Baker WinAST

Automated Stator Test System

User Guide

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CAUTION: Please read and thoroughly understand the contents of this entire guide before performing any installation of this product. Failure to follow the instructions and safety precautions in this manual can result in serious injury, damage to the product, damage to other equipment, or a malfunctioning system. Keep this guide in a safe and ready location for future reference.

Electrical and Calibration Standards

All Megger Baker Instruments standards are either certified directly or are traceable to certification by the National Institute of Science and Technology, formerly the United States Bureau of Standards. To obtain other information concerning calibration, contact Megger Baker Instruments.

Equipment Return

Before returning any equipment or components to Megger Baker Instruments, the following steps should be taken:

1. Call the Megger Baker Instruments Fort Collins service department at (970) 282-1200. Give the service representative a full description of the reason for the return, including any diagnostic or troubleshooting actions taken. Please provide the specific model and serial number of the instrument.
2. Equipment returned to Megger Baker Instruments must be packaged in such a manner that it will reach the factory undamaged from transit.
3. For non-warranty repairs, Megger Baker Instruments service will provide a cost estimate for your approval prior to your shipping.

Megger Acquisition of Baker Instruments

Megger Group Limited, a manufacturer of electronic test equipment and measuring instruments for power applications, acquired the Baker Instruments business from SKF Group in August of 2018

For over 50 years, the Baker Instruments business has led the electrical motor testing industry and has a recognized leading brand and position in this area. As such, legacy products will carry the Baker Instruments or SKF brands, which will be supported by Megger moving forward.

Trademarks

Megger is a registered trademark of Megger Group Limited.

All other trademarks are the property of their respective owners.

Patents

Megger Baker Instruments patents include: #US04768380 • #US05679900 • #US05845230 • #US05854553 • #US05992237 • #US06006164 • #US06199422 • #US06202491 • #US06275781 • #US06489884 • #US06513386 • #US06633822 • #US6,789,025 • #US6,792,360 • US 5,633,811 • US 5,870,699 • #WO_03_048714A1

NOTE: This equipment has been tested and found to comply with the limits for a Class A digital device, pursuant to Part 15 of the FCC rules. These limits are designed to provide reasonable protection against harmful interference with the equipment if it is operated in its installation. This equipment generates, uses, and can radiate radio-frequency energy and, if not installed and used in accordance with the product manual, may cause harmful interference to radio communications. If this equipment does cause harmful interference, the user is required to correct the interference.

Due to the phenomena being observed and the material properties being measured, this equipment radiates radio frequency energy while in active test mode. Care should be taken to make sure this radio frequency energy causes no harm to individuals or other nearby equipment.

CE Declaration of Conformity

Manufacturer's Name & Address:
Megger Baker Instruments
4812 McMurry Ave., Suite 100
Fort Collins, CO 80525
USA

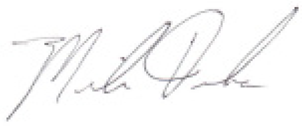
Equipment description: testers for surge, DC hipot, AC hipot and winding resistance of motor stators.
Equipment model designation: Baker WinAST

Application of Council Directive 72/23/EEC on the harmonization of the laws related to Member States relating to electrical equipment designed for use within certain voltage limits, as amended by: Council Directive 93/68/EEC and Council Directive 89/336/EEC on the approximation of the laws related to Member States relating to the electromagnetic compatibility, as amended by: Council Directive 93/68/EEC.
Note: Due to the phenomena being observed and the material properties being measured, this equipment does radiate radio frequency energy while in the active test mode.

Referenced safety standards:
EN 61010-1

Referenced EMC standards:
EN 61000-6-4
EN 61000-3-2
EN 61000-3-3
EN 61000-4-6

I hereby declare that the equipment specified above conforms to the above directives and standards.



Mike Teska
Engineering Manager
Megger Baker Instruments

Contents

1 — User Safety and General Operation

The general safety information presented here is for both operating and service personnel. You will find specific warnings and cautions throughout this manual where they apply.

WARNING: Contact with the test leads on this instrument can cause harmful or fatal shock. Never touch test leads or windings while a test is in progress.

- Ensure that the Baker WinAST unit is properly grounded. This product is grounded through the power cord's grounding conductor. To avoid electrical shock, plug the power cord into a properly wired/grounded receptacle before connecting the product test leads.
- For capacitor start motors or systems with surge arrestors/power factor capacitors, DISCONNECT all capacitors from the test circuit before testing.
- The Baker WinAST is NOT APPROVED for use in an explosive environment.
- This instrument is not waterproof or sealed against water entry.
- The unit is for indoor use. If using it outdoors, you must protect the unit from rain, snow, and other contaminants

A safety protection network minimizes electric shock hazard:

- The computer monitors safety switches and begins a test only when safety switches are engaged.
- The Baker WinAST hardware overrides all computer signals and prevents application of high-voltage to an unsafe test station.
- An Equipment Stop button is mounted on the front panel of the Baker WinAST and interrupts all high-voltage power supplies when pressed.
- A red light mounted on top of the Baker WinAST illuminates during all test procedures.
- If using the equipment in any manner not specified by Megger Baker Instruments the protection provided by the equipment may be impaired.

WARNING: Failure to adhere to the following safety precautions can result in severe electrical shock or death.

- Never attempt a two-party operation. Always know what test is being performed and when. For example, do not adjust test leads when operating a footswitch. Leads will have live voltage and severe electrical shock may result.
- For capacitor-started motors or systems with surge arrestors/power factor capacitors, be sure to disconnect all capacitors from the test circuit before testing.
- Upon completion of a DC High Potential (HiPot), megohm, Polarization Index (PI), Step Voltage, Dielectric Absorption (DA), or Continuous Ramp Test, before disconnecting the test leads, short the winding, motor, etc., to ground and allow time for discharge. If this is not complete, voltage may still be active on leads and tested components.
- Make sure to disconnect the tester leads before energizing or powering up the motor.
- Do not remove the product covers or panels or operate the tester without the covers and panels properly installed. Components on the inside of the tester carry voltage for operation and can render a shock if touched.
- Use appropriate safety equipment required by your organization, including high-voltage gloves and eye protection.
- Repair parts warning: you must replace defective, damaged or broken test leads with factory-authorized parts to ensure safe operation and maintain performance specifications.

WARNING: Danger from loss of ground: Upon loss of the protective ground connection, all accessible conductive parts, including knobs and controls that may appear to be insulated, can cause an electric shock!

Electrical and Calibration Standards

All Megger Baker Instruments standards are either certified directly or are traceable to certification by the National Institute of Science and Technology (NIST), formerly the United States Bureau of Standards.

Equipment Return

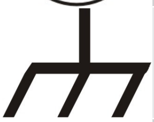
Before returning any equipment or instrument components to Megger Baker Instruments, the following steps should be taken.

1. Notify Megger Baker Instruments at 1-800-752-8272 (USA Only) or (970) 282-1200. Give the representative a full description of the difficulty, including troubleshooting steps that may have already been taken. Have the model and serial number of the instrument at hand.
2. Equipment returned to Megger Baker Instruments must be packaged in such a manner that it will reach the factory without damage.
3. For non-warranty repairs, Baker will submit a cost estimate for approval prior to shipping the equipment to Megger Baker Instruments.

Positioning Equipment

NOTE: Do not position equipment in such a way that it is difficult to operate the disconnecting device(s). Make sure to have 2.5 feet access to the right side of the machine and 2 feet from the rear of the machine.

Table 1: *Symbols on equipment.*

Symbol	Description
	Protective conductor terminal. Located beside black ground test lead on front panel of instrument.
	Earth (ground) terminal.
	Frame or chassis terminal. Located on rear panel of instrument by ground terminal.
	Warning about hazardous voltage and risk of severe electrical shock or death. Located beside each red test lead on front panel of instrument.

Cleaning and Decontamination

Keep the unit clean and in a dry environment. To clean the unit, power down and unplug the instrument. Wipe with a clean, water dampened cloth. Do not submerge in water or other cleaners or solvents. To clean the window, take a soft, water dampened cloth and gently wipe the surface.

Pollution Degree II

(From IEC 61010-1 3.6.6.2) Only non-conductive pollution occurs. However, temporary conductivity caused by condensation is expected.

Power Requirements

Using the provided AC power cord, connect the unit to a grounded AC power source. The unit's power requirements are 100-240 V AC, 50-60 Hz, 2 amps AC maximum current draw. An auto-reset circuit breaker protects the unit.

Environmental Conditions

- The unit has been tested for use up to 2,000 m (6,500 ft.).
- Only operate the tester in temperatures ranging from 5 to 40 °C (41 to 104 °F).
- This unit is for use at a maximum relative humidity of 80% for temperatures up to 31 °C (88 °F), decreasing linearly to 50% relative humidity at 40 °C (104 °F). This unit is intended for Installation Category II in a Pollution Degree II environment.

2 — Motor Testing Theory and Principles

Principles of HiPot (High Potential) Testing

The HiPot test is considered the mainstay of motor testing. The purpose of a HiPot test is to verify the quality of the insulation between two conductors. The most common HiPot test is conducted between a winding and a core. But, it can also be used to test the insulation between two separate windings as is the case with some two speed motors for example.

HiPot tests can be performed using either AC or DC high-voltage. In both cases, the leakage current is measured in order to verify that it does not exceed a set limit. HiPot testers typically also have arc detection capability to detect intermittent faults which may not be measured otherwise.

AC HiPot

The AC HiPot test is the standard test used by most winding manufacturers in a production environment. The AC HiPot test is preferred because of its faster test time. It is specified in UL, CSA, NEMA and other test procedures.

A high-voltage 50 or 60 Hz AC signal is applied to a winding. The core and/or other windings are grounded. The leakage current between the high-voltage winding and ground is measure in RMS current.

The equivalent circuit of an insulation system is a very large resistor (the insulation resistance) in parallel with a capacitor (the capacitive coupling between the two conductors). The insulation resistance is very large compared to the capacitive impedance so almost all of the leakage current is capacitive. The voltage and current waveforms are almost ninety degrees out of phase. The real or resistive leakage current is measured in micro-amps. The capacitive leakage current is measured in milliamps.

Some test specs call for a Capacitive Compensation capability when measuring leakage current. The goal is to measure the real or resistive leakage current. This is very difficult to be accurate and maintain short test times since the capacitive leakage is an order of magnitude greater than the resistive leakage. The test specifications take this into account and therefore have relatively large compensated leakage current limits.

AC HiPot Arc Detection

To improve on the RMS current measurement techniques, the WinAst 8800 has the ability of detecting both arcs and micro-arcs. Arc detection enables the tester to detect breakdowns sometimes missed by a capacitance compensated RMS (average) current measurement technique.

The WinAst 8800 detects arcs caused by insulation failure resulting in high current. The arcs are detected in one of two ways. During the initial "ramp-up" of the AC HiPot voltage, the voltage waveform is continuously sampled. If an arc occurs, dips or spikes will be detected on the waveform and reported as an arc. Once the AC HiPot voltage has stabilized, the hardware continuously monitors for higher frequency transients in current. Any transients in the current are reported as an arc. Since the hardware detection circuitry is always monitoring the current, arcs are always detected, unlike software sampling which may miss micro-arcs that occur between samples.

Micro-arcs can be seen in a stator that has an improperly inserted slot liner, or a turn that is on the wrong side of the slot liner. When this occurs, a small micro-arc can be seen in the slot between the wire and core. These micro-arcs differ from normal arcs which affect the average current in that they are not sustained and they are not high current. The sensitivity of this circuit is adjustable via a potentiometer on the AC HiPot board.

DC HiPot

Megger Baker Instruments testers provide the DC HiPot test as an alternative to the AC HiPot test. The DC HiPot leakage current is only affected by the quality of the insulation resistance. When a DC voltage is applied across an insulator, initially there is some capacitive charging current. But, this decays to zero leaving only the resistive current. Although it is more commonly used in predictive maintenance situations, some manufacturers, especially of larger motors, find it useful to measure insulation resistance. The DC HiPot test takes more time to conduct because of the charging and discharging times of the windings.

Knowledge of the real behavior of resistors, not just ideal resistors, will help the operator to test the winding insulation to a point before the insulation is broken down.

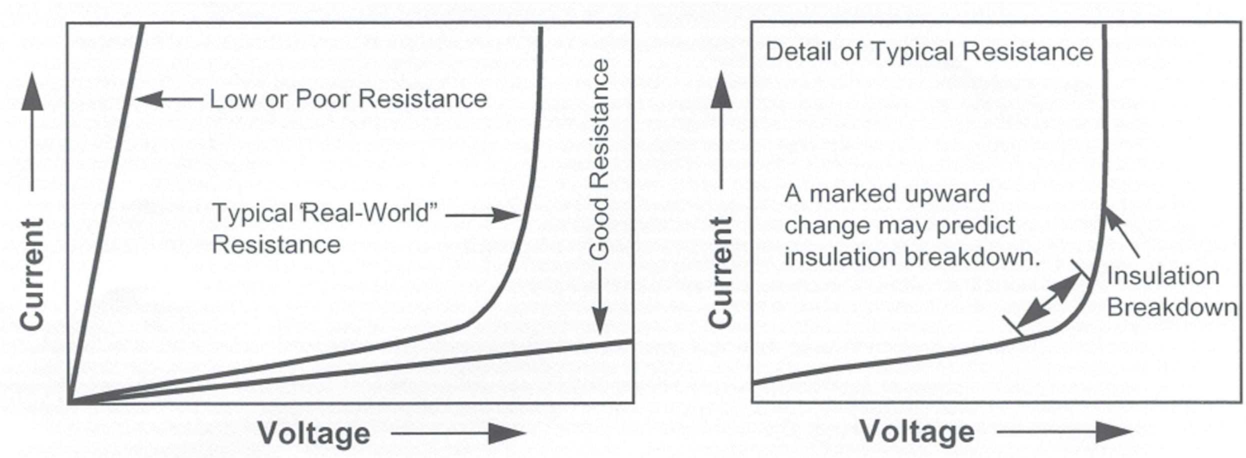


Fig 1: *Principle of Resistance.*

For an ideal resistor, as the voltage increases, the leakage current increases proportionately. However, insulation resistance in the real world rarely behaves in this manner. Instead, the current in a typical resistor will increase proportionately with voltage until the voltage is within as little as 5% of the breakdown voltage. Just before insulation breakdown, the current will rise faster than the voltage. At still higher voltage, the insulation will completely breakdown and the current will rise extremely fast.

Principles of Coil Resistance Testing

The coil resistance test is a very simple test to perform and is an immediate indication of the health of the conductor(s) in a winding. The coil resistance test consists of injecting a known constant current through the winding, measuring the voltage drop across the winding, and calculating the coil resistance using Ohm's law. If a coil is shorted somewhere in the interior of the winding the resistance will be lower than normal. This lower coil resistance can be compared to previous measurements of the same coil, compared measurements of identical coils, or compared to the motor name plate value to identify a "bad" coil.

The measured resistance is affected by the variation of copper conductivity with temperature. Therefore, the measured resistance value should be "corrected" to a common temperature, usually 25oC, before comparing two different measurements.

Because the windings found in many motors have very low resistances, the injected current might have to be as high as 2 amps to accurately measure the voltage drop across the coil. One of the difficulties encountered measuring the voltage drop across the coil itself is the affect of the contact resistance of the clip leads and external relays used to connect to the motor's winding. Contact resistances can be comparable or even greater than the resistance of some coils.

There is a practical lower limit to the coil resistance that can be successfully used to evaluate the condition of the copper conductor in a winding. An instrument must be able to resolve the change in copper resistance caused by a short in the winding before conclusions can be made regarding the coil resistance.

The Resistance Test provides a measure of the tendency of the winding to resist current and convert electrical energy into heat energy. Resistance is affected by temperature (see above)

The Baker WinAST Resistance Test compares the percentage difference in resistance between leads with the calculation of "Max Delta R". Define the acceptable Delta R tolerances for each motor, thereby giving the Analyzer pass/fail limits. The IEEE 118-1978 constant may be selected.

When the Resistance Test results are displayed by the Baker WinAST, measured resistance is listed, along with resistance corrected for temperature and the Delta Resistance percentage. When Delta Resistance is high, a problem with the motor under test may be indicated.

When the Baker WinAST detects Delta Resistance values not within the prescribed limits, the motor fails the test. This helps prevent the consequences of high-voltage tests on a faulty motor. Continuing the test sequence after a test failure is also possible.

Conducting Resistance Tests on the same motor over a period of time provides early warning signs of motor problems. Motors operated in conditions that allow corrosion, vibration, or other physical damage may show initial warning signs of failure through the Resistance Test.

Principles of Surge Testing

Prior to the introduction of surge testing, the most common electrical test for motors was a low-potential test of the winding insulation to ground (or frame). This popular test is the Insulation Resistance or Meg-Ohm test. This test is adequate for testing winding insulation to ground, but it does not detect failures between turns or phases.

A more thorough test is the Surge Test. A typical motor coil consists of copper wire turns or windings. Motor winding insulation failure often starts as a turn-to-turn, copper-to-copper, or winding-to-winding fault. Surge Tests can detect the early stages of insulation failures in the winding such as a coil-to-coil failures, short circuits, grounds, misconnections, and wrong turn counts without permanently damaging the winding.

Brief voltage surges (or pulses) are applied to the coil during a Surge Test to create a voltage gradient (or potential) across the length of the wire in the winding. This gradient produces a momentary voltage stress between turns.

The coil will respond, in the time periods between pulses, with a ringing or damped sinusoidal waveform pattern. Each coil has its own unique signature ringing or wave pattern which can be displayed on the window.

Fig 2: *Example of a "ringing" wave pattern resulting from Surge Testing.*

The wave pattern observed during a Surge Test is directly related to the coils inductance. (There are other factors influencing the wave pattern but inductance is the primary one.) The coil becomes one of two elements in what is known as a tank circuit – a LC-type circuit made up of the coils inductance (L) and the surge tester's internal capacitance (C).

Inductance (L) of a coil is basically set by the number of turns in a winding and the type of iron core it rests in. The frequency of the wave pattern is determined by the formula:

$$Frequency = \frac{1}{2\pi\sqrt{LC}}$$

This formula implies that when the inductance decreases, the frequency will increase.

A surge test can detect a fault between turns that is due to weak insulation. If the voltage potential is greater than the dielectric strength of the turn insulation, one or more turns may be shorted out of the circuit. In effect, the number of turns in the coil is reduced. Fewer working turns reduce the inductance of the coil and increased the frequency of the ringing pattern from the surge.

The voltage or amplitude of the surge wave pattern is also reduced due to the decrease in inductance of a coil with a fault between turns. It is determined by the formula:

$$Voltage = L\frac{di}{dt}$$

Where the current (i) varies according to pulse time (t)

When the insulation between turns is weak, the result is a low energy arc-over and a change in inductance. When this happens the wave pattern becomes unstable – it may shift rapidly to the left and right, and back to the original position.

A fast analog to digital converter is used to sample and display the surge waveform. Typically, a Master waveform is learned and stored from one or more known good windings. There is typically some variation between good windings due to things such as the magnetic properties of the core, the number of turns in the coil or size of the coil. When more than one winding is used to learn a Master, the Master waveform is averaged.

When testing subsequent windings, the test waveform is compared to the Master waveform. Baker has patented a sensitive, proprietary method for quantifying the changes in the surge waveform. It is called Error Area Ratio. The area between the test waveform and the Master waveform is calculated and divided by the total area under the Master waveform. The result is a percent error. If the two waveforms are identical, the difference is zero. The greater the differences in frequency or amplitude, the greater the error becomes.

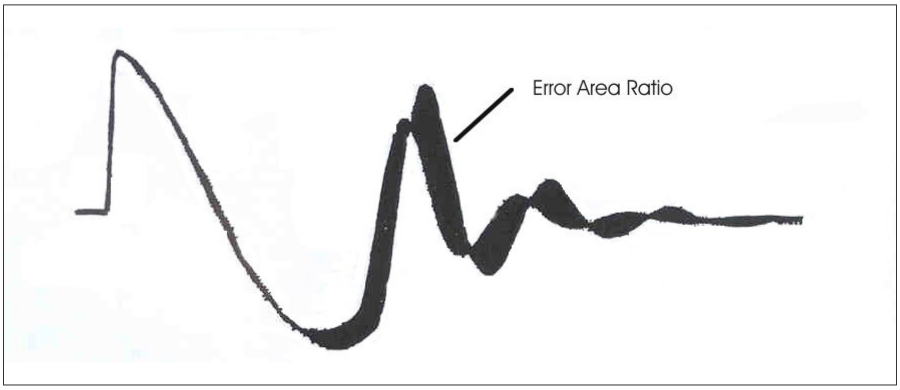


Fig 3: *Example of an error-area ratio (EAR) graph*

Like the resistance test, some difference between the test and Master waveforms is acceptable. Many manufacturers allow up to 15 or 20 percent deviation from the Master. Sometimes major differences in the materials or process cause the surge waveform to change significantly from the Master. It may become necessary to delete and relearn the Master waveform. For example, the magnetic properties of a laminated steel core may change the waveform substantially.

A surge balance test is also available. In this case, the waveforms from windings within a part are compared to each other rather than to a Master. The percent balance error limit is typically less than the absolute limit in comparison to the Master. It is typically used by three phase stator manufacturers who check for balance between the phases.

Principles of Partial Discharge and Corona Tests

Partial discharge (PD) also known as corona is a very small electrical discharge caused by the ionization of oxygen in the presence of a high-voltage electrical field. The ionized oxygen is also known as ozone. Ozone reacts with many insulation materials and over a long period of time is corrosive to the insulation causing premature failure in the winding insulation.

High-voltage HiPot and impulse testing has long been used to verify the integrity of the ground, phase and turn to turn insulation. The HiPot and surge test were used only to detect catastrophic insulation failure. Low voltage motors traditionally did not encounter voltages which generated ozone. So testing for the presence of corona at higher than nominal voltage was unnecessary.

Partial discharge has long been a known failure mode in high-voltage motors and generators due to the high operating voltages. Motors and generators which initially passed a high-voltage breakdown insulation test often still failed quickly if they do not also pass a partial discharge test.

Partial discharge has become a major concern in motors operating at nominally low voltages (i.e. under 600 volts) due to the effects of variable speed inverter drive systems. Variable speed drives are notorious for causing frequent over voltage transients which far exceed the nominal operating voltage. These transients can exceed the corona Inception Voltage (CIV) and therefore generate ozone damaging the insulation of low voltage motors slowly over a long period of time.

The inverter drive transients are best simulated by the high-voltage impulse test rather than the HiPot test. The HiPot test only tests the ground insulation. The high-voltage transient applied by the impulse test stresses the phase and turn insulation like the inverter transients. When a high-voltage impulse is applied to a winding and the CIV is exceeded, low energy, wide bandwidth electrical discharges are generated. It is beneficial to detect these discharges or the absence of them as a means of ensuring that the insulation system of a motor will have a long life when used with an inverter.

Partial discharge technology has been pioneered primarily by the predictive maintenance industry which uses it to detect the onset of premature insulation failure in high-voltage windings. Since these windings operate in a high-voltage environment, it is possible to monitor for the presence of or increase in partial discharge under normal operating conditions. In other instances, impulse generators or HiPot testers are used to apply a high-voltage signal to the winding. External analog or digital detection circuits are traditionally used to quantify the amount of partial discharge over a relatively long period of time. The detection circuits use either voltage or current transducers directly connected to the winding leads or some sort of antenna which captures the radiated energy.

Smaller motor manufacturers often find it difficult to use the technology developed for the maintenance industry. Motor manufacturers usually need to test low voltage motors in a higher volume production environment. Usually the tests are performed by lower skill employees. It is important to fixture the test hardware in such a way that the motors are tested quickly and easily. It is also important that the test data is quickly and repeat ably converted into a pass/fail result.

Principles of Rotation Direction Testing

The rotation direction test is used to sense the rotational direction of the magnetic fields in a winding. It uses a hall-effect probe placed near the stator bore. Power is applied to the windings and the magnetic fields rotate either clockwise or counter-clockwise. The sensor then detects the direction of rotation.

Phase power is normally stepped down to approximately 90 VAC and applied to the winding. For three phase stators, three phase power is applied. For two phase windings or stators with a main and start winding, two phase power is applied. Use of a start capacitor when testing a two winding, single phase stator is avoided with this method. For shaded-pole stators, single phase power is applied.

3 — Baker WinAST Introduction

The Baker WinAST Automated Stator Test System is a test system built for production-line testing of all types of windings.

Instrument Connections

This instrument does not require permanent mounting to a floor; it is mounted on casters for easy access.

Use the supplied required power cord. Spec 16-3-SJT (UL), E204241-C – (CSA), LL2126-C FT2 (WF). If rotation direction is used use the supplied power cord – Interpower P/N 86020410 cabling.

> NOTICE: New equipment installation requires a Megger Baker Instruments representative to physically install the instrument prior to first operation. This is required for safety, correct power configuration, and operation.
>
> Customer is required to supply appropriate power disconnect for the rotation direction option.

Requirements for Interconnecting Fixtures and Accessories

1. Fixtures purchased from Megger Baker Instruments.
    - Equipment supplied by Megger Baker Instruments are equipped with the proper connections on the rear of the instrument. These connections are distinctly labeled and must be matched up with each connection cable.
    - All necessary dry contact closures are present to establish the high-voltage output.
2. Fixtures not purchased from Megger Baker Instruments.
    - For fixtures not purchased from Megger Baker Instruments, the customer must supply a dry contact closure for a safe testing environment.
    - This dry contact closure can be a light curtain, pressure mat, or other fixture meeting customer requirements.
    - All Baker WinAST units require a dry contact closure to provide the high-voltage output.

Setting Up the Baker WinAST

The Baker WinAST software is installed on the Automatic Test System.

1. Turn the key on the front of the computer to the unlock position to verify that the computer is on.
2. When the computer has completed booting, press the green Master Enable button located on the front of the unit to enable the system for testing.
3. When the instrument has been logged into and the computer finishes booting up to the desktop view, double-click on the Baker WinAST Icon to start the software. The following window will appear:

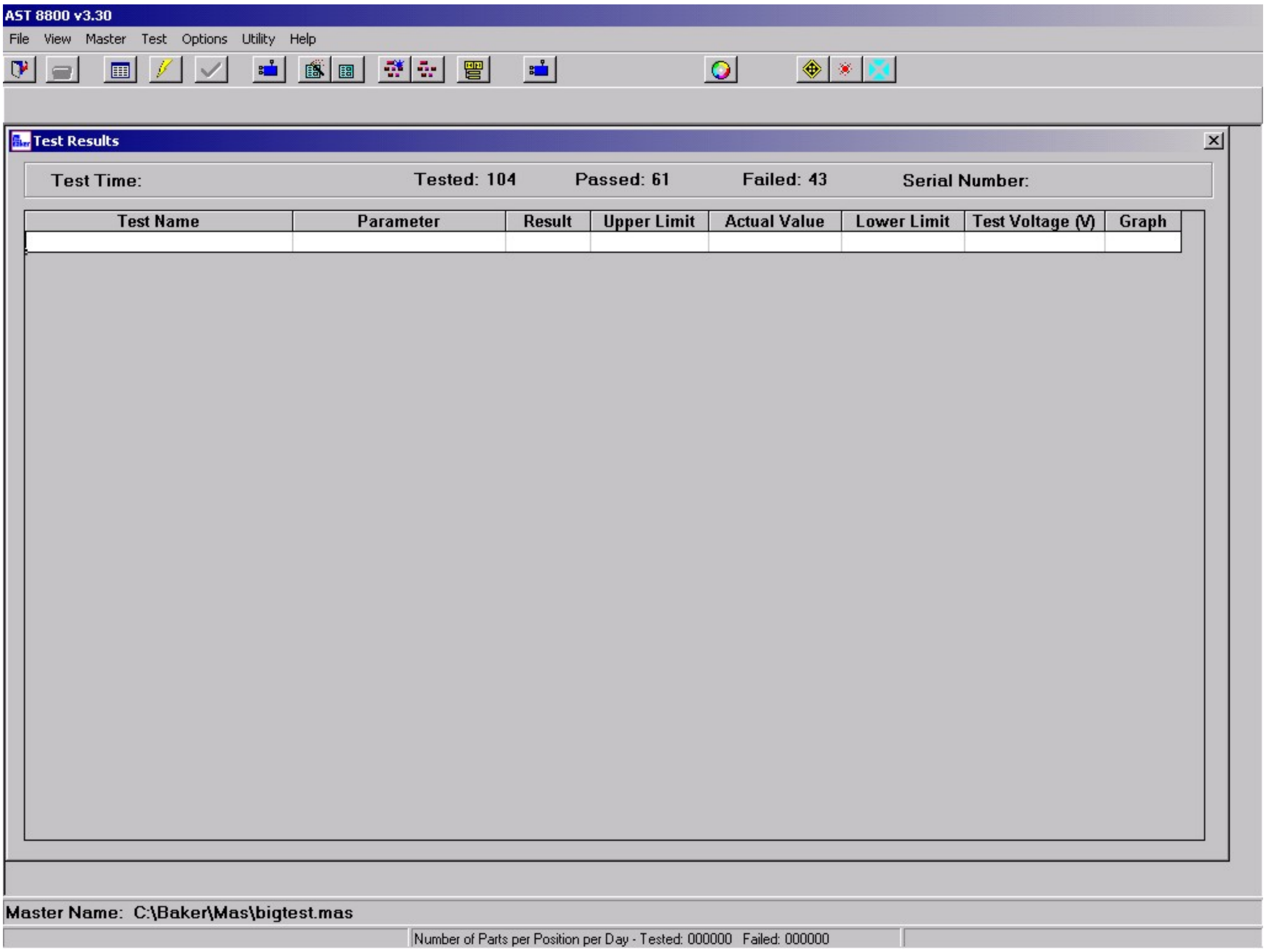


Fig 4: *Baker WinAST Main Window.*

Comprehensive Test Capabilities

The Baker WinAST Automatic Test Systems offers a wide range of tests that allow a comprehensive look at motor and process quality. These tests include:

- **AC and DC HiPot Tests**—Measures the integrity of the winding in relation to ground.
- **Resistance Test**—Measures the resistance between two leads.
- **Surge Test**—The high-voltage impulse (Surge) test checks for insulation weakness between turns, layers, coils, and phases of a winding. Surge tests also detect other faults that change the inductance or losses in a winding such as reversed coils and improperly annealed steel.
- **Partial Discharge Test**—Partial Discharge (PD; also known as corona) is a very small electrical discharge caused by the ionization of oxygen in the presence of a high-voltage electrical field. Ionized oxygen (ozone) reacts with many insulation materials. Over a long period of time, it is corrosive to the insulation causing premature failure in the winding insulation.
- **Field Strength Test (optional)**—Determines the magnetic flux per slot in a winding.
- **Rotation Test (optional)**—Determines whether the winding is wound in the proper orientation.

