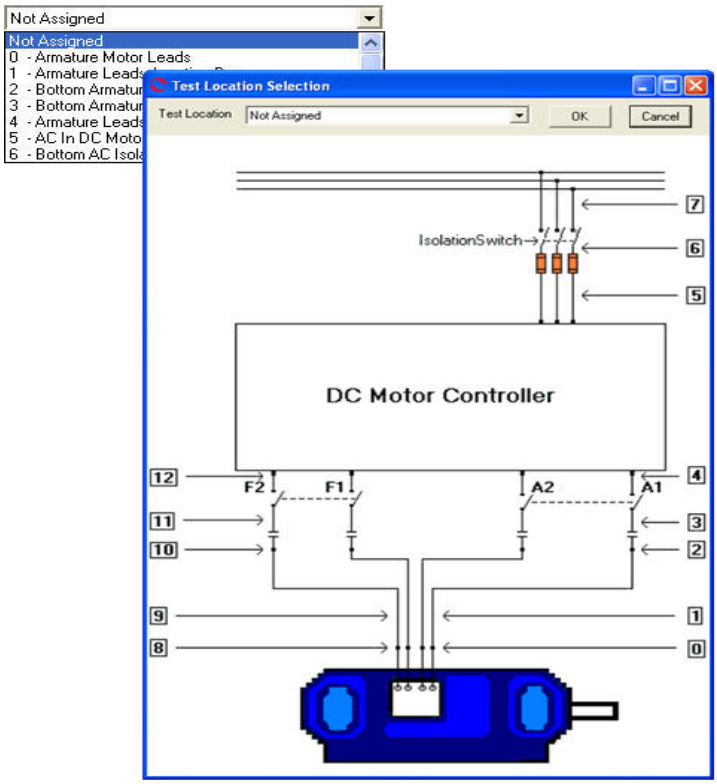
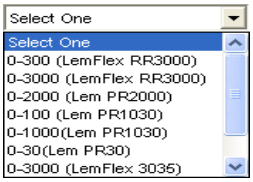
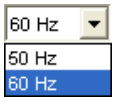


Figure 6-43: DC Asset Test Location

7. Select the Probe Settings from the drop down list, using the scroll bar to see the complete list if necessary.



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



9. Enter the Current Transformer Scale. Place the cursor in the text box, delete the value and enter the new current transformer scale value.

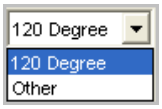
10. Enter the Potential Transformer Scale. Place the cursor in the text box, delete the value and enter the new potential transformer scale value.

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

    If Line-to-Neutral is selected then Phase Angle must be selected. See Step 12.

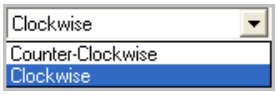
If Phase-to-Phase is selected then Missing Currents must be selected. See Step 13.

12. Select Phase Angle from the drop down list. This setting is only available when Line-to-Neutral is selected in the Phase Configuration setting.

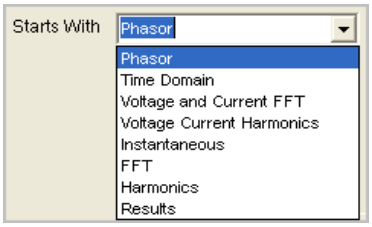


13. Select Missing Currents from the drop down list. This setting is when Phase-to-Phase is selected in the Phase Configuration setting.

14. Select Phase Sequence from the drop down list.



15. Select the Starts With selection by highlighting the desired display on the drop down list.



16. Click **Save** to save these settings for future testing of this asset. Or click **Reset** to return the original settings. This can only be done if the new settings have not been saved.

17. Connect the current probes to EMAX and the circuit to be measured. Ensure that the arrows on the probes point to the motor.

18. Click **Test** to begin testing. If you have not saved any changes to the setup settings, the system will ask you if you want to save test setup settings at this time.

19. This test only takes two seconds and may not display a progress bar.

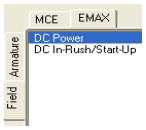
20. At the conclusion of testing, the test results window selected in Step 15 displays test data.

21. Close the Test Results windows by selecting File, Close or clicking the close button in upper right corner.

22. You will be asked if you want to save the changes, click desired answer. The Test Results window closes.

Field Section Tests

The Field Section Tests for DC assets are DC Power and DC In-Rush/Start-Up. DC Power is discussed in Chapter 7, Power Analysis.



DC In-Rush/Start-Up

Step-by-Step In-Rush/Start-Up

1. Connect the EMAX Data Acquisition cable.

2. Start MCEGold.

3. Highlight the motor being tested in the Site Navigator or Watch List.

4. Select the Test Selection icon on the toolbar. The Test Selection window, shown in Figure 6-44 opens.

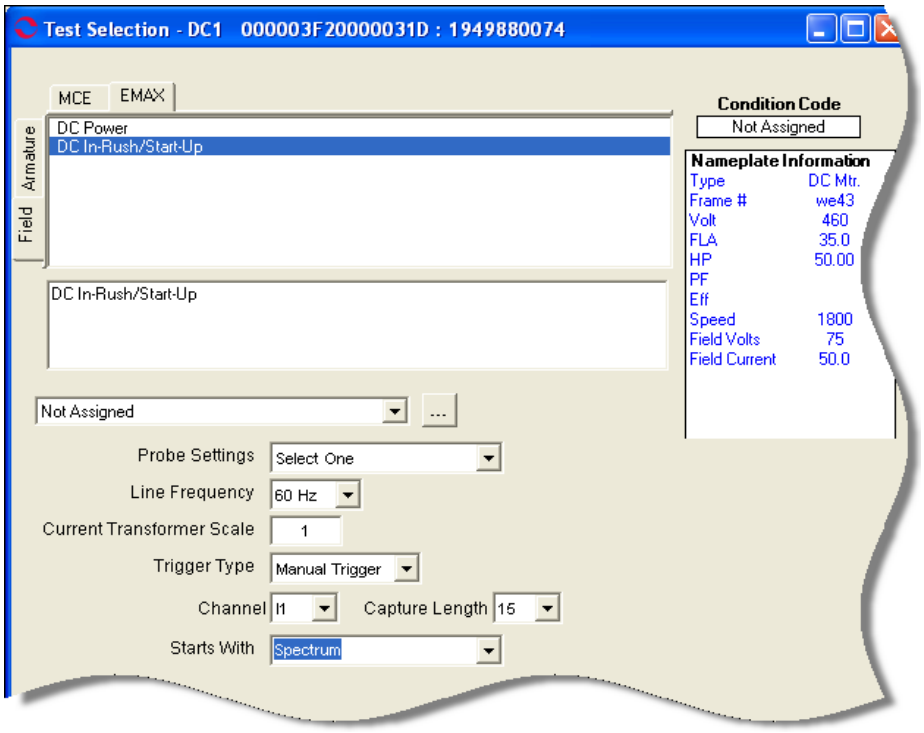


Figure 6-44: DC In-Rush/Start-Up Test Selection Window

5. Select EMAX tab in the Test Type.

6. Select In-Rush/Start-Up in the Test List, by clicking once on the name.

7. Select Asset Test Location. To insure consistent trending and assist in trouble shooting, the actual test location should be stored for each test. 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 6-45. 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.**

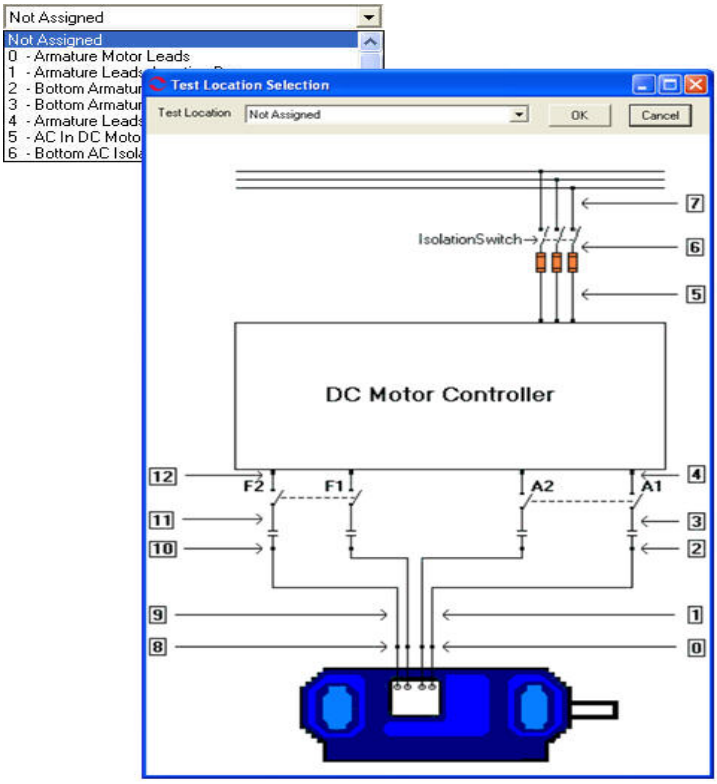
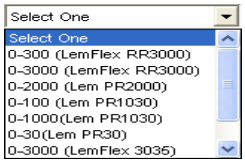
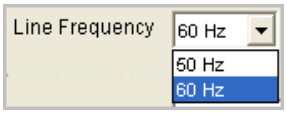


Figure 6-45: Test Location Selection

8. Select the appropriate probes for measuring the current for the asset by clicking on the down arrow to the right of the text box. Highlight the probe from the drop-down list.

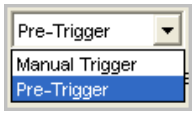


9. Select the correct Line Frequency by clicking on the down arrow to the right of the text box. Highlight either 50 Hz or 60 Hz.



10. Enter the Current Transformer Scale. Place the cursor in the text box, delete the value and enter the new current transformer scale value.

11. Select the Trigger Type form the drop down list. The choices are Manual Trigger (default) or Pre-Trigger. If Manual Trigger is selected go to step 13.



If Pre-Trigger is selected it is necessary to select the Pre-Trigger Length by clicking on the down arrow in the Pre-Trigger Length text box to display a list of available seconds. Highlight the desired length.

Also, if Pre-Trigger is selected it is necessary to select the Trigger Factor by clicking on the down arrow in the Trigger Factor text box to display a list of factors. Highlight the desired factor. See Figure 6-46. When the selection is made the software automatically calculates and displays the Trigger Factor on the Test Selection window. See Figure 6-47.

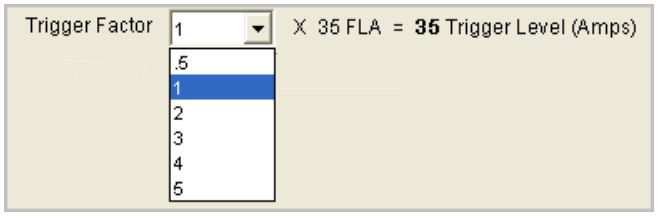
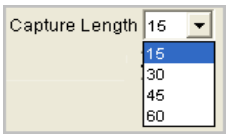


Figure 6-46: Trigger Factor Before Adjustment

Figure 6-47: Trigger Factor After Adjustment

12. Select the Channel. Use the down arrow in the Channel text box to display a list of available channels. Highlight the desired channel.

