

MOTOR CORE LOSS TEST SET

Model Number CL25A
Version 3.0

March 28, 2014

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SPECIFICATIONS

MODEL CL25A

Motor Core Loss Test Set with continuously variable output voltage and instrumentation for measurement of motor core losses.

INPUT: 400 VAC, 50 Hz; 480 VAC, 60Hz; 60 A, 1-phase

AC OUTPUT: 5 minutes ON / 15 minutes OFF

CL25A															
TAP		400 VAC, 50 Hz						TAP		480 VAC, 60 Hz					
10.4 V	L	0	-	3.46	VAC	@	2000 A	12.5 V	L	0	-	4.16	VAC	@	2000 A
	M	3.46	-	6.94	VAC	@	2000 A		M	4.16	-	8.33	VAC	@	2000 A
	H	6.94	-	10.41	VAC	@	2000 A		H	8.33	-	12.50	VAC	@	2000 A
20.8 V	L	0	-	6.94	VAC	@	1000 A	25 V	L	0	-	8.33	VAC	@	1000 A
	M	6.94	-	13.88	VAC	@	1000 A		M	8.33	-	16.66	VAC	@	1000 A
	H	13.88	-	20.8	VAC	@	1000 A		H	16.66	-	25.0	VAC	@	1000 A

INSTRUMENTATION:

AC Voltmeter: Digital, displayed on computer screen, true RMS

AC Currentmeter: Digital, displayed on computer screen, true RMS

AC Kilowattmeter: Digital, displayed on computer screen

STANDARD DESIGN AND SAFETY FEATURES:

- * Main power circuit breaker with indicator lamp
- * Fused control power circuits
- * Emergency OFF pushbutton control
- * External interlock provision
- * Thermal overload protection
- * Rugged steel cabinet with casters
- * Separate voltmeter leads for greater meter accuracy
- * 8-foot output cable
- * [OPTIONAL] Computer with printer
- * Control and data base software

Dimensions: 32" W x 42" D x 45" H

Weight: 890 pounds

CONTROL PANEL DESCRIPTION

- **MAIN POWER LAMP:** Indicates that the main power circuit breaker is on and control power is available.
- **OUTPUT LAMP:** Indicates that the test set output is energized.
- **CONTROL POWER FUSE:** Provides protection for all control and metering circuits including the 120 VAC outputs for the computer and printer.
- **EMERGENCY OFF PUSHBUTTON:** De-energizes the output of the test set.
- **DUPLEX OUTLET:** 120 VAC convenience outlet for the computer and printer. Fused at 3 Amperes.
- **DATA CONNECTOR (CX1):** USB data connector used to interface the computer with the internal Programmable Logic Controller (PLC).
- **COMPUTER:** Controls all functions, displays all metering and records test results.

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INSTALLATION

1. Position the test set in the desired location.
2. Connect the main service green lead to the main power ground.
3. Connect the main service leads to the main power source. The main power source requirements are single phase input 400 VAC, 50 Hz or 480 VAC, 60Hz at 60 Amperes.

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INTRODUCTION

The Phenix Technologies Core Loss Test Set is a continuously variable low voltage, high current power supply for testing stators, rotors, and armature cores. The basic test set includes complete instrumentation, output and voltmeter cables, computer and printer. The computer is used for complete control, metering, data storage and evaluation of test results.

The test set is used to energize the motor core steel to 85 kilolines per square inch flux density while measuring the applied voltage, current, and power. The test voltage required to excite the core to 85 kilolines per square inch flux density is calculated by the computer based on the core dimensional data which is manually entered by the operator.

Actual test data (volts, amps, watts) is automatically entered into the computer during the test. The computer then takes the test data and calculates apparent power factor and the watts per pound of core weight.

A number of factors can influence the readings obtained from *good* motor cores. These factors range from manufacturers design criteria, to type of core steel, to steel stamping and assembly process. The computer bases its pass/fail criteria on the following generally accepted levels of core performance:

Apparent Power Factor:	0.1 to 0.7	Good
	0.7 to 0.9	Marginal
	0.9 to 1.0	Bad
Watts per Pound:	1-6 W/lb.	Good
	6-10 W/lb.	Marginal
	>10 W/lb.	Bad

In all cases, the computer will allow you to perform a hot spot check by physically checking the core for any localized areas of heating. If areas are found, they should be marked for further inspection and possible repair.

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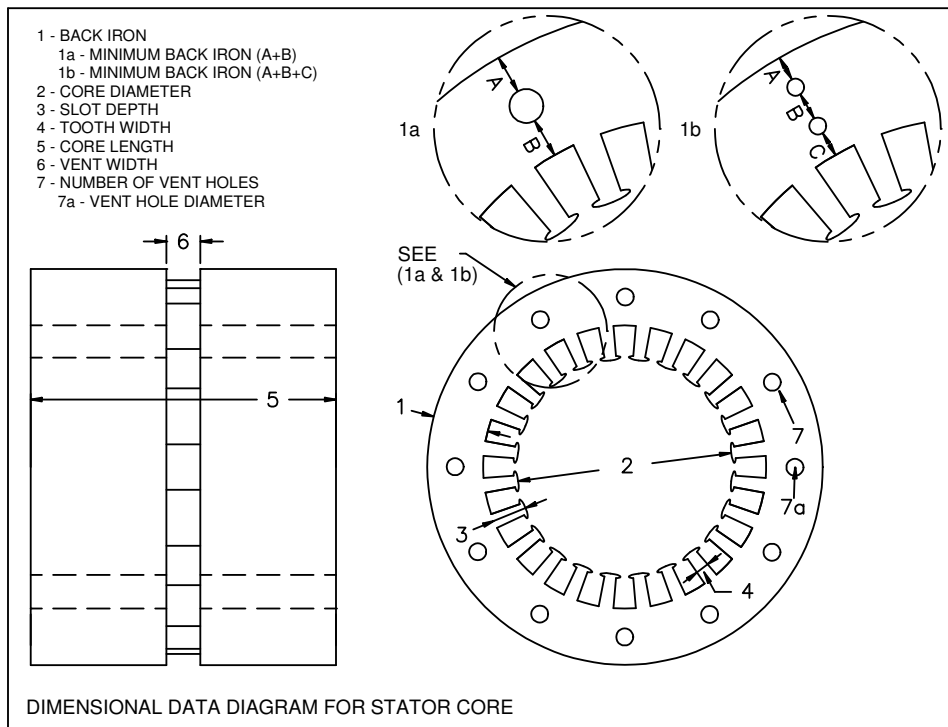
SET-UP PROCEDURE

1. Connect the data cable (USB) between the computer and the CX1 connector on the Core Loss Tester control panel.
2. Connect the printer cable between the computer and the printer.
3. Connect the computer's power input/power supply cable and the printer's power cable to the 120 VAC outlets located on the Core Loss Tester control panel.
4. Place the Core Loss Tester main breaker to the ON position. Turn on the computer and printer.
5. After the computer startup is complete, click the WinCore icon to launch the system software.
6. Please see Section 8-1 SOFTWARE for a more detailed description of the WinCore software.

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STATOR TEST PROCEDURE

1. On the main screen of WinCore, select *Stator* as the Core Type.
2. In the Work Order Number box, click the *New...* button. Enter the Work Order Number. This number will identify the test on the test results screen. Optionally, you may then enter a Report ID. This field gives you the ability to perform and save multiple tests under the same Work Order Number.
3. In the Customer box, click *Lookup...* to browse your customer list to find the customer you are testing for; or, if it is a new customer then click *New...* to add it.
4. In the Motor box, click *Update...* to browse your motor list to find the motor configuration you wish to test; or, if it is a new motor type then click *New...* to add it. Measure the core and enter the dimensions for each of following parameters:

Length of Core
Core Diameter
Back Iron Width
Slot Depth
Vent Width (If no vents exist, leave blank)
Number of Vents (If no vents exist, leave blank)
Number of Vent Holes (If no vent holes exist, leave blank)
Vent Hole Diameter (If no vent holes exist, leave blank)



5. Click on *Automatic Core Loss Test* to proceed with the test. The computer calculates the test voltage required to produce the desired flux density in the back iron and recommends the appropriate output tap. It will then prompt the operator to connect the output power and voltmeter cables.
3. Place the output power cable loop through the center of the stator. Connect the free end of the power cable to the voltage tap specified by the computer.