Operational Controls

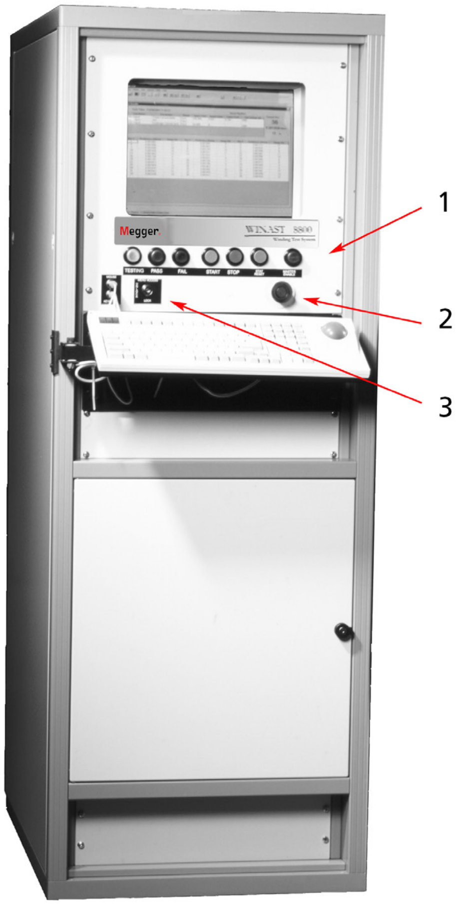


Fig 5: *Baker WinAST operational controls.*

Table 2: *Baker WinAST operational controls.*

Item	Element	Description
1	Control Panel	■ Pass Light—Green light that will light when a test has passed. ■ Fail Light—Red light that will light when a test has failed. ■ Testing—Yellow light that will light during a test. ■ Start Button—Green button that can be used to start a new test. ■ Retest—Blue button that can be used to retest a part. ■ Fail—Red button that that acknowledges a failure. When a test fails a choice needs to be made to either retest or acknowledge the failure. In order to test a new part the failure from the original test or the possible re-failure of the retested part must be acknowledged. ■ E-Stop—Equipment stop that removes 12v power from the system.
2	Master Enable Button	Enables the system to test parts (turns on 12V E-Stop power).
3	Menu Access	Lock/Unlock: In locked position, allows only restricted software access, tests can be run but not changed.

Fixtures Control Panel

A control panel of some type is furnished with each machine. Depending on customer configuration and requirements, this panel can look different; however, it will always have a set of six buttons.

If a fixture is purchased by the customer, there will be an attached control panel. If a fixture is not purchased, the control panel will be located on the instrument itself.

Fig 6: *Fixtures control panel.*

Baker WinAST Statistical Information

Statistical information is stored in two operational modes. One is to store statistical data on all parts that are tested on the unit within the period set by the operator when a “Restart” (reset counter) command is given. A history of the prior counts is saved automatically. The second is to store statistical data on a per master basis. This information is held by the software even when changing back and forth between masters, until a “Restart” (reset counter) command is given. Although all masters will have the statistical counter reset to zero, the prior information is not lost.

A task bar is provided to give the operator a visual indication of the operational count of the Tested, Passed and Fail. A task button is also provided to display a window of the accounting action.

When the ALL STATISTICS mode is used, the task bar window shows the statistics of testing on all parts tested on the unit during the time period chosen. A “Show Log” button will display the storage file of statistical data. A “Save Log” button is to save the information for future use. A “Restart” button will reset the count to zero. This information is stored in the C:\BAKER\STATISTICS.LOG file.

When the MASTER STATISTICS mode is used, the task bar window shows the statistics of testing on all parts tested using a certain master. The master name is displayed for reference. A "Show Log" button will display the storage file of the statistical data for the Assigned master. In this mode the button has no use and is grayed out. A "Restart" button is used to save the information for future use and to reset the counter to zero. This button will reset all master count information to zero not just the one assigned. The information is not lost but is stored for future use. This information is stored in the C:\BAKER\DB directory. It is stored in files using the master name followed by a ".sts". These files will create automatically if not present and will continue to save information as needed. The files are a "TAB" delimited text file and as such can be opened in Xcel®.

These files in both modes can be copied and/or deleted. New ones will be recreated as needed by the software and operator. The statistical data is always on and counting. The file size is very small will not slow down testing time.

The statistical information is also dependent on the operator using the "Retest" button to produce proper counts of the testing. A "Retest" button will erase the prior test as if it was never run.

The choice between these modes is made by the correct Registry Editor entry. (See Software Maintenance in this manual or contact Megger Baker Instruments support.)

Software Icons

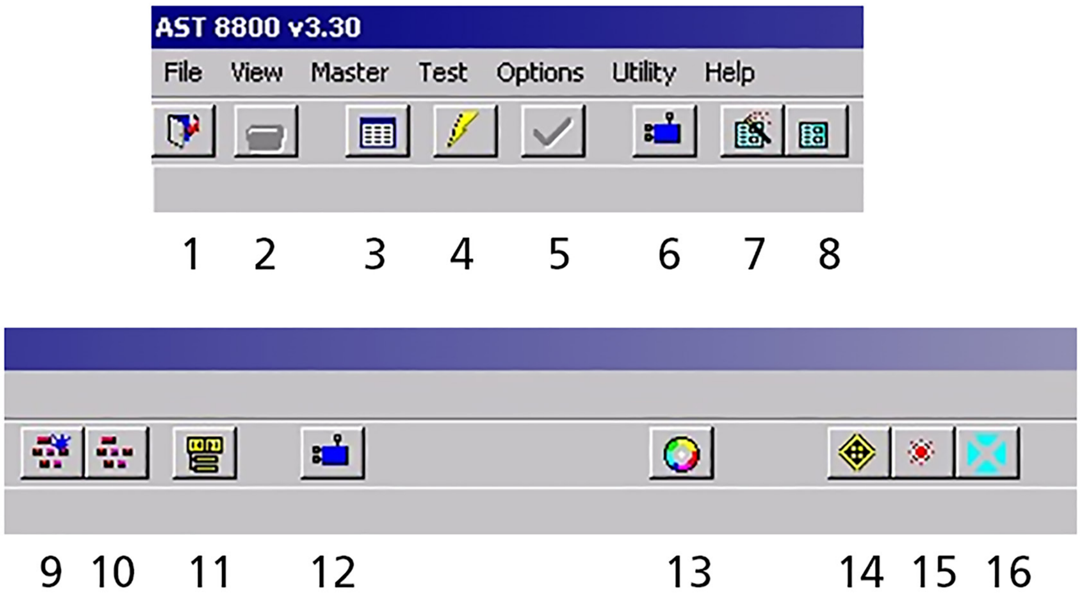


Fig 7: *Software Icons; all top of window.*

Table 3: *Main window icon descriptions.*

Item	Description	Item	Description
1	Close Program	8	Modify Parameter List
2	Print Results	9	Create Master
3	Show Test Statistics	10	Modify Master
4	Reset all Boards	11	Assign Both Stations
5	Fail ACK (Ctrl 2)	12	Display Station 1 Winding Group
6	Create/Modify Winding Group	13	Start Test
7	Create Parameter List	14	Repeatedly Run Test

Table 4: *Function key assignments.*

Function Key	Assigned Function
F1	Assign Master Station 1
F2	Assign Master Station 2
F3	Assign Master Stations 1 & 2
F4	Set Serial Number Station 1
F5	Set Serial Number Station 2
F7	Manual Test

4 — Programming the Software

Before performing any tests on windings or stators, the system must be configured to the process specifications. This process involves three steps: (1) creating or assigning winding group(s), (2) creating a parameter list, (3) and creating a master.

The winding configuration file (group(s)) contains information about the leads on the winding to correctly map them to the tester's leads.

NOTE: At least one winding configuration file (group(s)) is needed in order to perform tests.

The parameter list contains the test parameters for each family of product along with the order in which they will be executed. It contains test-specific data rather than pass/fail limits for a specific winding. This gives the ability to change one parameter, such as test voltage, that applies to a family of windings rather than changing the parameter for each individual winding.

Each winding type needs its own master file, which contains all configuration information necessary for testing. These are winding type specific settings such as leakage current limits, resistance limits, surge master, rotation direction, and more.

NOTE: Not all test units will have all test options installed. Please refer to the service manual for which options are installed on the unit.

Creating a New Winding Group

1. Click on Master then select Create/Modify Winding Group or click on the Create/Modify Winding Group icon in the main toolbar.

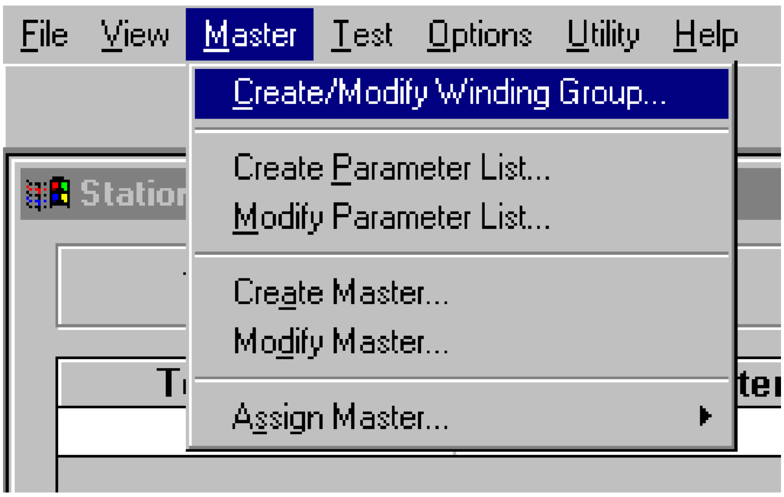


Fig 8: *Create/Modify Winding Group drop-down menu.*

2. Click New.

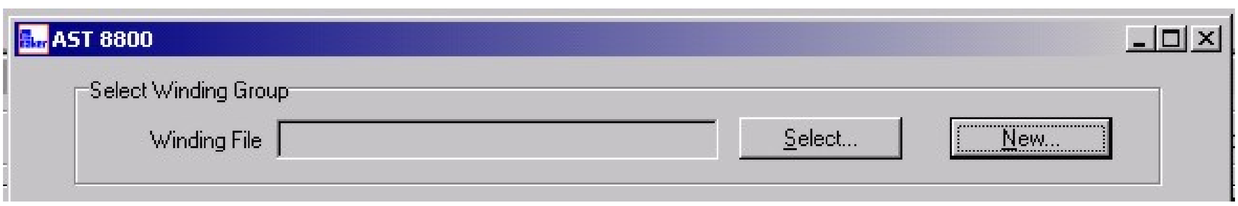


Fig 9: *New Winding Group.*

3. A list of all Winding Groups will appear. Assign a name to the new group that can identify the group most appropriately.

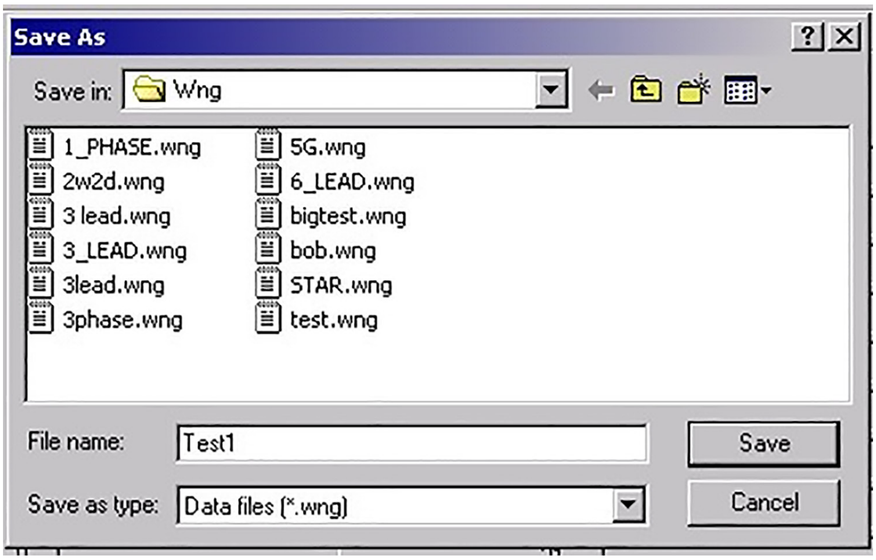


Fig 10: *Saving a new Winding group.*

4. Name or identify each lead with a unique name. For example, names could correspond to the colors of wire present or the lead number related to the winding configuration. Ensure that the name chosen corresponds and is distinct to the process being tested. For example: r-b-g-single for red, green, blue single phase.

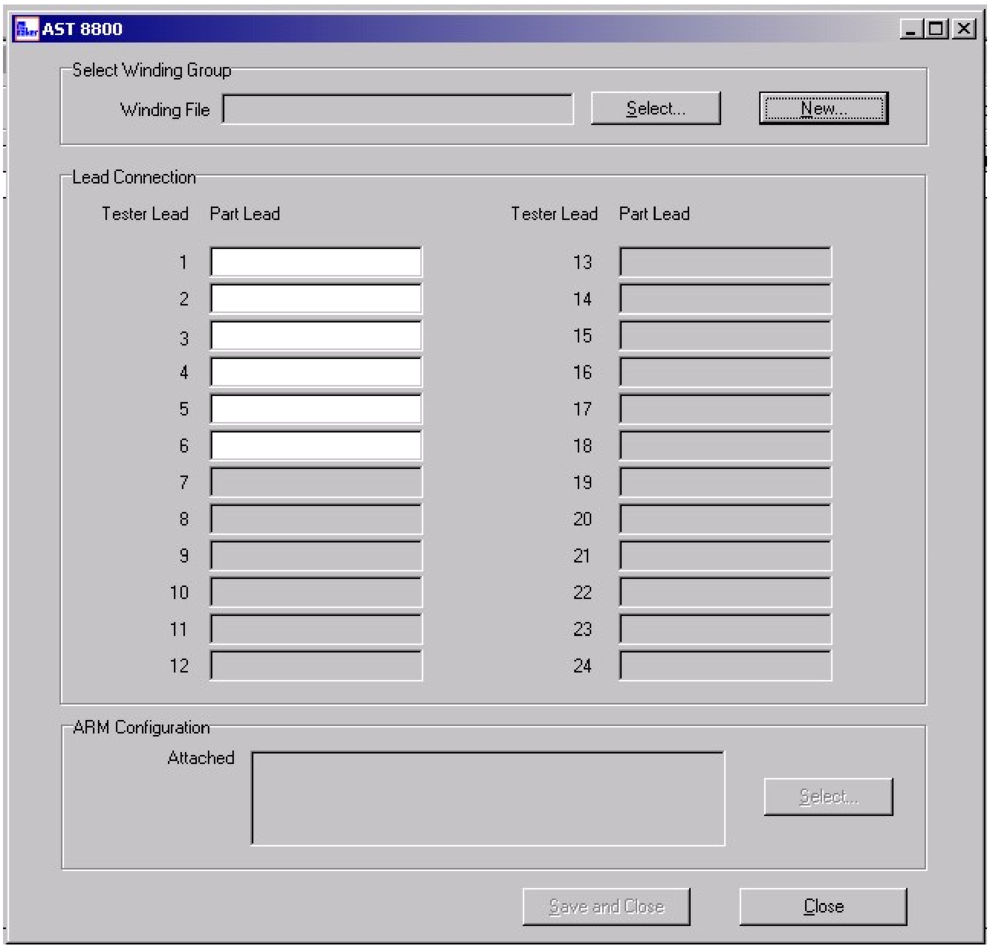


Fig 11: *Naming of leads.*

5. ARM (Auxiliary Relay Matrix) Configuration—If available allows you to make connections internally to the machine to perform surge and resistance summation.

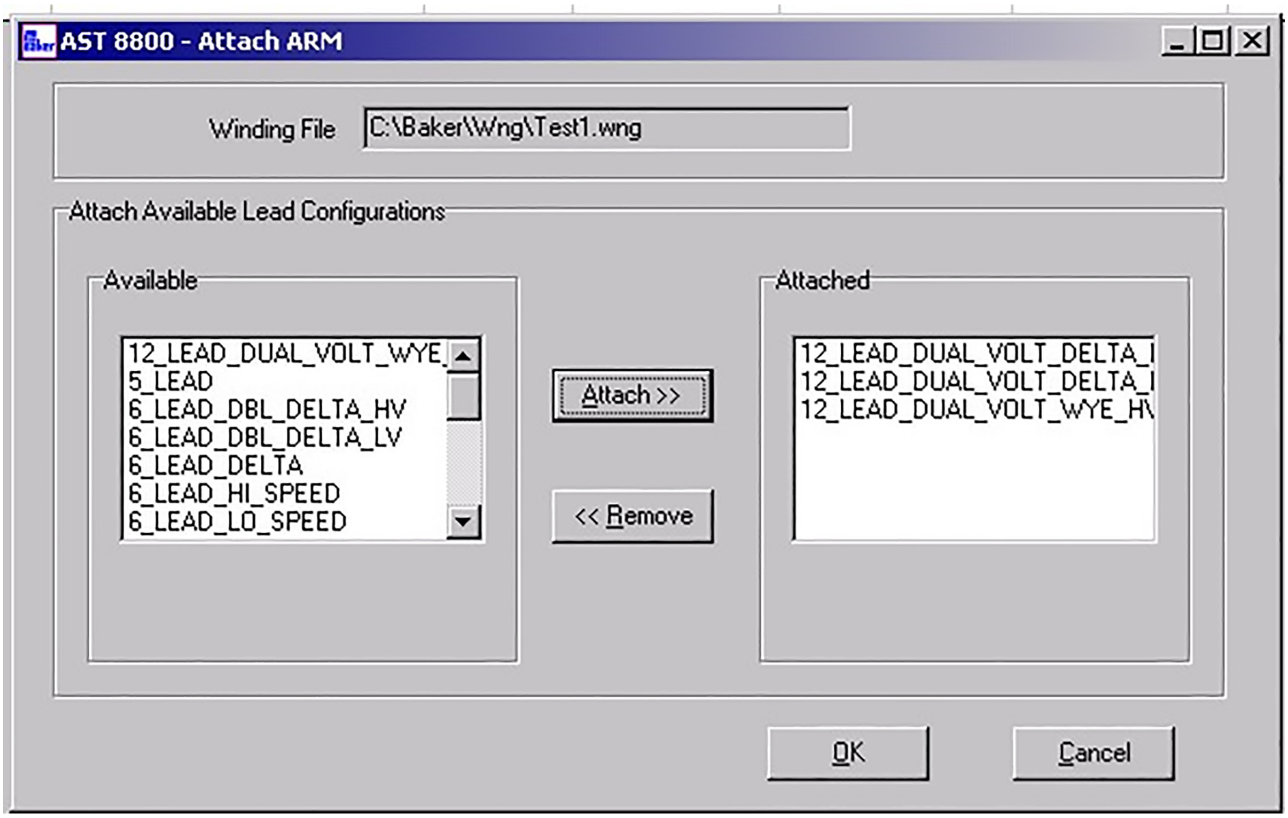


Fig 12: *ARM Configuration.*

6. Click Select in the ARM Configuration section of the Window.
7. Highlight the needed Lead Configurations and click on Attach. If multiple lead configurations are needed click and hold the Ctrl Key to highlight multiple configurations and click Attach.
8. If an unwanted Lead Configuration is attached, highlight it and click on Remove.
9. Click OK.
10. Click Save. This returns the software to the main Select Winding Group window.

NOTE: The following list is the ARM Configurations that exist in the software.

Motor Type	Lead Connect	Resistance Summation Formula
6 LEAD WYE	L1, L2, L3, L4, L5, L6	L1-L4, L2-L5, L3-L6
	TIE L4-L5-L6	
6 LEAD DELTA	L1, L2, L3, L4, L5, L6	L1-L4, L2-L5, L3-L6
	L1-L6, L2-L4, L3-L5	
6 LEAD LO SPEED	L1, L2, L3, L4, L5, L6	L1-L2, L1-L3, L2-L3
	OPEN L4, L5, L6	
6 LEAD HI SPEED	L1, L2, L3, L4, L5, L6	L4-L5, L4-L6, L5-L6
	TIE L1-L2-L3	L4-L5=(L1-L4//L3-L4)+(L3-L5//L2-L5) L4-L6=(L1-L4//L3-L4)+(L1-L6//L2-L6) L5-L6=(L2-L5//L3-L5)+(L2-L6//L1-L6)
6 LEAD PWS SEPARATE	L1, L2, L3, L7, L8, L9	L1-L2, L7-L8, L1-L3, L7-L9, L2-L3, L8-L9
6 LEAD PWS PARALLEL	L1, L2, L3, L7, L8, L9	L1-L2, L1-L3, L2-L3
	TIE L1-L7, L2-L8, L3-L9	L1-L2=L1-L2//L7-L8 L1-L3=L1-L3//L7-L9 L2-L3=L2-L3//L8-L9
6 LEAD DBL DELTA LV	L1, L2, L3, L7, L8, L9	L1-L2, L1-L3, L2-L3

	TIE L1-L7, L2-L8, L3-L9	L1-L2=(L1-L8//L2-L7)//[(L1-L9//L3-L7)+(L2-L9//L3-L8)]
		L1-L3=(L1-L9//L3-L7)//[(L2-L9//L3-L8)+(L1-L8//L2-L7)]
		L2-L3=(L2-L9//L3-L8)//[(L1-L9//L3-L7)+(L1-L8//L2-L7)]

6 LEAD DBL DELTA HV	1, L2, L3, L7, L8, L9	L1-L2, L7-L8, L1-L3, L7-L9, L2-L3, L8-L9
	OPEN L7, L8, L9	
9 LEAD PWS	L1, L2, L3, L4, L5, L6, L7, L8, L9	
	TIE L4-L7, L5-L8, L6-L9	
9 LEAD DBL DELTA HV	L1, L2, L3, L4, L5, L6, L7, L8, L9	L1-L2, L1-L3, L2-L3

	TIE L4-L7, L5-L8, L6-L9	L1-L2=(L1-L4+L2-L7)//(L1-L9+L3-L6+L3-L8+L2-L5)
		L1-L3=(L1-L9+L3-L6)//(L1-L4+L2-L7+L2-L5+L3-L8)
		L2-L3=(L2-L5+L3-L8)//(L1-L4+L2-L7+L1-L9+L3-L6)

9 LEAD DBL DELTA LV	L1, L2, L3, L4, L5, L6, L7, L8, L9	L1-L2, L1-L3, L2-L3
	TIE L1-L6-L7	L1-L2=(L1-L4//L2-L7)//[(L2-L5//L3-L8)+(L3-L6//L1-L9)]
	TIE L2-L4-L8	L1-L3=(L3-L6//L1-L9)//[(L1-L4//L2-L7)+(L2-L5//L3-L8)]
	TIE L3-L5-L9	L2-L3=(L2-L5//L3-L8)//[(L1-L4//L2-L7)+(L3-L6//L1-L9)]
9 LEAD DUAL VOLT HV	L1, L2, L3, L4, L5, L6, L7, L8, L9	L1-L2, L1-L3, L2-L3
	TIE L4-L7	L1-L2=L1-L4+L7-L8+L2-L5
	TIE L5-L8	L1-L3=L1-L4+L7-L9+L3-L6
	TIE L6-L9	L2-L3=L2-L5+L8-L9+L3-L6
9 LEAD DUAL VOLT LV	L1, L2, L3, L4, L5, L6, L7, L8, L9	L1-L2, L1-L3, L2-L3
	TIE L1-L7	L1-L2=(L1-L4//L2-L7)//[(L1-L9//L3-L6)+(L2-L5//L3-L8)]
	TIE L2-L8	L1-L3=(L1-L9//L3-L6)//[(L2-L7//L1-L4)+(L2-L5//L3-L8)]
	TIE L3-L9	L2-L3=(L2-L5//L3-L8)//[(L1-L4//L2-L7)+(L3-L6//L1-L9)]

9 LEAD DUAL VOLT HV DELTA	L1, L2, L3, L4, L5, L6, L7, L8, L9	L1-L2, L1-L3, L2-L3
	TIE L4-L7	L1-L2=(L1-L4+L2-L7)//(L1-L9+L2-L5+L3-L6+L3-L8)
	TIE L5-L8	L1-L3=(L1-L9+L3-L6)//(L1-L4+L2-L5+L2-L7+L3-L8)
	TIE L6-L9	L2-L3=(L2-L5+L3-L8)//(L1-L4+L1-L9+L2-L7+L3-L6)
9 LEAD DUAL VOLT LV DELTA	L1, L2, L3, L4, L5, L6, L7, L8, L9	L1-L2, L1-L3, L2-L3
	TIE L1-L6-L7	L1-L2=(L1-L4//L2-L7)//[(L1-L9//L3-L6)+(L2-L5//L3-L8)]
	TIE L2-L4-L8	L1-L3=(L1-L9//L3-L6)//[(L1-L4//L2-L7)+(L2-L5//L3-L8)]
	TIE L3-L5-L9	L2-L3=(L2-L5//L3-L8)//[(L1-L9//L3-L6)+(L1-L4//L2-L7)]
12 LEAD DUAL VOLT WYE HV	L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12	L1-L2, L1-L3, L2-L3
	TIE L4-L7	L1-L2=L1-L4+L2-L5+L7-L10+L8-L11
	TIE L5-L8	L1-L3=L1-L4+L3-L6+L7-L10+L9-L12
	TIE L6-L9	L2-L3=L2-L5+L3-L6+L8-L11+L9-L12
	TIE L10-L11-L12	
12 LEAD DUAL VOLT WYE LV	L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12	L1-L2, L1-L3, L2-L3
	TIE L1-L7	L1-L2=(L1-L4+L2-L5)//(L7-L10+L8-L11)
	TIE L2-L8	L1-L3=(L1-L4+L3-L6)//(L7-L10+L9-L12)
	TIE L3-L9	L2-L3=(L2-L5+L3-L6)//(L8-L11+L9-L12)
	TIE L4-L5-L6	
	TIE L10-L11-L12	
12LEAD DUAL VOLT DELTA HV	L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12	L1-L2, L1-L3, L2-L3
	TIE L1-L12	L1-L2=(L1-L4+L7-L10)//(L2-L5+L3-L6+L8-L11+L9-L12)
	TIE L2-L10	L1-L3=(L3-L6+L9-L12)//(L1-L4+L2-L5+L7-L10+L8-L11)
	TIE L3-L11	L2-L3=(L2-L5+L8-L11)//(L1-L4+L3-L6+L7-L10+L9-L12)
12 LEAD DUAL VOLT DELTA LV	L1, L2, L3, L4, L5, L6, L7, L8, L9, L10, L11, L12	L1-L2, L1-L3, L2-L3
	TIE L1-L6-L7-L12	L1-L2=(L1-L4//L7-L10)//[(L2-L5//L8-L11)+(L3-L6//L9-L12)]
	TIE L2-L4-L8-L10	L1-L3=(L3-L6//L9-L12)//[(L1-L4//L7-L10)+(L2-L5//L8-L11)]
	TIE L3-L5-L9-L11	L2-L3=(L2-L5//L8-L11)//[(L1-L4//L7-L10)+(L3-L6//L9-L12)]

Creating a Parameter List

NOTE: A Winding Group must be configured prior to creating the parameter list. If this has not been done see Creating a Winding Group.

1. Click on Master select Create Parameter List or click on the short cut on the tool bar.
2. Click on Select then choose the Winding Group you need.
3. Click Open.

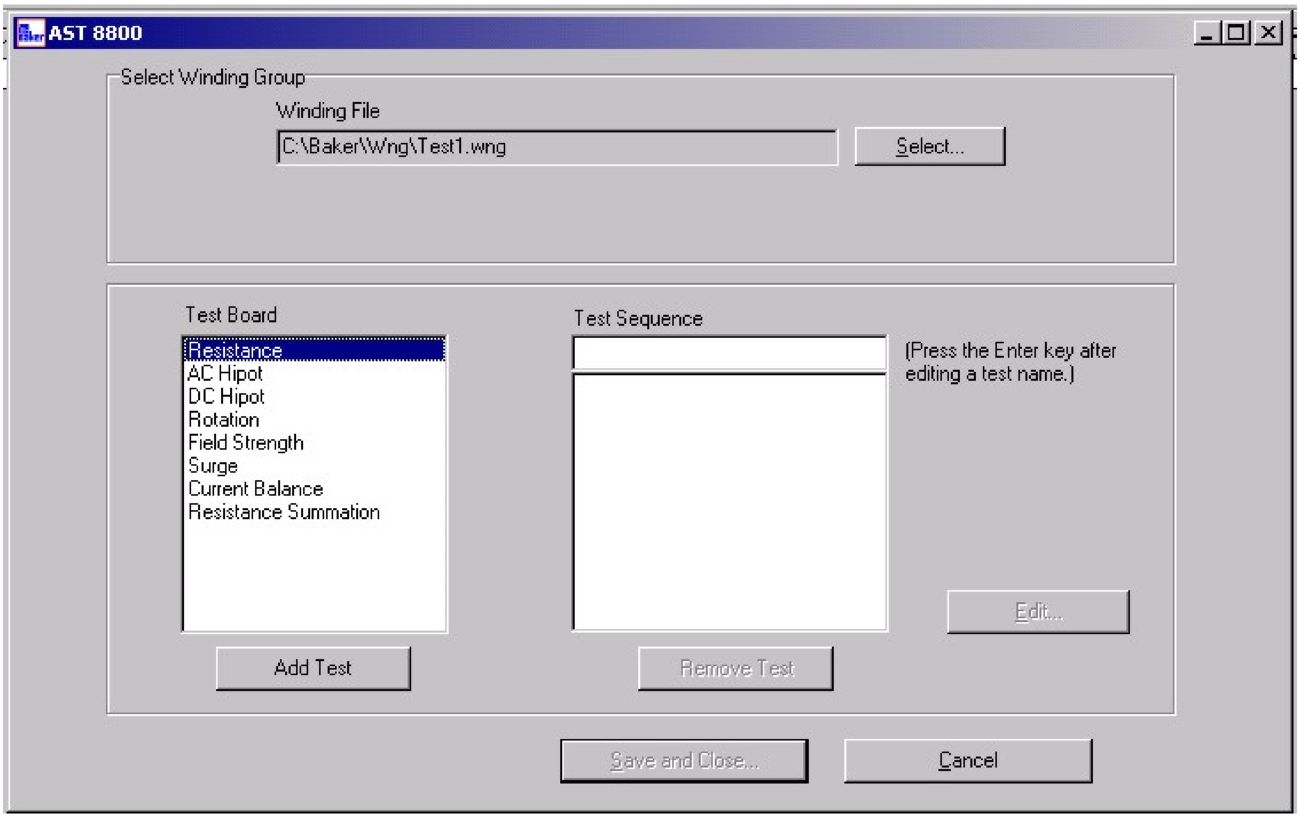


Fig 13: *Creating a Parameter List*

4. Add Tests in the order of testing process.
5. To Add Tests click on the test in the Test Board box one at a time and click on Add Test.