13. Select the Capture Length. Use the down arrow in the Capture Length text box to display a list of available settings. Highlight the desired length.



14. The Starts With category defaults to Spectrum, the only choice.

15. Click **Save** to save these settings for future testing of this asset. Or click **Reset** to return the original settings. This can only be done if the new settings have not been saved.

16. Connect the current probes to EMAX and the circuit to be measured. Ensure that the arrows on the probes point to the motor.

17. Click **Test** to begin testing. If you have not saved any changes to the setup settings, the system will ask you if you want to save test setup settings at this time.

18. This test only takes two seconds and may not display a progress bar.

19. At the conclusion of testing, the DC In-Rush/Start-Up Spectrum displays test data. This spectrum is discussed in the Analysis section, page 6-80.

20. Close the Test Results windows by selecting File, Close or clicking the close button in upper right corner.

21. You will be asked if you want to save the changes, click desired answer. The Test Results window closes.

ANALYSIS

EMAX Auto

The EMAX Auto test produces six test results windows. How and the order they appear in is determined by the selections made in the test setup. The current analysis results are: Eccentricity Spectrum, Eccentricity Time Domain, Rotor Evaluation Spectrum, Rotor Evaluation Time Domain, and Demod spectrum. They are discussed in this chapter under the appropriate test. The power analysis results are discussed in Chapter 7.

Rotor Evaluation

Rotor Evaluation testing is used for rotor bar analysis. The test is performed by selecting the EMAX tab on the Test Selection window and Rotor Evaluation from the test list. See page 6-20 for detailed information on the testing procedures. At the end of the test, the Test Results window shown in Figure 6-48 opens.

Note: You can also access the Test Results by highlighting the asset on the Site Navigator or WatchList and selecting the Test History icon on the tool bar.

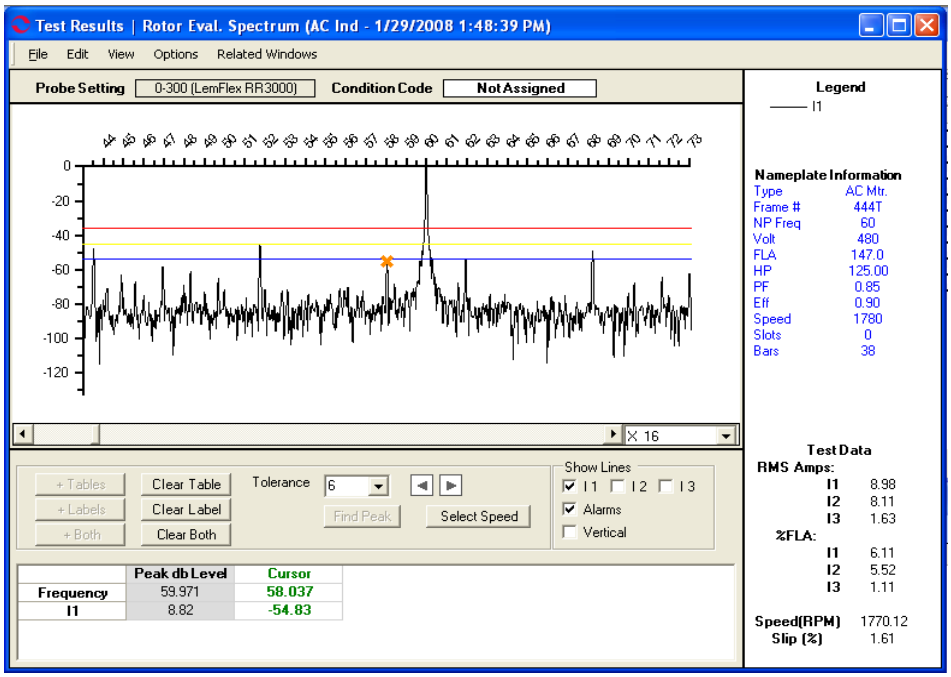
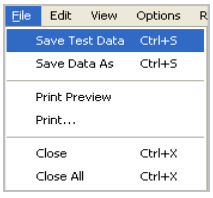


Figure 6-48: Test Results - Rotor Evaluation Spectrum



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 Rotor Evaluation test that are open. If you have not saved the test data you will be asked if you want to save.

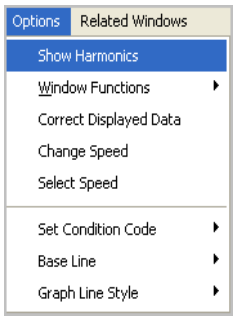
Edit

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.

View

The two test result choices for the Rotor Evaluation test are Spectrum and Time Domain. The result to be displayed is selected during test setup in the Starts With section. You can view additional test results windows by selecting View, Time Domain or Spectrum. The current window will remain open, in addition to the selected test results window.



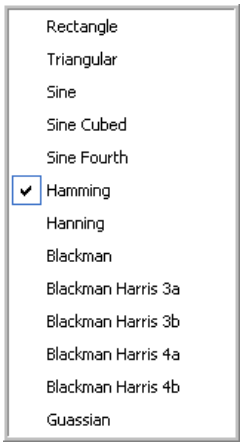
Options

Show Harmonics

Selecting Show Harmonics acts as a toggle to cause an x to be placed on the graph at whole number multiples of line frequency location or to removes it. A check mark indicates the harmonics are marked.

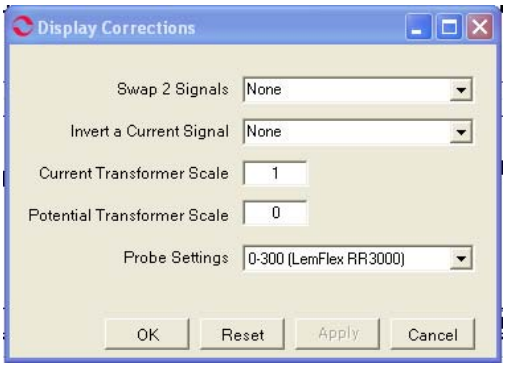
Window Functions

Selecting Options, Window Functions allows you to change the way the test results graph is displayed. See graphic for a list of the choices. A check mark in front of the name indicates how the results are being displayed.



Correct Displayed Data

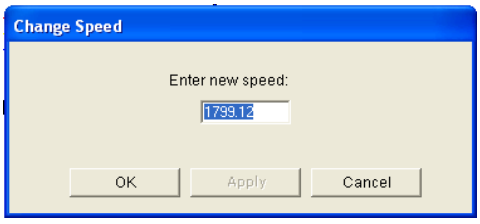
Selecting Options, Correct Displayed Data allows you to make four adjustments to the test results. Those adjustments are: Swap 2 Signals, Invert a Current Signal, Current Transformer Scale, Potential Transformer Scale, and Probe Settings.



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.

Change Speed

Selecting Options, Change Speed opens the Change Speed window. Enter a new speed in the text box and click **OK** to make the change and close the window or **Apply** to make the change and leave the window open.



Set Condition Code

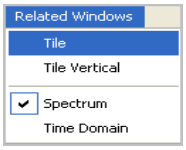
Selecting Options, Set condition Code displays the submenu shown on the right. Click on the desired condition code.

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.



Related Windows

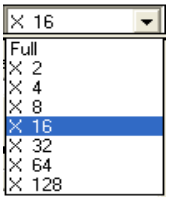
Selecting Related Windows, displays functions that control how the open windows are displayed and lists the open windows.

Display Options

The area below the 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.



+ 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

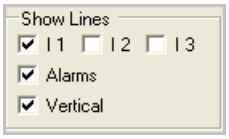
When the cursor has been moved, click the **Find Peak** button to locate the cursor on the highest frequency peak within the tolerance selected. The values will change in the appropriate table below the graph.

Select Speed

Click the Select Speed button to calculate the speed in RPM from the F_p side band.

Show Lines

Show Lines consists of check boxes used to add or remove lines for l1, l2, l3, Alarms, and Vertical cursor. A check mark indicates the line is visible.



Review Spectrum

The Rotor Evaluation Spectrum displays at the end of testing or it can be reached by highlighting the asset on the Site Navigator or WatchList and clicking the Test History icon on the toolbar. From the Test History window, highlight the desired test and select View, Raw Data from the menu.

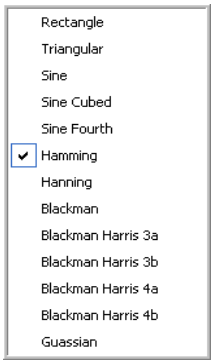
The spectrum is a graph of current amplitude in dB versus frequency in Hz. This spectrum is achieved by performing a Fast Fourier Transform (FFT) of the current data. The Amplitude scale is in decibels (dB), shown on the left side of the display. It automatically scales as necessary to display the entire graph.

The highest peak, which occurs at line frequency, is set at a reference level of 0 dB. The Peak dB level box below the display is filled in with line frequency and the uncorrected line frequency amplitudes when the current graphs are displayed. The uncorrected amplitude is the true value of the line frequency before referencing the graph to zero. This is done so that the other peaks in the spectrum can be easily compared to line frequency. The Frequency scale is in hertz (shown horizontally across the top) and centers on the fundamental frequency.

Pole pass side band (Fp) amplitude indicates the condition of the rotor bars. Fp equals the number of poles times the slip frequency. As the rotor bars deteriorate, the amplitude of the Fp side band increases. At loads greater than 70%, the dB difference between the line frequency and F_p side band peaks of greater than 54 dB indicates a healthy rotor condition.

If the dB difference is between 54 and 45, this indicates problems could be developing on the rotor, including cracked rotor bars and high resistance joints. At this dB level, EMAX places the F_p Amplitude values in the Test History in a Caution condition.

The default method of display is Frequency (Hz) - Hanning. There are different methods of displaying this graph. To change the different displays, select Options, Window Functions and select the desired method from the list. The list is shown on the right.



Review the Spectrum to identify the F_p side bands and its associated amplitude to determine the condition of the rotor. When the side bands and amplitude have been identified, motor speed can be determined and used for eccentricity analysis. Eccentricity analysis is covered in the Eccentricity section.

Activate the vertical bar cursor by clicking on the spectrum graph. To identify the Fp side band, click on the highest peak to the left of the line frequency peak. Click **Find Peak** to move the cursor to the true peak.

Review the cursor entry in the data table. If the dB value of the displayed current at the cursor position is greater than 54, this indicates that the rotor is in a healthy condition.

Click **Select Speed** to calculate the speed in RPM from the F_p side band frequency. If the speed calculation does not appear correct based on the motor's load, move the cursor to a different F_p side band and click **Select Speed** to recalculate the speed. Moving the cursor to the right increases the selected speed; moving it to the left decreases speed. Use of a strobe tach is recommended to confirm the speed.

When the speed is calculated and placed in the Speed (RPM) box, compare this speed along with the % FLA value to the nameplate speed in the speed (NP) box to verify that the highlighted peak is the Fp side band frequency. Refer to the graph in Figure 6-49 to aid in verification.

- If the % FLA value is near 100%, the Speed (RPM) value should be close to the Speed (NP).
- If the % FLA value is less than 100%, the Speed (RPM) value should be higher than the Speed (NP). For maximum test effectiveness, % FLA should be greater than 70% during the tests.
- If you determine that the highlighted peak is not the Fp side band frequency, select another peak and recalculate the Speed (RPM).