STATOR TEST PROCEDURE

4. Place the voltmeter cable thru the center of the stator. Plug the ends of the voltmeter cable into the common voltmeter terminal and the voltmeter terminal corresponding to the voltage tap being used.
5. Click *Begin Test* to proceed with the test. The Core Loss Tester will automatically ramp up the voltage to the calculated target value. The meter readings and calculations are continually updated in real time. When the target voltage is reached, the tester will remove the excitation voltage and ramp back down to zero. All readings and calculations on the screen will be held.
6. Click on the *Hot Spot Test* tab; the Hot Spot Test page will appear. Click *Begin Test* to proceed with the test.
7. The Test Set will automatically ramp up the output current to the target current which is between two and three times the core loss test measurement, but not exceeding the rated current of the test set.
8. Click *Test Complete* after sufficient time has elapsed to create any hot spots in the core. The test set will now remove the output and ramp back down to zero. Examine the core for hot spots then record your findings.
9. Click *Save* to save your test results.

ARMATURE/ROTOR TEST PROCEDURE

1. On the main screen of WinCore, select *Rotor* as the Core Type.
5. In the Work Order Number box, click the *New...* button. Enter the Work Order Number. This number will identify the test on the test results screen. Optionally, you may then enter a Report ID. This field gives you the ability to perform and save multiple tests under the same Work Order Number.
6. In the Customer box, click *Lookup...* to browse your customer list to find the customer you are testing for; or, if it is a new customer then click *New...* to add it.
7. In the Motor box, click *Update...* to browse your motor list to find the motor configuration you wish to test; or, if it is a new motor type then click *New...* to add it. Measure the core and enter the dimensions for each of the following parameters:

Length of Core

Back Iron Width

Core Diameter

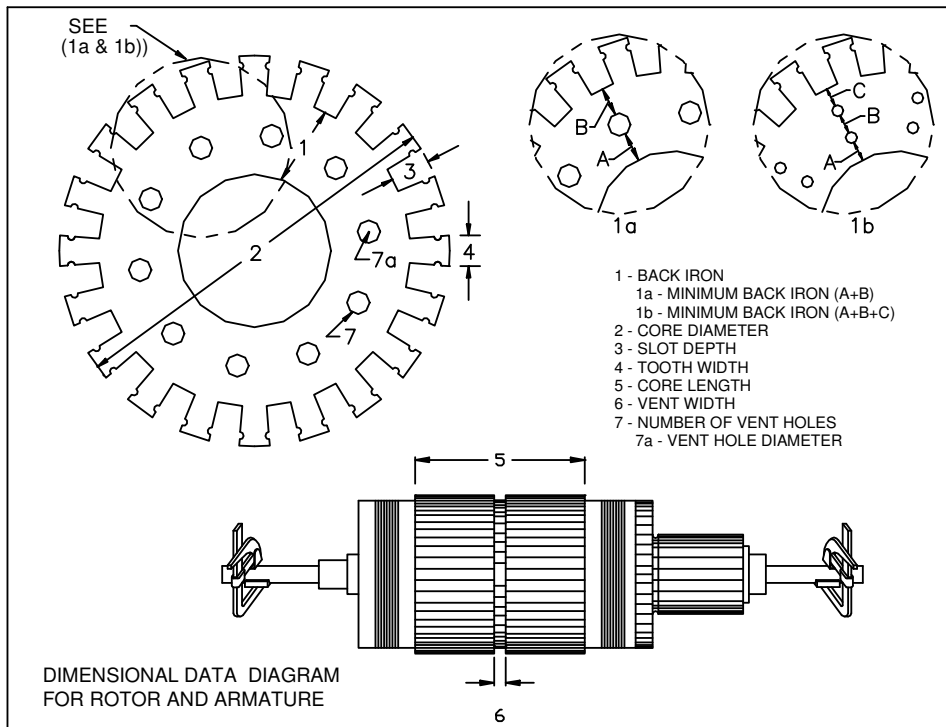
Slot Depth

Vent Width (If no vents exist, leave blank)

Number of Vents (If no vents exist, leave blank)

Number of Vent Holes (If no vent holes exist, leave blank)

Vent Hole Diameter (If no vent holes exist, leave blank)



3. Click on *Automatic Core Loss Test* to proceed with the test. The computer calculates the test voltage required to produce the desired flux density in the back iron and recommends the appropriate output tap. It will then prompt the operator to connect the output power and voltmeter cables.

ARMATURE/ROTOR TEST PROCEDURE

4. Connect one "C" type rotor clamp to the connector on the end of the cable, which is hard-wired to the test set. Attach the clamp to the rotor shaft. Connect the other "C" clamp to the opposite end of the rotor shaft; connect the cable plug to the voltage tap specified by the computer.
5. Place the voltmeter lead through the spokes. If this is not possible, use a second set of voltmeter leads (with clips on the ends) and clip the voltmeter leads to the shaft clamps. Plug the ends of the voltmeter cable into the common voltmeter terminal and the voltmeter terminal corresponding to the voltage tap being used.
6. Click *Begin Test* to proceed with the test. The Core Loss Tester will automatically ramp up the voltage to the calculated target value. The meter readings and calculations are continually updated in real time. When the target voltage is reached, the tester will remove the excitation voltage and ramp back down to zero. All readings and calculations on the screen will be held.
7. Click on the *Hot Spot Test* tab; the Hot Spot Test page will appear. Click *Begin Test* to proceed with the test.
8. The Test Set will automatically ramp up the output current to the target current which is between two and three times the core loss test measurement, but not exceeding the rated current of the test set.
9. Click *Test Complete* after sufficient time has elapsed to create any hot spots in the core. The test set will now remove the output and ramp back down to zero. Examine the core for hot spots then record your findings.
10. Click *Save* to save the test results.

8-1 SOFTWARE

WinCore was developed to be used with the Phenix Technologies' automatic core loss tester. This software was designed for maximum user flexibility. You may run fully automatic tests, operate the tester with the manual controls or perform tests with a mixture of both approaches.

If you are upgrading from an earlier version of Core Loss for Windows, there is a Database Converter Tool that you may use to import your old data into WinCore. For more information, see the Database Maintenance section near the end of this manual.

Installation

If you have purchased a new core loss test set, then WinCore will be pre-installed and tested on the accompanying notebook computer. No further software installation or setup is required. If you should ever need to re-install the software, here are the system requirements and the installation procedure.

Minimum System Requirements:

- 500 Mhz Pentium Computer or higher
- 512 MB of system RAM or greater
- 50 MB available hard disk space
- Microsoft Windows XP

Additional Hardware Requirements:

The computer must have one USB 2.0 port available. You MUST install the USB driver before connecting the tester to the computer for the first time.

To Install WinCore:

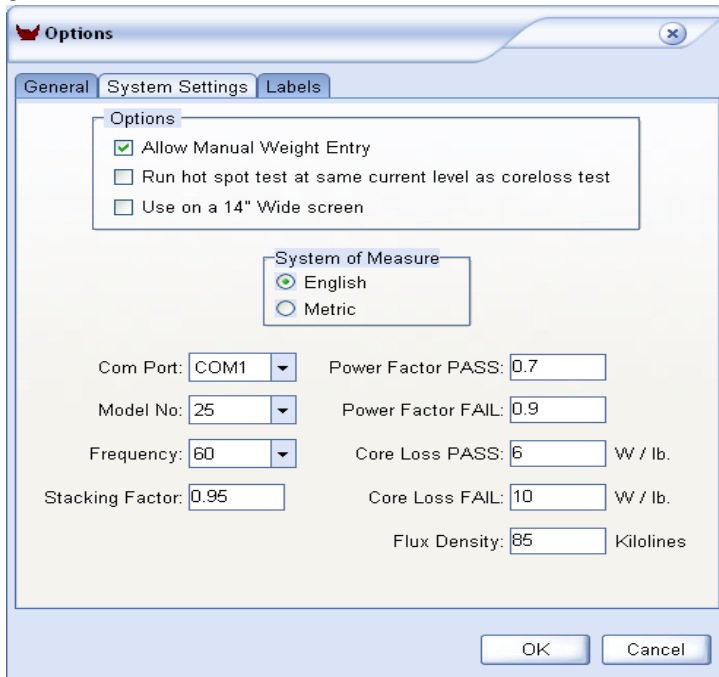
1. Insert the WinCore CD.
2. Click Start, then choose Run.
3. Type 'd:setup' and click *Ok*. NOTE: 'd:' is the CD-ROM drive specification.
4. Follow the installation instructions as they appear on the screen.
5. When the installation is complete, double-click on the "WinCore" icon to launch the software.

To Install the USB Driver:

1. Click *Start, All Programs, Phenix Technologies* then "Install USB Driver".
2. Follow the installation instructions as they appear on the screen.
3. When the installation is complete, connect the USB cable between the tester and the computer.
4. Click *Start, Control Panel, System, Hardware* then *Device Manager*. Look under *Ports* to see which COM port is assigned to the USB converter. Configure WinCore to use this COM port as described below.

System Configuration

Before you can use WinCore on a new installation, you must first configure the software to match the hardware configuration of your tester. Configure WinCore by using the setup screen *System Settings*. Access this screen from the main screen of WinCore by clicking the *Options* button, then *System Settings* tab.