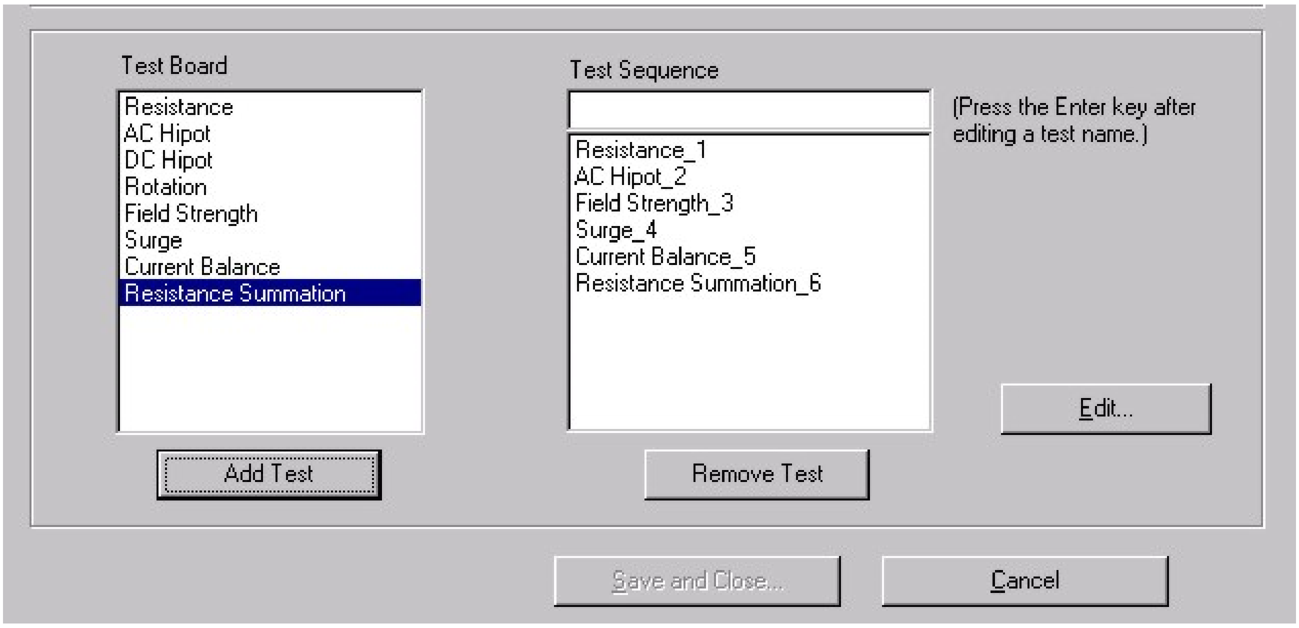


Fig 14: *Adding tests to parameters list.*

6. The test names can be edited. Highlight name of test and it will appear in the small box right below Test Sequence. Type whatever is appropriate for the process and press enter after each name change. That name will now appear in the Test Sequence box.

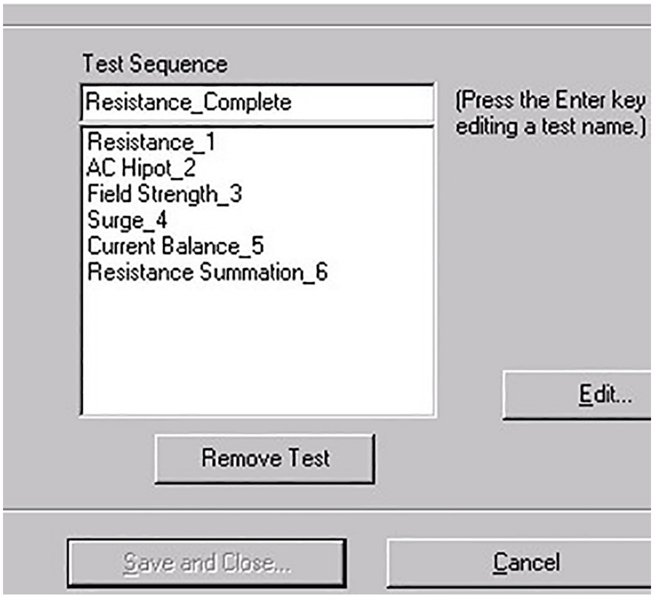


Fig 15: *Editable tests.*

NOTE: Tests must be named with unique names. If two tests are named the same the tester will not operate correctly and testing results could be invalid.

Editing Test Parameters

1. Highlight the Test Name in test sequence box and Click Edit Test Parameters. A large edit box will appear with window tabs for each test listed on the Test Parameters window.
2. Click on each window tab and edit accordingly. All tabs must be edited for it to be accepted. If all editing is not done, an Error message will appear and take you to the window that needs further editing.

Editing Resistance Test Parameters

1. Choose which lead will be active and which one the current will return.

NOTE: Attempt to configure leads to correspond with selected test name. There needs to be a general understanding of the wiring diagram of the part being tested in order to correctly set up the resistance test. These leads need to be electrically connected in order to perform the test.

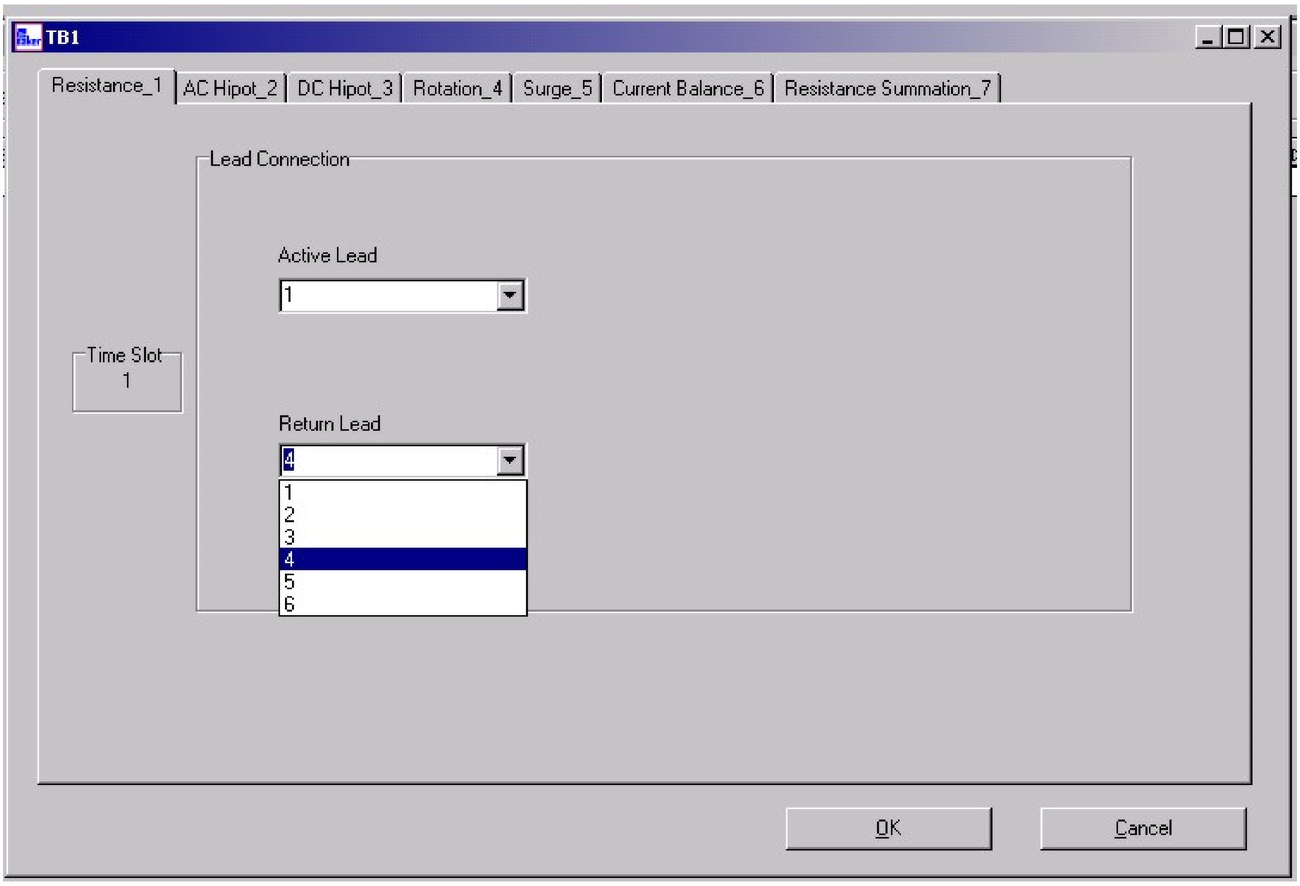


Fig 16: *Editing Resistance Test parameters.*

Editing AC HiPot Test Parameters

1. Set Test Voltage appropriately to the part by using the up and down toggles or highlighting and typing the appropriate voltage level.

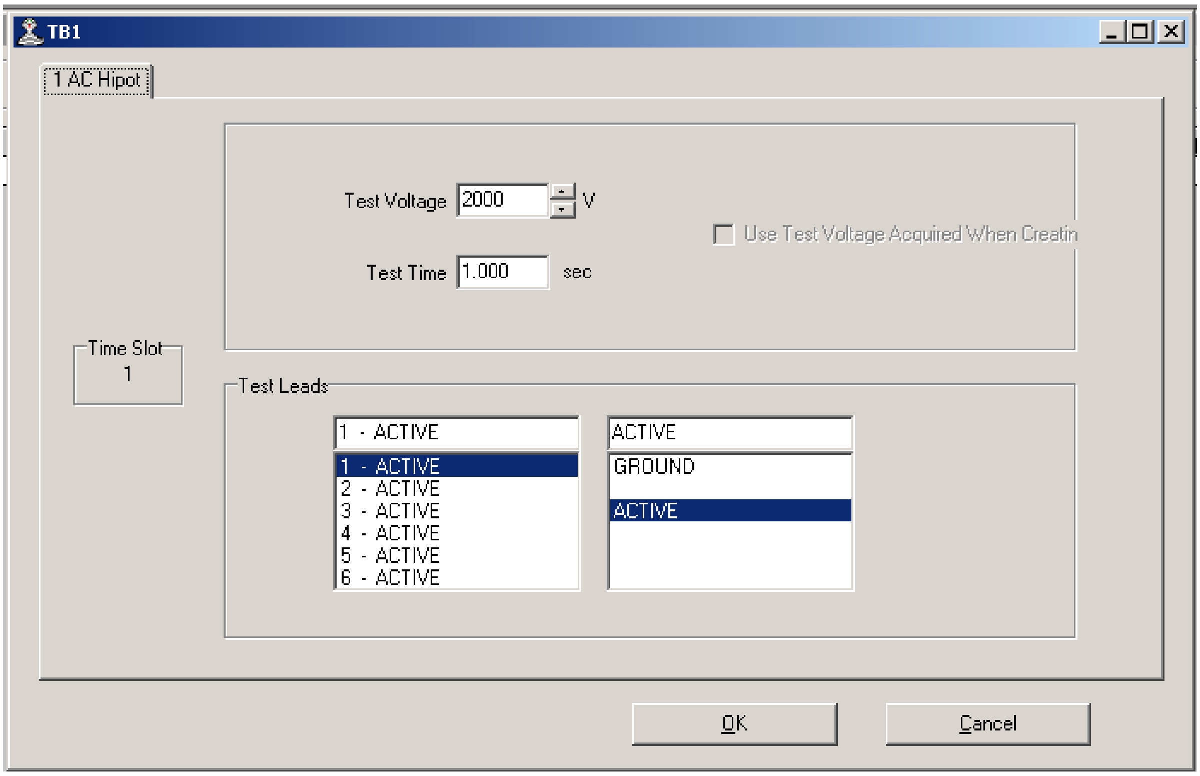


Fig 17: *Editing AC HiPot Test parameters.*

2. Set Test Time by Highlighting the box and typing the appropriate time.
3. Set Test Lead status by highlighting each test lead and then click on Active, Open (optional), or Ground as is appropriate for the process (depending upon build). In order to change a lead from ground to active or active to ground highlight the appropriate lead and click either ground or active. The lead will automatically change at this point.

NOTE: In general all leads are active for AC HiPot.

Editing DC HiPot Test Parameters

1. Set Ramp-Up Voltage by using the up or down toggles or highlighting and typing in the appropriate value.
2. Set Hold Time by highlighting and typing in an appropriate value.
3. Set Test Lead Status by highlighting each test lead and then click on Active, Open (optional), or Ground as is appropriate for the process.

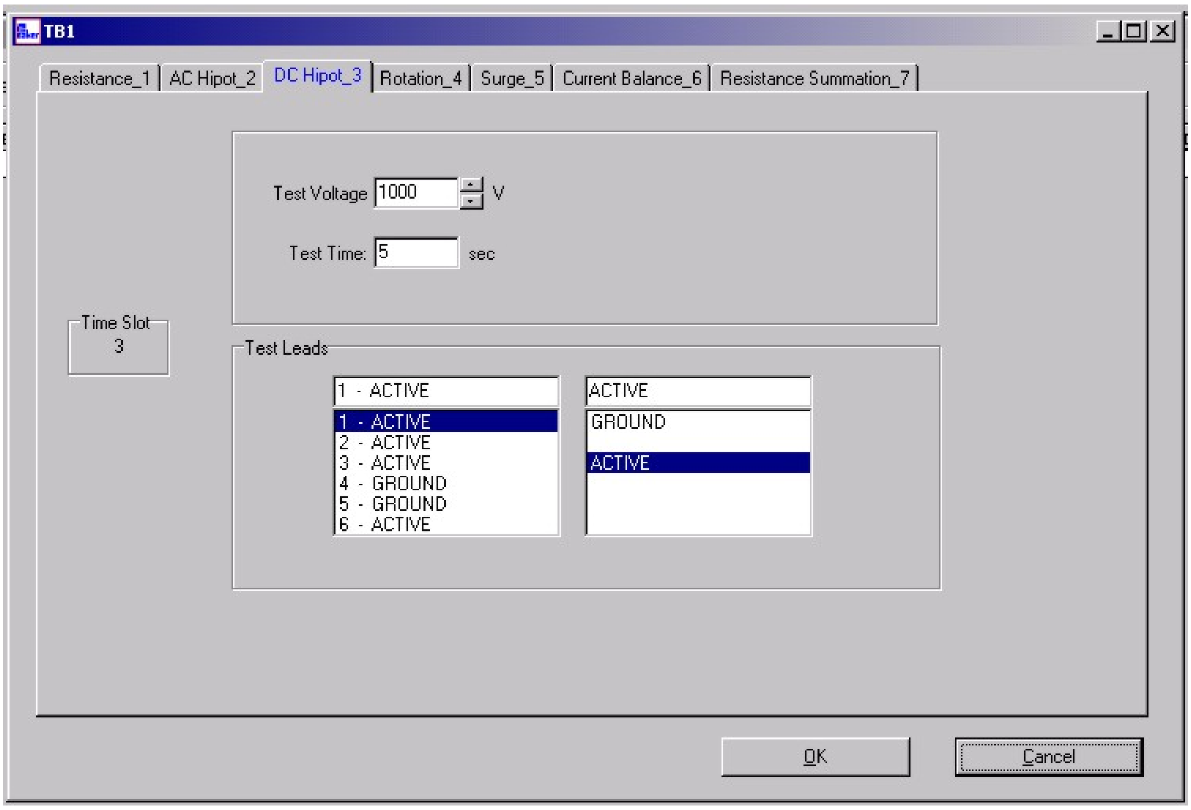


Fig 18: *Editing DC HiPot Test parameters.*

NOTE: In general all leads are active for DC HiPot.

Edit Rotation Test Parameters

1. Determine Number of Poles. Use the toggle switch to change.

> NOTE: The number of poles is dependent on the speed of the motor. For example, a 2-pole motors speed is 3600 rpm at 60 Hz and a 4-pole motors speed is 1800 rpm at 60Hz.

2. Determine Phase (1 or 3). Use toggle switch to change.
3. Set Test Lead Status. For a 1-phase motor and a 3-phase motor, all phase leads must be active. For example, on a three-phase motor apply power to the power leads.

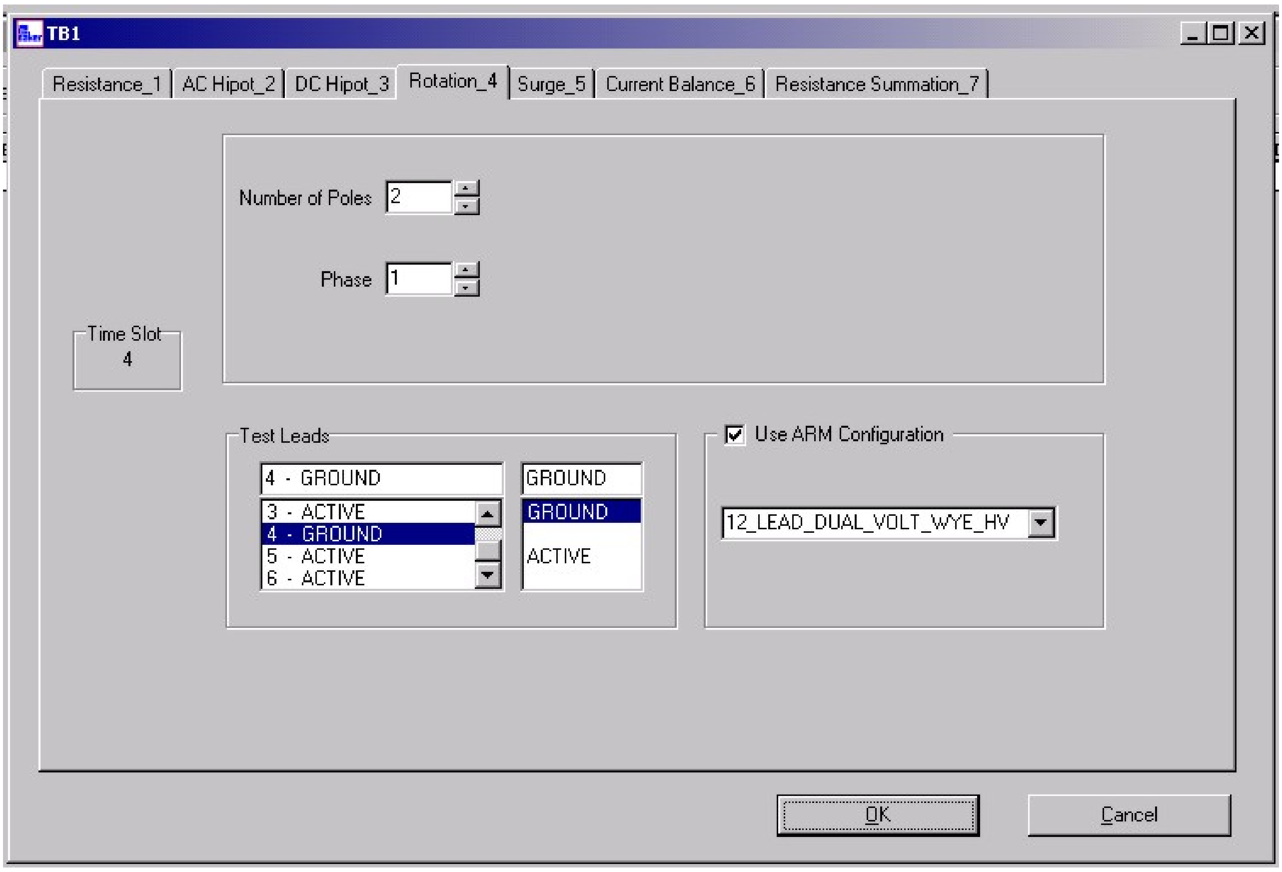


Fig 19: *Editing Rotation Test parameters.*

Editing Surge Test Parameters

1. Set Test Voltage using the up or down toggle switch or highlight and type in appropriate voltage.
2. Set # of Pulses by using the up or down toggle switch or highlight and type in appropriate amount of pulses.

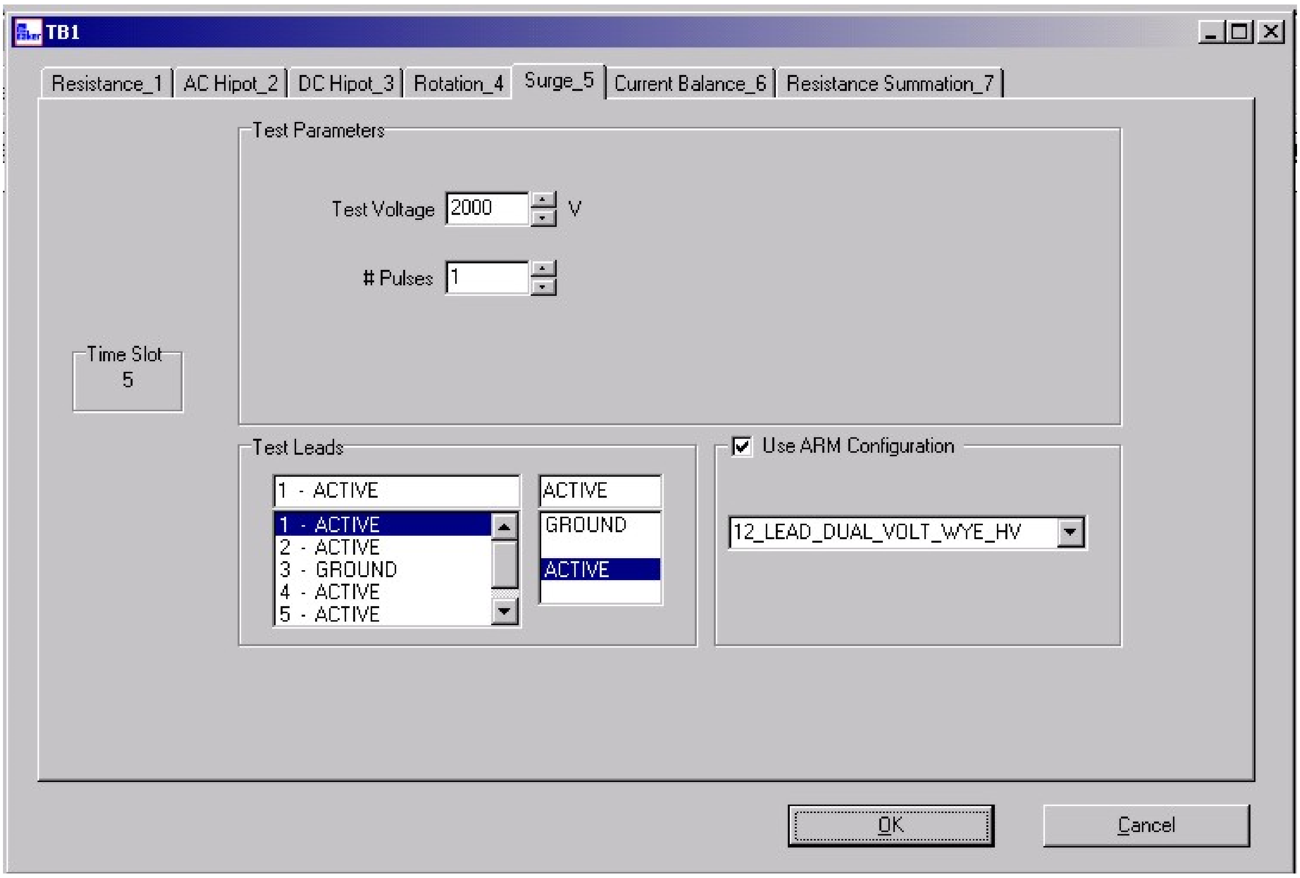


Fig 20: *Editing Surge Test parameters.*

3. If available, you can use an ARM Configuration. However, you must understand the part wiring diagram and the ARM Configuration for this to work properly.

Editing Current Balance Test Parameters

1. At this point in time, no parameters are editable for this test.

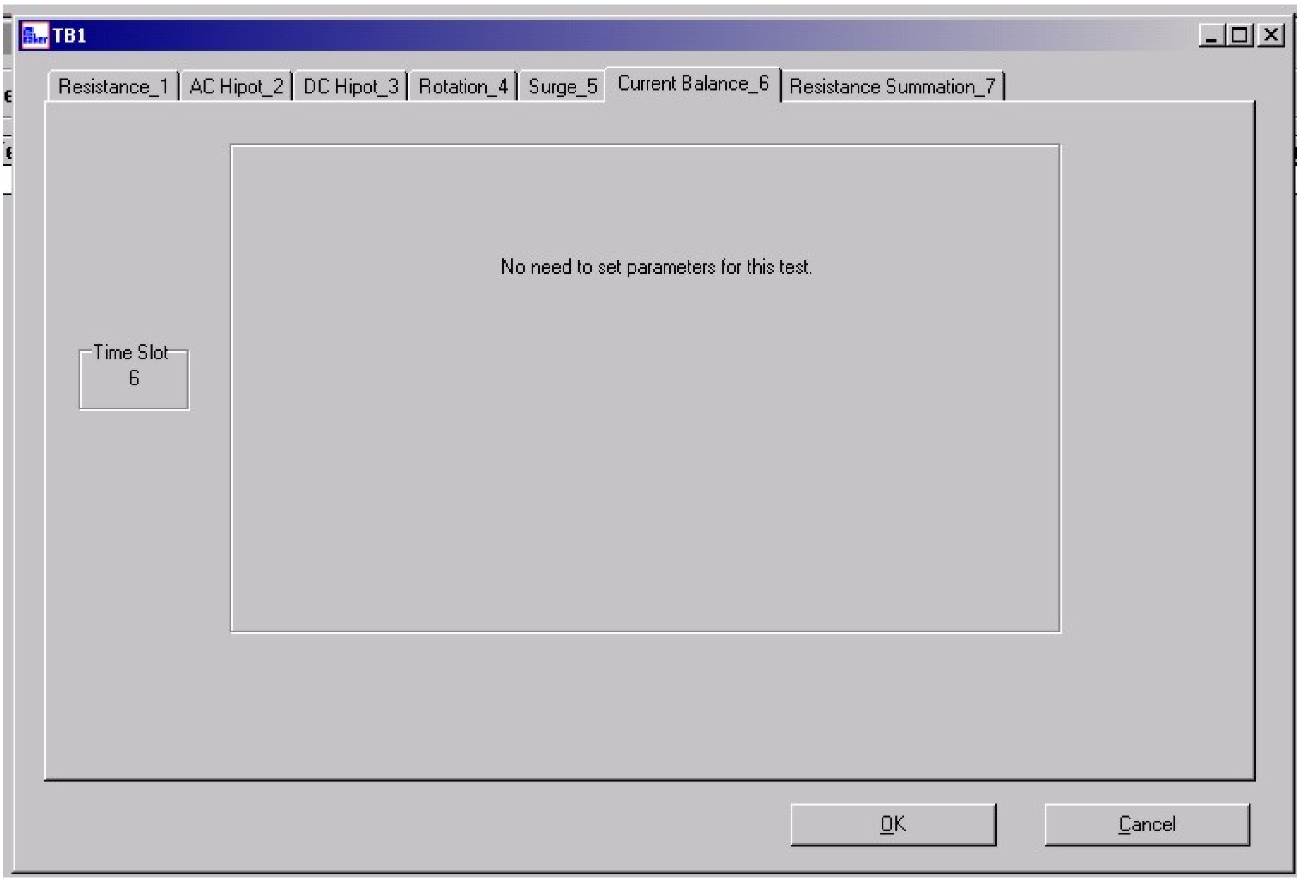


Fig 21: *Editing Current Balance Test parameters.*

Edit Resistance Summation Parameters

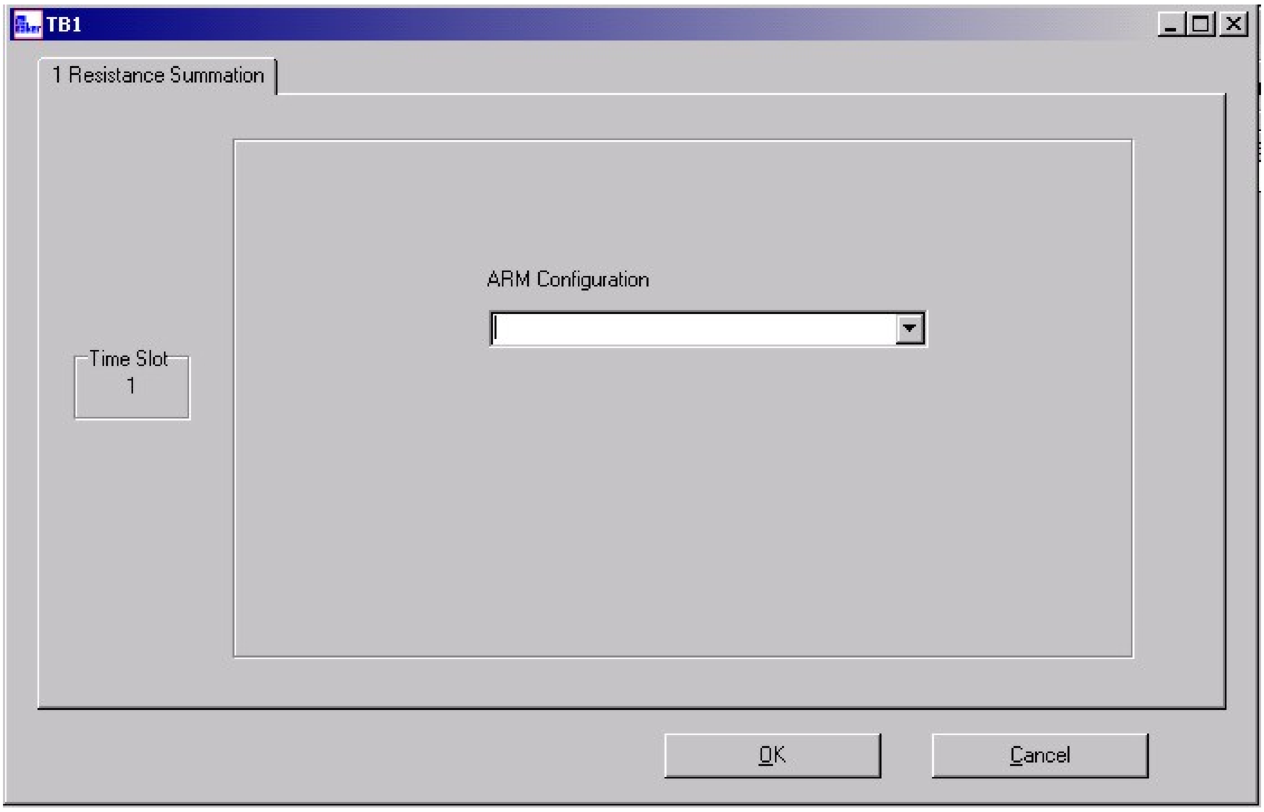


Fig 22: *Editing Resistance Summation parameters.*

1. After all editing has been done click Ok and the software will return to the Create Parameters List window.
2. If all parameters have not been completed an error message will appear.