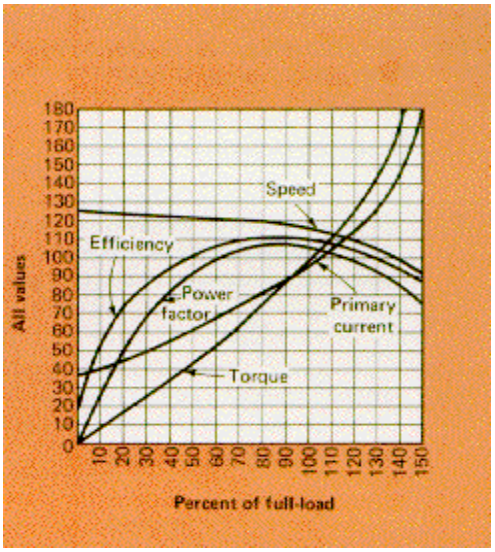


Figure 6-49: Motor Parameters vs. Percent Full Load

If a tachometer is used to determine the speed, F_p side band frequency can be identified by moving the cursor to a point near the F_p side band frequency. Click **Select Speed**. Continue to move the cursor and calculate the speed until the calculated speed value matches the motor speed from the tachometer. At this speed, the cursor will be on the F_p side band frequency.

The rotor condition should be based on the phase with the highest Fp side band frequency (least negative) value. Review the cursor entry line in the data area.

- If the dB value is between 45-54, place the motor in a caution condition. Increase monitoring of the motor and correlate with other technologies (i.e., MCE, vibration) to assist in determining the condition of the rotor.
- If the dB value is less than 45, place the motor in an alarm condition. Correlate with other technologies to assist in determining the severity of the problem. Schedule an inspection at the next availability.
- If the dB value is less than 30, consider taking immediate actions to shut down the motor and investigate.

Review Time Domain

To verify the data capture was valid, review the Time Domain display. When reviewing the display, ensure all three current signals are visible. The Time Domain display can be reached by selecting View, Time Domain from the Rotor Evaluation Spectrum window. See Figure 6-50.

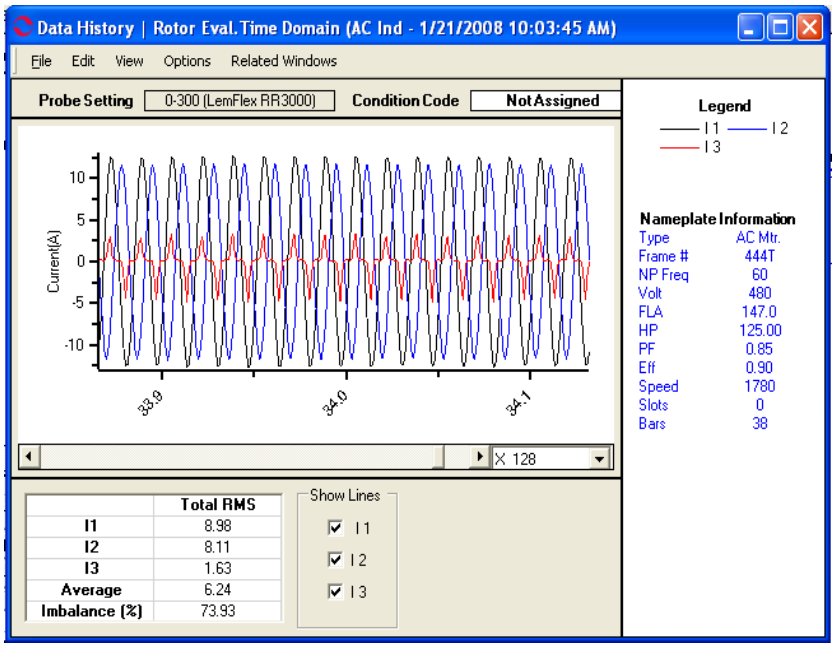


Figure 6-50: Rotor Evaluation - Time Domain

The Time Domain display can indicate if any of the following have 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 observing 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. Observe 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 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 Rotor Evaluation tab. Locate the test by using the scroll bar at the bottom of the window. Figure 6-51 shows the Test History window for an AC Induction asset, EMAX Rotor Evaluation test. The Test History window menus and functions are discussed in Chapter 3 - MCEGold, page 3-28.

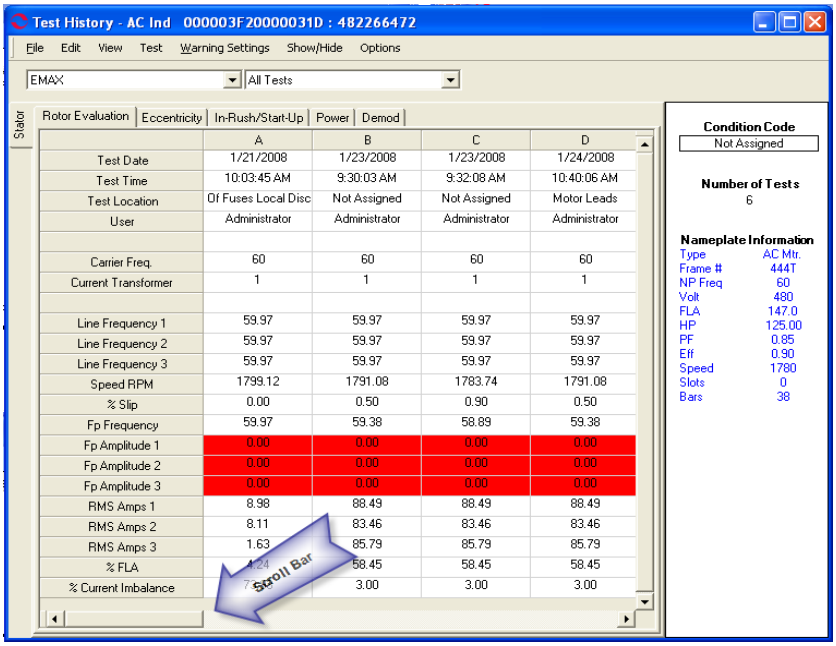


Figure 6-51: Test History - Rotor Evaluation

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 Carrier Frequency and Current Transformer 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.

Test Result Values

Line Frequency is the frequency of the incoming power source to the motor.

Speed RPM is the calculated motor speed based on the Fp side bands highlighted on the spectrum. If you have not selected a side band frequency for a test, this value is 0. If the speed is calculated on the Spectrum View window and the data is saved, the next time the Test History is reviewed, the calculated value is displayed.

% Slip is the difference between the shaft speed and the stator's rotating synchronous magnetic field. An increase in the slip value could result from an increase in load or a rotor defect. An increasing slip value coupled with increasing RMS Amp values indicates an

increase in load. An increasing slip value coupled with steady RMS Amp values indicates rotor bar defects.

Fp Frequency is the frequency at which the Fp side band is located. A decrease in the slip frequency value could result from an increase in load or a rotor bar defect. If the speed is calculated on the Spectrum View window and the data saved, the next time the Test History is reviewed, the slip frequency value is displayed.

Fp Amplitude (1, 2, and 3) is the amplitude of the Fp side band. The difference between fundamental and Fp should be greater than 54 dB. Amplitudes between 45-54 indicate a moderate condition and are displayed in yellow (Caution). This indicates problems could be developing on the rotor, including cracked rotor bars and high resistance joints. Amplitudes less than 45 indicate a severe condition and are displayed in red (Alarm). This indicates cracked rotor bars and high resistance joints are likely.

RMS Amps (1, 2, and 3) are the root mean square (RMS) values of the current data. These can be compared to changes in the Slip and Slip Frequency values to differentiate between load changes and possible rotor bar defects. An increasing Slip or decreasing Slip Frequency value coupled with increasing RMS Amp values indicates an increase in load. An increasing Slip value or decreasing Slip Frequency value coupled with steady RMS Amp values indicates rotor bar defects.

% Full Load Amps (FLA) is the percentage of nameplate FLA at which the motor is operating.

% Current Imbalance indicates a difference in current between phases of a three phase motor. It is calculated using the three phase current measurements and the following equation: % I_{imb}=(max deviation from avg)/avg x 100.

Analysis

Review the Test History for any Caution and Alarm values. To assist in the analysis process, graphing may be used for visual trending on motors with more than one set of test results. To view a graph, highlight the row of test results to be trended, then select View, Graph from the menu.

If the test results appear erratic, verify the data by reviewing the time domain display. To view the time domain, highlight the column for the test results, then select View, Raw Data from the menu. When the Rotor Evaluation spectrum window opens, select View, Time Domain.

Eccentricity

Eccentricity is the non-uniformity of the air gap between the rotor and stator. Eccentricity testing is used to indicate static or dynamic air gap problems. Static eccentricity occurs when the centerline of the rotor is offset from the centerline of the stator and is stationary. Dynamic eccentricity occurs when the centerline of the rotor is offset from the centerline of the stator and is not stationary. In extreme cases, dynamic eccentricity can result in rotor/stator contact. The Eccentricity test sample is approximately 0-6000 Hz.

The Eccentricity Test is performed by selecting the EMAX tab on the Test Selection window and Eccentricity from the test list. See page 6-23 for detailed information on the testing procedures. At the end of the test, the Test Results window shown in Figure 6-52

opens. The window menu items and buttons behave the same as for a Rotor Evaluation Spectrum and are discussed on page 6-49.

Note: You can also access the Test Results by highlighting the asset on the Site Navigator or WatchList and selecting the Test History icon on the toolbar.

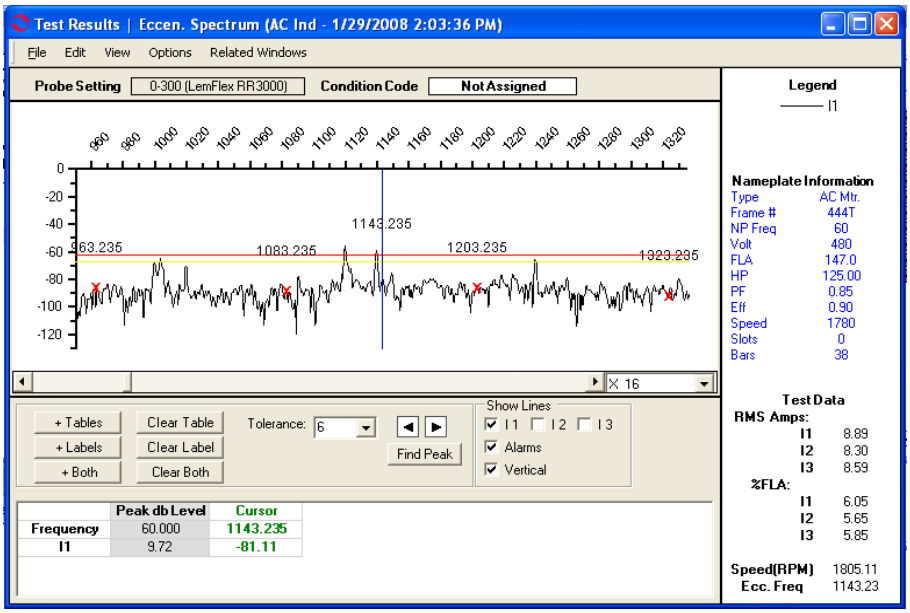


Figure 6-52: Test Results - Eccentricity Spectrum

Review Spectrum

The default Current Spectrum window display, see Figure 6-52, shows only one waveform - phase 1 current. Current for phases 2 and 3 can be displayed by clicking the check boxes located in the Show Lines section below the graph.