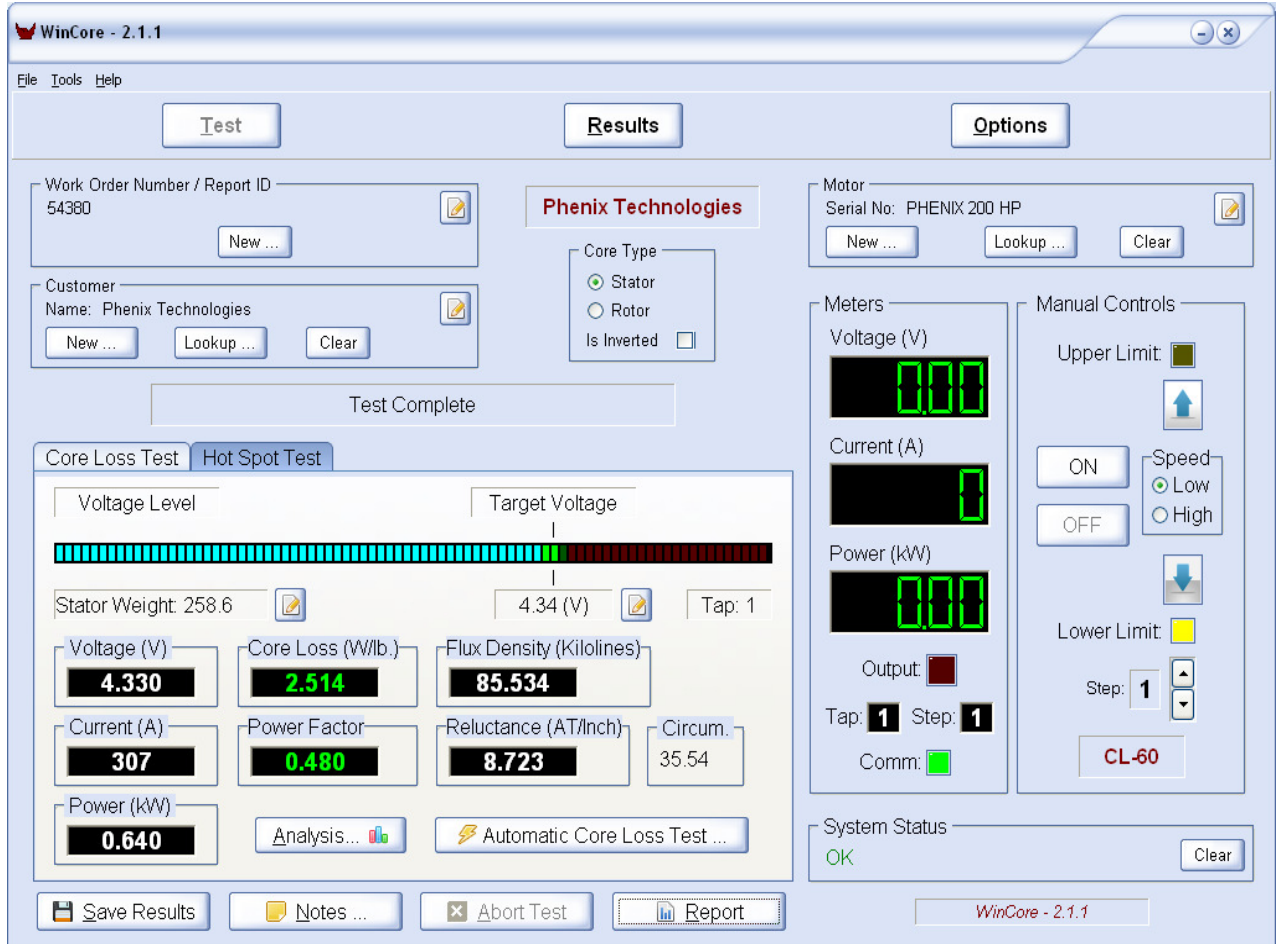


The System Settings Configuration screen

The System Settings screen contains hardware and test parameter information. The default settings are appropriate for most installations. The *Model No* and *Com Port* settings **MUST** be changed to match your configuration.

Model No: This setting **must** match the model number of your core loss tester.

Com Port: The serial port designation that the USB-to-Serial converter is configured to use. This information can be found in the Windows Device Manager under Ports.



The main screen of WinCore is shown above. The **Results** button will take you to the test results screen. The **Test** button will return you to the main test screen. The **Options** button will open the system settings and user options screen.

WinCore has a flexible user interface that accommodates fully automatic testing while permitting pure manual control of the output supply. You may manually enter the test set points and core weight, or have these values calculated from the motor dimensions that you enter.

If you wish, you may save the test results under a work order number and report ID combination, but this is not required. You may also enter the customer and motor nameplate information, but again this is not required. You may enter all data, perform automatic tests then save and generate a report. Or, you may simply run a manual test discarding the results.

Performing a Test

The following is the step-by-step procedure for automatically testing a core. The main screen contains all the appropriate test information.

- In the Work Order Number box, click the **New...** button. Enter the Work Order Number. This number will identify the test on the test results screen. Optionally, you may then enter a Report ID. This field gives you the ability to perform and save multiple tests under the same Work Order Number.

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9. In the Customer box, click *Lookup...* to browse your customer list to find the customer you are testing for; or, if it is a new customer then click *New...* to add it.
10. In the Motor box, click *Update...* to browse your motor list to find the motor configuration you wish to test; or, if it is a new motor type then click *New...* to add it.
11. Click on the Core Type that identifies the type of core you will be testing; stator or rotor and whether or not it is an inverted core. An example of an inverted core is a core that is actually a stator that looks like a rotor.
12. Click on *Automatic Core Loss Test* to proceed with the test.
13. The *Begin Test* screen will appear. The Test Voltage Level and recommended output tap will be displayed on the top of this screen. Click *Begin Test* to initiate the automatic Core Loss test.
14. The Test Voltage Level will be displayed on the top of this screen. Click *Begin Test* to initiate the automatic Core Loss test.
15. After the test is complete, click *Analysis* to view the core loss test results.
16. Click the *Hot Spot Test* tab to perform a automatic hot spot test. Then click on *Automatic Hot Spot Test...* the *Begin Test* screen will appear.
17. The target current level and recommended output tap will be displayed in the top of the screen (between 2 and 3 times the core loss test current level). Click *Begin Test* to initiate the automatic hot spot test.
18. The timer will begin once the two times target level has been reached. Click *Test Complete* when you are done ; the timer will stop.
19. Check for hot spots and record your findings in the *Hot Spot Findings* box.
20. Click on *Notes...* to add any additional test notes.
21. Click *Save* to save all the test results.
22. Click *Report* to generate a test report. You may view the report on screen or send it to the printer.

Printing a Previous Report

You may generate a report from any test result that is saved in your test history.

1. On the opening screen of WinCore, click the *Results* button. The Test Results screen will appear.
2. Browse the test results to find the test result you wish to print. The most recent test will already be highlighted.
3. Click *Report* to generate the test report . Click *Edit Notes...* to view or edit the test notes. Click *Other Data ...* to add / edit the winding and no-load test information.

NOTE

You may change the order in which the results appear by changing the *Sorted By* control.

Motor Nameplate Data

The motor nameplate screen is where you add or modify a motor configuration.

Motor Nameplate

Serial No: PHENIX 200 HP Frame: Model: Flux Density: 85.0

Manufacturer: Voltage: 480 Current: RPM: 1800 HP / kW: 200

Stator Dimensions Rotor Dimensions

Stator Dimensions Diagram ...

Core Length	Slot Depth	Vent Width
20	1 3/16	1/2
Core Diameter	Tooth Width	Number of Vents
7 7/8	9/32	2
Back Iron	Number of Teeth	Vent Hole Diameter
1 1/16	48	
Min. Back Iron		Number Vent Holes

NOTE: All dimensions are in inches.

Stator Calculated

Approx. Weight (lb.)
258.6

Mean Circumference
35.54

Target Voltage (V)
4.34

**TIP: Dimensions may be entered in decimal or fractional notation.
Example: 2.333 -or- 2 1/3**

OK Cancel

The Motor Nameplate screen

Serial Number: This field is used as the primary identifier, it identifies a given motor configuration. A value is required here and it must be unique.

All other fields are optional. They may be used to identify the size of the motor. The Flux Density field may be used to cause this motor to be tested at a different flux density level than the system default.

Stator Dimensions: Click to display the stator dimensions page. This page contains the measurements of the stator and calculates the approximate weight, the mean circumference and the appropriate test voltage level.

Stator Dimensions Diagram ... Click to display an image that shows the location of each dimension on the stator.