Fig 23: *Error Message*

3. Click Ok and the software will return to the test that the parameters have not been edited appropriately.
4. Click on Save and Close Parameter List.
5. The software will ask for a name for the file. Name it something that will be distinct to the process and similar to the name given to the Winding Group file associated with this Parameter List.

Creating a Master

Each winding model needs it own master file, which contains all the configuration information necessary for testing. Settings that are configured within the master include leakage limits, resistance limits, surge master, rotation direction, and more.

1. To create a new Master, click on Master then Create Master or click on the Create Master icon.

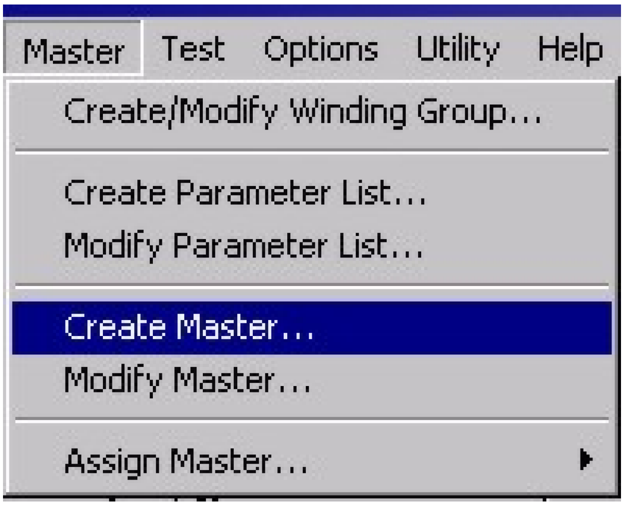


Fig 24: *Create Master droop-down menu.*

2. Select the appropriate parameter list by clicking Select and selecting the needed parameter list. This will also automatically select the associated winding file.

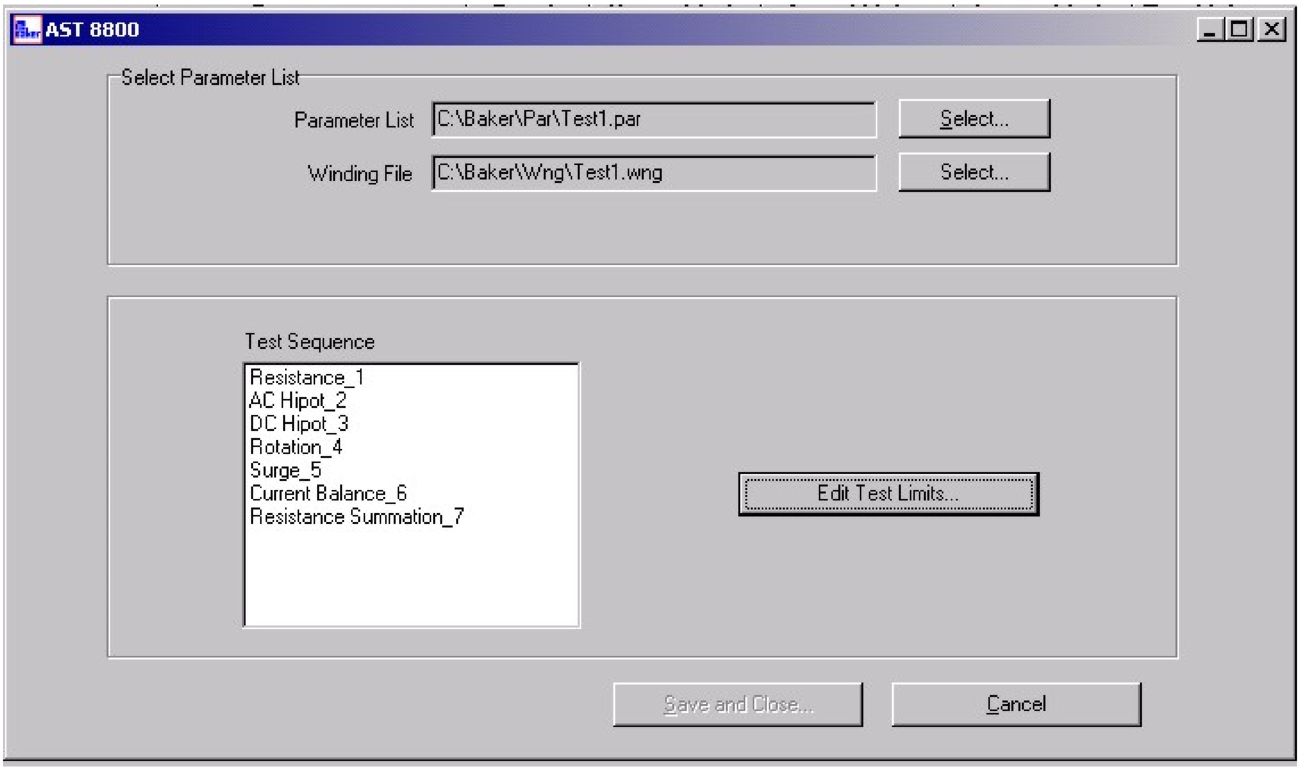


Fig 25: *S*elect parameter list.

Editing Resistance Test Limits

1. When you select Resistance_1 from the Test Sequence list then click on Edit Test Limits, the following window appears.

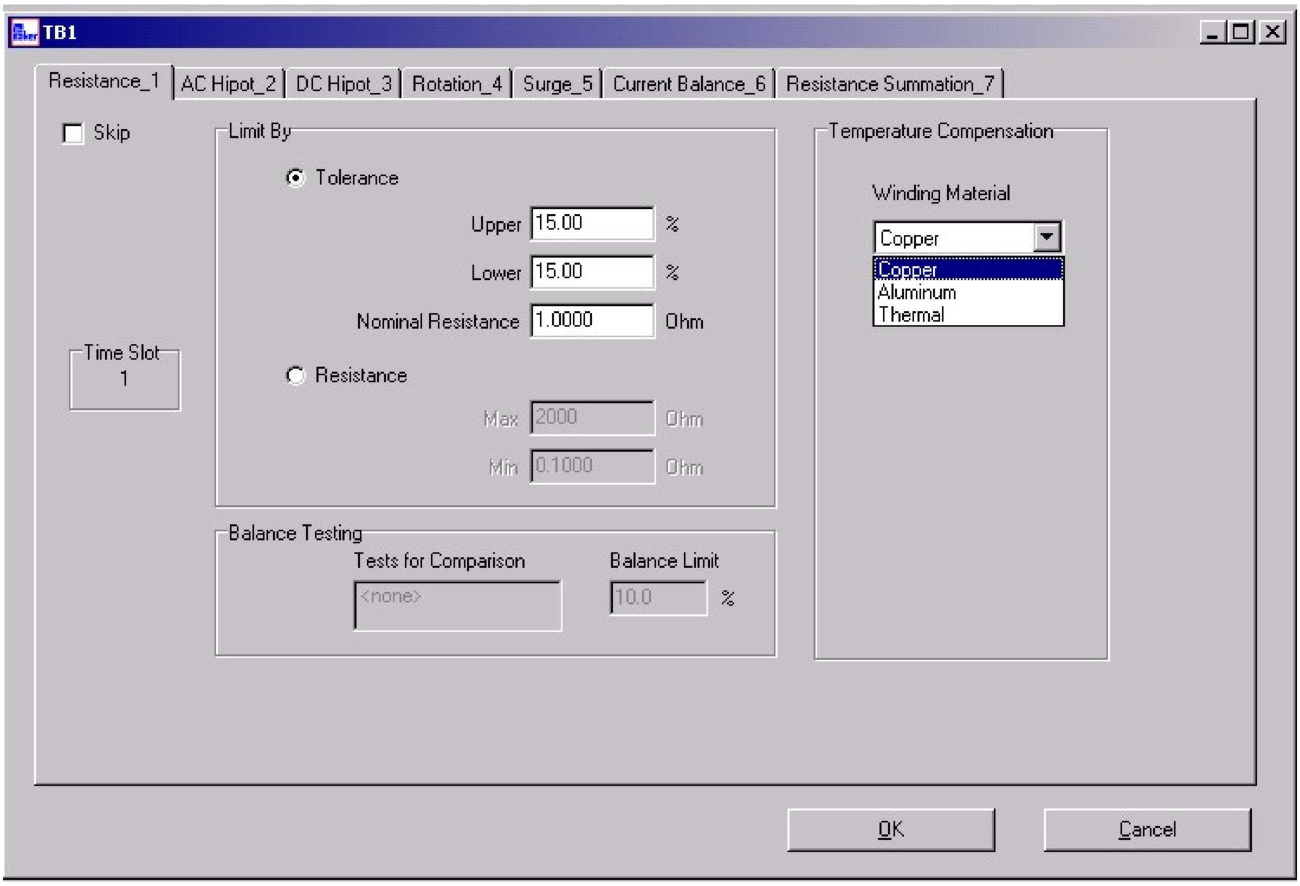


Fig 26: *Editing resistance test limits.*

2. Select Tolerance or Resistance according to the process requirements. The system default is Tolerance.
3. If using Tolerance, type in the appropriate values for the Upper, Lower, and Nominal Resistance limits in their respective fields.
4. If using Resistance, type in the values for the Maximum and Minimum resistance limits in their respective fields.

Resistance Balance Calculation

The Baker WinAST can compare multiple resistance measurements to each other to verify that the resistances are all within a specified percentage tolerance of each other. It is often beneficial to check for tighter resistance balance tolerances within a winding than can be maintained with absolute tolerances.

There are two formula options for the calculation. One option calculates the difference between the highest and lowest values. The other option calculates the difference between the value most different from the average and the average. The option is specified during the initial configuration of the tester. If you need to change the formula selection, contact Megger Baker Instruments support for assistance.

The balance test must be programmed in the last of the resistance menus which will be compared. In the example shown, the resistance of Res1-4, Res 3-6 and Res 7-10 are checked for balance. The last test which will be conduced is the test furthest to the right in the sequence of tests. Since Res 3-6 is the last conducted of the three tests, this is the menu where the balance test is programmed.

1. To activate the calculation, under Tests for Comparison, scroll to the other resistance tests that need to be

included in the calculation and left mouse click them.

2. If multiple selections are desired, press and hold the Ctrl key and click together for each additional entry. They will turn dark blue when active. All resistances that are dark blue, along with the test in the present programming menu, will be compared for balance.
3. To unselect a test from the balance calculation, press the Ctrl key when the left mouse click.
4. Enter the percent balance limit.

The Results window shows the calculated balance error highlighted. The displayed value will be beneath the measured value for the test in which the balance test was programmed.

Editing AC HiPot Test Limits

1. Highlight or tab and type the appropriate μA value for MaxTotal.
2. Highlight or tab and type the appropriate μA value for MinTotal.

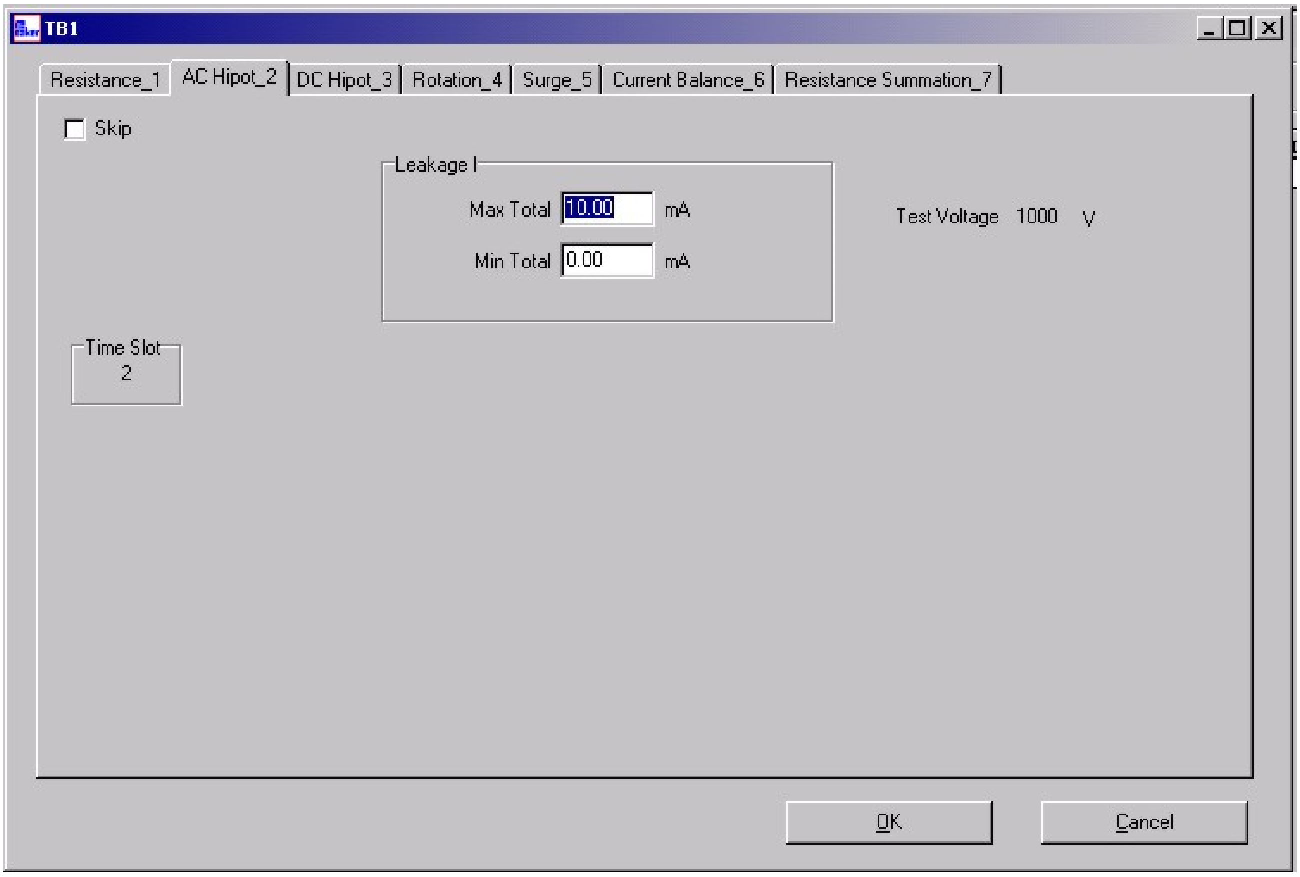


Fig 27: Editing AC HiPot test limits.

The minimum leakage current is used to verify that the ground is attached in situations where the ground is manually attached to the core by the operator. Otherwise, set the minimum to zero. The minimum current value is always compared to the total current even when Capacitive Compensation is active. This is because the resistive current may be too small to verify that the ground is attached when Capacitive Compensation is active.

3. The Test Voltage is given for reference, but is set in the Parameter file.

AC HiPot—Partial Discharge

NOTE: Hardware set, not available as a software control at this time.

Editing DC HiPot Test Limits

1. Select Max and type the appropriate μA value.

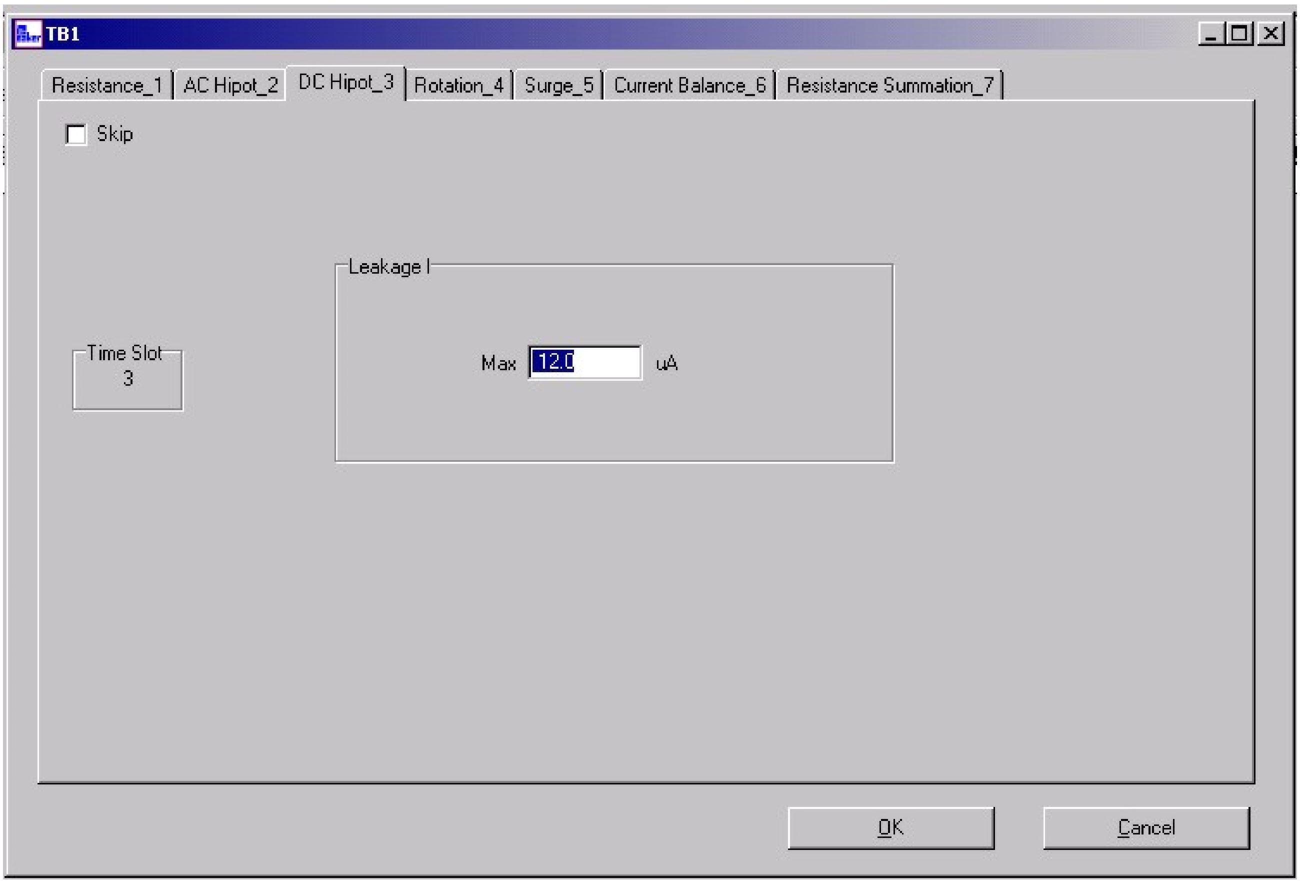


Fig 28: *Editing DC HiPot test limits.*

Editing Rotation DirectionTest Limits

1. Click on the radio button that is appropriate for the application. Either clockwise or counter clockwise. If the unit is dual station, be sure to choose the correct Station for learning the part.
2. Click on acquire. This will take a look at the connected part and acquire the rotation. If the machine acquires the rotation it will state Rotation Acquired Successfully in the grey box. The machine at this point has learned the rotation of the part and will look at all other parts to see if the rotation is the same.

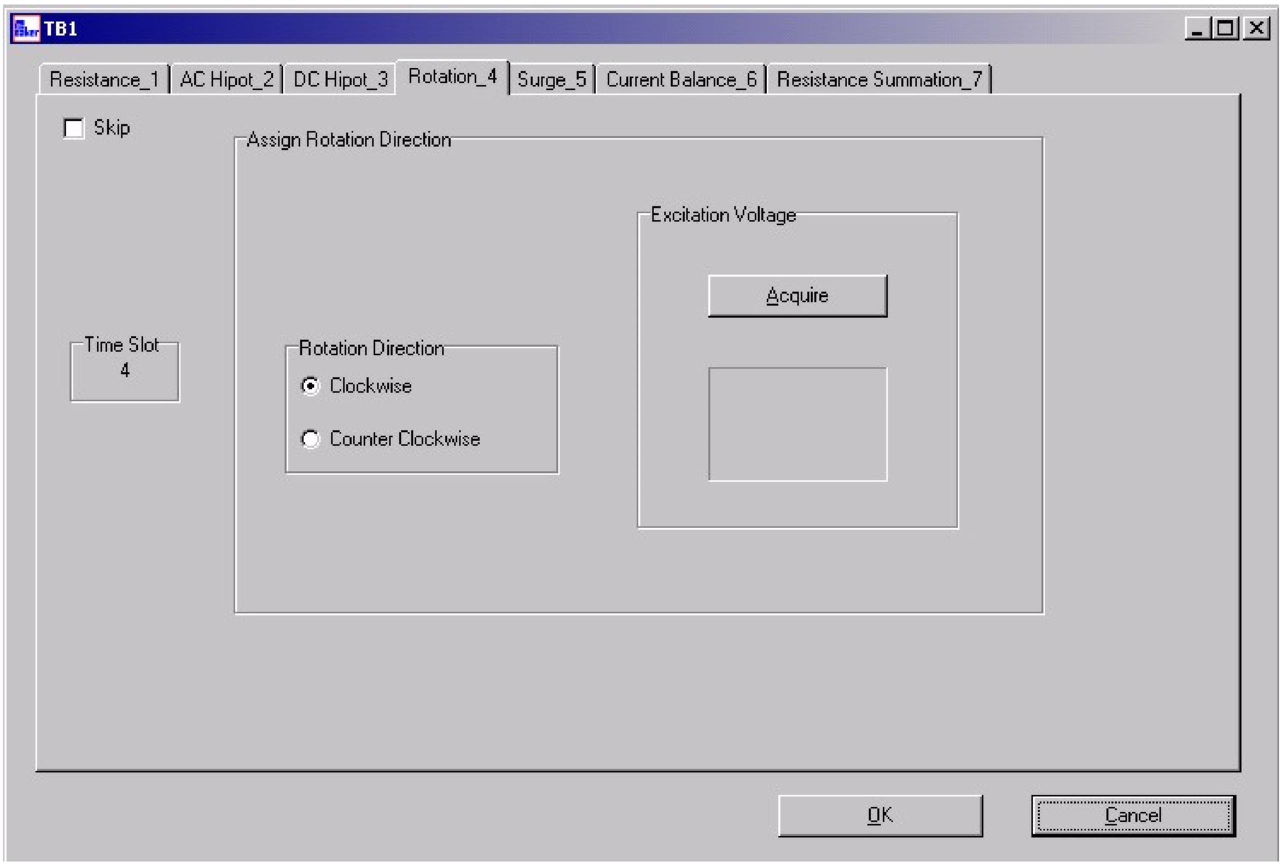


Fig 29: *Edit Rotation Direction test limits.*

NOTE: It is important to make sure that the part that is being used has been check out and is verified to which direction rotation is and that the part is good. The Baker WinAST will administer pass/fail criteria on all other parts from the information gathered from this part.

Editing Surge Test Limits

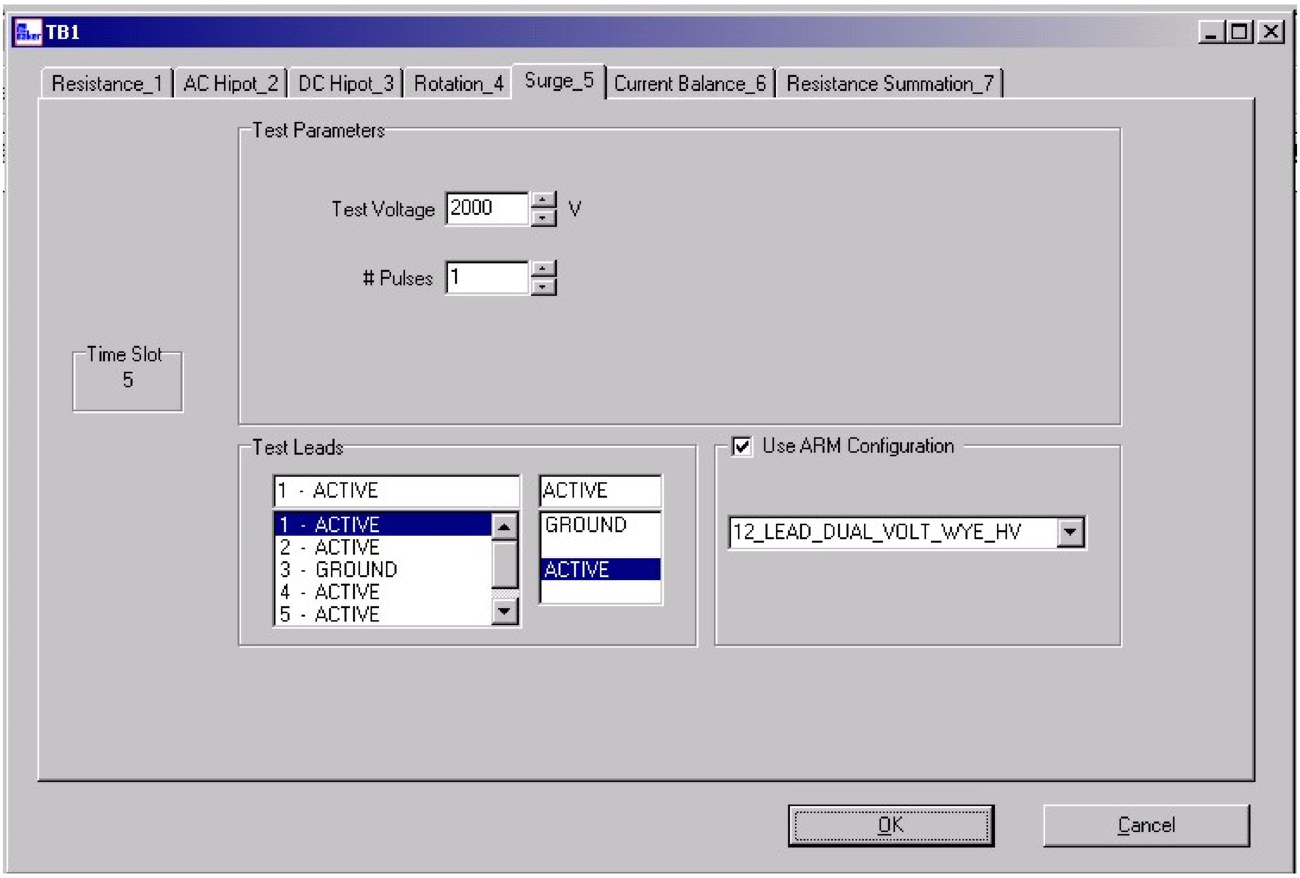


Fig 30: *Editing Surge test limits.*

1. If you are using a dual-station machine, select the station where the part being learned is positioned and type 1 or 2, or use the Up and Down toggle switch to change the station number.
2. Highlight or Tab and set voltage compensation to :
   - Off – No compensation.
   - Manual – Highlight and type appropriate Voltage increase.
3. Highlight, tab or toggle AutoTime Base to on or off. The system is default set to auto. If the surge time base needs to be set identically for each part, the Auto checkbox can be unlit and the level changed. For typical tests the auto check box is usually left checked>
4. Click Acquire.

> NOTE: For a single surge test, click on the top level Acquire button to acquire the individual test. As a time saving procedure, if multiple surge tests are involved (for example Main, Aux, and Reverse), click on the second level Acquire button (under the All Surge Time Slots) to acquire all the surge test waveforms if all limits have been set for each Surge Test. The singular Acquire button can be also used to individually acquire each Surge Test separately.

A surge waveform will appear on the window for each of the surge tests acquired. If multiple surge tests have been acquired, the graphical displays will be overlayed over each other. Hover the mouse cursor over the graph to see the waveform for another surge test.

5. Click Accept on the top level for an individual surge test, or click on Accept under the all time slots to accept all surge tests.

Using the Partial Discharge-Corona Test

Megger Baker Instruments has incorporated a method for detecting the presence of partial discharge into the standard high-voltage impulse test used to check for breakdown. Modifications to the traditional impulse test hardware circuit were necessary. The impulse A/D circuit was modified so that the high-frequency partial discharge energy is not attenuated before the impulse waveform is digitized. The digitizing circuit samples the waveform at high speed so that the high-frequency component can be captured. More sampled data is stored so that the high-frequency components can be properly displayed and analyzed.

Software algorithms are used to separate the high-frequency component from the low-frequency impulse waveform. The low-frequency waveform is displayed and analyzed using our patented Error Area Ratio analysis method as before. The high-frequency data is displayed and analyzed using a Sum of the Delta Ys calculation to quantify the corona data in to a single value. This value is calibrated to convert it to Coulombs.

After learning the shape of the surge waveform from a known good winding, you can also set a window defining the start time and end time of the data included in the calculated partial discharge data. You can thus exclude data that is not likely to be useful PD data. Using the learned PD value as a gauge for what might be considered acceptable PD at this test voltage, you can enter a pass/fail threshold above which the PD will be unacceptable.