The Spectrum is a graph of amplitude versus frequency. The Amplitude scale is in decibels (shown vertically on the left side of the display). It auto-scales as necessary to display all of the values. The Frequency scale is in hertz (shown across the top of the display).

The default method of display is Frequency (Hz) - Hanning. There are various methods of displaying this graph. The display function operates as described in the Rotor Evaluation section on page 6-49.

The table area located across the bottom of the window is for Peak dB Level and Cursor location. The Peak dB level box is filled in with line frequency and the uncorrected line frequency amplitudes when the current graphs are displayed. This uncorrected amplitude is the true value of the line frequency before referencing the graph to zero. The Cursor box indicates the frequency and dB levels at the point where the cursor is located.

In the area below the Nameplate information is the Test Data section. This area contains RMS Amps, % FLA, Speed (RPM), and Ecc. Freq (eccentricity frequency). The values are produced automatically by MCEGold.

Speed (RPM) is taken from the demod test in EMAX Auto. If the speed acquisition in demod fails or a stand alone eccentricity test is run, speed will not be identified. The RPM value is converted to an equivalent frequency. Eccentricity frequency (Ecc. Freq.) is calculated by multiplying the number of rotor bars and the Speed (Hz) value. If speed is not available Ecc Freq. will not be identified.

Review the spectrum to identify the first and third harmonics of line frequency as sidebands around the eccentricity frequency. When these harmonics and their amplitudes have been identified, the condition of the air gap between the rotor and the stator can be evaluated.

The eccentricity frequency is calculated by multiplying the number of rotor bars by the speed (in Hz). Speed (in Hz) is calculated by dividing the speed (RPM) by 60.

The first harmonic of line frequency appears at +\- 60 Hz from the eccentricity frequency. The third harmonic of line frequency appears at +\- 180 Hz from the eccentricity frequency.

All four of these harmonics will be non-synchronous to line frequency. This means that they are at a frequency which is not a whole number multiple of line frequency i.e., 60, 120,180,200, etc. For example, a frequency peak at 1200 Hz is the 20th synchronous harmonic of line frequency (1200/60=20). A frequency peak at 1000 Hz however, is a non-synchronous harmonic of line frequency (1000/20=16.667).

If these four harmonics are less than 20 dB above noise level, there is no immediate concern. Place the motor in an observation mode and monitor changes.

Review 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 can be reached by selecting View, Time Domain from the Eccentricity Spectrum window. See figure 6-53.

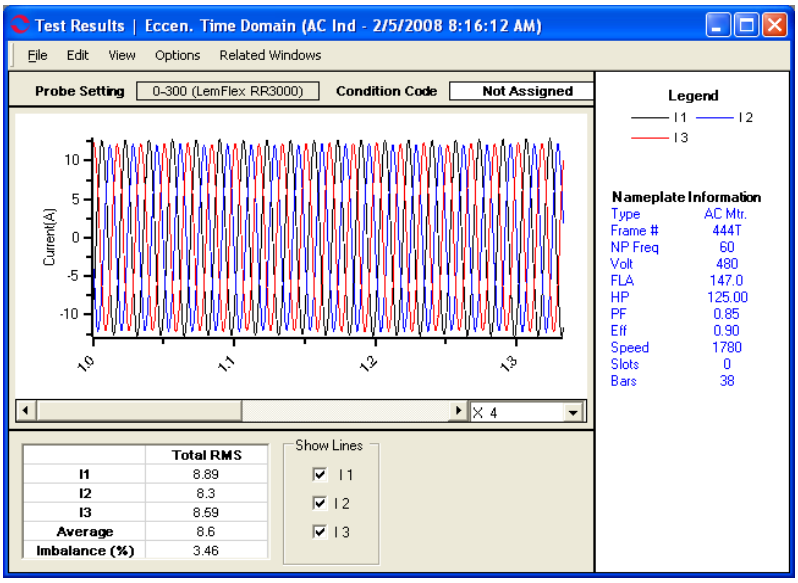


Figure 6-53: Test Results - Eccentricity Time Domain

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 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 Eccentricity tab. Locate the test by using the scroll bar at the bottom of the window. Figure 6-54 shows the Test History window for an AC Induction asset, EMAX Eccentricity test. The Test History window menus and functions are discussed in Chapter 3 - MCEGold, page 3-28.

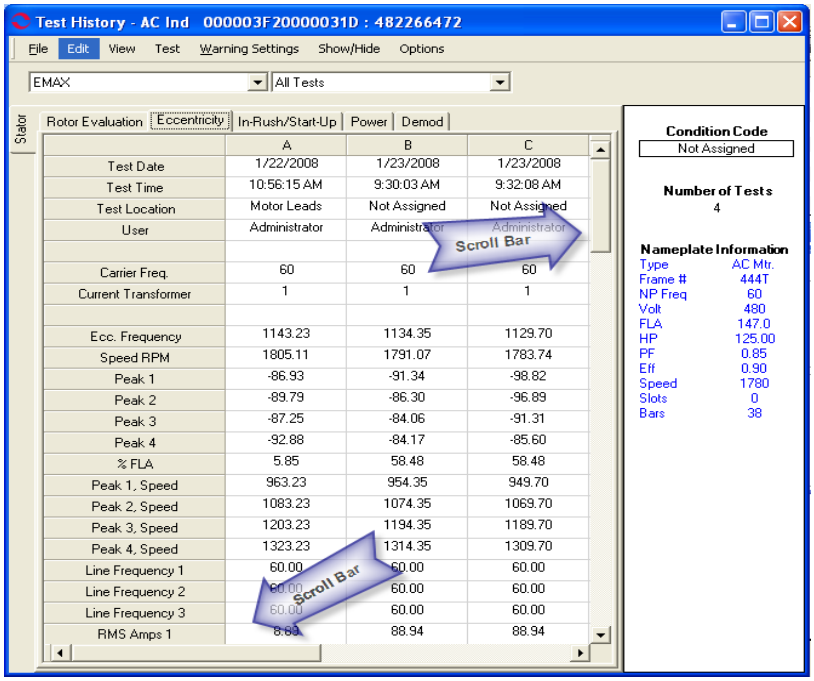


Figure 6-54: Test History - Eccentricity

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 Carrier Frequency and Current Transformer 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.

Test Result Values

Ecc. Frequency is calculated by multiplying the number of rotor bars by the speed (in Hz). Speed (in Hz) is calculated by dividing the speed (RPM) by 60.

Speed RPM is the calculated motor speed recorded at the time of the Eccentricity test. If no speed is recorded this value is 0. If the speed is calculated on the Spectrum View window and the data is saved, the next time the Test History is reviewed, the calculated value is displayed.

Peak 1, 2, 3, 4 are the amplitudes of the 1st and 3rd harmonic sidebands around the eccentricity frequency.

%FLA (Full Load Amps) is the percentage of nameplate FLA at which the motor is operating.

Peak 1, 2, 3, 4 Speed are the amplitudes of the 1st and 3rd harmonic sidebands around the eccentricity frequency.

Line Frequency (1, 2, 3) are the frequencies associated with the fundamental F_c of each phase.

RMS Amps (1, 2, 3) are the root mean square (RMS) values of the current data.

% Current Imbalance indicates a difference in current between phases of a three phase motor. It is calculated using the three phase current measurements and the following equation: $\% I_{imb}$=(max deviation from avg)/avg x 100.

In-Rush/Start-Up

In-Rush/Start-Up testing is used to monitor the changes in current during motor startup. Changes in the high in-rush current are good indicators of motor health. The startup signal may be monitored for up to 60 seconds.

The test is performed by selecting the EMAX tab on the test Selection window and In-Rush/Start-Up from the test list. See page 6-25 for detailed information on the testing procedures. At the end of the test, the Test Results window shown in Figure 6-55 opens.

Note: You can also access the Test Results by highlighting the asset on the Site Navigator or WatchList and selecting the Test History icon on the tool bar.

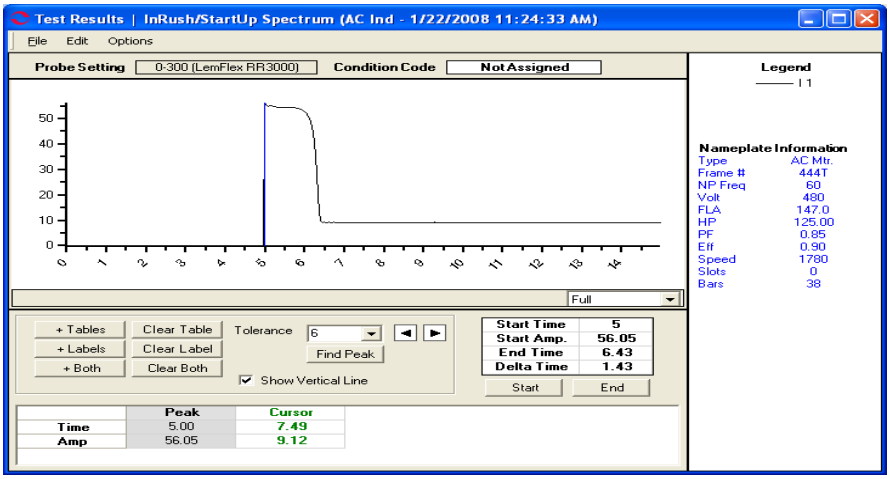
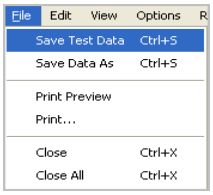


Figure 6-55: Test Results - In-Rush/Start-Up Spectrum



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 are 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 In-Rush/Start-Up 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 Menu

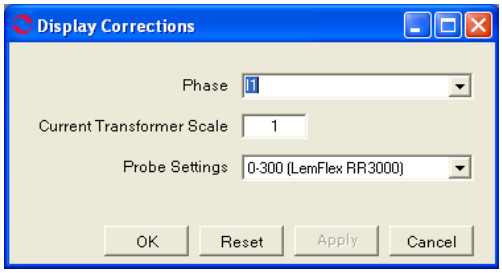
Create Message (Ctrl+M)

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 make three adjustments to the test results. Those adjustments are: Phase, Current Transformer Scale, and Probe Settings



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 set the test results as the baseline.

Graph Line Style

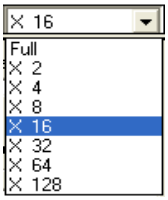
electing Options, Graph Line Style displays the sub menu containing options to Show Patterns and Show Markers on the test results graph. A check mark indicates the option is active.

Display Options

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.



+ 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

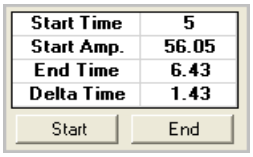
When the cursor has been moved, click the **Find Peak** button to cause the cursor to be placed exactly on the highest peak. The values will change in the appropriate table below the graph.

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 Time

The Test Time area is located below the graph. It displays the Start Time of the capture, the Start Amps, the End Time of the capture, and the Delta (elapsed) test time.