Dimensions may be entered in decimal or fractional notation. For example: a measurement of 2 and one-third inches may be entered as "2.333" or "2 1/3".

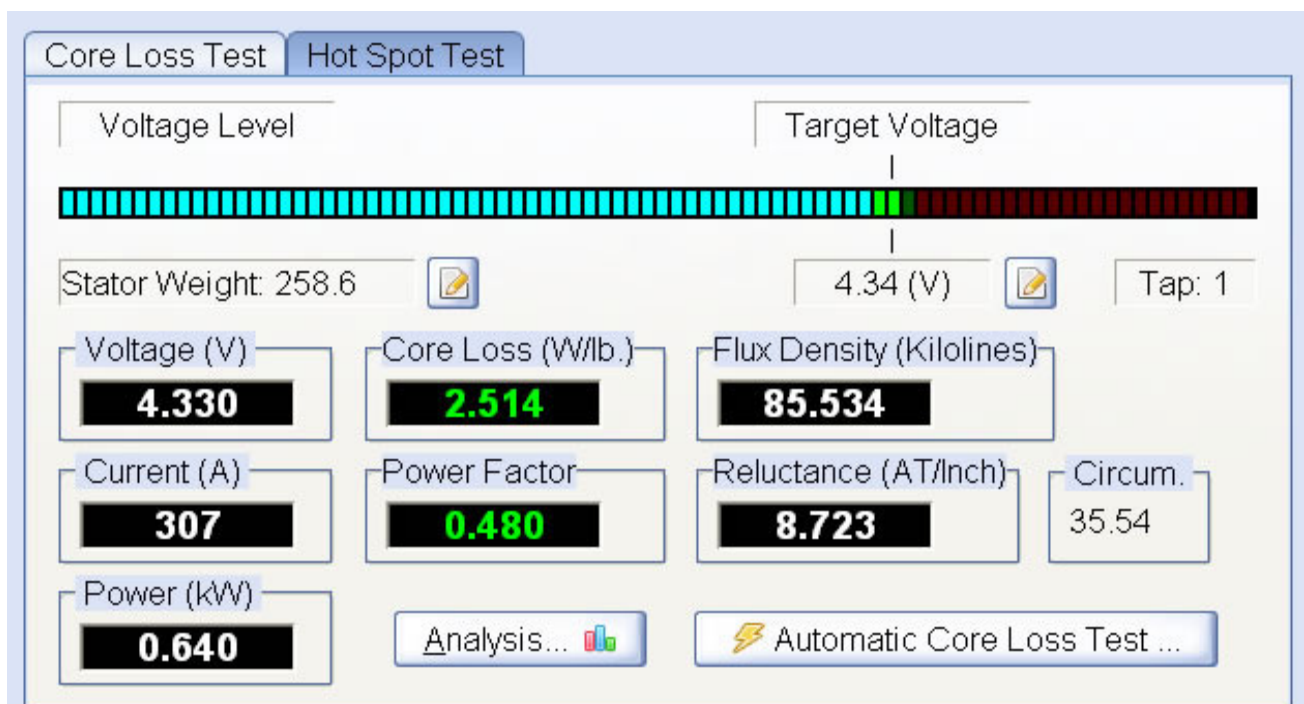
NOTE

The format "2 1/3" must be strictly followed. A space is required between the whole and fractional parts. To see the decimal equivalent of a fraction, hold the cursor on the field for about one second. A yellow box containing the decimal equivalent will appear.

Rotor Dimensions: Click to display the rotor dimensions page. This page contains the measurements of the rotor and calculates the approximate weight, the mean circumference and the appropriate test voltage level.

The Core Loss Test

The core loss test page displays the test set meters, the core loss calculations, and the target voltage and voltage tap. The meter readings and calculations are continually updated in real time.



The Core Loss Test screen

Target Voltage: The voltage level that will produce the desired level of flux density in the core (usually 85 kilo lines).

Analysis: Click to see a graphical view of the core loss test results. The power factor and core loss results are displayed in bar graphs stamped with acceptable, marginal, and unacceptable markings.

Hot Spot Test: Click to perform a hot spot test (recommended). The hot spot test page will appear.

Notes: Click to edit the test notes.

Report: Click to generate a report of the current test results. The report may be reviewed on the screen or sent to the printer.

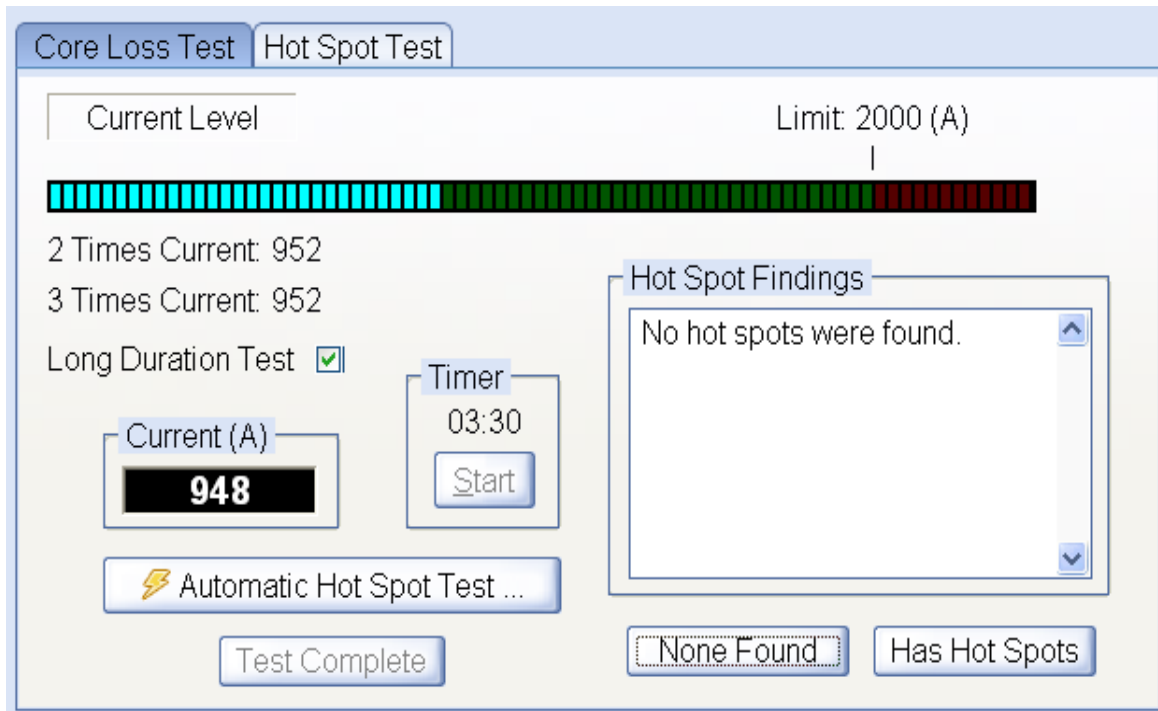
8-7

Save Results: Click to save test results.

Abort Test: Click to immediately cancel the automatic test.

The Hot Spot Test

The hot spot test page displays the output current, the target current level, the hot spot findings and the timer.



The hot spot test screen

Current Level: Shows the target current level for the test, between two and three times the core loss test current level, but not exceeding the rated current of the test set.

Long Duration Test: Check this if you will be running the hot spot test for an extended period of time. This will reduce the test current level down to the core loss test current level.

Timer: The duration of the test. Timer starts counting once the output current reaches the 2 times current level or when you click the Start button.

Hot Spots Findings: A text box where you may enter a description of the hot spot test findings.

None Found, Has Hot Spots: Click to add this text to the findings text box.

Options

Use the general options screen to change the header that appears at the top of the test reports and to control various report options. Access this page by clicking *Options* then the general tab.