PD by its nature is not perfectly repeatable from test to test. So it is likely that a winding will have some PD value variation between tests. You will best learn the PD threshold settings that work for your products through experience in a production environment.

Some users perform an impulse breakdown test on each winding at a relatively high-voltage and perform the corona evaluation as part of that test. Using this approach, the winding might exhibit significant corona even on a good winding if the breakdown test voltage is above the CIV. You can set a pass/fail limit at a level above the acceptable level of corona.

Most users find it beneficial to conduct a second impulse test for corona at a voltage near the expected CIV. This is the preferred test method if the additional test time is tolerable. Using this approach, the acceptable PD threshold is usually set fairly close to zero.

Programming a Partial Discharge Test

In units with the partial discharge hardware installed, the software is configured differently. In the Surge Learn menu, there is an Enable Corona button that can be activated by the mouse.

NOTE: The enable corona button must be individually enabled in every surge test. Enabling the corona test in one surge test tab does not enable the corona test in all the other surge tests.

The corona test must be enabled prior to learning the surge waveforms from a known good winding. If you enables the corona test after the surge is learned, the learned data must be deleted and relearned.

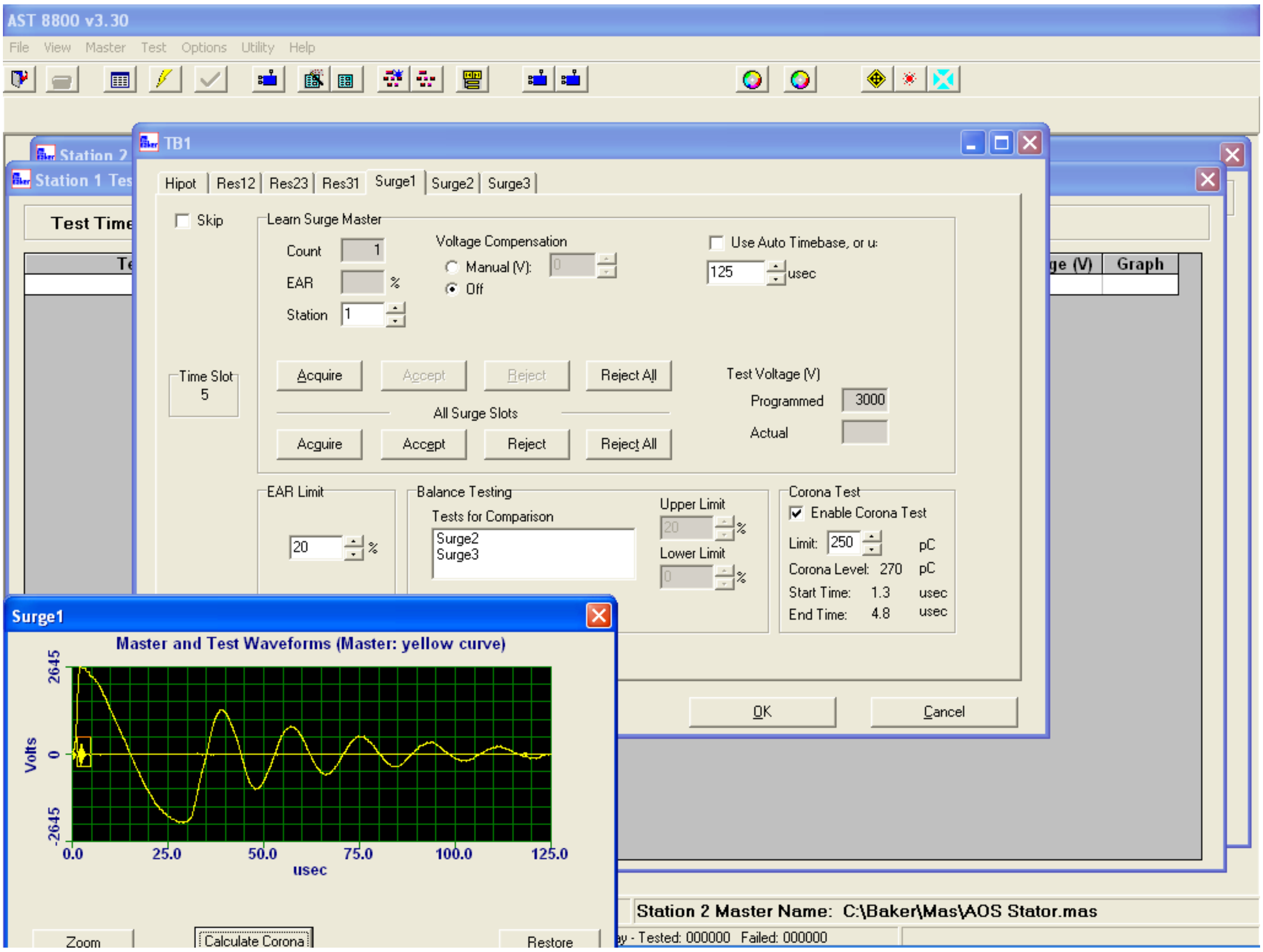


Fig 31: *Typical surge/corona program window after programming. Note the high-frequency corona data in the window below the surge peak.*

When the surge test is learned while the corona test is enabled, both the fundamental lower frequency surge waveform will be displayed on the graphs as well as the high-frequency corona. The corona data is filtered to separate it from the low-frequency damped sinusoidal surge waveform. The corona data will appear as high-frequency “noise” on the time axis. Corona is generally most prevalent at the peak applied impulse voltage. If corona exists, it occurs within a few microseconds of the peak voltage. It might also appear at other voltage peaks in the waveform. You can see the amount of high-frequency corona increase as the test voltage increases above the CIV.

The software filter used to separate the high-frequency corona data from the fundamental frequency can create some minor high-frequency noise in the corona display. However, you can quickly learn how real corona appears different from this type of noise. A time window allows you to select only the portion of the corona data that you suspect is valid corona data.

After the surge test is learned, the Start time and End time of the window used in the corona evaluation are both zero micro seconds. So the calculated corona value is zero pico Coulombs. The mouse is used to create a time window for the corona evaluation. In the learn surge menu, create a box around the corona data to be included in the evaluation. The Start time and End time will change accordingly. A corona value which is calculated from the Sum of the Delta Ys in the corona window is displayed.

After creating a window around the PD data on the surge graph, select the Zoom on the graph to enlarge the PD data. In the Zoomed graph, create a new window and select "calculate corona" again to fine tune the start and end time.

You can use this information as a guide to what might be considered an acceptable level of corona in a good winding. You then enters a corona threshold limit above which the corona test will fail.

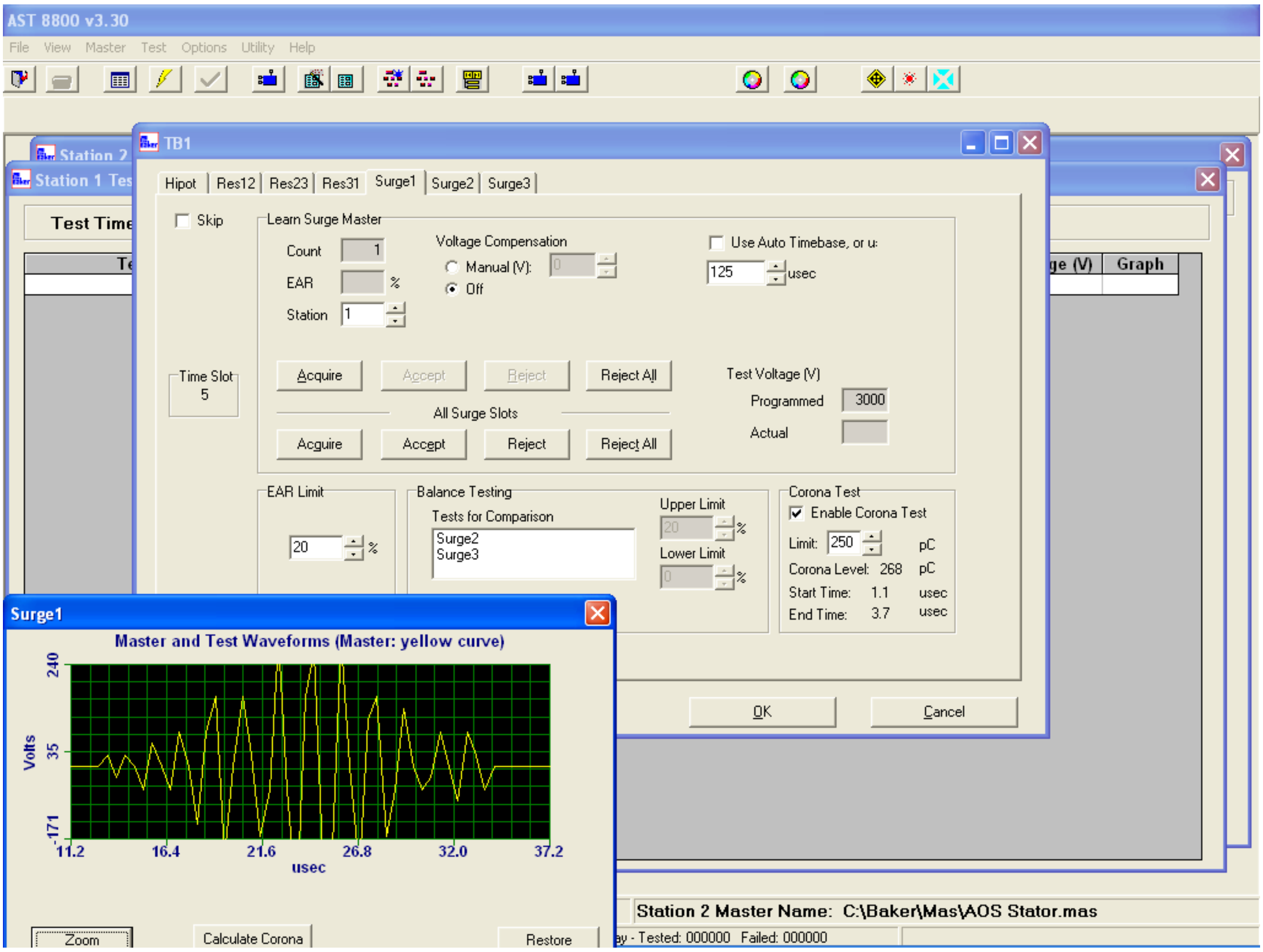


Fig 32: *PD data displayed after using the Zoom button to fine tune the window's start and end time.*

When you have finished adjusting the surge and corona window, save and exit the learn surge menu.

Editing Current Balance Limits

The Current Balance test is an optional test that checks for reversed coils in certain stators, which cannot be detected with the other more common tests. Usually, this problem is detected by the Surge test. Some winding configurations have coil groups that do not couple in a way that changes the inductance when one of the coils is reversed. The current balance test detects these reversed coils.

In this test, a three-phase voltage is applied to a three-phase stator. The current in each phase is compared to the other two phases to verify that the current is balanced within a desired tolerance. If the current imbalance is greater than the limit, a failure is generated.

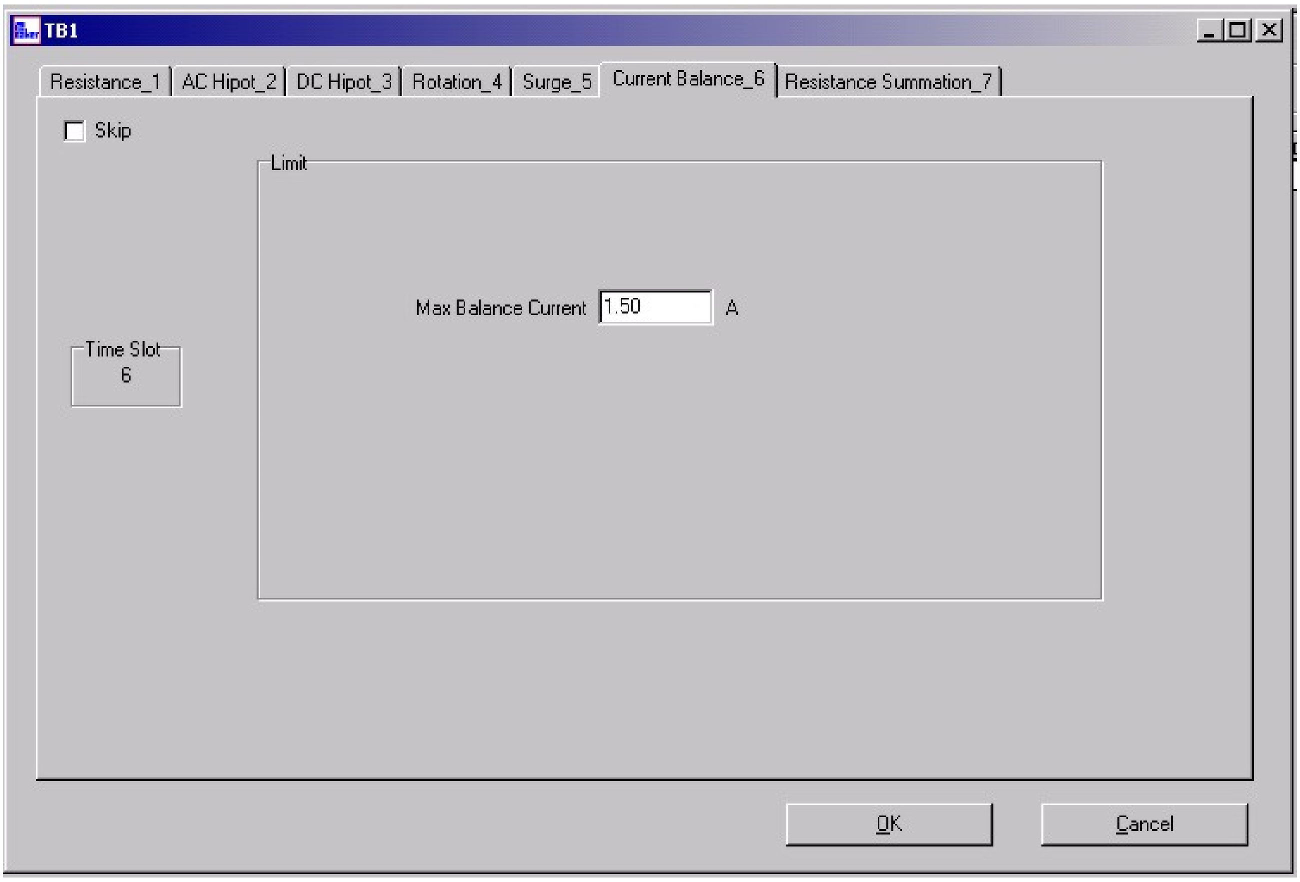


Fig 33: *Editing Current Balance limits.*

Editing Resistance Summation Limits

Resistance Summation is a calculation used when testing three phase stators with more than 3 leads. Many companies want to perform a resistance test on individual coils to verify that each coil falls within the pass/fail limit. But, they also want to verify that the phase to phase resistance is correct.

If a low resistance stator is resistance tested between all leads, it is not possible to directly measure the phase to phase resistance at the same time. For example, a 12 lead dual voltage wye stator usually has 6 resistance tests performed. Resistance is measured between leads 1 to 4, 2 to 5, 3 to 6, 7 to 10, 8 to 11 and 9 to 12. With all 12 leads connected to the Baker WinAST it is not possible to directly measure the high-voltage wye connected resistance from leads 1 to 2, 2 to 3 as well as 3 to 1.

The Baker WinAST resolves this problem by summing the individual resistances to obtain the phase to phase resistance values. In the above example, the phase to phase resistance between leads 1 and 2 is calculated by summing the resistance measurements of leads 1 to 4, 7 to 10, 2 to 5 and 8 to 11. A similar summation is performed to obtain the 2 to 3 and 3 to 1 resistance. After all three phase to phase resistance values are calculated, these can be compared to pass/fail limits as well as for resistance balance.

The resistance summation is tied to the auxiliary relay matrix (ARM) function. The ARM selection denotes the motor winding diagram configuration thereby selecting the resistance summation calculations performed.

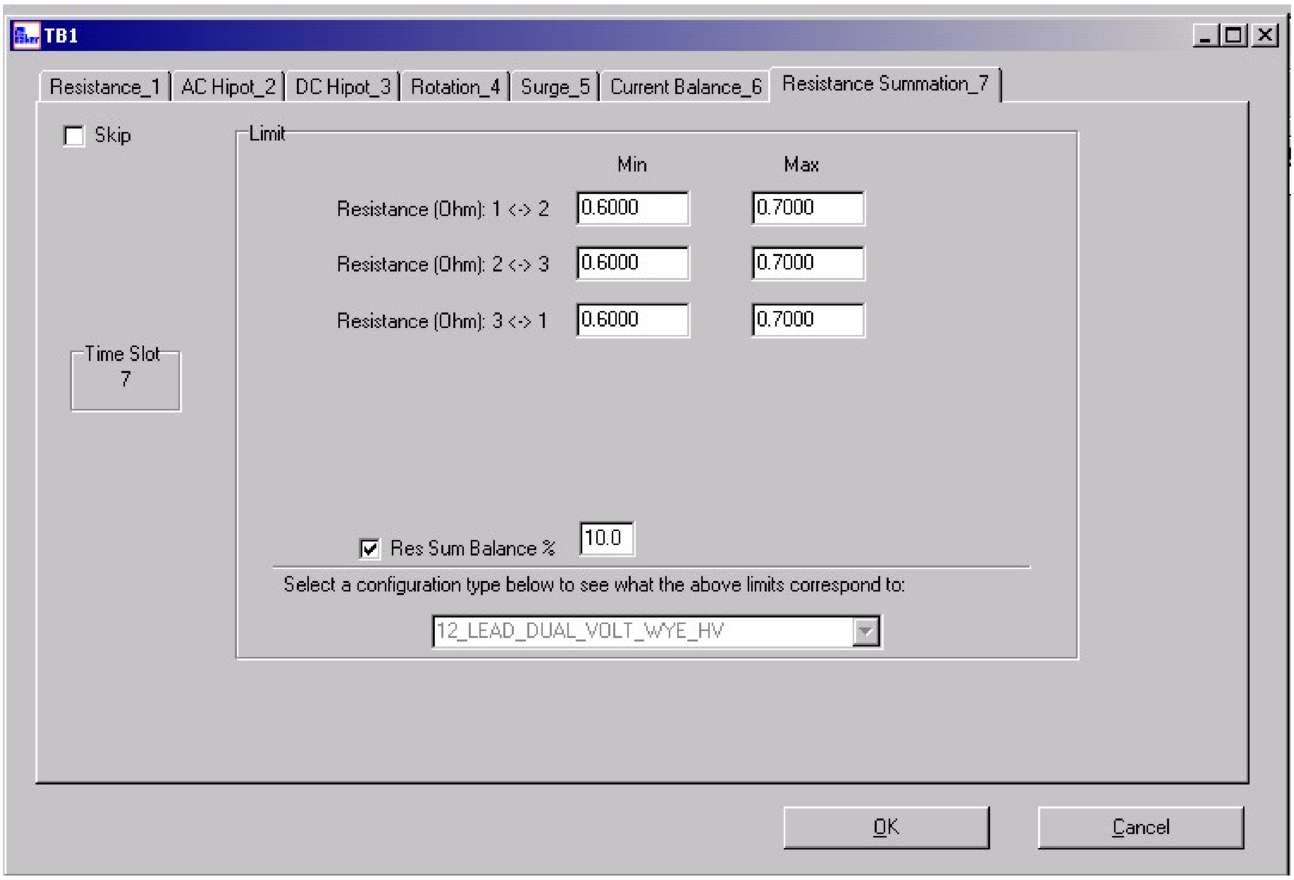


Fig 34: *Editing Resistance Summation limits.*

1. After all limits have been set, click save & close. The software will ask for a name for the Master file. Usually this is the part number of the winding.

NOTE: All folder windows contain a Skip button that allow you to skip a specific test. If you are creating masters off line, or prior to a part being available to learn, click the Skip button to be able to save the created master. When parts become available to learn, unclick the test in edit mode.

Three-Lead Single-Phase Stator Example

A considerable amount of thought should be put into the list of tests that are appropriate for the process.

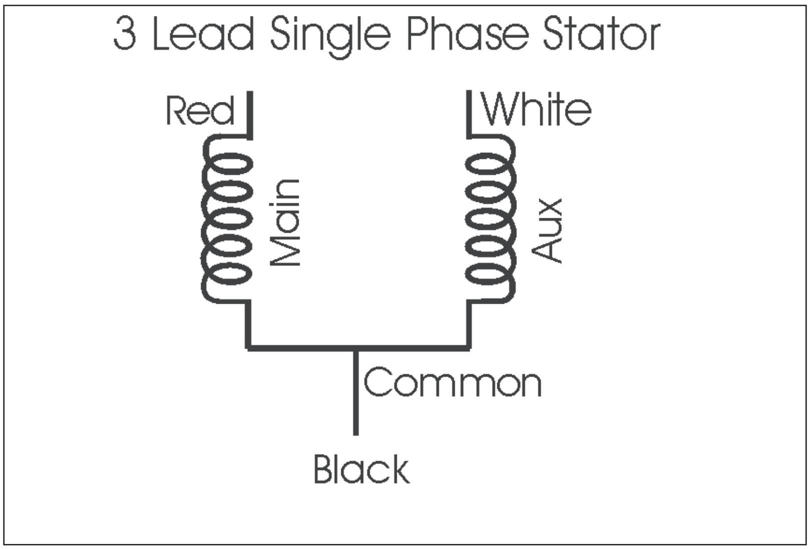


Fig 35: *Three-lead single-phase stator schematic.*

The first test in the sequence is the AC HiPot.

1. Click on the Test Board; a box will appear with a list of tests.
2. Select AC HiPot Test.
3. Click Add Test.

The next test needed is a Main Resistance Test.

4. Click on the Test Board box.
5. Select Resistance and Click Add Test.
6. In the Added Test Box, highlight Resistance and rename the test "Main Resistance."

The next test needed is an Aux Resistance Test.

7. Select Resistance again from the Test Board Box.
8. Click Add Test.
9. In the Added Test Box, highlight the second Resistance Test and rename the test "Aux Resistance."

Three surge tests will be needed. One each for the Main Winding, Aux Winding, and a reverse (Main/Aux Winding in parallel).

10. Select Surge, click Add Test three times.
11. Highlight the first surge and rename to Main Surge.
12. Highlight the second Surge and rename to Aux Surge.
13. Highlight the third Surge and rename Main/Aux Parallel.

Three-Phase Stator Example

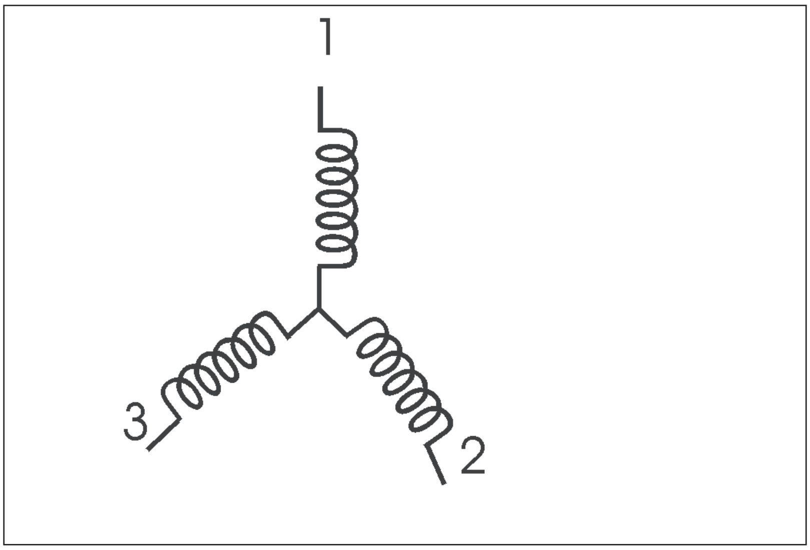


Fig 36: *Three-phase stator schematic.*

The first test in the sequence is the AC HiPot.

1. Click on the Test Board; a box will appear with a list of tests.
2. Select AC HiPot Test.
3. Click Add Test.

The next test is the Resistance. There is a need for three Resistance Tests: Resistance Phase A–B, Resistance Phase B–C, and Resistance Phase A–C.

4. Click on the Test Board box.
5. Select Resistance and click Add Test three times.
6. Highlight the first Resistance test and rename it to Resistance Phase A–B.
7. Highlight the second test and rename it to Resistance Phase B–C.
8. Highlight the third test and rename it to Resistance Phase A–C.

Three Surge tests will be needed. One each for Surge Phase A–B, Surge Phase B–C, and Surge Phase A–C.

9. Select Surge then click Add Test three times.
10. Highlight the first Surge test and rename it to Surge Phase A–B.
11. Highlight the second test and rename it to Surge Phase B–C.
12. Highlight the third test and rename it to Surge Phase A–C.

5 — Modifying the Software

An existing programming test set could need to be modified for various reasons. For example, the company might have another production line that has the same test needs, but is under another part number. Perhpas changes are necessary within the process, and the test limits and parameters need to be changed to match the process change.

When the circumstances call for it, the Baker WinAST software can be modified to make the necessary changes.

Modifying an Existing Winding Configuration

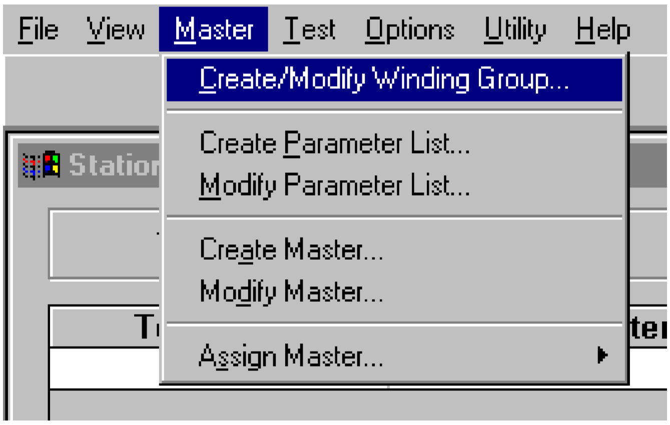


Fig 37: *Selecting Create/Modify Winding Group from the Master drop-down menu.*

1. Click on Master then Create/Modify Winding Group, or click on the Create/Modify Winding Group icon.
2. Click box Select, which brings up a list box of existing Winding Groups.

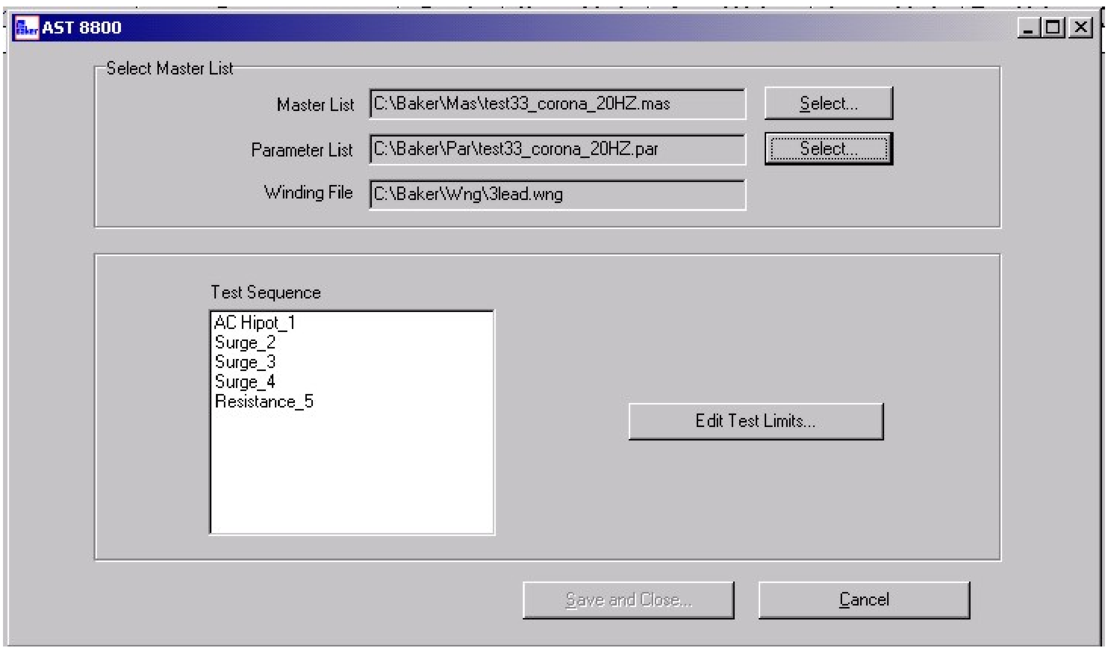


Fig 38: *Select Master List.*

3. Highlight the Winding Group that needs modification and click Open.
4. Highlight the portion that needs modification and make needed changes.
5. Click Save and Close. The changes have been made.