Use the Start and End buttons to change the display. To do this, place the cursor at the desired location on the graph and click the appropriate button. The values on the test time table will be updated.

Review Spectrum

The In-Rush/Start-Up Spectrum displays at the end of testing or it can be reach by highlighting the asset on the site Navigator or WatchList and clicking the Test History icon on the toolbar. From the Test History window., highlight the desired test and select View, Raw Data from the menu.

Each In-Rush/Startup test measures current in one phase, designated at the beginning of the test. The default display shows the current signal captured during the test, and the baseline, if a baseline is designated.

The current scale is in amps (shown vertically on the left side of the display). It auto-scales as necessary to display all of the data. The current scale is referenced to time in seconds (shown horizontally at the bottom of the display).

Review the graph to determine the in-rush current amplitude and start-up time, and to identify any anomalies in the startup signature.

Place the arrow cursor on the start point of the startup transient and click with the left mouse button to activate the vertical bar cursor. This places the vertical bar cursor at the start point and activates the **Start** button to the right of the data box.

To assist in accurately identifying the highest peak, as indicated by the value in the box below the graph, move the cursor by clicking on the cursor arrows located to the right of the Tolerance drop down list box. When you get close to the peak, click **Find Peak** to

move the cursor to the highest point of the peak. Click **Start** to record the start time. The Start Time and Start Amp. values are entered in the data boxes.

Move the arrow cursor to the point where the current levels off at the end of the transient and click with the left mouse button to activate the vertical bar cursor. This places the vertical bar cursor at the end of the transient. Verify that the vertical bar cursor is on the end point of the transient and click **End**. This places values in the End Time and Delta Time boxes.

By following the above steps, you can calculate the time between any two points on the graph.

The startup signature should not change significantly from one test to the next. Compare the signatures of subsequent tests to the baseline test and identify any changes. Changes indicate a change in the operating conditions or deterioration of motor health. For maximum effectiveness in analyzing and comparing, in-rush/startup data, ensure you are monitoring the same phase in all subsequent tests.

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 In-Rush/Start-Up tab. Locate the test by using the scroll bar at the bottom of the window. Figure 6-56 shows the Test History window for an AC Induction asset, EMAX In-Rush/Start-Up test. The Test History window menus and functions are discussed in Chapter 3 - MCEGold, page 3-28.

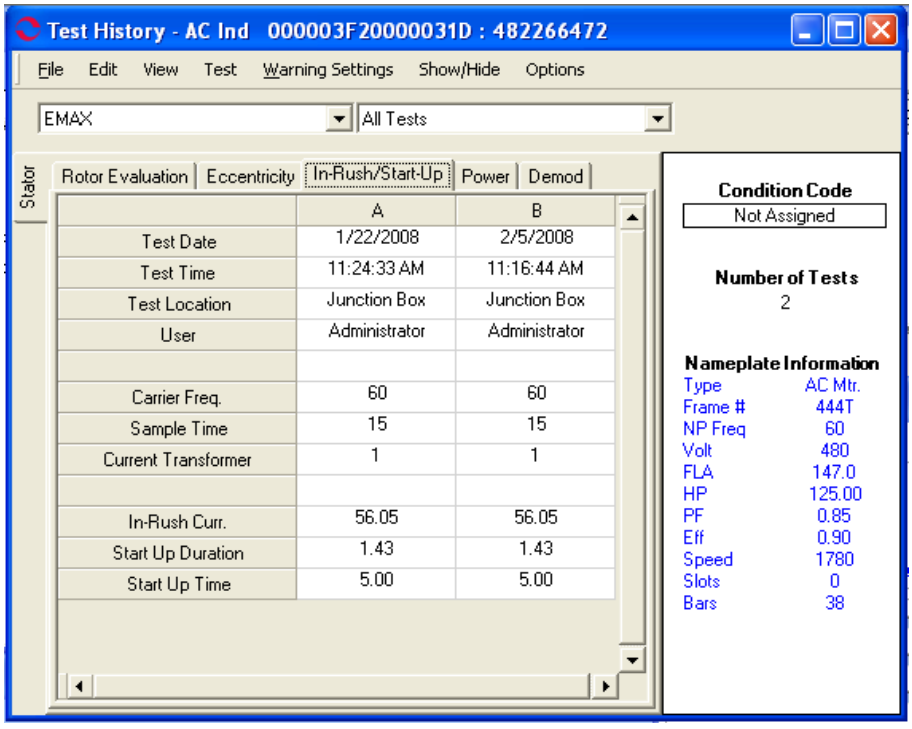


Figure 6-56: Test History - In-Rush/Start-Up

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 Carrier Frequency Sample Time and Current Transformer 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.

Review the History Chart for any caution and alarm values. To assist in the analysis process, graphing may be used for visual trending on motors with more than one set of test results. Highlight the row containing the test value to be graphed and select View, Graph from the Test History window menu.

In-Rush Current is the maximum current felt by the motor during in-rush. When the History Chart is reviewed for the first time, the value is 0. If the Start Amplitude is calculated on the InRush/Startup window and the data is saved, the next time the History Chart is reviewed, the In-Rush Current is displayed.

Under the same operating conditions, the amplitude of this in-rush current should not change from one test to the next. Changes in in-rush current amplitude are caused by changes in operating conditions or deteriorating motor health.

Start Up Duration is the time difference between the point of in-rush and the time the motor reaches steady state. When the History Chart is reviewed for the first time, this value is 0. If the Delta time is calculated on the In-Rush/Start-Up window and the data is saved, the next time the History Chart is reviewed, the Start Up Duration value is displayed.

Under the same operating conditions, the value of Start Up Duration should not change from one test to the next. Changes in the Start Up Duration are caused by changes in operating conditions or deteriorating motor health.

Demod

Demodulation filters out the 60Hz carrier frequency and reveals the hidden signals, representing repetitive load variations. These load variations can then be analyzed. Advanced Spectral Analysis is the process of determining what those load variations mean and allows you to identify potential faults with belts, bearings, gears, pumps, compressor stages and other mechanical related anomalies.

The test is performed by selecting the EMAX tab on the Test Selection window and Demod from the test list. See page 6-28 for detailed information on the testing procedures. At the end of the test the Test Results, Demod Spectrum window shown in Figure 6-57 opens.

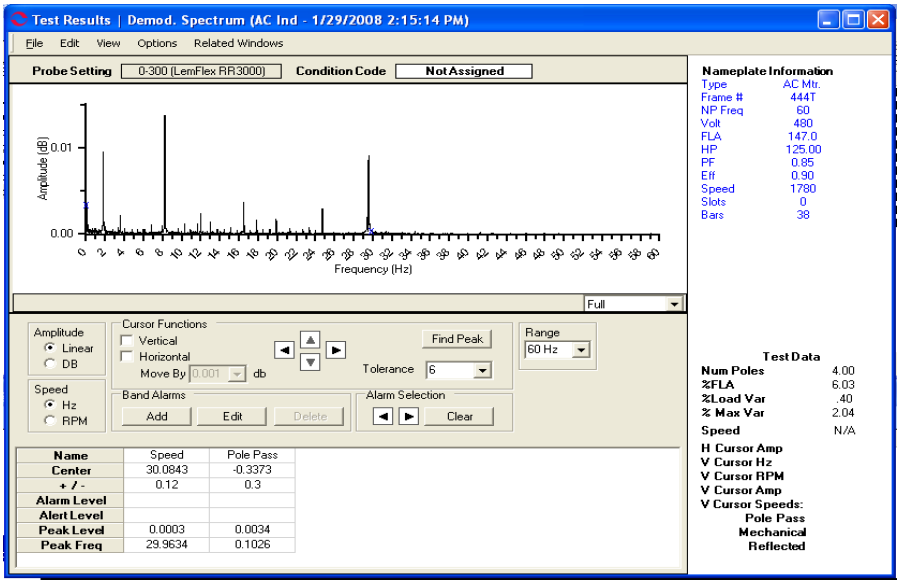
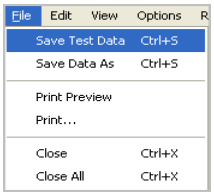


Figure 6-57: Test Results - Demod Spectrum



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 PFD 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.

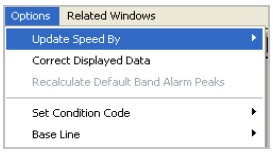
Edit

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.

View

The two test results choices for the Demod test are Spectrum and Time Domain. The result to be displayed is selected during test setup in the Starts With section. You can view additional test results windows by selecting View, Time Domain or Spectrum. The current window will remain open, in addition to the selected test results window.

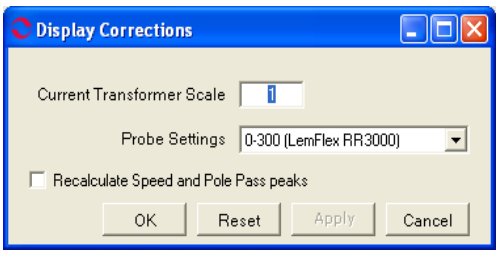


Options

Update Speed By

Selecting Options, Update Speed By allows you to change the speed by Pole-Pass or Mechanical means.

Correct Displayed Data



Selecting Options, Correct displayed Data allows you to change the Current Transformer Scale, Probe Settings, and then Recalculate the Speed and Pole-Pass peaks.

Make the desired adjustments, ensure a check mark is in the Recalculate speed and Pole-Pass peaks check box if you wish the displayed data to reflect the changes. Click **OK** to make the changes and close the window or **Apply** to make the changes and leave the window open.

Recalculate Default Band Alarm Peaks

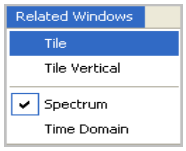
Selecting Options, Recalculate Default Alarm Band Peaks will perform a recalculation of the motor speed based on the existing F_p and speed band alarms.

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

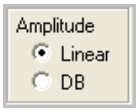
Selecting Related Windows, displays functions that control how the open windows are displayed and lists the open windows related to the displayed test results.

Display Options

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

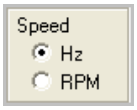
Amplitude

The amplitude default display is Linear. Selecting the dB changes the vertical axis on the graph to a decibel display. It also affects the Move By drop down list in the Cursor Function section.



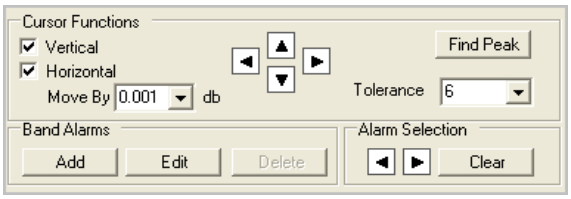
Speed

The speed default display is in Hertz (Hz). Selecting the RPM changes the horizontal axis on the graph to RPM.



Cursor Functions

The cursor can be displayed on the graph either vertical, horizontal, or both by placing a check mark in the box in front of the desired function.



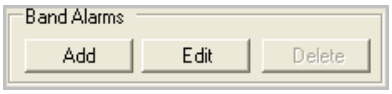
Selecting Vertical activates the Find Peak and Tolerance options. Clicking Find Peak moves the vertical cursor to the nearest peak on the graph. Tolerance is a drop down list of values used to limit the cursor movement to within a range.