Options

General System Settings Labels

Company: Phenix Technologies

Header 1: 75 Speicher Drive

Header 2: Accident, MD 21520

Header 3: 301-746-8118

Report Options

- Print First Page Only
- Print Address in Header
- Print Test Notes
- Print Sign Off
- Send Directly To Printer

Logo File Name (.BMP): image.bmp

Data Path: C:\Program Files\WinCore\Data

OK Cancel

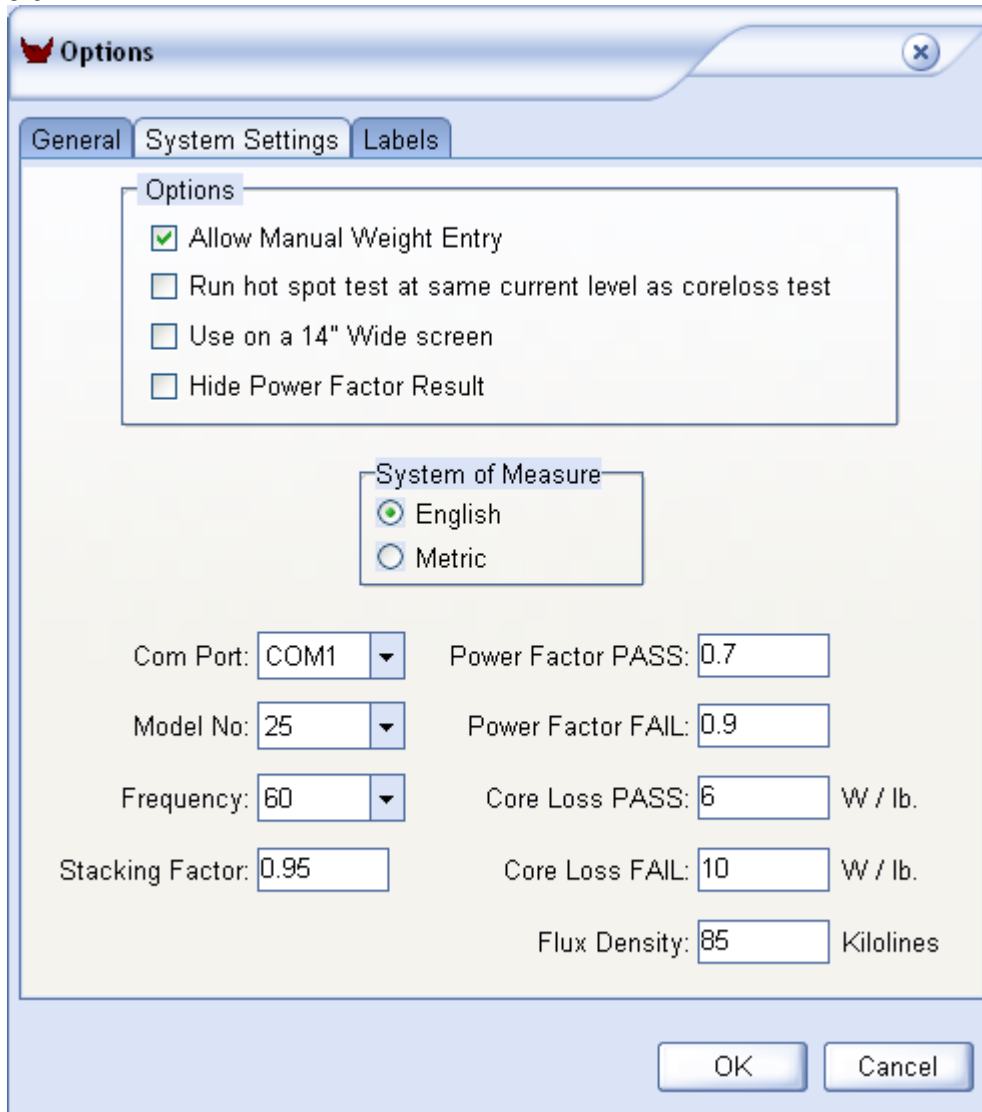
The General Options screen

Logo File Name: Full path to the location of a company logo bitmap file (BMP) that will be displayed in the upper left hand corner of the test report. It is your responsibility to adjust the size of the bitmap file so that it fits in the allocated space. If you place the file in the main program folder (C:\Programs Files\WinCore) than you only need to enter the filename.

Data Path: The location of the WinCore database files. You are responsible for moving all the data files if you change this path.

System Settings

Use the System Settings page to control system functions. Access this page by selecting Options and then *System Settings*.



Options

General System Settings Labels

Options

- Allow Manual Weight Entry
- Run hot spot test at same current level as coreloss test
- Use on a 14" Wide screen
- Hide Power Factor Result

System of Measure

- English
- Metric

Com Port: COM1 Power Factor PASS: 0.7

Model No: 25 Power Factor FAIL: 0.9

Frequency: 60 Core Loss PASS: 6 W / lb.

Stacking Factor: 0.95 Core Loss FAIL: 10 W / lb.

Flux Density: 85 Kilolines

OK Cancel

The System Settings page

System of Measure: The measuring system you use to measure the cores, normally set during installation.

NOTE

Changing the system of measure after motor dimensions have been entered will cause data to become invalid. Dimensions are NOT automatically converted.

Com Port: The serial port designation that the USB-to-Serial converter is configured to use. This information can be found in the Windows Device Manager under Ports.

Model No: The model number of your test set. This setting is critical to the software as it needs to know what the output capabilities of the test set are.

Frequency: The frequency of your input line voltage (default is 60).

Stacking Factor: Factor used in the volume calculations that compensates for the "air" in the lamination steel (default is 0.95).

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Allow manual Weight Entry: Normally, the software calculates the weight from the given dimensions. If checked, the user may over-write this calculated value with an actual measured value.

Run hot spot test at same current level as core loss test: Normally, the hot spot test is performed at a current level that is 2-3 times the core loss test current level. If checked, it is run at the same current level as the core loss test.

Use on a 14" Widescreen: Check this if your notebook computer has a smaller 14" widescreen display. The main screen will be resized to fit the display.

Hide Power Factor Result: Check this if you do not want to see the calculated power factor and do not want the power factor printed on the test report.

Power Factor PASS: The maximum power factor value that is considered acceptable or "good" (default is 0.7).

Power Factor FAIL: The maximum power factor value that is considered marginal (default is 0.9).

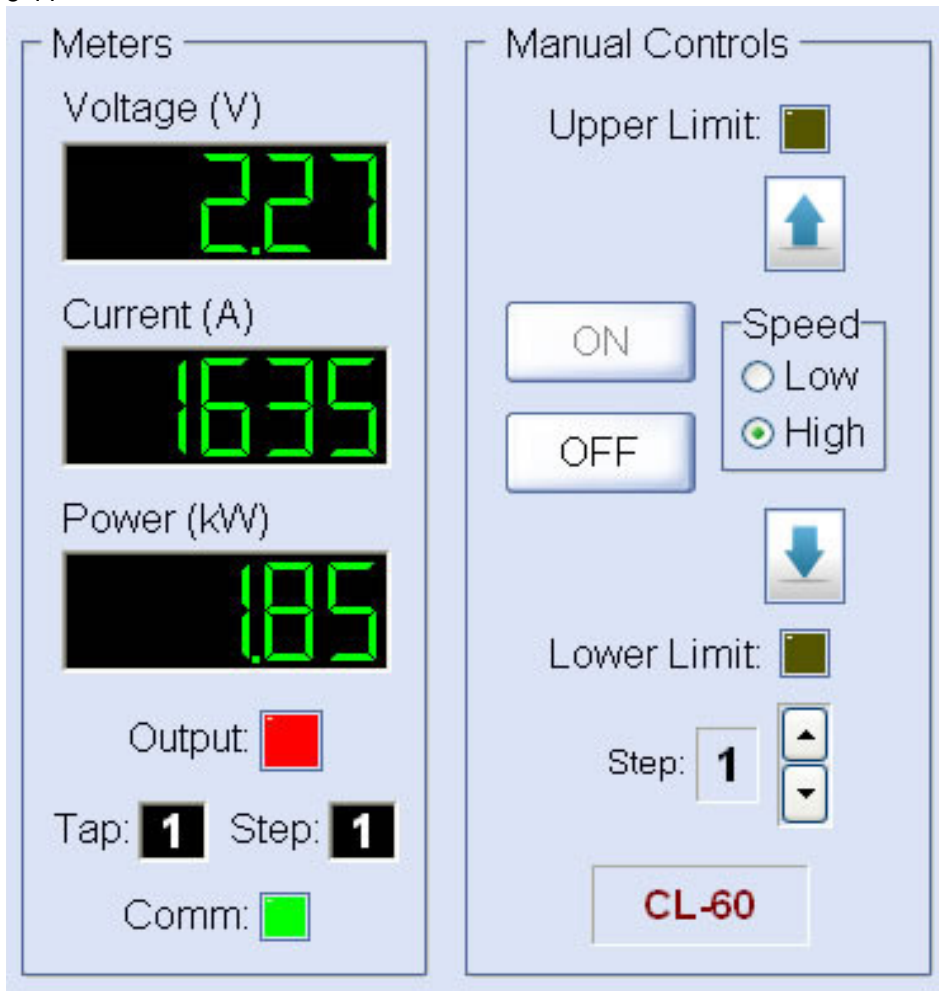
Core Loss PASS: The maximum core loss value that is considered acceptable or "good" (default is 6, 13.2 W/kg.).

Core Loss FAIL: The maximum core loss value that is considered marginal (default is 10 W/lb., 22 W/kg.).

Flux Density: The level of flux density that is required for the core loss test. The target voltage is computed to achieve this value (default is 85 Kilo lines, 13.17 Kilo gauss).