Modify an Existing Parameter List

1. Click on Master then Modify Parameter List, or click on the Modify Parameter List icon.

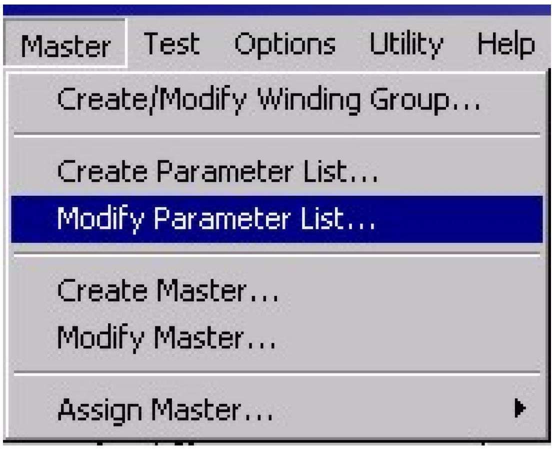


Fig 39: *Modify Parameter List selected from Master drop-down menu.*

2. The Parameter List window will appear. Click on SELECT and select the file name that needs modification.

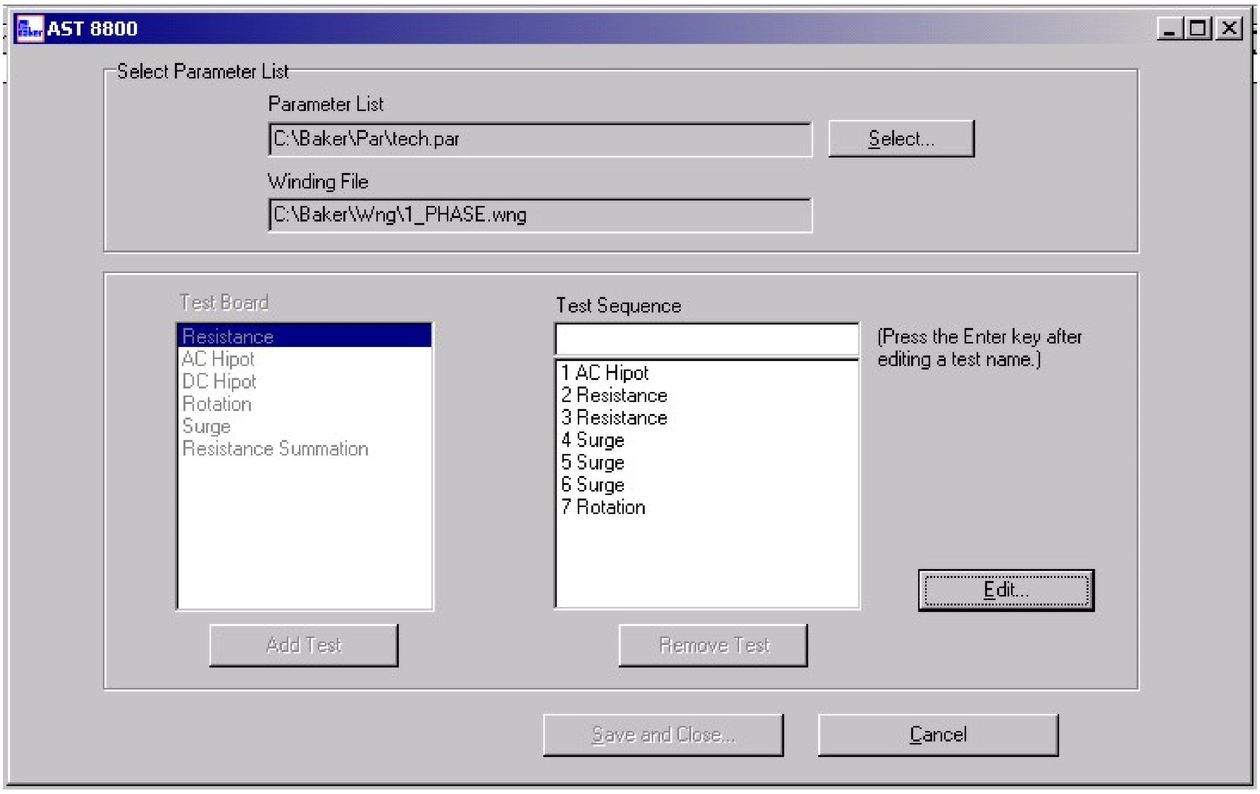


Fig 40: *Modify Parameter List.*

3. All test parameters can be modified in the same fashion as they were when programming. See Editing Parameter List.
4. Click Save and Close to resave the changes.
5. The software will ask if the file needs to be saved under a different name. Choose a name that will be easily identified.
6. Click OK. A second parameters list has now been created.

Modifying an Existing Master

1. Click on Master then Modify Master or the Modify Master icon.

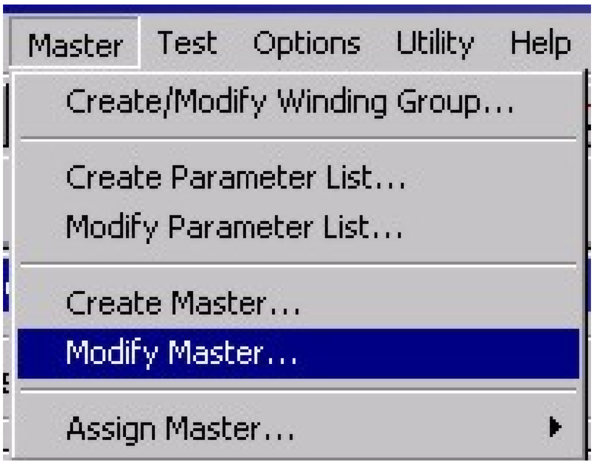


Fig 41: *Modify Master selected from Master drop-down menu.*

2. The Master List window will appear. Click on Select and select the filename that needs modification.

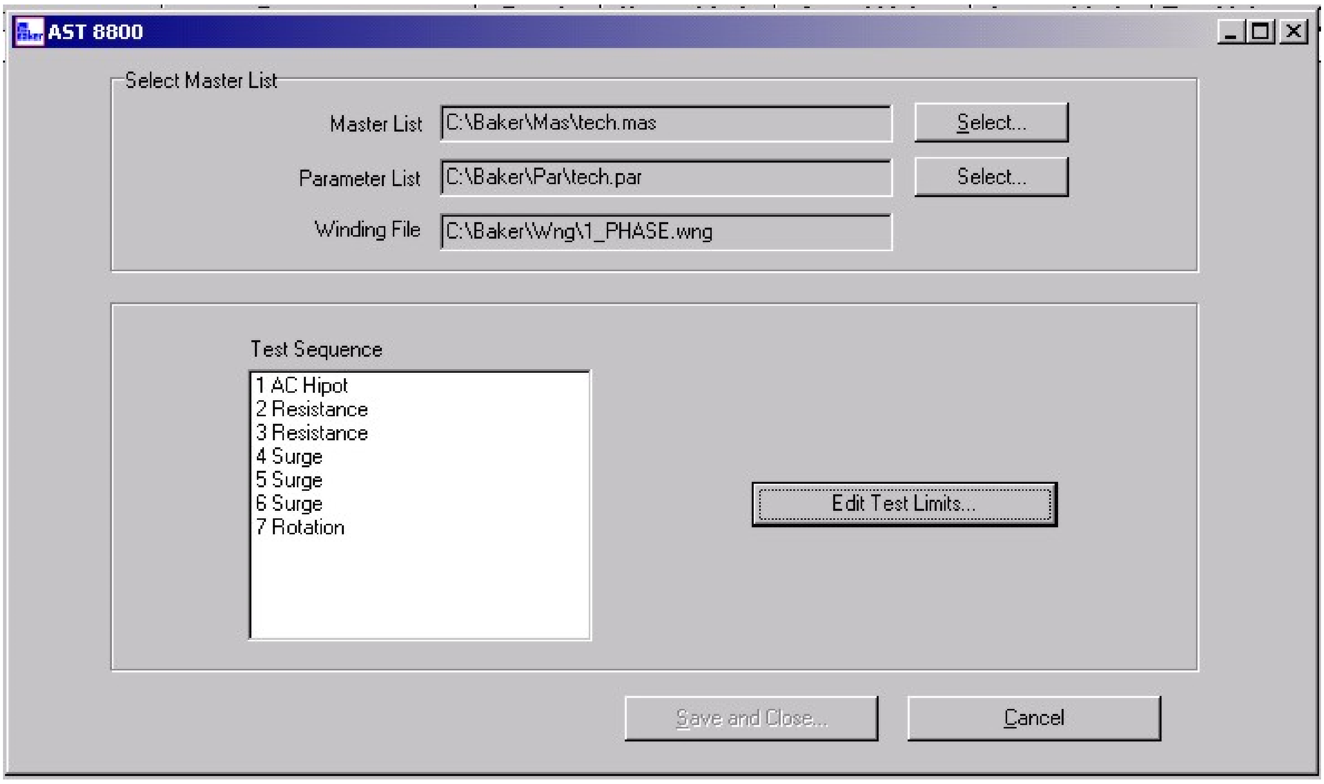


Fig 42: *Select Master List.*

3. All the tests can be modified in the same fashion as they were when originally programmed.
4. Click Save and Close to resave the changes.
5. The software will ask if it is necessary to save it under a different name. Choose a name that will be easily identified.
6. Click OK.

6 — Running Tests

Running a Sample Test

1. Click on Master.
2. Click on Assign Master. Choose one of the three options (Station 1, Station 2, both).

NOTE: If the use has a single station machine it will only have Station 1. If a dual station machine is used and is running the same parts on one line choose both. This will allow you to access both fixtures for the line. If you has a dual station machine, but is running different parts on different lines you will want to assign the stations according to the line that are running.

3. Load parts into fixture and attach appropriate leads. Close fixture safety hood.
4. Start Test in one of the following three ways:
   4.1. Click on Test and then click Start Station 1 or Station 2.
   4.2. Click on Icon on Window.
   4.3. Press the green or start button on the fixture.

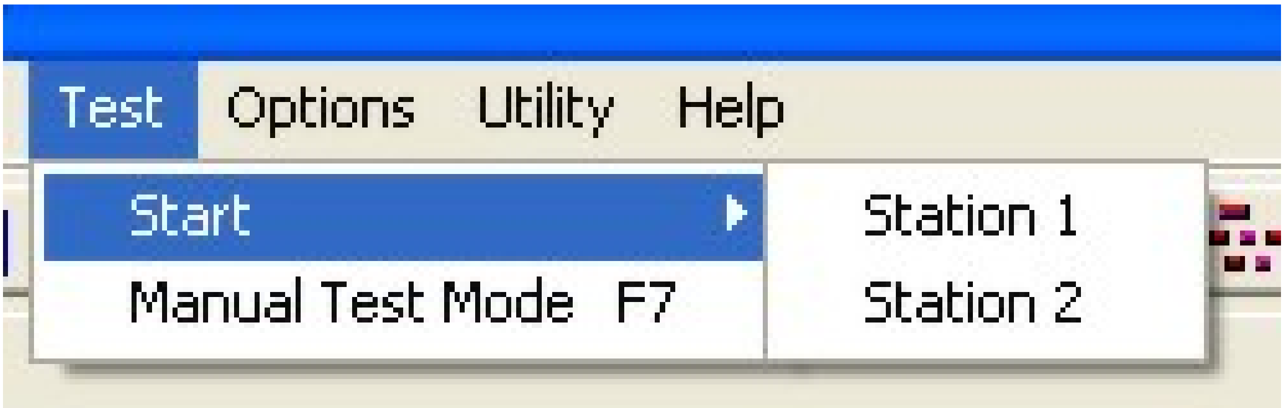


Fig 43: *Test drop-down menu.*

5. Within the Options menu on the software select the Baker WinAST to AutoStart the test. The test will begin as soon as the hood on the fixture registers closed and will continue this way until AutoStart is removed.

WARNING: When the test is started as noted above, high voltage will be present on the unit under test. Electical shock can occur! To avoid injury or death, do not touch test leads or connections.

NOTE: The instrument will follow the preprogrammed test schedule that was set up in the parameters for the given master. As the test is being done, the yellow or testing light on the fixture will be lit. As the tests are completed, they will display the results on the window.

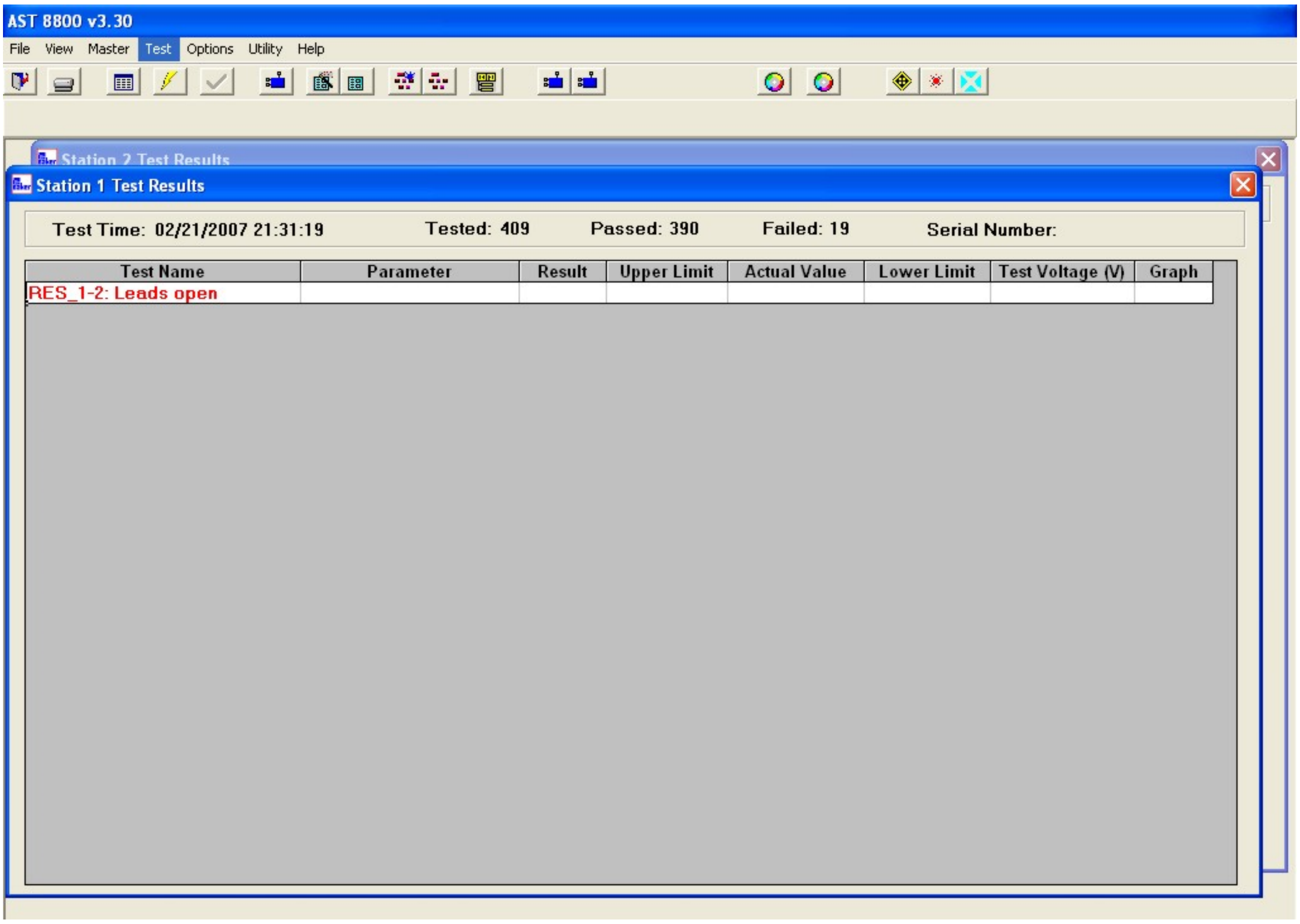


Fig 44: *Main test window.*

6. If the part passes the preprogrammed tests, the green light on the fixture will light and the software will stop and wait for the next part to be run.

NOTE: Database functionality of the Baker WinAST will not be fully operational until early 2003. Data from everyday operation can be reclaimed within the Baker/DB folders under Parts.dbf or Results.dbf.

7. If the part does not pass the preprogrammed tests, the red light on the fixture will light. The software will display an error message at the top of the window in blue to inform you that they must either retest the part or acknowledge the failure. To acknowledge the failure, press the red failure button on the fixture, or click on the green check mark (failure acknowledge icon) on the window. The instrument is now prepared for the next test.

Partial Discharge/Corona Test Results

After a winding test, a test result line will appear on the window for each corona evaluation performed. The measured corona value will appear along with the pass/fail limit. If the measured value is below the pass/fail limit, the value will be displayed in green. If the measured value is above the pass/fail limit, the value will be displayed in red.

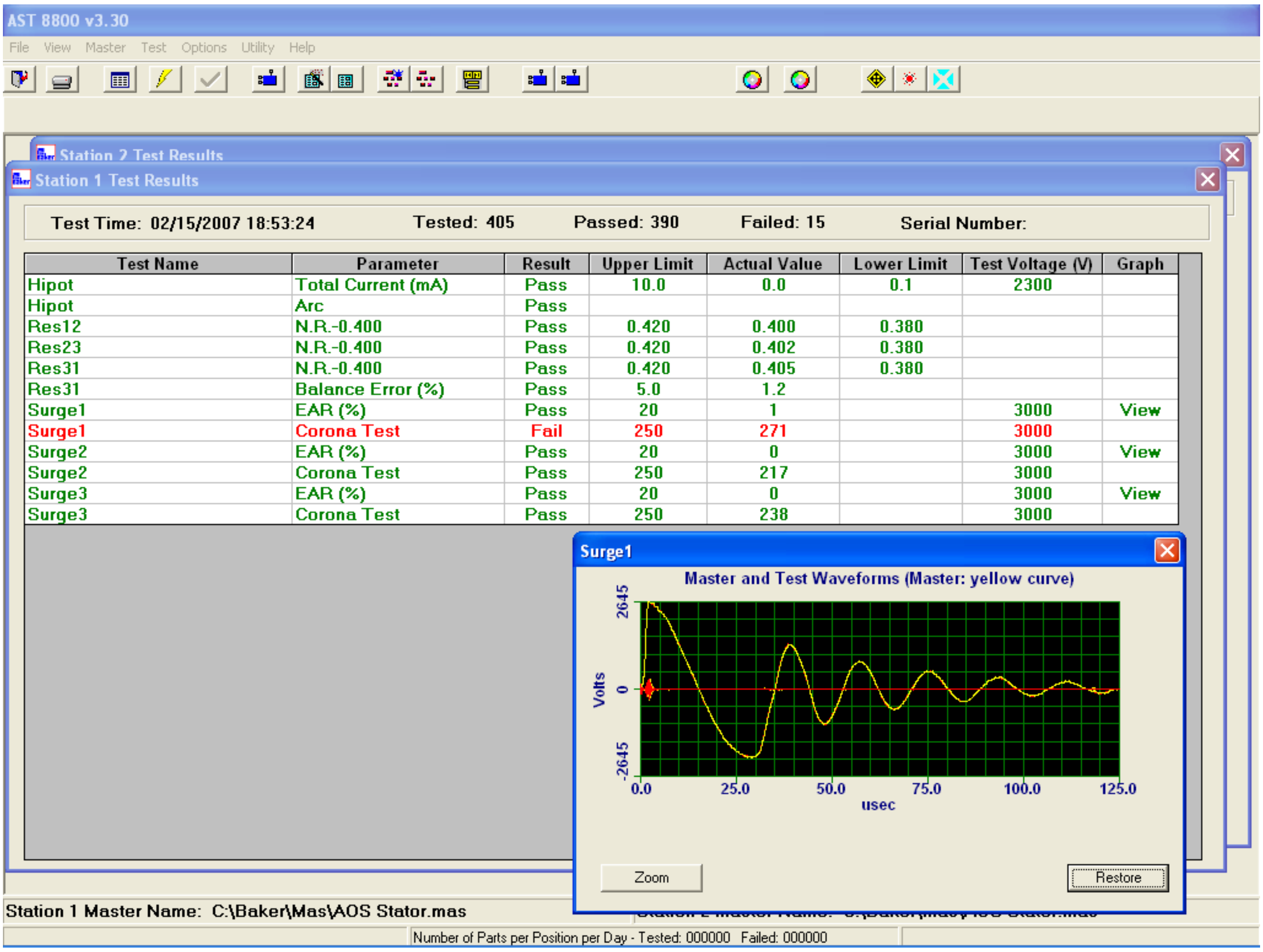


Fig 45: *A typical results window in which the measured corona value exceeds the limit.*

Using the mouse to click on the View Surge waveform graph will display the digitized corona data.

The number of corona failures is tallied in the Statistics file which can be displayed on the front window.

Corona test values are included in the raw test data stored to the xml results database

Manual Test

This test mode is useful for quickly troubleshooting intermittent or unusual results from general run processes. A part can be tested quickly within the manual mode without having to create, modify or assign masters.

1. Start the Manual Test in one of two ways:
   1.1. Click on Test and then on Manual Test.
   1.2. Press F7.
2. This will show the Manual test window.

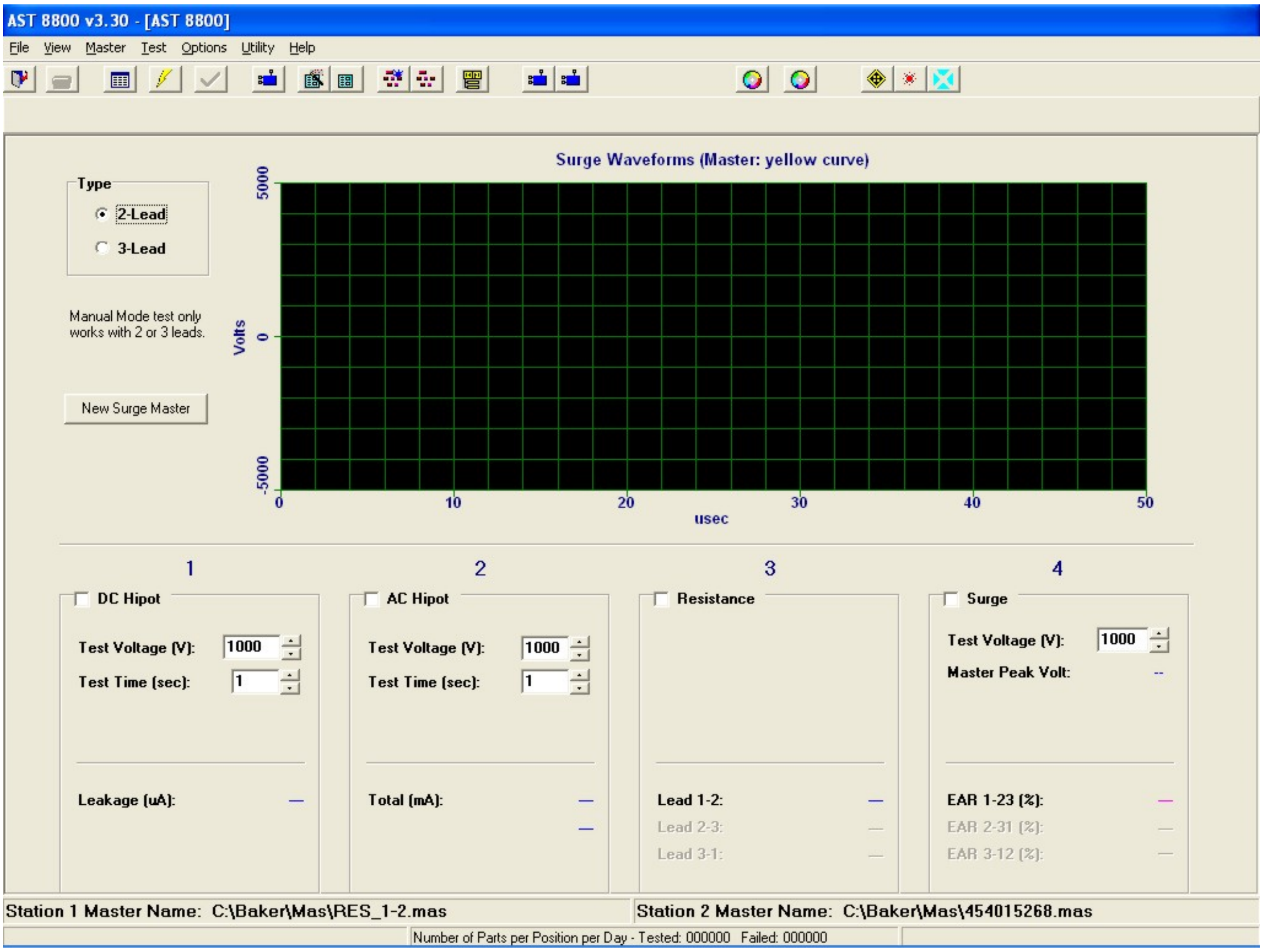


Fig 46: *Manual test window.*

3. Click on the 2-Lead or 3-Lead radio button according to the part to be tested.

NOTE: Manual mode works only on 2-Lead and 3-Lead parts.

4. Click on the tests that are to be performed and change any parameters as necessary.

NOTE: Tests will be done in the sequence from left-to-right on the window.

5. To start test:
   5.1. Hit green start button on fixture.
   5.2. Click on Test then click on Start.

5.3. Click on Start Test icon.

WARNING: When the test is started as noted above, high voltage will be present on the unit under test. Electical shock can occur! To avoid injury or death, do not touch test leads or connections.

NOTE: If the surge test is done the waveforms will appear on the window. This waveform becomes the master waveform. In order to clear this waveform, click on the New Surge Master.

The center line of the surge waveform registered if there is corona present on the part. If the line fluctuates and has spikes on it, there is corona.

6. To exit from the manual test, press the F7 key or click on test and click on.

7 — Options

The Options menu contains a number of features as described in this section.

NOTE: Many of the options listed in the drop-down menu are toggle switches. Click on the menu item to turn on or off. The menu item is considered on when a check mark is displayed in front of the item. These items include:

Fig 47: *Options drop-down menu.*

Table 5: *Option menu item descriptions.*

Menu Item	Function/Description
Set Compensation Temperature	Set the ambient temperature in one of three ways. ■ If an IR Probe is available, you can plug it into the port and have the temperature read. ■ User Entered—From whatever reliable source that in use can enter by hand the temperature. ■ Ambient Probe—an ambient probe is standard with the Baker WinAST.Use a Barcode Scanner if available.
Use Barcode Scanner	If available, toggle to support use of the scanner.
Use Temperature Compensation	will use the temperature compensation set up in the programming mode.
Auto Assign after Editing Master	A convenient feature to speed up testing process.
ACH Compensated Current	Enables the AC HiPot capacitive compensation current measurement. When this is enabled the current displayed during the AC HiPot test is resistive leakage current.
Continue on Fail	Testing will continue on part after failure.
Fail Acknowledge	The tester will acknowledge there was a failure before continuing.
Print Pass/Fail Label	Enables label Printers (optional equipment).
Save Results to Database	Automatically saves testing results to database.

Menu Item	Function/Description
Update Key Lock State	Baker WinASTs are equipped with a physical lock and key to disable menu access so that operators cannot change master limits and parameters. Selecting this menu item updates the menu access based on the key switch.
Reset Parts Counter	Will reset parts counter to zero.
Set Serial Number	Will increment serial numbers to next number available if checked. Will log this information into the database.
Auto Start	When toggled to the on position, will automatically start tests once the fixture lid is in the closed/locked position.

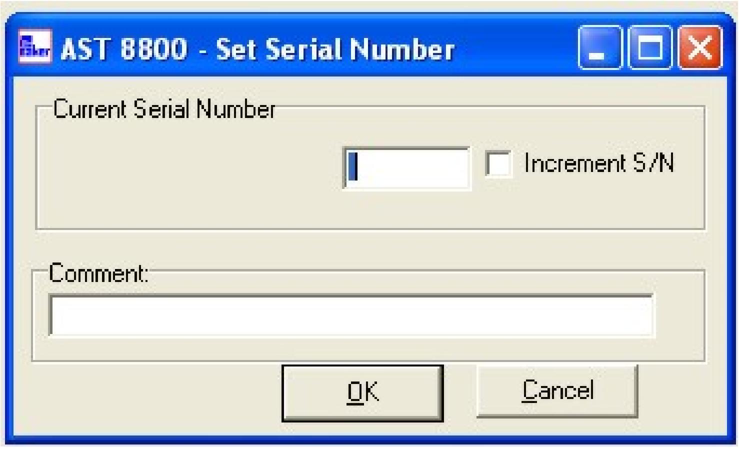


Fig 48: *Set serial number dialog box.*

8 — Using the Utilities

The Utilities menu provides access to functions for configuring the Accounting Period for storing raw test data, to calibrate the Baker WinAST, to show a Pass/Fail statistics table on the front window, and to perform a self-test of the power supplies on internal loads.

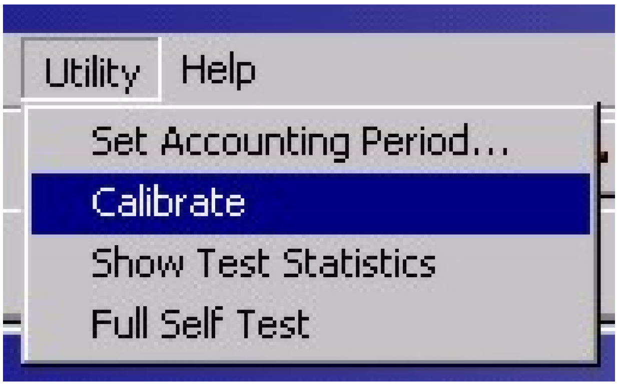


Fig 49: *Utility drop-down menu.*

Setting Accounting Period

The Accounting Period is used to organize the stored test data files. Raw test data is stored in files in attributed xml format. The files are backed up and a new file is created periodically as specified by the selected Accounting Period.

The current data files are stored in the `c:\Baker\data` directory. When a new Accounting Period is entered, the current data files are backed up and stored with a date and time as part of the file name in the `c:\Baker\data/archive` directory.

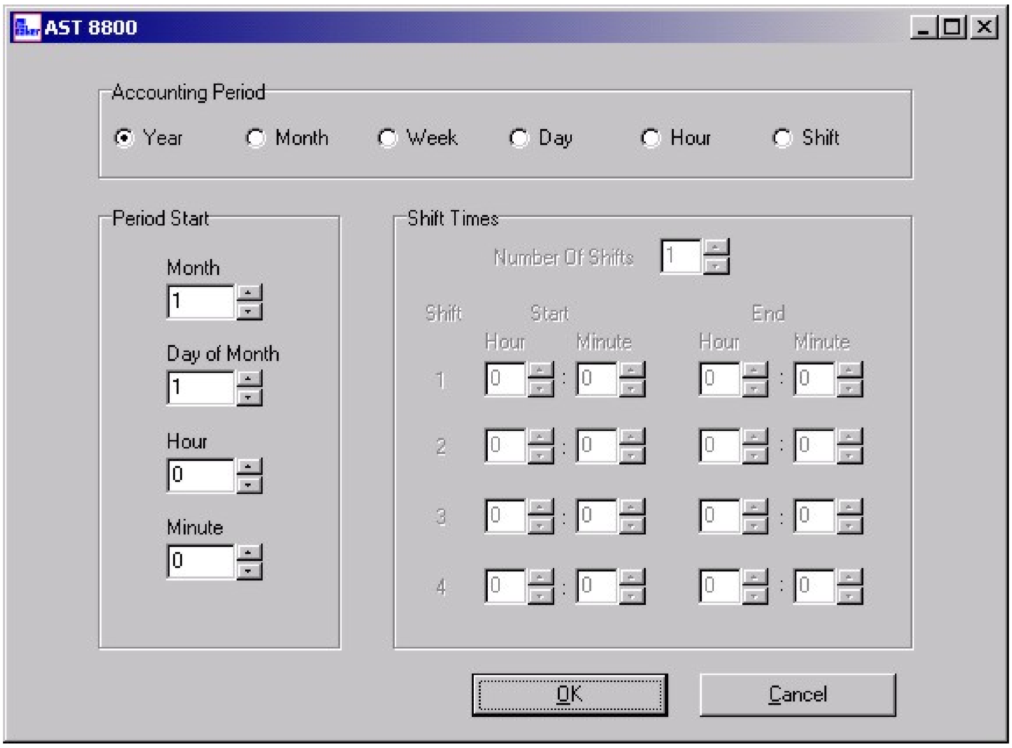


Fig 50: *Setting accounting period.*

The accounting period can be set up to back up the current files and create new files in time increments of one shift, one hour, one day, one week, one month and one year. After selecting the time increment, select the start time of the time increment.