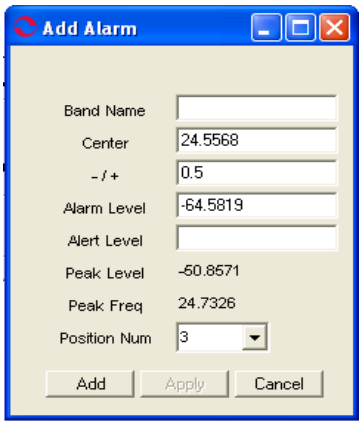
Selecting Horizontal activates the Move By option. Move By is a drop down list that controls the increments the cursor moves when using the up and down arrow buttons.

The arrow keys move the cursor in the direction of the arrow.

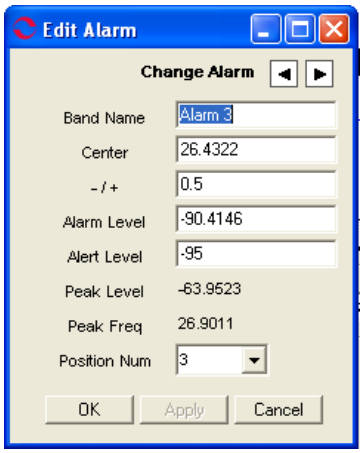
Band Alarms

Selecting **Add** in the Band Alarms section opens the Add Alarm window. Fill in the text boxes and click **Add**. This places a new column in the table in the lower section of the window.

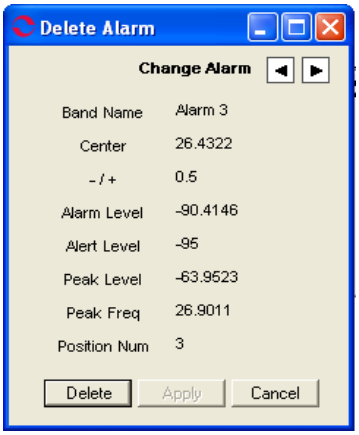




To change values in any of the columns, highlight the column and click **Edit**. The Edit Alarm window opens. When values are entered in the text boxes the Apply button becomes active. If you wish to change values in a second column, click Apply and then use the change arrow to move the highlight to the desired column. Continue until all changes have been made then click **OK** to close the window.



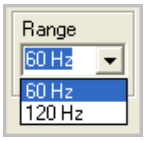
To Delete a column, highlight the column and then click **Delete**. The Delete Alarm window opens, verify it is the correct column and click **Delete**. If you wish to change the column, use the change arrow to move the highlight to the desired column.



Alarm Selection

Using the arrows in the Alarm Selection section causes an alarm band column to be highlighted and the appropriate markers placed on the graph. Clear removes the highlighting, but does not remove the graph markers. They are removed when the alarm band column is deleted.

Range



The Range drop down list allows you to change the Frequency to either 60 or 120 Hz. When a selection is made the graph automatically changes.

Review Spectrum

The Demod. Spectrum displays at the end of testing or it can be reached by highlighting the asset on the Site Navigator or WatchList and clicking the Test History icon on the toolbar. From the Test History window, highlight the desired test and select View, Raw Data from the menu.

Review the spectrum for increasing peaks. Increasing amplitudes of peaks identified indicate a changing condition of the system associated with that peak. Increasing speed peaks on the spectrum indicate possible imbalance related abnormalities. The speed frequency is also used for speed acquisition. Increasing pole-pass frequency (F_p) amplitude indicates possible rotor degradation, such as cracked or broken rotor bars or end rings. F_p is also used for speed acquisition. Increasing frequencies related to belts indicate possible belt damage, angular offset of the pulleys or a loose belt.

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 Demod tab. Locate the test by using the scroll bar at the bottom of the window. Figure 6-58 shows the Test History window for an AC Induction asset, EMAX Demod test. The Test History window menus and functions are discussed in Chapter 3 - MCEGold, page 3-28.

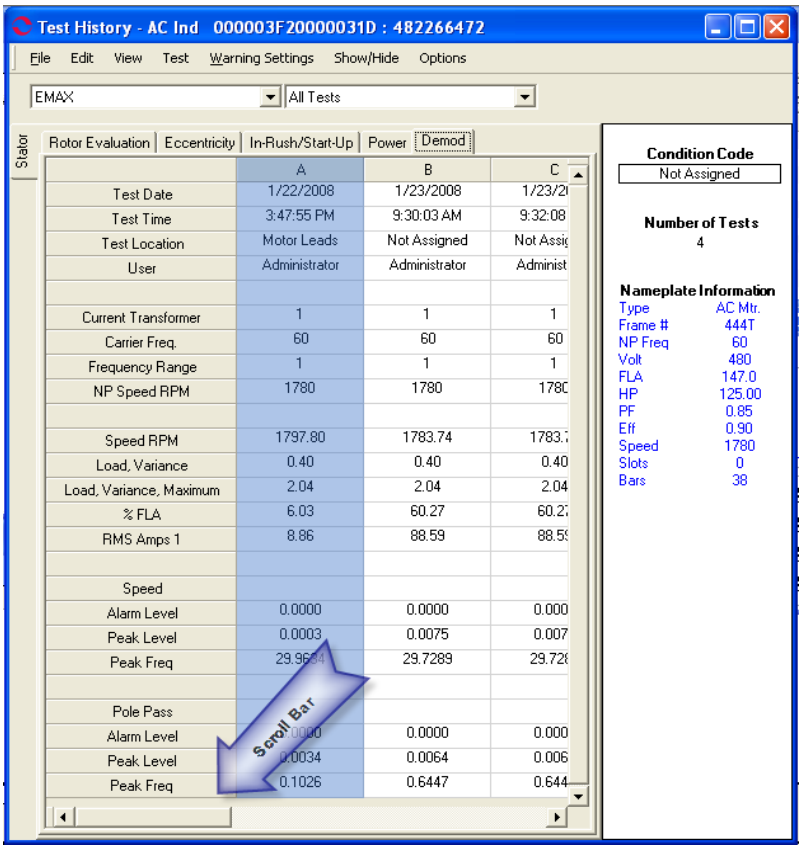


Figure 6-58: Test History - Demod

Test Results Values

Current Transformer is a value entered by the user in the Test Selection window at the time of the test setup.

Carrier Freq. is the value entered by the user in Test Selection window at the time of the test setup.

NP Speed RPM is the speed entered in the nameplate section when the asset was added.

Speed RPM is the calculated motor speed based on the Fp side bands highlighted on the spectrum. If you have not selected a side band frequency for a test, this value is 0. If the speed is calculated on the Spectrum View window and the data is saved, the next time the Test History is reviewed, the calculated value is displayed.

Load, Variance is the average load variation calculated during the test.

Load, Variance, Maximum is the peak load variation calculated during the test.

% Full Load Amps (FLA) is the percentage of nameplate FLA at which the motor is operating. Operating the motor at above 70% FLA is recommended for a good signal-to-noise ratio.

RMS Amps 1 is the root mean square (RMS) values of the current data. These can be compared to changes in the Slip and Slip Frequency values to differentiate between load changes and possible rotor bar defects. An increasing Slip or decreasing Slip Frequency value coupled with increasing RMS Amp values indicates an increase in load. An increasing Slip value or decreasing Slip Frequency value coupled with steady RMS Amp values indicates rotor bar defects.

Speed - Alarm Level is the alarm level assigned by the technician for the default speed band alarm.

Speed - Peak Level is the measured amplitude of the speed peak for the given acquisition.

Speed - Peak Frequency is the frequency measured for the speed peak.

Pole-Pass - Alarm Level is the calculated speed in RPM based on the vertical cursor being located at the F_p. The alarm level is assigned by the technician for the default pole-pass band alarm.

Pole-Pass - Peak Level is the calculated speed in RPM based on the vertical cursor being located at the F_p. The Peak Level is the measured amplitude of the pole-pass peak for the given acquisition.

Pole-Pass - Peak Frequency is the calculated speed in RPM based on the vertical cursor being located at the F_p. The Peak Frequency is the frequency measured for the pole-pass peak.

Analysis

Review the Test History for any Caution and Alarm values. To assist in the analysis process, graphing may be used for visual trending on motors with more than one set of test results. To view a graph, highlight the row of test results to be trended, then select View, Graph from the menu.

Increasing amplitudes of peaks identified indicate a changing condition of the system associated with that peak. Commonly, peaks are associated with a mechanical function which modulates the fundamental frequency at a given frequency.

Compare the pole-pass frequencies (F_p) levels. Increasing F_p indicates possible rotor degradation, such as cracked or broken rotor bars or end rings.

Compare speed peak levels. Increasing speed peaks indicated possible imbalance related anomalies.

DC Assets

For DC assets the primary interest is the condition of the ground wall and turn insulation systems of the armature and field and the health of the DC drive supplying power to the asset. Many common faults such as shorted turns or commutator bars, grounded windings, and off magnetic neutral axis faults may be detected using online current and voltage signature analysis.

Armature Section

DC EMAX Auto

The DC EMAX Auto test produces three test results windows. How and the order they appear in is determined by the selections made in the test setup. They are DC Power Time domain, DC Current Spectrum, and DC Current Time Domain. The DC Current Spectrum and DC Current Time Domain are discussed in this chapter under the appropriate test. The DC Power Time Domain results are discussed in Chapter 7.

DC Current Analysis

DC Current Analysis is used for qualitative analysis of armature current**.** The test is performed by selecting the EMAX tab on the Test Selection window and DC Current Analysis from the test list. See page 6-37 for detailed information on the testing procedures. At the end of the test, the Test Results window shown in Figure 6-59 opens.

Note: You can also access the Test Results by highlighting the asset on the Site Navigator or WatchList and selecting the Test History icon on the toolbar.

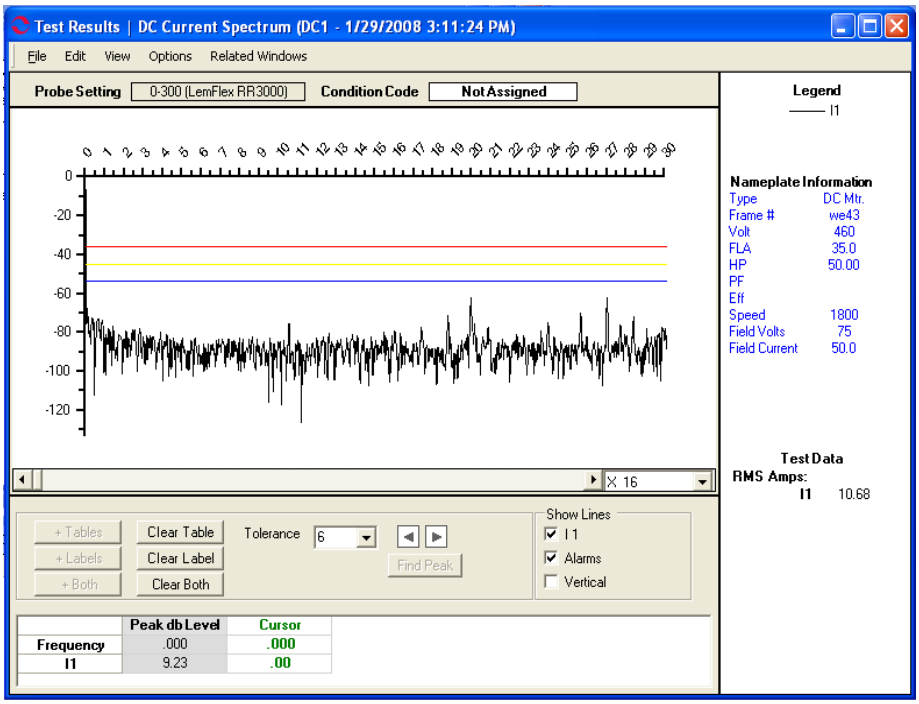
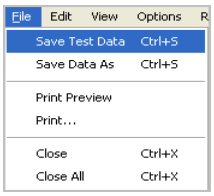


Figure 6-59: Test Results - DC Current Spectrum



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.