Manual Controls

Manual control of the automatic core loss tester is made possible by the controls in the Manual Controls box, located on the main screen. These controls are inactive when an automatic test is in progress.



Speed: Controls the rate-of-rise of the output voltage.

Output On, Output Off: Controls the state of the output.

Step: Controls the output step position. This determines the maximum output voltage. Step 1 provides the lowest output voltage while step 5 (or whatever the max. step is) provides the highest output voltage.

Raise / Lower Buttons: Controls the output voltage level; from zero to the maximum voltage of the current step. A right-click on the button will lock the function on, then use one left mouse click to undo the lock.

System Status, Clear: Shows all error conditions and system status messages. Click Clear to clear error conditions.

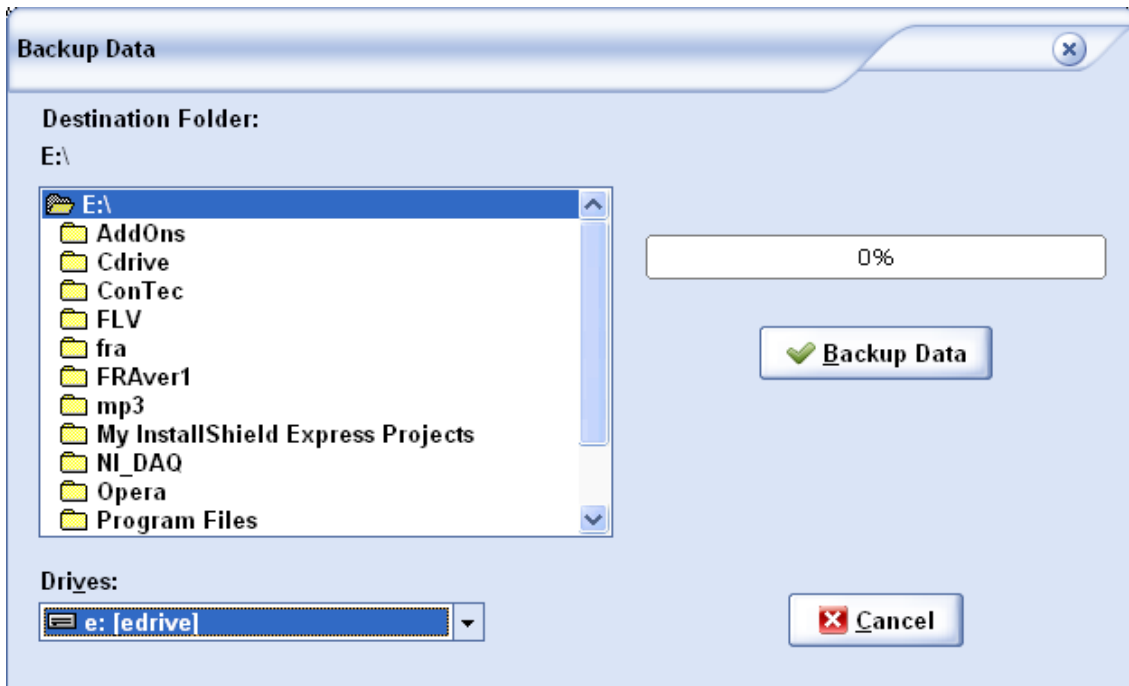
Meters Box: Shows the real-time status of the output supply.

Database Maintenance

Backup Data

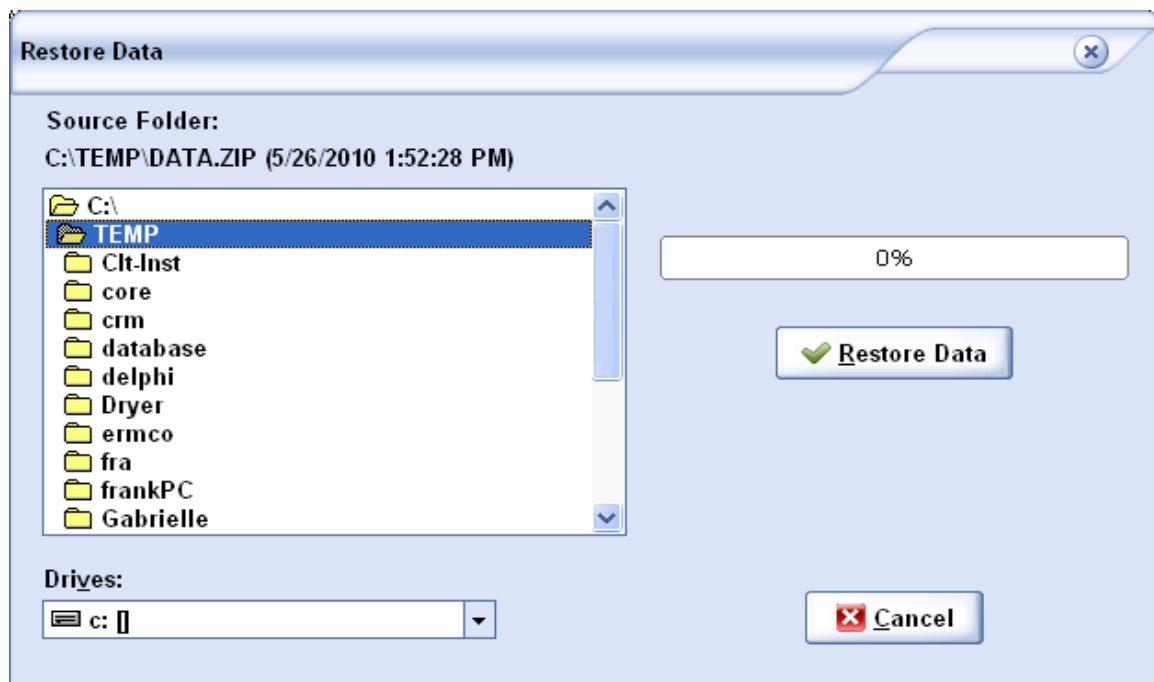
8-12

WinCore data should be backed up on a regular basis. Hard disks do fail, you don't want to lose years of valuable data. We recommend that you maintain at least two separate backup archives on a USB memory stick or network drive. WinCore has backup and restore functions that make this an easy task.



The Backup Data screen

The backup data screen allows you to easily select a drive/directory as a destination for your data backup. Access this form by selecting File and then Backup Data... . Select the drive/directory and Click *Backup Data* to begin the backup.



The Restore Data screen

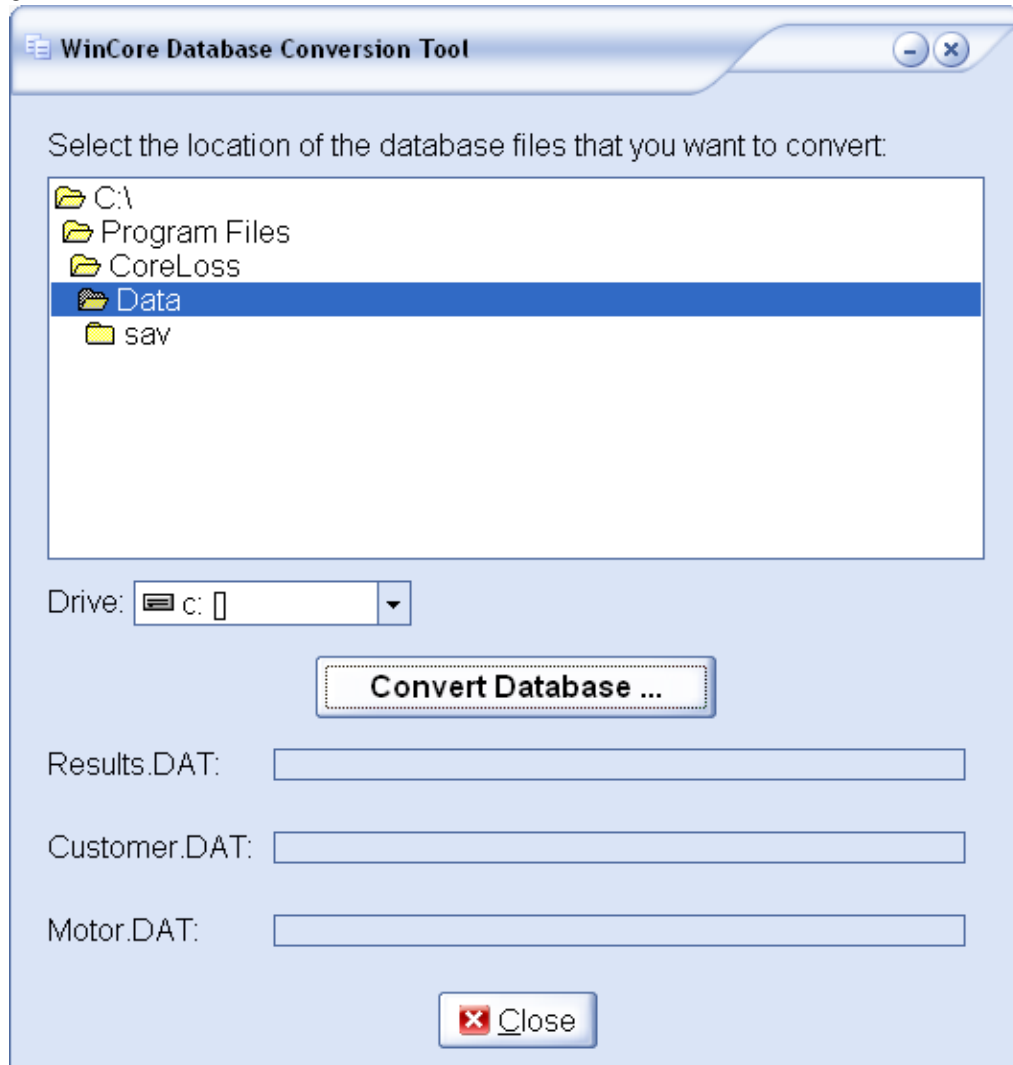
Should something serious happen and you need to restore data from a backup, WinCore provides a similar function for restoring data. The restore data screen allows you to easily select a drive/directory as a source for your data recovery. Access this form by selecting *File* and then *Restore Data...*. Select the drive/directory and Click *Restore Data* to begin the data recovery. This function should ONLY be used as a last resort. ALL existing data will be replaced by the data contained in the backup archive.