The Baker WinAST recognizes that a new accounting period has been entered the first time that it tests a Master within the new accounting period. So, the most recent data file is always stored in the `c:\Baker\data` directory until that Master is tested after a new accounting period has been entered.

Calibrate—Field Calibration

The Calibrate menu item provides access to adjusting the Baker WinAST calibration values from the Baker WinAST program without exiting the program and editing the primary `cal.txt` file (field calibration). The field cal coefficients are multipliers that adjust the measured values up or down. The field cal coefficient changes the real `cal.txt` coefficient by multiplying it by the field cal value. For everything except the temperature, these values are percentages.

For example, if the Baker WinAST measures winding resistance of a 10.0 ohm resistor to be 10.2 ohms, the measured value will be two percent over. Adjust the < 20 ohm field calibration coefficient to 0.98 and the Baker WinAST will subsequently measure all resistances between 2 and 20 ohms as 2 percent lower.

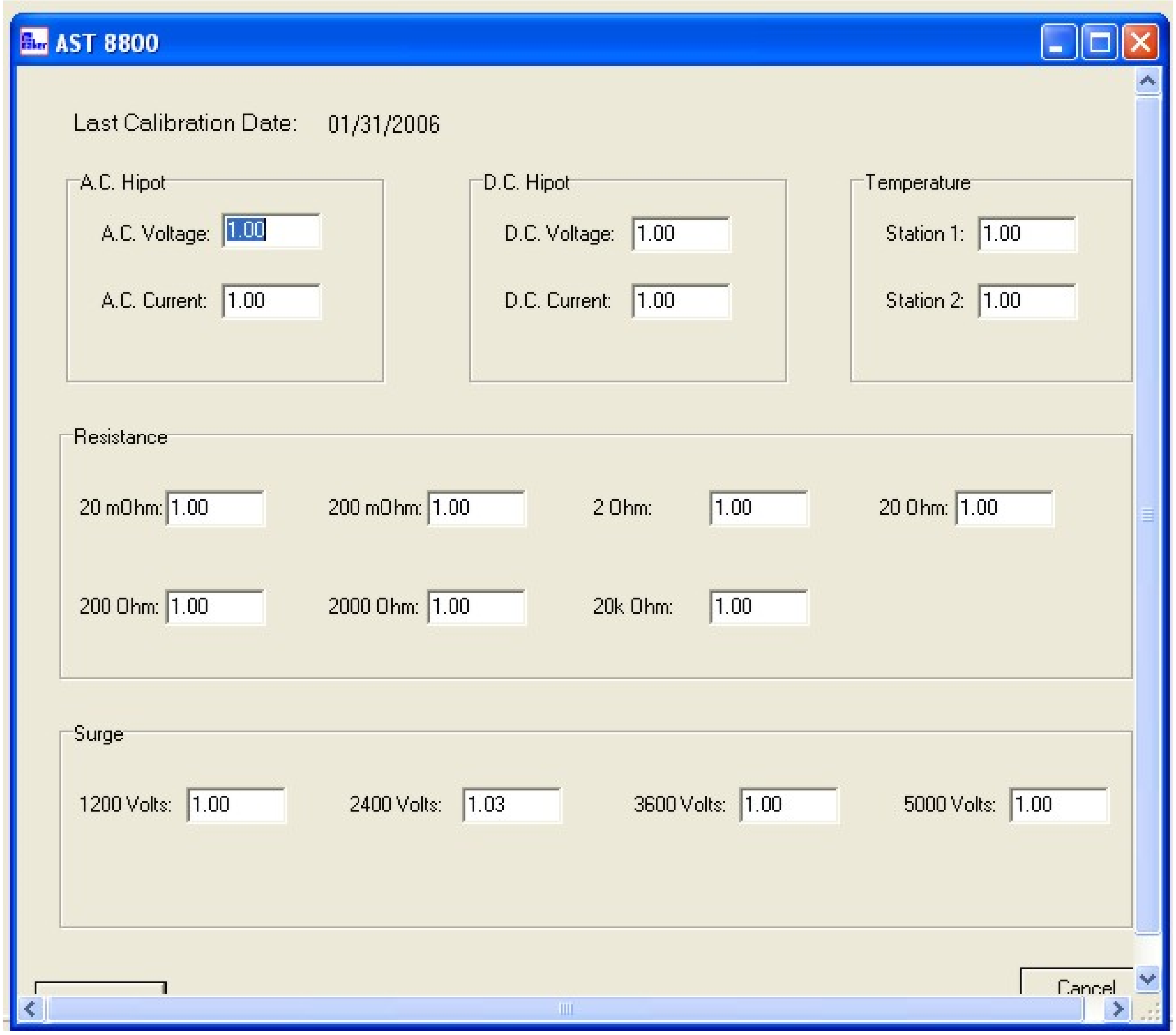


Fig 51: *Calibrate utility.*

The temperature field cal coefficient is not a percentage, so you may need to adjust this coefficient using a trial and error process.

For a major or complete calibration, you should adjust the calibration coefficients in the cal.txt file. Only qualified technicians should attempt to adjust the cal.txt file.

Show Test Statistics

The Show Test Statistics menu displays a table on the front window with total parts tested, parts passed and parts failed. In addition, the failure tally for each type of failure is quantified. In the options menu there is a option to reset this table

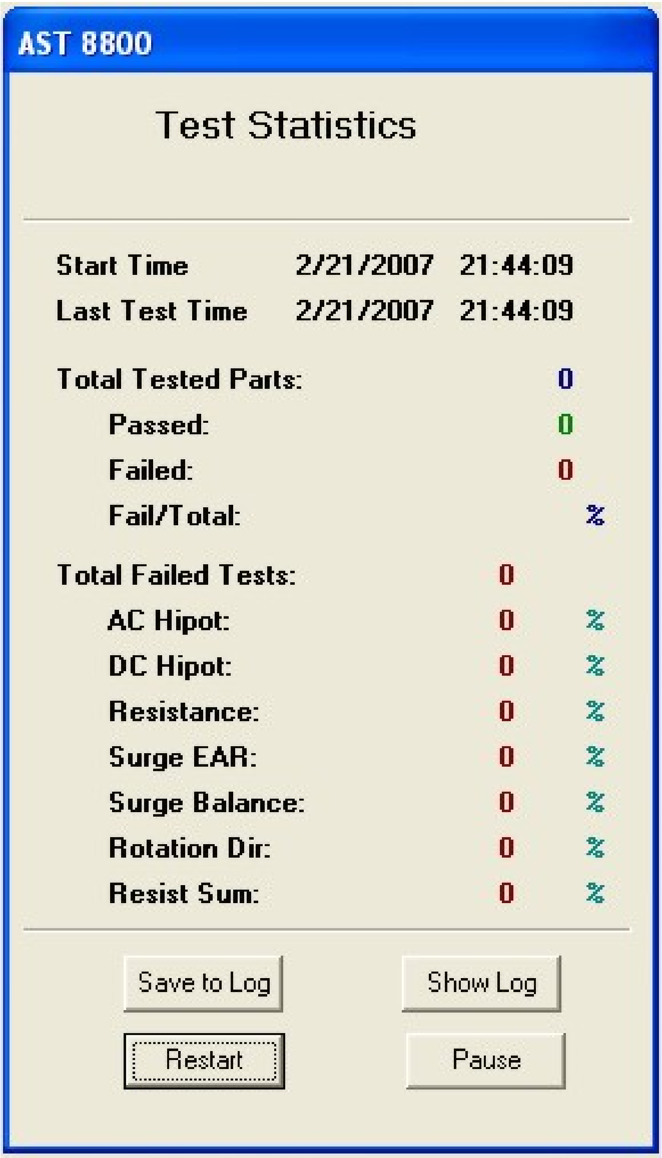
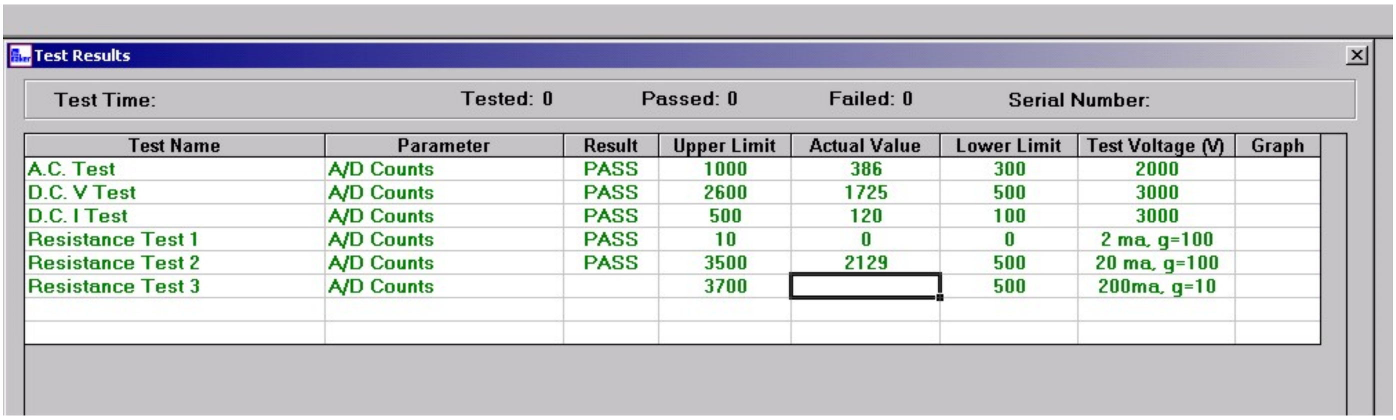


Fig 52: *Test Statistics utility.*

Full Self Test

The Self-Test utility operates the AC HiPot, DC HiPot, resistance and surge power supplies of the Baker WinAST. All power supplies are used to energize internal loads during the Self Test. No power is supplied to the test leads. Measured values are displayed on the window as each power supply is energized.

The measured values are compared to expected values. Values which fall within tolerance are displayed in green. Values which fall outside of tolerance are displayed in red.



Test Name	Parameter	Result	Upper Limit	Actual Value	Lower Limit	Test Voltage (V)	Graph
A.C. Test	A/D Counts	PASS	1000	386	300	2000	
D.C. V Test	A/D Counts	PASS	2600	1725	500	3000	
D.C. I Test	A/D Counts	PASS	500	120	100	3000	
Resistance Test 1	A/D Counts	PASS	10	0	0	2 ma, g=100	
Resistance Test 2	A/D Counts	PASS	3500	2129	500	20 ma, g=100	
Resistance Test 3	A/D Counts		3700		500	200ma, g=10	

Fig 53: *Self test utility.*

Run the Self Test any time there is a suspected hardware problem with an Baker WinAST. If the Self Test passes, there may still be a hardware failure associated with the test lead relays. Document the data collected from the Self Test as well as the results from production testing and contact a Baker technician for assistance with additional troubleshooting.

9 — Maintenance and User Safety

Please read the following before servicing the Baker WinAST.

WARNING: Contact with the test leads on this instrument can cause harmful or fatal shock. Never touch the test leads or a winding while a test is in progress.

1. Ensure that the Baker WinAST is properly grounded. Use a three-lead grounded supply or an extra ground lead if unsure of ground supply.
2. Ensure that the safety hood is closed on the test fixture and all safety devices are engaged before testing a winding.
3. The Baker WinAST is NOT APPROVED for use in an explosive environment.
4. Operation of the tester by persons who are using a pacemaker may present unusual safety risks. Such persons should take special precautions!

Safety Protection Network Minimizes Electric Shock Hazard

1. The computer monitors the Safety Switches and begins a test only when the Safety Switches are engaged.
2. The Baker WinAST hardware overrides all computer signals and prevents application of high voltage to an unsafe test station.
3. Depending on the instrument an Equipment Stop button is mounted on the front panel of the Baker WinAST or on the attached Fixture that interrupts all high-voltage power supplies.
4. A yellow Testing light, mounted on the Baker WinAST FIXTURE control box is illuminated during all test procedures.

CAUTION: High-voltage test equipment should be handled with caution! High-voltage test procedures should be followed!

Maintenance and Troubleshooting

The Baker WinAST has been designed for maximum long-term reliability, and has a limited one-year warranty against defects in materials and workmanship.

The Baker WinAST is designed for easy troubleshooting and repair. Each system board has built in self-test and diagnostic capability. The self-test enables the boards to conduct tests on internal circuits to verify that they are functioning properly. Failure of the self-test is indicated by the Error Message window in the Baker WinAST software.

Basic Operation

The Baker WinAST consists of a computer and several test circuit boards in a rack-mounted configuration.

There are normally four different test signal sources:

1. Resistance measurement board for winding resistance tests.
2. High-voltage DC power supply for DC HiPot tests.
3. High-voltage DC Stack for surge tests.
4. High-voltage AC power supply for AC HiPot tests.

Test signals are routed to the test winding through a test bus. Any of the test signal sources can be switched onto the test bus through high-voltage relays located on the various boards. Only one source at a time can be routed onto the bus. The test bus can be connected to any combination of test leads through high-voltage relays on the Test

Lead Multiplexer (TL MUX) board. Each TL MUX board is capable of switching three test leads.

Table 6: *Power requirements.*

Parameter	Value/Description
Input Voltage:	230V, 50Hz, 2A
Power consumption:	500VA Maximum
Over-current protection:	two-pole magnetic circuit breaker

Protection

- Line surge: Withstands 1.2/50 microsecond, 6000 volt, 3000 ampere impulse without damage or loss of data. Meets IEEE 587, Category B and IEC 664 Category IV standards.
- Electrostatic Discharge: Withstands 25 kV, 15 ampere, 80 milli-joule discharge to any point on the instrument enclosure, terminal, or test leads without damage or loss of data.

Environmental Specifications

- The operational temperature range is zero to forty degrees Celsius.
- The non-ventilated instrument enclosure is dust-tight to IP40 standard and is suitable for most industrial environments.
- Water and dust-proof IO55 (NEMA 12) enclosures are available as an option.

Maintenance Schedule

- The lithium battery in the computer should be replaced every five years by a Baker service technician. This is not a user-serviceable part.
- The filter—located on the front panel of the PC Sub-rack—should be removed and cleaned at least once a week. Wash the filter with warm water and a mild detergent, or by blowing the dust free with a compressed air source.
- Fixtures—such as test stands—may need routine maintenance. Test leads and contacts can wear out from normal operation. The frequency of component replacement and routine scheduled maintenance will vary among fixtures depending of the amount of use.

10 — Calibration

Calibration for Low Voltage

Doc. No. 76-502-001 Rev. No: A

Date: 2/16/99 Page: 1 of 5

Required Tools and Equipment

- Ambient temperature measurement device for degrees Celsius. Accuracy: +/- 2oC.
- Oscilloscope with 100x or 1000x probe (optional).
- Volt-resistance-current meter (4 place measurement). (Fluke 8062A multimeter.)
- HV capacitor for AC HiPot cal. 5Kv minimum. (.01 uf for 13 mA HiPots and .02 uf for 40 mA HiPots and .06 for 400 ma TATS.)
- 100 megohm resistor; 200 watts minimum.
- Resistors of known value (at least one for each resistance range). ½ watt minimum.
  Resistor ranges:
  - 0.00 –.002 (TATS only)
  - .002–.02 ohms (not used with the 20,000 ohm option).
  - .02–.2 ohms.
  - .2–.2.0 ohms.
  - 2.0–.20 ohms.
  - 20–.200 ohms.
  - 200–.2000 ohms (TATS excluded)
  - 2000–.20,000 ohms (optional)

This procedure uses the `Cal.txt` file in the `C:\Baker\config` directory for calibration. To access this file close the operating program and launch Windows Explorer. It may help to create a desktop icon shortcut. Edit the appropriate fields in the file. To return to the WinAST program click the close button upper right and save the changes. Launch the WinAST desktop icon to reenter the testing program.

> NOTE: Several versions of the Cal.txt file exist; line 1 of cal.txt contains the version #. For Cal.txt version 4 and higher, lines 36, 37, and 38 exist for faster Pentium processors. These are configured for a specific speed of CPU processor and should not be changed (see cal.txt notes in brackets). There are also additional lines of calibration numbers not discussed in this procedure DO NOT CHANGE THEM.
>
> The calibration is usually performed in this order: Temperature, Resistance, DC HiPot, AC HiPot, and Surge with the fixture connected.

1. To set up the Baker WinAST for calibration, turn off all of the options in the OPTIONS menu. Disconnect any stators or other loads form the fixtures.
2. The calibration procedure involves testing the calibration loads and checking output voltages in the MANUAL TEST portion of the Baker WinAST program. If adjustments need to be done the calibrator must exit from MANUAL TEST and proceed to the cal.txt file in the C:\Baker\config directory. You of this procedure should be familiar with the operation of the , including the software and the test lead/test fixture configuration.

Calibrating the Baker WinAST

1. Check the temperature at the Baker WinAST temperature probe (+/- 2 degrees is satisfactory) against a calibrated temperature probe. If the temperature is out of calibration, proceed to the Cal.txt file. Change the calibration number for the TEMP_GAIN_ST1 or ST2. Raising the calibration number will raise the temperature reading, while lowering to a smaller number will lower the temperature reading. Change this number in very small increments. The temperature offset should be left at 273 for solid state sensor and 0.000 for Exergen infrared sensor. See notes in parentheses.
2. Check the resistance calibration. The Baker WinAST is equipped with temperature compensation for resistance and can be turned on or off in the Options menu. Turn the compensation off for calibration. This test must be done using four wire Kelvin test leads. For calibration to be truly accurate, measure the calibration resistors with a calibrated resistance measurement device. Compare the device's reading to the Baker WinAST 's reading. The calibration resistors supplied by Megger Baker Instruments are measured with a four-wire ohmmeter. Set the RES>PRECISION to greater than "200" in the Cal.txt file for best repeatability.
3. Test the resistance at least once at each range. The new version 6 Cal.txt has the ability to calibrate at the upper, middle, and lower area of each resistance range thus insuring better accuracy across the range.

NOTE: If the resistance is out of calibration, go to the cal.txt file. The ranges in the Cal.txt are labeled to represent the highest resistance for the range and for the upper and lower calibration points of each range. Adjust the calibration number up or down to raise or lower the resistance reading. (True resistance/AST resistance X old cal number.)

For the 20 kOhm modification the label represents the lowest resistance for the range. The last digit in the resistance reading may fluctuate. It may take several attempts to calibrate the resistance range.

4. Calibrate the DC high-voltage power supply. Go to the manual test window and check DC HiPot. Set the time to 4-5 seconds and the voltage at 1000v. Connect a high-voltage probe to the VOM between TL1 and Ground. Run the test and check the voltage.

WARNING: Isolate all other test Leads as they will have high-voltage during this test.

5. Step through the voltages at 1000V per step until 5000V is reached. Check the voltage. If the voltage is more than 5% from the programmed voltage proceed to the Cal.txt file. Adjust line 6 for the DC HiPot voltage. (Since there is only one cal #, use the required testing voltage.)
6. Check the DC HiPot current calibration with and without a load before making any changes. Check the HiPot leakage open circuit with no meters or probes attached to the test leads. The test time should be reduced to 1 second. Check the current at 1000V intervals up to 4000V. At open circuit, the HiPot must read zero or near zero on the Baker WinAST before it can be calibrated with a load.
7. Check the leakage current calibration with a load. Attach a 100 megohm resistor across TL1 and Ground. Disconnect any voltmeters and probes from the load. 10uA of leakage current should exist for every 1000V of output.

NOTE: If the current does not show 10uA per 1000V, leakage, or a high open circuit current, follow the procedure below to calibrate the leakage current.

8. Check the current open lead with no probes or meters attached. Check the current at 1000V intervals up to 4000V. If the current is inaccurate by a constant percentage across the range, then adjust line 2 DCI_SLOPE in the cal.txt file. Increasing this number will decrease the slope. Check the current again.
9. If the current reading is constant across the voltage ranges, adjust line 3 DCI_INTERCEPT to a lower value until a reading of 0-1uA is reached across the ranges. Check the currents again. If the open circuit currents read 0 consistently, raise the DCI_INTERCEPT until readings are accurate, then attach the 100 megohm load between TL1 and Ground.

NOTE: Disconnect any voltmeters and probes from across the load.

10. Check the leakage at 1000V intervals. 10uA of leakage current should exist for every 1000V of output. If the current does not show 10uA per 1000V leakage follow the procedure below:
11. If the current is inaccurate by a constant percentage across the range, adjust line 4 DC_CURRENT_SLOPE in the cal.txt file. Increasing this number will increase the slope. Check the current again.
12. If the current reading is inaccurate by a constant amount across the voltage ranges, adjust line 5 DC_CURRENT_INTERCEPT to a lower value until a reading of 10uA per 1000V is achieved across the ranges. Check the currents again.
13. Next, calibrate the AC HiPot power supply. Go to the Manual Test window and check AC HiPot. Set the time to 8 seconds and the voltage at 1000V. Connect a high-voltage probe to the VOM between TL1 and Ground.

WARNING! Isolate all other leads. These leads will have high-voltage during the procedure.

14. Check the voltage. If the voltage is more than 5% from the programmed voltage, proceed to the Cal.txt file. Type in a new calibration constant and test at another voltage. Step through the voltages at 1000V intervals up to 3500V. Adjust line 18 AC_V_SLOPE to adjust the voltage calibration. Increasing this number will decrease the slope.

NOTE: The voltage on the AC HiPot will fluctuate and may read higher than the programmed voltage momentarily. The voltage will be steady for the actual time of the test.

15. Check the open circuit current. Set the unit with neither leads nor probes connected. A reading of .5 mA is normal at any voltage. Check the leakage current calibration. Attach a .02 uF 5Kv minimum voltage capacitor across TL1 and Ground. If the AC HiPot is a 13 mA HiPot, use a .01 uF load.

NOTE: Disconnect any voltmeters and probes from across the load. 7.5 mA leakage current should exist for every 1000V of output with the .02 uF load. 3.5 mA per 1000V should exist with the .01 uF load. These results can be verified by placing a current meter in series with the load on the LOW voltage (ground) side. Perform this test at 1000V intervals up to 3500V. If the current does not match follow the procedures:

16. With no probes or meters attached, check the current open lead leakage current at 1000V intervals up to 3500V. If the current is inaccurate by constant percentage across the range, then adjust line 24 AC_I_SLOPE in the cal.txt file. Increasing this number will increase the slope. Check the current again.
17. If the current reading is constant across the voltage ranges, adjust 25 AC_I_INTER to a lower value until a reading of 0-1 mA across the ranges is achieved. Check the currents again.
18. If the open circuit currents read 0 consistently, raise the AC_I_INTER until reading of 0-1 mA open circuit are achieved across the voltage ranges.
19. Once the open circuit readings are correct, attach the appropriate capacitor load between TL1 and Ground.

NOTE: Disconnect any voltmeters and probes from across the load.

20. Check the leakage at 1000V intervals. 7.5mA (3.5ma) of leakage current should be present for every 1000V of output. If the current does not display 7.5mA (3.5ma) per 1000V leakage or too high of an open circuit follow the procedure below.
21. If the current is inaccurate by a constant percentage across the range, adjust line 24_AC_I_SLOPE in the cal.txt file. Increasing this number will increase the slope. Check the current again. If the current reading is inaccurate by a constant amount across the voltage ranges, adjust line 25 AC_I_INTER to a lower value until a reading of 7.5mA per 1000V is achieved across the ranges. Check the currents again.
22. The surge test needs to be calibrated in the manual test mode open circuit.

NOTE: Using an oscilloscope and a high-voltage probe, monitor TL1 with no other load attached. Surge test at 1000V, 2000V, 3000V, and 4000V. Record the peak reading on the waveform. Compute the compensation multiplier needed to achieve the best peak readings across the range. For cal.txt version 5 and higher, alter line 39 SURGE_COMP and recheck.

23. Start at 1000V and increase the voltage in 1000V intervals. Press the F1 button for every 1000V interval and attain a new master waveform so the Baker WinAST will read the voltage of the waveform. If the displayed voltage is inaccurate, proceed to the calibration window and retest the surge calibration. The formula to correct is requested voltage divided by displayed peak times the old cal number. The surge test has 4 ranges: 0-1200V, 1200-2400V, 2400-3600V, and 3600-4800V.
24. Change the peak voltage reading by adjusting the SURGE_1,2,3 or 4 ranges in the cal.txt file. A higher number will display a higher voltage on the window. Use an oscilloscope if available with at least an x1000 probe connected to TL1 to check the voltage level.

NOTE: When calibration is complete, print the file or document the calibration numbers for reference and make a backup in the event of hard drive corruption.

This is a typical cal.txt file. Do not add lines to the file or try to type beyond column 80. The computer reads the cal numbers in this file in the order and in the positions shown. Calibration will be inaccurate if extra lines are inserted and if the numbers are shifted.

```
Column 80
Customer #155 new stator calibration by John White
Cal date 09/25/98
NOTE:  To edit this file.
1. Use the Windows editor.
2. Field values must be of the correct type(integer or float)and in range.
3. Field values must start in the 1st column.
4. Line lengths must exceed 80 characters
5. Line numbers must be in consecutive order(i.e. Line 8 must precede
Line 9).
6. Do not add any lines.
7. Normal ranges are indicated in “[ ]” type brackets.
```

8	Line1	Cal. file type (* DO NOT CHANGE THIS LINE *) [2]
0.546	Line2	DCI_SLOPE (Open circuit) [.5-.6][HV:/3]
10	Line3	DCI_INTERCEPT (Open circuit) [50.-300.][HV:/3]
0.116	Line4	DC_CURRENT SLOPE (into load) [.1-.13]
0	Line5	DC_CURRENT_INTERCEPT (into load) [0.]
33.07	Line6	DC_VOLTAGE (D/A counts mult32.78) [50.-52.][HV:/3]
62.876	Line7	CAL_20000_OHM_HI [.59-.61][20k:x10] >1333
62.95	Line8	CAL_20000_OHM [.59-.61][20k:x10]
63.322	Line9	CAL_20000_OHM_LO [.59-.61][20k:x10] <666
6.238	Line10	CAL_2000_OHM_HI [.59-.61][20k:x10] >1333
6.246	Line11	CAL_2000_OHM [.59-.61][20k:x10]
6.308	Line12	CAL_2000_OHM_LO [.59-.61][20k:x10] <666
0.6183	Line13	CAL_200_OHM_HI [.059-.061][20k:x10] >133
0.6193	Line14	CAL_200_OHM [.059-.061][20k:x10]
0.6295	Line15	CAL_200_OHM_LO [.059-.061][20k:x10] <66.6
0.06198	Line16	CAL_20_OHM_HI [.0059-.0061][20k:x10] >13.3
0.06203	Line17	CAL_20_OHM [.0059-.0061][20k:x10]
0.06285	Line18	CAL_20_OHM_LO [.0059-.0061][20k:x10] <6.6
0.006253	Line19	CAL_2_OHM_HI [.00059-.00061][20k:x10] >1.33
0.006238	Line20	CAL_2_OHM [.00059-.00061][20k:x10]
0.006275	Line21	CAL_2_OHM_LO [.00059-.00061][20k:x10] <0.66
0.0006181	Line22	CAL_200_MOHM_HI [.000059-.000061][20k:x10] >0.133
0.0006176	Line23	CAL_200_MOHM [.000059-.000061][20k:x10]
0.0006297	Line24	CAL_200_MOHM_LO [.000059-.000061][20k:x10] <0.066
0.00006056	Line25	CAL_20_MOHM_HI [.0000059-.0000061][20k:x10] >0.0133
0.00006357	Line26	CAL_20_MOHM [.0000059-.0000061][20k:x10]
0.00006072	Line27	CAL_20_MOHM_LO [.0000059-.0000061][20k:x10] <0.0066 [.45]
0.00000603	Line28	CAL_2_MOHM_HI [HV:.00000059-.00000061][HV:20k:HVx10] >0.00133
0.000006011	Line29	CAL_2_MOHM [HV:.00000059-.00000061][HV:20k:HVx10]
0.000006	Line30	CAL_2_MOHM_LO [HV:.00000059-.00000061][HV:20k:HVx10] <0.00066
10.11	Line31	SURGE_1 (1KV) [8.-12.][HV:x3]
19.425	Line32	SURGE_2 (2KV) [18.-22.][HV:x3]
28.854	Line33	SURGE_3 (3KV) [28.-32.][HV:x3]
38.096	Line34	SURGE_4 (4KV) [38.-42.][HV:x3]
2.18	Line35	AC_V_SLOPE (3.5KV) [1.4-1.5]
-10	Line36	AC_V_INTER (3.5KV) [0.-40.]
1.438	Line37	AC_V_SLOPE_2 (ESA)(3.5KV) [1.4-1.5]
0	Line38	AC_V_INTER_2 (ESA)(3.5KV) [0.-40.]
0.06398	Line39	AC_V_OL_SLOPE (OpenLoop seek) [.06398][5kv:.2208]
10.8034	Line40	AC_V_OL_INTER (OpenLoop seek) [10.8034][HV:-32.75]

Fig 54: *Typical cal.txt file.*

Calibration Check Sheets

NOTE: This form may be locally reproduced.

Date: ________________________________

Table 7: Resistance.