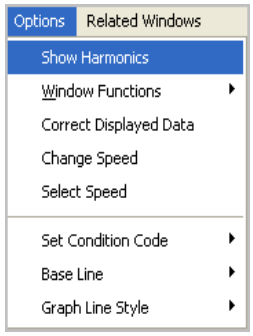
Edit

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 3-43.

View

The two test result choices for the DC Current Analysis test are Spectrum and Time Domain. The result to be displayed is selected during test setup in the Starts With section. You can view additional test results windows by selecting View, Time Domain or Spectrum. The current window will remain open, in addition to the selected test results window.



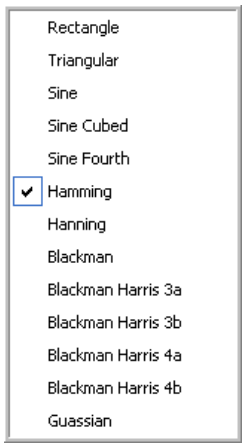
Options

Show Harmonics

Selecting Show Harmonics acts as a toggle to cause an x to be placed on the graph at the line frequency and each integer multiple after or to remove it. A check mark indicates the harmonics are marked.

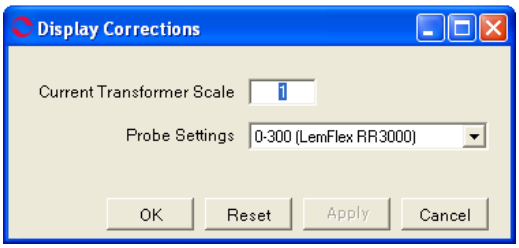
Window Functions

Selecting Options, Window Functions allows you to change the way the test results graph is displayed. See graphic for a list of the choices. A check mark in front of the name indicates how the results are being displayed.



Correct Displayed Data

Selecting Options, Correct Displayed Data allows you to make adjustments to the Current Transformer Scale and the Probe Settings.



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

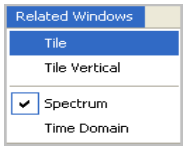
Selecting Options, Set condition Code displays the submenu shown on the right. Click on the desired condition code.

Baseline

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

Graph Line Style

Selecting 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.



Related Windows

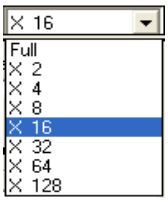
Selecting Related Windows, displays functions that control how the open windows are displayed and lists the open windows related to the displayed test results.

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.



+ 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

Use the drop down list to select the tolerance/range to be used when the Find Peak function is used to place the cursor.

Arrows

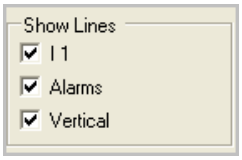
Use the arrow buttons to move the active cursor right or left one increment at a time.

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 Lines

Show Lines consists of check boxes used to add or remove the l1, Alarms, and Vertical cursor lines. A check mark indicates the line is visible.



Review Spectrum

The DC Current Spectrum displays at the end of testing or it can be reached by highlighting the asset on the Site Navigator or WatchList and clicking the Test History icon on the toolbar. From the Test History window, highlight the desired test and select View, Raw Data from the menu.

Review Time Domain

The DC Current Time Domain is reached by selecting View, Time Domain on the DC Current Spectrum window menu. The DC Current Time Domain allows for a longer evaluation of the Armature signal for VFD and Armature winding anomalies.

DC In-Rush/Start-Up

The DC In-Rush/Start-Up evaluates the initial in-rush transient current, after applying the initial voltage to the asset.

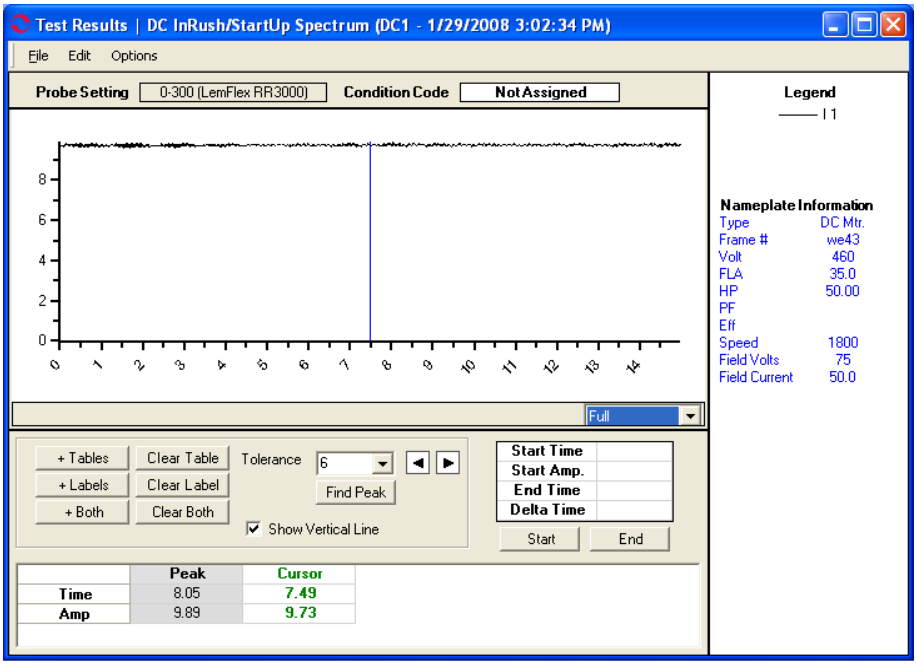
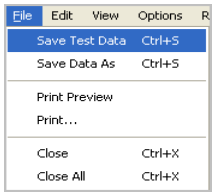


Figure 6-60: Test Results - In-Rush/Start-Up Spectrum



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 are 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

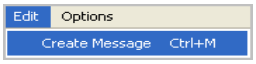
Selecting File, Print causes the Print window to open, verify the printer destination, and click **OK**.

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

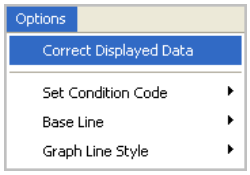
Selecting File, Close All closes all Test Results windows associated with the Eccentricity test that are open. If you have not saved the test data you will be asked if you want to save.



Edit Menu

Create Message (Ctrl+M)

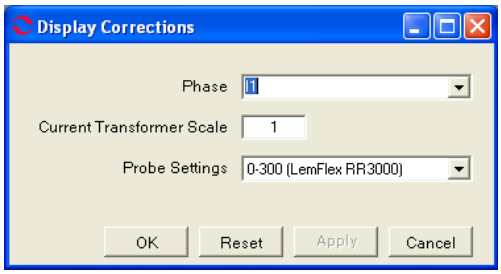
Selecting Edit, Create Message opens the Compose Asset Message window. Use this function to add a message/note to the asset record. The messages/notes can be read using the Message Center. Compose Asset Message and the Message Center are discussed in Chapter 3- MCEGold, Message Center on page 3-43.



Options

Correct Displayed Data

Selecting Options, Correct Displayed Data allows you to make three adjustments to the test results. Those adjustments are: Phase, Current Transformer Scale, and Probe Settings



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 set the test results as the baseline.

Graph Line Style

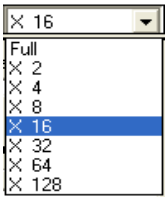
Selecting Options, Graph Line Style displays the sub menu containing options to Show Patterns and Show Markers on the test results graph. A check mark indicates the option is active.

Display Options

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.



+ 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

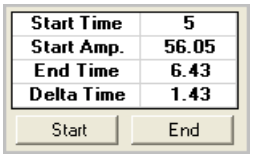
When the cursor has been moved, click the **Find Peak** button to cause the cursor to be placed exactly on the peak. The values will change in the appropriate table below the graph.

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 Time

The Test Time area is located below the graph. It displays the Start Time of the capture, the Start Amps, the End Time of the capture, and the Delta (elapsed) test time.



Use the Start and End buttons to change the display. To do this, place the cursor at the desired location on the graph and click the appropriate button. The values on the test time table will be updated.

Review Spectrum

The In-Rush/Start-Up Spectrum displays at the end of testing or it can be reach by highlighting the asset on the site Navigator or WatchList and clicking the Test History icon on the toolbar. From the Test History window, highlight the desired test and select View, Raw Data from the menu.

Each In-Rush/Start-Up test measures current in one phase. The default display shows the current signal captured during the test, and the baseline, if a baseline is designated.

The current scale is in amps (shown vertically on the left side of the display). It auto-scales as necessary to display all of the data. The current scale is referenced to time in seconds (shown horizontally at the bottom of the display).

Review the graph to determine the in-rush current amplitude and start-up time, and to identify any anomalies in the start-up signature.

Place the arrow cursor on the start point of the startup transient and click with the left mouse button to activate the vertical bar cursor. This places the vertical bar cursor at the start point and activates the **Start** button to the right of the data box.

To assist in accurately identifying the highest peak, as indicated by the value in the box below the graph, move the cursor by clicking on the cursor arrows located to the right of the Tolerance drop down list box. When you get close to the peak, click **Find Peak** to move the cursor to the highest point of the peak. Click **Start** to record the start time. The Start Time and Start Amp. values are entered in the data boxes.

Move the arrow cursor to the point where the current levels off at the end of the transient and click with the left mouse button to activate the vertical bar cursor. This places the vertical bar cursor at the end of the transient. Verify that the vertical bar cursor is on the

end point of the transient and click **End**. This places values in the End Time and Delta Time boxes.

By following the above steps, you can calculate the time between any two points on the graph.

The startup signature should not change significantly from one test to the next. Compare the signatures of subsequent tests to the baseline test and identify any changes. Changes indicate a change in the operating conditions or deterioration of motor health. For maximum effectiveness in analyzing and comparing, in-rush/startup data, ensure you are monitoring the same phase in all subsequent tests.

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 DC In-Rush/Start-Up tab. Locate the test by using the scroll bar at the bottom of the window. Figure 6-61 shows the Test History window for a DC asset, EMAX DC In-Rush/Start-Up test. The Test History window menus and functions are discussed in Chapter 3 - MCEGold, page 3-28.