Rebuild Database Files

Occasionally, a database index file may become corrupted and unusable. WinCore has a function that will rebuild all database index files. If a database error occurs during software operation, this function should be executed. To rebuild the indexes, select *Tools* and then *Rebuild Database Files*.

Database Converter Tool

If you are upgrading to WinCore from an earlier version of Core Loss for Windows, you may use this tool to convert your old test data. WinCore MUST be closed, then to launch the converter click *Start, All Programs, Phenix Technologies* then *Database Converter*.

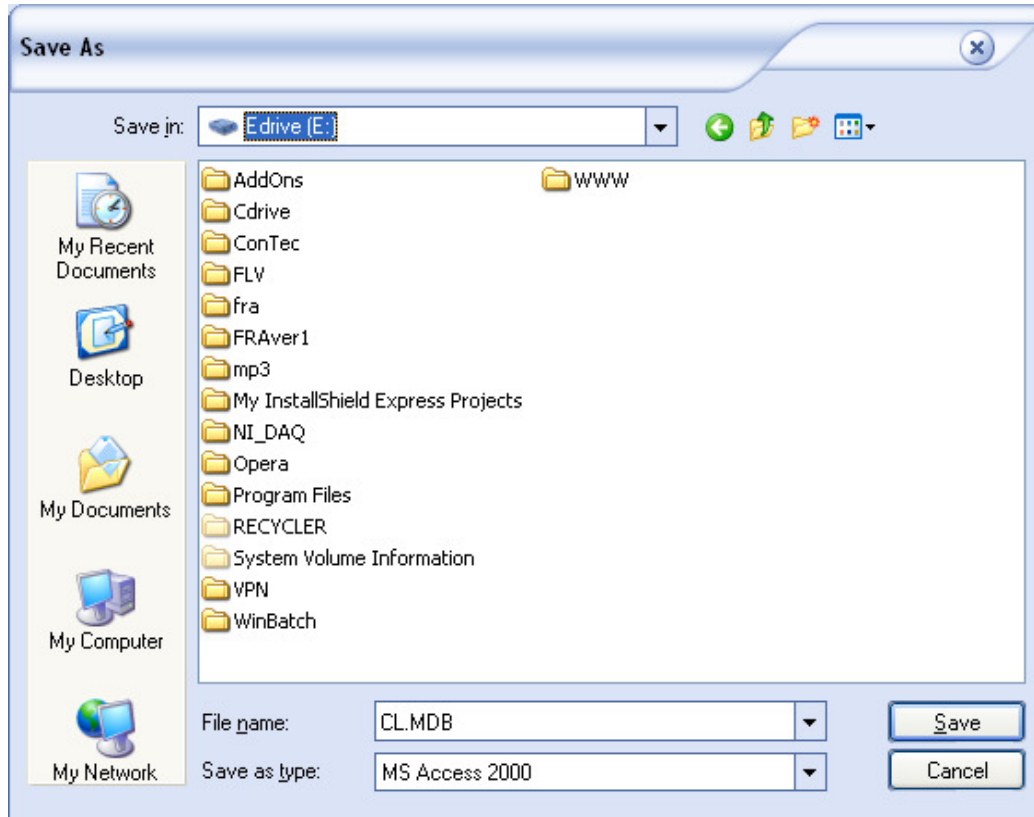


The Database Converter Tool

The converter will look for your old data in the default path. If your data is located in a different path then you will need to browse to that folder. Click Convert Database.. to perform the conversion. **WARNING!** Any existing WinCore data that you have will be deleted and replaced with the converted data.

Export Database...

This function will export all core loss data into an MS Access database file. To access this function click *File* then *Export Database...* then select the destination folder.



Calculations

This appendix contains all of the calculation formulas used in WinCore. These formulas were derived from conventional core loss testing theory. NOTE: The approximate core weight is determined by calculating the total volume and converting this result to a weight.

Rotor Area/Weight

$$\begin{aligned}
\text{Outer_Area} &= 0.785 * \text{Sqr}(\text{Diameter}) \\
\text{Inner_Area} &= 0.785 * \text{Sqr}(\text{Diameter} - (\text{Slot_Depth} * 2)) \\
\text{Tooth_Ring_Area} &= \text{Outer_Area} - \text{Inner_Area} \\
\text{Outer_Circum} &= \text{Pi} * \text{Diameter} \\
\text{Center_Area} &= 0.785 * \text{Sqr}((\text{Diameter} - (2 * (\text{Slot_Depth} + \text{Back_Iron})))) \\
\text{Tooth_Area} &= ((\text{Tooth_Width} * \text{Num_of_Teeth}) / \text{Outer_Circum}) * \\
&\quad \text{Tooth_Ring_Area} \\
\text{Vent_Hole_Area} &= 0.785 * \text{Sqr}(\text{Vent_Hole_Dia}) \\
\text{Cross_Section} &= \text{Inner_Area} + \text{Tooth_Area} - \text{Center_Area} - \\
&\quad \text{Vent_Hole_Area} * \text{Num_of_Vent_Holes} \\
\text{Volume} &= \text{Cross_Section} * (\text{Core_Length} - \\
&\quad (\text{Num_of_Vents} * \text{Vent_Width})) * \text{Stacking_Factor} \\
\text{Rotor_Weight (english)} &= \text{Volume} * 0.276 \\
\text{Rotor_Weight (metric)} &= \text{Volume} * 0.0000076 \\
\text{Rotor_Mean_Circumference} &= (\text{Diameter} - \\
&\quad ((\text{Slot_Depth} * 2) + \text{Min_Back_Iron})) * \text{Pi}
\end{aligned}$$

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Stator Area/Weight

$$\text{Center_Area} = 0.785 * \text{Sqr}(\text{Diameter})$$

$$\text{Outer_Area} = 0.785 * \text{Sqr}((\text{Diameter} + (2 * (\text{Slot_Depth} + \text{Back_Iron}))))$$

$$\text{Inner_Area} = 0.785 * \text{Sqr}(\text{Diameter} + (\text{Slot_Depth} * 2))$$

$$\text{Tooth_Ring_Area} = \text{Inner_Area} - \text{Center_Area}$$

$$\text{Tooth_Circum} = \text{Pi} * (\text{Diameter} + (\text{Slot_Depth} * 2))$$

$$\text{Tooth_Area} = ((\text{Tooth_Width} * \text{Num_of_Teeth}) / \text{Tooth_Circum}) * \text{Tooth_Ring_Area}$$

$$\text{Vent_Hole_Area} = 0.785 * \text{Sqr}(\text{Vent_Hole_Dia})$$

$$\text{Back_Ring_Area} = \text{Outer_Area} - (\text{Inner_Area} + (\text{Vent_Hole_Area} * \text{Num_of_Vent_Holes}))$$

$$\text{Cross_Section} = \text{Back_Ring_Area} + \text{Tooth_Area}$$

$$\text{Volume} = \text{Cross_Section} * (\text{Core_Length} - (\text{Num_of_Vents} * \text{Vent_Width})) * \text{Stacking_Factor}$$

$$\text{Stator_Weight (english)} = \text{Volume} * 0.276$$

$$\text{Stator_Weight (metric)} = \text{Volume} * 0.0000076$$

$$\text{Stator_Mean_Circumference} = (\text{Diameter} + ((\text{Slot_Depth} * 2) + \text{Back_Iron})) * \text{Pi}$$