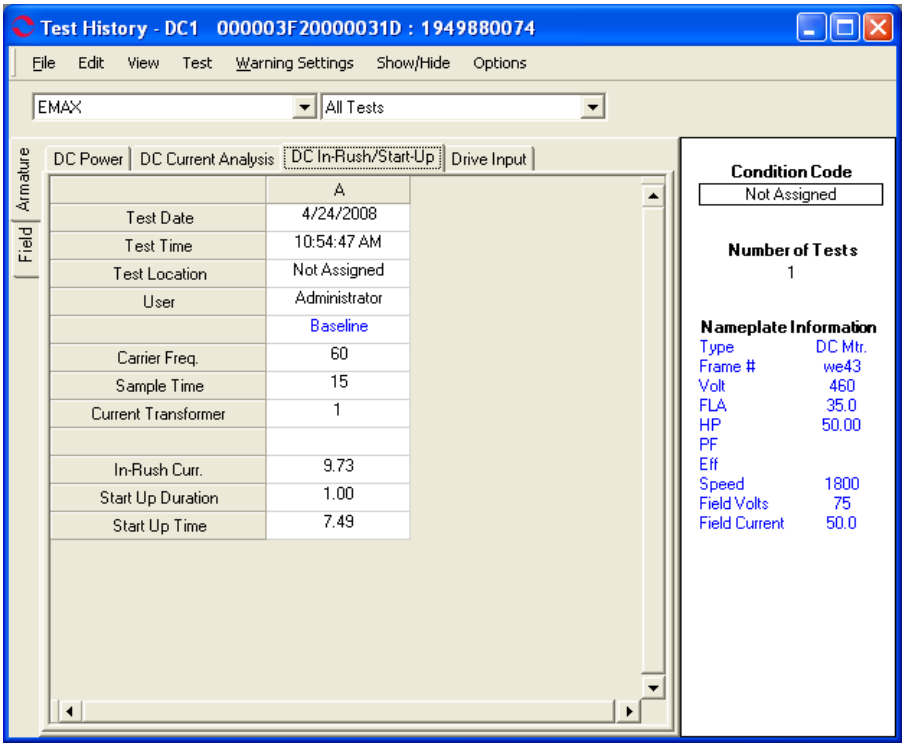


Figure 6-61: Test History - DC In-Rush/Start-Up

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 Carrier Frequency, Sample Time and Carrier Transformer 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.

Review the History Chart for any caution and alarm values. To assist in the analysis process, graphing may be used for visual trending on motors with more than one set of test results. Highlight the row containing the test value to be graphed and select View, Graph from the Test History window menu.

In-Rush Current is the maximum current felt by the motor during in-rush. When the History Chart is reviewed for the first time, the value is 0. If the Start Amplitude is calculated on the InRush/Startup window and the data is saved, the next time the History Chart is reviewed, the In-Rush Current is displayed.

Under the same operating conditions, the amplitude of this in-rush current should not change from one test to the next. Changes in in-rush current amplitude are caused by changes in operating conditions or deteriorating motor health.

Start-Up Duration is the time difference between the point of in-rush and the time the motor reaches steady state. When the History Chart is reviewed for the first time, this value is 0. If the Delta time is calculated on the In-Rush/Start-Up window and the data is saved, the next time the History Chart is reviewed, the Start-Up Duration value is displayed.

Under the same operating conditions, the value of Start Up Duration should not change from one test to the next. Changes in the Start Up Duration are caused by changes in operating conditions or deteriorating motor health.

Drive Input

Drive Input provides a snapshot of the distribution system power quality. The current recorded during the test can be used to determine if there are potential problems in both the rectifier circuit and possibly the firing circuit. Comparison of these power tests over time with specific attention to the current trace provides valuable information when troubleshooting a potential DC drive fault.

The test is performed by selecting the EMAX tab on the Test Selection window and Drive Input from the test list. See page 6-43 for detailed information on the testing procedures. At the end of the test, the Test Results window shown in Figure 6-62 opens.

> Note: You can also access the Test Results by highlighting the asset on the Site Navigator or WatchList and selecting the Test History icon on the toolbar.

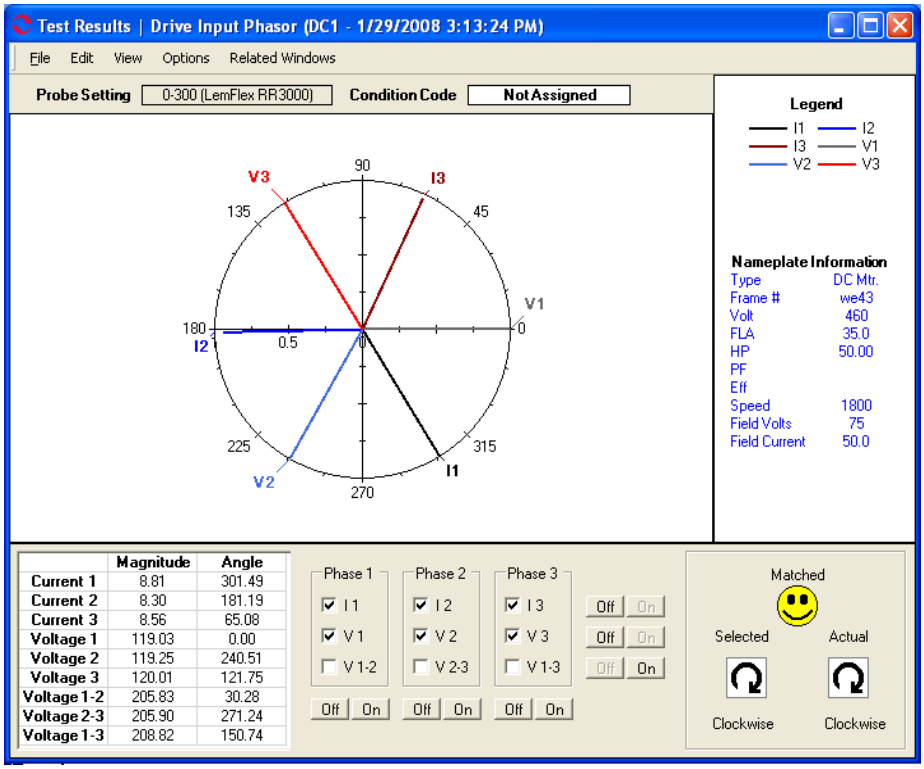
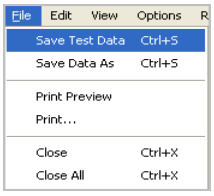


Figure 6-62: Test Results - Drive Input Phasor



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 are 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.

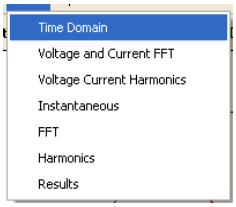
Close All

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 Menu

Create Message (Ctrl+M)

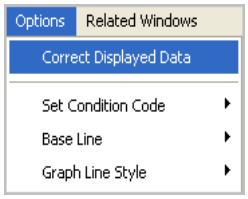
Selecting Edit, Create Message opens the Compose Asset Message window. Use this function to add a message/note to the asset record. The messages/notes can be read using the Message Center. Compose Asset Message and the Message Center are discussed in Chapter 3- MCEGold, Message Center on page 3-41.



View Menu

The View menu provides the option to open additional test result windows by clicking on the desired window. A check mark in front of the name indicates that window is open. It is possible to have multiple windows open at the same time. Use the Related Windows menu to display them in a tile format. The test results windows available are:

Time Domain
Voltage and Current FFT Voltage Current Harmonics
Instantaneous
FFT
Harmonics
Results

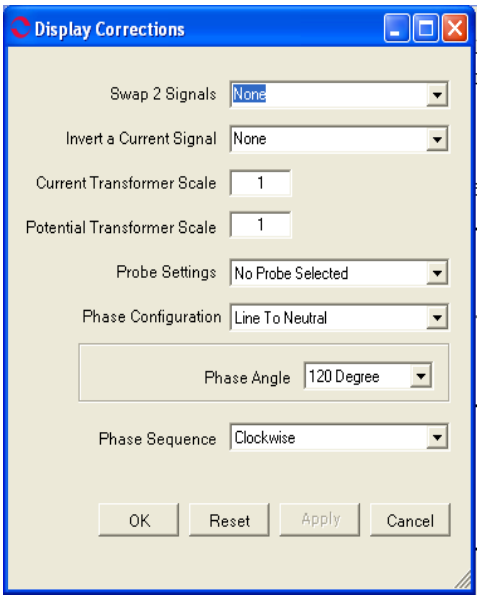


Options

Correct Displayed Data

Selecting Options, Correct Displayed Data allows you to make multiple adjustments to the test results using selections from the drop down list or in the case of current and potential transformer scales entering a value in a text box. Those adjustments are:

- Swap Two Signals
- Invert a Current Signal
- Current Transformer Scale
- Potential Transformer Scale
- Probe Settings
- Phase Configuration
- Phase Angle
- 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

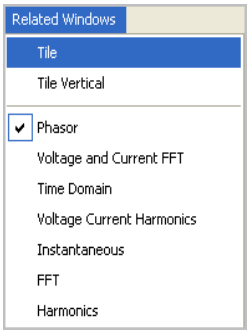
Selecting Options, Set condition Code displays the submenu shown on the right. Click on the desired condition code.

Baseline

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

Graph Line Style

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



Related Windows

Selecting Related Windows, displays functions that control how the open windows are displayed and lists the open windows. The Drive Input Phasor window is the default, the other window are opened using the View menu. A check mark indicates the active window.

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 Drive Input 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.

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 is useful to see the phase relationships for voltage and current. This display does NOT show the magnitude difference of each of the signals. To see 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 Phase 1, 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 “frown” face.

Field Section

DC In-Rush/Start-Up

The DC In-Rush/Start-Up test provides data on how the field circuit builds during start-up. The data is used for comparison to baseline data. Changes of the established baseline need to be investigated.

Same as Armature Section DC In-Rush/Start-Up testing. See page 6-80.

WARNING SETTINGS

Warning levels can be set for each individual motor to indicate problems that exist within that motor or motor circuit. 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. Preset change from baseline values are 5% for Caution and 10% for Alarm.

Default warning setpoints are based on testing at the MCC. As you gain experience with the EMAX tester, you may choose to narrow the range of acceptable values. The condition of the motor and the criticality of its application to your operation or process are other factors that should 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 asset notes.

Warning levels may be set on the parameters listed below:

Voltage Line to Line [+-#%NP]
Voltage Line to Neutral (Tot)
Voltage Imbalance (LL) [>#]
Voltage Imbalance (Tot LN) [XXX]
Voltage Crest Factor (LL) [>#]
Voltage Crest Factor (LN) [>#]
Voltage THD (LL) [>#]
Voltage THD (LN)
Harmonic Factor [>#]
Current RMS [>#%FLA]
Current Imbalance [>#]
Current Crest Factor [>#]
Current THD [>#]
Self Impedance Imbalance [>#]
Line Frequency [Base+-#]
Speed
Fp Frequency
Fp Amplitude [<#]
% Full Load Amps [>#]

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 example, the Line Caution or Alarm value is “<Base-#.” In the number box enter 5 for Caution and 10 for Alarm. This means that if a subsequent test measures 5 RPM more or less than the baseline value, RPM indicates in a Caution condition. If a subsequent test measures 10 RPM more or less than the baseline value, RPM indicates in an Alarm condition.

For the settings which do not reference a baseline, the value obtained will be in Caution or Alarm if it is outside the specific parameter of the Caution or Alarm setting.

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 no Caution or Alarm 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 3-7. 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.