Target Voltage

$$\text{Target_Voltage (metric)} = (4.44 * \text{Frequency} * (\text{Core_Length} - (\text{Vent_Width} * \text{Num_of_Vents})) * \text{Stacking_Factor} * \text{Min_Back_Iron} * (\text{Flux_Density} / 645.2)) / 100000$$

$$\text{Target_Voltage (english)} = (4.44 * \text{Frequency} * (\text{Core_Length} - (\text{Vent_Width} * \text{Num_of_Vents})) * \text{Stacking_Factor} * \text{Min_Back_Iron} * \text{Flux_Density}) / 100000$$

Test Results

$$\text{Core_Loss} = \text{Watts} / \text{Weight}$$

$$\text{Power_Factor} = \text{Watts} / (\text{Voltage} * \text{Current})$$

$$\text{Flux_Density (english)} = (100000 * \text{Voltage}) / (4.44 * \text{Frequency} * (\text{Core_Length} - (\text{Vent_Width} * \text{Num_of_Vents})) * \text{Stacking_Factor} * \text{Min_Back_Iron})$$

$$\text{Flux_Density (metric)} = \text{Flux_Density} * 100 \quad \{ \text{convert from MM to CM} \}$$

$$\text{Reluctance (A.T./inch)} = \text{Current} / \text{Mean_Circumference}$$

Conversion Factors

$$1 \text{ Lb.} = 0.4536 \text{ kG}$$

$$1 \text{ in.} = 25.4 \text{ mm}$$

$$1 \text{ Kilogauss} = 6.452 \text{ Kilolines}$$

$$1 \text{ Kilolines} = 0.1545 \text{ Kilogauss}$$

Calibration Procedure

Enter the Calibration Screen: Click *Tools*, then *Calibrate*. Your password is CL.

Calibration Standard: Rotek 8000 or higher

1. Calibrate Currentmeter
 - Connect Rotek to secondary of current CT
 - Zero currentmeter
 - Go to each range with slide panel and calibrate each range
 - Inject proper current for tap
 - Take injected current amount divided by computer currentmeter reading and multiply by existing calibration factor
 - Insert answer as new cal factor
 - Repeat for each tap

2. Calibrate Voltmeter
 - Connect Rotek to banana jacks on output panel for first tap
 - Inject proper voltage for tap
 - Divide the injected voltage amount by computer voltmeter reading, then multiply by existing calibration factor
 - Insert answer as new cal factor
 - Repeat for each tap

3. Calibrate Wattmeter
 - Connect Rotek current leads to secondary of CT and connect voltmeter leads to banana jacks
 - Choose tap and power factor
 - Set Rotek for chosen power factor
 - Inject proper voltage and current
 - Divide the injected wattage amount by computer wattmeter reading, then multiply by existing calibration factor
 - Insert answer as new cal factor
 - Repeat for each tap and power factor

NOTE: CL 10A, 25A, and 60A have 2 taps
CL125A has 3 taps

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ELECTRICAL SCHEMATIC

	Drawing Number	Description
1.	9307425	CL25A Core Loss Test Set

MAINTENANCE

No solution or chemical any stronger than ordinary mild soap and water solution should be applied to the cabinet area of this unit. Care must be used when cleaning the meter faces and console panel. Abrasives may remove printing and descriptive titles and scratch meter faces. When cleaning, always have unit disconnected from power source. Never attempt to clean inside the unit, as the cleaning solution may cause damage to the electronic components.

In the event it becomes necessary to replace any parts, a complete description can be found with the supplied parts list.

PARTS LIST

Qty	Item	Description	Computer Number	Comments
1	CABLE	USB Cable	1001403	
1	CB1	Ckt Brkr ABB#S3N060TW-2	1601160	
1	CT1	Current Xfmr 2500/5A	1892001	
1	CT2	Current Xfmr 5SFT101	1892200	
1	CX1	1 Port DB9 Serial-to-USB Conv	1001409	
1	CX1	Panelmount USB	1001391	
1	CX1	Sealing Cap	1001395	
2	F1, F2	Fuse 2 ½ Amp	1603664	
1	F1, F2	Fuse Holder Dual	1603923	
1	F3	Fuse Holder, 3AG,Single	1603920	
1	F3	Fuse 10 Amp	1603610	
2	F4-5	Fuse 3A 250V	1603603	
1	F4-5	Fuse Holder, 3AG,Dual	1603905	
1	INTLK	MS12S-3S Assembly	3150105	
1	J2	Binding Post, Black	1356214	
2	J3, J4	Binding Post, Red	1356215	
2	J6, J7	Receptacle, Cam Lok	1152900	
2	K1, K9	Contactora A50-3-11-84	1705085	
2	K2-3	Contactora 5X847, 30A	1700720	
2	K4-5	Contactora EB2200, 25A	1705462	
5	K6-8,KS1,KS9	Relay, 4-Form C, 1310-4C-120A	1701300	
5	K6-8,KS1,KS9	Socket, Relay, 1310 Pnl Mt	1157345	
1	OL1	115 VAC Receptacle	1159925	
1	OVLD1	Overload Relay, #TA25DU5.0	1709900	
1	OVLD1	Mounting Adapter, #DB25/25A	1709901	
1	P2	MULTILAM Plug, Black	1356212	
1	P3	MULTILAM Plug, Red	1356213	
1	P5	Plug, Cam Loc	1152905	
1	PC1	KBDM-14 PMNS, SCR CTRL	1565100	
1	PL1	Lens Green	1422320	
2	PL1-2	Lamp, 130 Volt	1420255	
2	PL1-2	Socket, Pilot Light	1423150	
1	PL2	Lens Red	1422300	
1	PLC1	PLC Module, 1761-L20AWA-5A	1001913	
1	PLC1	Cable, uC to PC, 1761-CBL-PM02	1001981	
1	PT1	Potential Xfmr PTA-0958	38700958	
1	R1	Resistor 2Ω, 25W	1740114	
1	R2	Resistor 10kΩ, 0.5W	1722190	
1	R3	Resistor, 1 MΩ (KBDM)	1769999	
1	R4	Resistor, 150kΩ, 0.5W	1714020	
2	R5	Resistor 24.9KΩ, .25W	1722617	
1	R6	Resistor 2.5Ω, 400W	1740116	
1	SW1	Mushroom Pushbutton	1862116	
1	SW1	Switch Contact, NC	1862905	
6	SW2-7	Roller Switch, 20A	1866005	
1	SW4-7	½" Aluminum Cam	41000002	
1	T1	Transformer 480/120 1kVA	3860024C	
2	T2	Transformer Var."6020"	1890320	
1	T3	Transformer High Current	38601008	
1	XDCR1	RMS Volt XDCR, AVTR-001B	1882060	
1	XDCR2	Current XDCR, ACTR-005E	1882065	
1	XDCR3	Watt XDCR, AGW-001B	1883056	

PARTS ORDERING INFORMATION

Replacement parts are available from Phenix Technologies, Inc.

Changes to Phenix Technologies' products are sometimes made to accommodate improved components as they become available, and to give you the benefit of the latest technical improvements developed in our Engineering Department. It is, therefore, important when ordering parts to include the serial number of the unit as well as the part number of the replacement part.

When your purchase order is received at our office, a representative of Phenix Technologies will contact you to confirm the current price of the part being ordered. If a part you order has been replaced with a new or improved part, an Applications Engineer will contact you concerning any change in part number.

Your order for replacement parts should be sent to:

Replacement Parts Department
Phenix Technologies, Inc.
75 Speicher Drive
Accident, Maryland 21520

RECOMMENDED SPARE PARTS

In order to maintain your set in full operating condition with a minimum of down time, the following spare parts should be kept on hand to avoid unnecessary phone calls, expensive modes of shipment, delays in repairs, etc. Pricing is available upon request.

Part Number	Description	Quantity
1603603	Fuse, 3A, 3AG	5
1603664	Fuse, 2½A	5
1603610	Fuse, 10A	5
1891926	Brush for Staco 6020 Variac	1
1420255	Lamp, 130V, 3SBOA-BL1	3

RETURNED MATERIAL

If for any reason it should become necessary to return this equipment to the factory, the Service Department of Phenix Technologies, Inc. must be given the following information:

Name Plate Information
Model Number
Serial Number
Reason for Return
Cause of Defect

If Phenix Technologies, Inc. deems return of the part appropriate, it will then issue an "Authorization for Return".

If return is not deemed advisable, other inspection arrangements will be made.

NOTE: Material received at this plant without the proper authorization shall be held as "Customer's Property" with no service until such time as the proper steps have been taken.

Your cooperation is requested in order to ensure prompt service.