Resistance Range	Expected Resistance Value (ohms)	Cobra 5000 Resistance Value (ohms)	Resistance Error %

Rotation Direction: Clockwise ________ Counter-clockwise _________

Table 8: DC HiPot (Open Circuit Test)

Cobra 5000 Program Value	Calibrated Multimeter Voltage Value	Voltage Error %	Cobra 5000 Leakage Current (μA)

Table 9: DC HiPot (resistive load). *Resistor Value: _______ ohms.*

Cobra 5000 Program Value	Calibrated Multimeter Voltage Value	Voltage Error %	Cobra 5000 Leakage Current (μA)

Table 10: AC HiPot (Open Circuit Test)

Cobra 5000 Program Voltage (RMS)	Calibrated Multimeter Voltage (RMS)	Voltage Error %	Cobra 5000 Leakage Current μA) (RMS)

Table 11: AC HiPot (capacitive load). *Capacitor Value: __________ μF.*

Cobra 5000 Program Value (RMS)	Calibrated Multimeter Leakage Current (μA RMS)	Cobra 5000 Leakage Current (RMS)	Leakage Current Error %

Table 12: Surge (Open Circuit Test).

Cobra 5000 Program Voltage	Cobra 5000 Peak Voltage	Calibrated Oscilloscope Peak Voltage	Peak Voltage Error%

Calibration Certificate

Megger Baker Instruments certifies that the Baker WinAST, serial number _____________, was calibrated on the date below using test instruments and meters with current calibration certificates traceable to the National Institute of Science and Technology (NIST). The following is a record of the tests which have been made, the loads and instruments used for the calibrations, and their next calibration due dates. The measured calibration check values are recorded. Actual values are those measured by the reference test instruments. Measured values are those measured by the Baker WinAST. The following measurements fall within the calibration tolerances listed in the Technical Specifications.

Megger Baker Instruments Representative Signature: ____

Date of Baker WinAST Calibration: _______________________

AC HiPot Voltage Leakage Current (if installed)

Leakage Current Method Installed:

"Total or Absolute Leakage Current" Method ☐

"Real or Resistive Leakage Current" Method ☐

Table 13: *Test Instruments: and calibration due dates.*

Test Instrument	Calibration Due Date
Fluke, model 8062A Multimeter	
Fluke, model 80K-40 High-voltage Probe	

Table 14: *Open circuit test.*

Program Voltage (V)	Actual Voltage (V)	Measured Current (mA)
1000		
2000		
3000		
3500		

Table 15: *Load test. Calibration Load: __________ µfarad capacitor.*

Program Voltage (V)	Actual Voltage (V)	Measured Current (mA)	Actual Current (mA)
1000			
2000			
3000			
3500			

DC HiPot Voltage and Leakage Current

Table 16: *Test Instruments: and calibration due dates.*

Test Instrument	Calibration Due Date
Fluke, model 8062A Multimeter	
Fluke, model 80K-40 High-voltage Probe	

Table 17: *Open circuit test.*

Program Voltage (V)	Actual Voltage (V)	Measured Current (mA)
1000		
2000		
3000		
4000		
5000		

Resistance Test

Table 18: *Test Instruments: and calibration due dates.*

Test Instrument	Calibration Due Date
Cambridge Tech., model 510 Micro-Ohm Meter	
Fluke, model 8062A Multimeter	

Table 19: *Resistance ranges.*

Resistance Range	Value	Actual Resistance (ohms)	Measured Resistance (ohms)
2-20K Ohms (optional)	(18K)		
	(10K)		
	(2200K)		
200 Ohms – 2K Ohms (optional)	(1800)		
	(1000)		
	(220)		
20-200 Ohms	(180)		
	(100)		
	(22)		
2-20 Ohms	(18)		
	(10)		
	(2.2)		
0.2-2 Ohms	(1.8)		
	(1)		
	(0.25)		
0.02-0.2 Ohms	(0.15)		
	(0.1)		
	(0.05)		
<0.02 Ohms	(0.015)		
	(0.01)		
	(0.005)		

Resistance Range	Value	Actual Resistance (ohms)	Measured Resistance (ohms)
<0.002 Ohms (Optional)	(0.0015)		
	(0.001)		
	(0.0005)		

Surge Test

Table 20: *Test Instruments: and calibration due dates.*

Test Instrument	Calibration Due Date
Tektronix, model 2430 Digital Oscilloscope	
Tektronix, model P6015A High-Voltage Probe	

Table 21: *Open circuit test.*

Program Voltage (V)	Actual Voltage (V)	Display Peak Voltage (V)
1000		
2000		
3000		
4000		
5000		

Temperature

Table 22: *Test Instruments: and calibration due dates.*

Test Instrument	Calibration Due Date
Fluke, model 77 Multimeter	
Fluke, model 80TK Temperature Probe	

Actual Temperature: ____________ Measured Temperature: _____________

11 — Self-tests and Troubleshooting

Baker WinAST Mantest Procedures

Accessed from the Utilities menu, a Self Test will run an optional test of the power boards in the sub-rack and their communication with the computer boards. There is an AC HiPot test, DC HiPot test, Resistance range test, and a Surge test. An operational system will return all green with a green pass light. Any faults will be noted in red. This will not test the output MUX boards and the fixture for proper operation.

CAUTION: This procedure is provided as a tool for diagnostics and troubleshooting of the Baker WinAST tester. It is software that manually controls relays and power supplies ***without the safeguards*** of the Baker WinAST testing software. Only qualified personnel should use this procedure with guidance from Megger Baker Instruments support. The improper use of this software can cause injury to the personnel using it and/or damage to the equipment. Megger Baker Instruments is not to be held responsible for the improper use of this software.

The testing screen is divided into several areas. The upper section is used for digital inputs such as switch closures, power supply status, rotation direction, and so on. These are active lows indicated by a check mark in the box. A generalized description of each digital input (DI) line is given below.

The large center area is a list of the available digital outputs. These are user interfaced to turn on relays, lamps, power supplies, and so on. They can initiate tests on specific leads, connect relay matrix, isolate trouble areas, and more. They are also an active low, indicated by a mouse click in the adjacent box with a check mark. Clicking on the Reset All button at the bottom will reset all lines together.

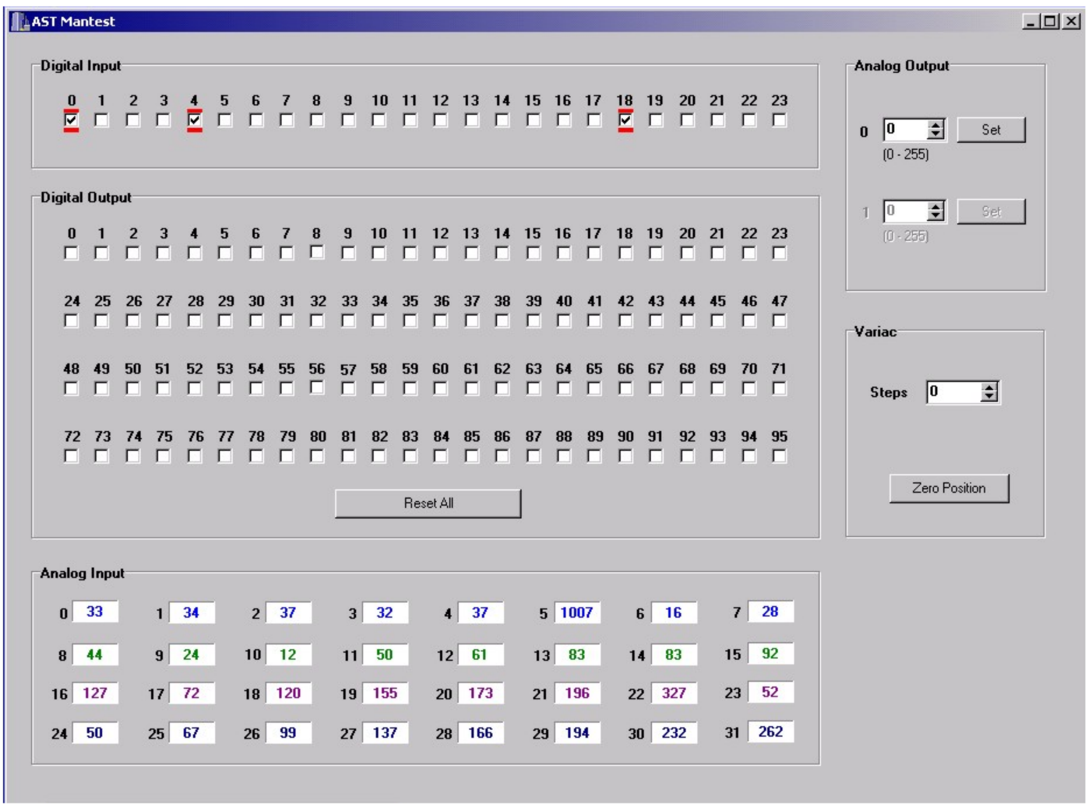


Fig 55: *Baker WinAST Mantest.*

NOTE: Be sure to power down all power supplies before resetting.

Table 23: *Digital Inputs.*

Input #	Description	Input #	Description	Input #	Description
0	Power	8	Station 2 Start	16	Clockwise Rotation
1	Keylock	9	Station 2 stop	17	Counter Clockwise Rotation
2	Supply status	10	Micro Arc Detection	18	Station 1 autostart
3	Master enable	11	Station 2 Fail Reset/ Continuity	19	Station 2 autostart
4	Station 1 safety switch	12	ACHiPot Variac Zero	20	Unused
5	Station 1 start	13	Station 1 Stats Reset	21	Unused
6	Station 2 safety switch	14	Station 2 Stats Reset	22	Unused
7	Station 1 stop	15	Station 1 Fail Reset/ Continuity	23	Unused

A generic list of the digital outputs is given below. The lower area is used to display the analog values. The system uses 0–5 vdc/vac analog values from the testing boards to the Baker AIO board in the computer. The analog values of voltage and current are converted into digital values to be used by the software for analysis. They are values that ride on a noise level that is evident. The maximum count is 4095 (hexidecimal for 8-bit processor) that represents 5 volts or greater input. They should never be at hard ‘0’ or ‘4095’ as this condition indicates a fault.

Table 24: *Digital outputs.*

Output #	Description	Output #	Description	Output #	Description
0	Resistance Open Lead	32	TL-7/TL-4/	64	TL-19/TL-16/
1	HVDC Relay	33	TL-8/TL-5/	65	TL-20/TL-17/
2	Surge Relay	34	TL-9/TL-6/	66	TL-21/TL-18/
3	Resistance P/S Enable	35	FB-7/FB-4/	67	FB-19
4	Resistance Scale 0	36	FB-8/FB-5/	68	FB-20
5	Resistance Scale 1	37	FB-9/FB-6/	69	FB-21
6	HVDC P/S Enable	38	Enable Rotation Sensor	70	Relay Matrix
7	Enable Test Lead 1	39	Enable Rotation Sensor Station SW	71	Relay Matrix
8	Enable Test Lead 2	40	TL-10/TL-7/ROT-4	72	TL-22/TL-19/
9	Enable Test Lead 3	41	TL-11/TL-8/ROT-5	73	TL-23/TL-20/
10	Enable Feedback 1	42	TL-12/TL-9/ROT-6	74	TL-24/TL-21/
11	Enable Feedback 2	43	FB-10/FB-7/	75	FB-22
12	Enable Feedback 3	44	FB-11/FB-8/	76	FB-23
13	Station 1 Testing	45	FB-12/FB-9/	77	FB-24
14	Station 1 Pass	46	Station Switch	78	Relay Matrix
15	Station 1 Fail	47	Relay Matrix	79	Relay Matrix
16	TL-4/ROT-1/	48	TL-13/TL-10/	80	Unused
17	TL-5/ROT-2/	49	TL-14/TL-11/	81	Unused
18	TL-6/ROT-3/	50	TL-15/TL-12/	82	Unused
19	FB-4	51	FB-13/FB-10/	84	Unused
20	FB-5	52	FB-14/FB-11/	84	Unused
21	FB-6/Enable Rotation P/S	53	FB-15/FB-12/	85	Unused

Output #	Description	Output #	Description	Output #	Description
22	Station 2 Testing	54	Relay Matrix	86	Unused
23	Station 2 Pass	55	Relay Matrix	87	Unused
24	ACHiPot Relay	56	TL-16/TL-13/	88	Unused
25	Enable ACHiPot P/S	57	TL-17/TL-14/	89	Unused
26	ACHiPot AC Relay	58	TL-18/TL-15/	90	Unused
27	ACHiPot Variac Step	59	FB-16/FB-13/	91	Unused
28	ACHiPot Variac Direction	60	FB-17/FB-14/	92	Unused
29	ACHiPot Variac	61	FB-18/FB-15/	93	Unused
30	Station 2 Fail	62	Relay Matrix	94	Unused
31	Motor Pulse/Resis Scale	63	Relay Matrix	95	Unused

A generic list of the analog inputs is given below. The AIO board generates a 0–5 vdc signal to set the HVDC power supply to requested voltage. The area in the upper right is for this purpose with '255' representing maximum output of the supply. The last area on the right is used to control the ACHiPot stepper motor, which drives the variac. Drive the variac up, down, or reset it back to its zero position. (Indicated by a check in the digital input box #12.)

Table 25: *Analog inputs.*

Input #	Description	Input #	Description	Input #	Description
0	Noise Level	8	FB-1 Analog	16	Temperature Sta-2
1	Resistance Feedback	9	FB-2 Analog	17	FB-10 Analog
2	Program Output	10	FB-3 Analog	18	FB-11 Analog
3	DC-V Analog	11	FB-4 Analog	19	FB-12 Analog
4	DC-I Analog	12	FB-5 Analog	20	FB-13 Analog
5	Temperature Sta-1	13	FB-6 Analog	21	FB-14 Analog
6	AC-V Analog	14	FB-7 Analog	22	FB-15 Analog
7	AC-I Analog	15	FB-8 Analog	23	FB-16 Analog

NOTE: The section in the lower right operates and communicates with the indexing function of the Baker WinAST system fixture and the computer.

1. To operate the indexing function, select Ch 1 (Ch 2 for station 2). The direction desired.
2. Click the Init S.M.C button to initialize the board.
3. Click the Start Slow button to begin the jogging function.
4. The Optical Sensor = will show recognition of the bar or slot by the optics.
5. To witness an index operation, click the Learn button to index one bar. The number of steps it took to achieve the index will be displayed in the box. This verifies proper operation of the 80-539 Stepper Motor Controller, Stepper Motor circuit, and the optics. The I. Res button is for future use.

Table 26: *Comprehensive spare parts list (high-voltage).*

Quantity	Description	Manufacturer	Megger Baker Part Number
1	HV Power and Logic Board	Megger Baker	80-518
1	HV HVDC Board	Megger Baker	80-519
1	HV Stack Board	Megger Baker	80-520
1	MUX/Readout Board	Megger Baker	80-521
1	HV TL/MUX	Megger Baker	80-527
1	Miscellaneous lamps, fuses, relays, belts, etc…	Various	
1	Commutator Contact Brushes	Megger Baker	40-612-001
1	Stepper Motor Controller Board, Dual Channel	Megger Baker	80-539
1	Stepper Motor Driver Module, CNO162	Centent	28-508
1	Opto Sensor, PS-49	Keyence	20-525
1	Opto Sensor Amplifier, PS-X28	Keyence	20-526
1	Baker WinAST A/D Board	Megger Baker	80-535
1	24 VDC Power Supply	Sola	28-500
1	48 VDC Power Supply	Elpac	28-501

12 — Test Fixture Interface

Test Lead/Ground Connector

The Test Lead/Connector in the test fixture connector wiring is the wire to the Kelvin contacts on the fixture. Test leads and feedback leads must contact the winding independently. These leads must be kept as short as possible.

Model No:

Pin Number:

1	Test Lead 1
2	Feedback Lead #1 for Kelvin Resistance Test
19	Ground Lead
21	Test Lead #2
26	Feedback Lead #2
27	Test Lead #3
31	Feedback Lead #3

Safety Connector

The Safety Connector requires relay or switch closure to indicate that the station is ready and safe to test. Tests will not start until this closure is made.

Model Number:

Pin Number:

1	Safety Switch
2	Safety Switch Return

Test Status Connector

TESTING, PASS, and FAIL and other lines output. These outputs are wired parallel with the control console lamps. The TESTING line outputs when a test is in progress. The PASS or FAIL line is activated when the test is complete, indicating test outcome.

Model No:

Pin Number: TBD

13 — Software Maintenance

Baker WinAST/Windows Software Installation

Installing Windows XP

1. Enter BIOS and setup CDROM to Boot. Boot up the computer with the Windows XP setup disk installed. When prompted press <enter>.
2. Scroll thru licensing agreement using ‘page down’ and press ‘F8’.
3. Create partition in un-partitioned space, press ‘C’.
4. Create partition to full size of hard drive <enter>.
5. Install Windows on highlighted partition, press <enter>.
6. Format using the NTFS file system, press <enter>.
7. Setup will format the partition and choose location for files, ‘\WINDOWS’, press <enter>.
8. Setup copies needed files to hard disk.
9. Install default files. Gathering information, click <next>.
10. Enter name as BAKER, organization as BAKER, the click <next>.
11. Enter OEM number from the original booklet when prompted and click <next>.
12. Enter computer name as BAKER, administrator password as baker, confirms with baker, <next>.
13. Do not create an emergency disk. Install most common components. <next>
14. Do not connect to network at this time if no network card is installed. Finish setup. <Finish>
15. Remove any disks and restart Windows.
16. WINDOWS XP requires you to license your OS. You will need a network connection or contact Microsoft to obtain a pass key.
17. Restart the computer for all settings to take effect.

Installing Baker WinAST Software and Support Programs

1. Install the Baker WinAST install disk in the CD ROM drive or flash memory. Open Windows Explorer.
2. Copy the “Baker” folder from the CD to the “C:\” root directory.
3. Make the “C:\Baker” folder and files writeable by right-clicking the “Baker” folder and select the Properties menu and unchecking the Read-only box.
4. Open the C:\Baker\Accessories\System32 folder and copy directory to the C\winnt\System32 (windows 2000) or C:\windows\System32 (windows XP). If asked for Overwrite confirmation, select <Yes for All>.
5. Double-Click the C:\Baker\Accessories\SLGRAPH\setup.exe. Finish the rest of its setup using default settings and when prompted for a password, type 1342-crhf-4681.
6. Click the Start>Programs>Command Prompt menu to bring up the Command Prompt window. Type the following, “cd c:\winnt\system32” (2000) or “ cd c:\windows\system32” (Windows XP) in the Command Prompt window. Then type regsvr32 vcf132.ocx in the window and <enter>. A dialog should come up with message “DLLRegisterServer in vcf132.ocx succeeded.”
7. Run the Acrobat reader setup program in C:\Baker\Accessories\Acrobat
8. Copy the C:\Baker\Ast.exe file to the desktop to provide a shortcut to the WINAST program. Right click the icon and select properties. Edit the target to c:\Baker\ast.exe /debug.
9. Create a “MANTEST” icon on the desktop by creating a shortcut to the C:\Baker\Mantest.exe.
10. Change the Windows desktop wallpaper to C:\BAKER\LogoBaker2.bmp by right clicking the desktop and selecting Properties>Background Wallpaper. Locate .bmp by using Browse button. Also choose Baker Blue for background.

11. Restart Windows again to have changes made selectable.

Baker WinAST Windows Driver Installation

1. The WINAST unit has Megger Baker Instruments computer boards used to control and analyze the tests. These boards need to communicate with the WINAST software. The drivers for these boards need to be loaded.
2. Select the Start>Control Panel>Add Hardware. Launch the Hardware Wizard. Next, choose 'Yes, I have already connected the hardware' option. Select Next. Select 'Add new hardware device'. Choose the "Install the hardware that I manually select from a list" option. Select "show all devices". After some computer time choose the 'Have disk' option and choose the <Browse> button. Locate the Aio_0x318.inf file in the C:\Baker\Drivers folder. Open it and select OK. Select AIO_0x318 from the list and select next then finish. You do not have to restart the computer yet.
3. Run the "Add Hardware" from the Control Panel. Next, choose 'Yes, I have already connected the hardware' option. Select Next. Select 'Add new hardware device'. Choose the "Install the hardware that I manually select from a list" option. Select "Baker Drivers". Choose the 'Have disk' option and choose the <Browse> button. Locate the Dio_0x300.inf file in the C:\Baker\ Drivers folder. Open it and select OK. Select DIO_0x300 from the list and select finish. You do not have to restart the computer yet.
4. Repeat step 3 for the fastatodio2000 driver. If you are installing WIN2000 you will have to reboot the computer after loading all drivers.
5. If the WINAST unit is built with a second DIO board you need to load the drivers for it. The .inf file is located and installed as in step 3.
6. For Windows XP to make the drivers active, open SYSTEM, Device Manger, and Baker Drivers. Right click the first driver (AIO) and select properties. Left click the folder Resources and left click the button labeled Install Drives Manually. Close the properties window but do not restart the computer.
7. Repeat these steps for each the Baker drivers to make them active. Restart the computer.

WinAST Customer Selections for a Specific Unit

Contact Megger Baker Instruments support.

1. The proper operation of the WINAST unit depends on the correct programming of the configuration file. When completing this section a copy should be made of the Sysconfig.cfg and I/Oconfig.cfg files into the C:\Baker\TEMP directory. It is also important to 'write protect' these files to avoid corruption by accidental use.
2. Double click the C:\Baker\Dalconfig.exe to open the I/Oconfig.cfg file. Set the 'Number of Stations' box and the 'Number of TL Mux Boards' box . Then select the tests that the unit will be running. (This is dependent upon the hardware build of the WINAST unit.) If a PLC is to be used, select the Master box and enter the correct digital lines as per the hardware build. Next enter the correct digital input and output lines for Station 1 (default) and if used, Station 2. (These also are based upon the hardware build of the WINAST unit.) In the System I/O area enter the station switch (-1 if there is a dual station and no station switch) and keylock (1) digital lines if used. (Hardware builds). Again if a PLC is to be used there is a box for Miscellaneous I/O digital lines, again dependent upon hardware build. When complete click the close file in the upper right corner. Click the save option. Right click the file I/Oconfig.cfg and select properties. Select Read-Only to protect.
3. Double click the C:\Baker\Sysconfig.exe program to open the Sysconfig0.cfg file. Set the '# of Stations' box, the '# of Leads per Station' box (hardware build), the 'Language' of choice, and the 'WINAST SN'. The Options area is used for optional hardware used on this specific unit. The ARM is checked if an auxiliary matrix is installed in this unit. The IR probe is checked if Exergen Infared probes are used. If left unchecked the unit will default to the Solid State temp probe of most units.
4. The PLC box is checked for PLC operation and number of Master lines. The corona box is checked only if corona hardware is installed. The Fail Printer is checked only if fail printer software is installed in Windows. The Barcode/Serial Interface is selected when a serial number input via the RS232 input or a USB barcode scanner is to be used. (It must be set up according to manufacturers spec's.) The Two State Leads box is checked if the unit DOES NOT HAVE OPEN LEAD ABILITY via the hardware build. (This will by default only give a choice during master building of active or grounded lead. For open lead a third choice of open is given. A hardware build open lead machine is necessary for this to work.) The Station 2 Cal Temp Gain is to be checked only if a Station

2 temperature sensor us used. The Temp Comp box is checked if temperature compensation is to be used in the operation of the WINAST. The Station 1 and 2 Auto Start digital input lines are hardware chosen and entered here (18 & 19). Along the bottom is the Test Bus area. Select the tests that will be used on this WINAST unit (hardware dependent).

5. This section will deal with the Lead Map and testing parameters. A copy of the hardware lead map is necessary to properly program these pages. A copy can be obtained from Megger Baker Instruments (1-800-752-8272) if not available. Select the Lead Map button at bottom of page. Enter the correct digital output line for the lead map of the WINAST unit. If open lead is hardware built then input the digital output lines for its lead map. For 3 lead units the correct settings are achieved with the <Default> button. The WINAST unit will not operate correctly if these numbers are not correct. Next in the Resistance folder at right choose the required Resistance Balance Formula and the Max Resistance (hardware build) for the WINAST unit. In the AC HiPot folder select the Max AC Current that is hardware built for this WINAST unit. In the Surge folder the Sample Rate is selected for the necessary sample rate, which is customer part dependent. Consult support about these settings. Default is 5 MHZ. The Rotation page is a list of the necessary digital input and output lines (hardware build decided) to operate the rotation tests if installed. Almost all (99%) of all Baker WinAST units will use the same Enable Rotation Sensor (38), Sensor Station Select (39), Enable Rotation (21), Sensor CW (16), and Sensor CCW (17) digital lines. (Consult Baker if different). The Phase 1, 2, & 3 digital lines will apply rotation power during Rotation Test #1 of the Master. Phase 4, 5, & 6 digital lines will apply rotation power during Rotation Test #2. Phase 7, 8, & 9 digital lines will apply rotation power during Rotation Test #3. Phase 10, 11, & 12 are used for Test #4 if needed. When complete, close the folder by clicking the close folder button at the upper right corner. Select save to save the entries made to the Sysconfig0.cfg file. It is necessary to lock this file by right clicking the file Sysconfig0.cfg and selecting Read-Only.
6. Complete the programming by copying the I/Oconfig.cfg and the Sysconfig0.cfg files to the C:\Baker\Temp directory.
7. If any problems are encountered following this routine contact Megger Baker Instruments support for assistance. Baker heartily encourages the customer to limit the personnel allowed to access this procedure as an improper set up can render the WINAST unit unuseable and possibly could damage the unit.
8. Launch the WINAST icon to start the program. You will notice a quick shut down (normal for first time). Launch again and you will notice an incomplete window. Set up a default master for a resistance test from lead 1 to 2. Assign this master and the window will be complete. Open the "Show Debug Messages" icon and drop down the HELP menu. Select "Create Regedit Defaults". This will set the most common default settings in the registry editor. This can be verified by selecting <Start> <Run> and typing REGEDIT in the selection box. This will give a REGEDIT string. Select HKEY_CURRENT_USER\SOFTWARE\COBRA5000\OPTIONS to view the entries. NOTE: For software builds that do not use a Menu Lockout Key it is necessary to right click the CheckKeyLock name and set the value to 0.

NOTE: Software after 6/2/03. The ACHiPot has a new additional control feature. Different frame size stators have a different capacitive compensation phase angle. There is now an entry into the Registry Editor to vary the phase angle computation. To enter a new value go to <START> <RUN> and type in <regedit> and <enter>. Locate in the Registry Editor tree the following folder: 'HKEY_CURRENT_USER\SOFTWARE\COBRA 5000\DEFAULT\ACH'. Locate string value CAP_ANGLE and change string value. The lower the value the closer to zero the computed leakage compensation will be. The default value will be set to 80.

9. For units with the corona option the CAL.txt file must be modified. Add "1.00 <tab>Line55<tab>Corona" below line 54. Add "1.00<tab>Line56<tab>Corona" below line 55.

ARM Configuration File Setup (for units with an auxiliary relay matrix)

1. The new Windows software uses an `ARMLead.cfg` to setup the relay matrix for surge and rotation. It also keys the resistance summation routines. The file is located in the `C:\Baker` directory and is opened in Notepad to edit. The header has instructions on modification of this file. This file is only to be used in conjunction with the hardware build to produce the desired results.
2. The build instructions for the necessary digital lines to engage for each motor type hookup are needed. This can be obtained from customer support at 1-800-752-8272.
3. This information is formatted to match the software. The first line is for organization and is ignored. The second line denoted a configuration to follow. The third line is always the same (hold over from Cobra software). The fourth line is the motor type name. This name is critical to be formatted correctly for the software to recognize it. The fifth line is to describe to the software which digital line to toggle for the relay matrix. The sixth line is for structure to alert the software how many lines of information will follow. (The actual motor lead hookup the relay matrix is doing for surge and rotation.
4. The file will be given with a <space> in from of line 4, the motor type. This will prevent the name from being given in the operator setup of a master. To enable the connection, just remove the <space> from in front of the motor type. Do not change the format of the name.
5. As with the plc and barcode setup, check the ARM box in the `sysconfig.cfg` as described in the "AST Customer Selections For Specific Unit" instructions above for the ARM configuration to work.
6. The resistance summation formulas for each motor type are embedded in the software. These are referred to by the enabled configurations.

> NOTE: If there are two or more digital lines necessary to operate the relay matrix, add line 'IO_LINE' with the next digital number. (refer to #11).

As with any of the `.cfg` files, you should save work to the `C:\BAKER\TEMP` directory and lock it for safe keeping. Lock the file by using the right mouse button and enter properties.

```
ARMLead_Default.cfg
#  Lines starting with space or # are ignored.  LEAD_CFG signals the
start of
#  a configuration section.  No empty or comment lines are allowed within
a
#  section.  CFG_COUNT denotes the number of configurations
#  lines to follow.  No line should exceed 100 characters long.
#  Do not change the config names (eg.  6_:LEAD_PWS) because resistance
summation
#  uses them.  From #12 on are only for the resistance summation, not for
the surge, fsd,
and
# rotation.  To edit out a config place a space in front of name.  ( 6_
LEAD_WYE)

#1
LEAD_CFG
IO-BOARD         0
 5_LEAD
CFG_COUNT        0
```

```
#2
LEAD_CFG
IO_BOARD          0
 6_LEAD_WYE
IO_LINE           55
CFG_COUNT         1
4-5-6

#3
LEAD_CFG
IO_BOARD          0
 6_LEAD_DELTA
IO_LINE           62
CFG_COUNT         3
1-6
2-4
3-5

#4
LEAD_CFG
IO_BOARD          0
 6_LEAD_LO_SPEED
IO_LINE           55
CFG_COUNT
4-5-6

#5
LEAD_CFG
IO_BOARD          0
 6_LEAD_HI_SPEED
IO_LINE           55
CFG_COUNT         1
1-2-3

#6
LEAD_CFG
IO_BOARD          0
 6_LEAD_PWS_SEPARATE
CFG_COUNT         0

#7
LEAD_CFG
IO_BOARD          0
 6_LEAD_PWS_PARALLEL
IO_LINE           71
CFG_COUNT         3
1-7
2-8
3-9
```

```
#8
LEAD_CFG
IO_BOARD          0
 6_LEAD_DBL_DELTA_LV
IO_LINE           78
CFG_COUNT         3
1-7
2-8
3-9

#9
LEAD_CFG
IO_BOARD          0
 6_LEAD_DBL_DELTA_HV
CFG_COUNT         0

#10
LEAD_CFG
IO_BOARD          0
 9_LEAD_PWS
IO_LINE           54
CFG_COUNT         3
4-7
5-8
6-9

#11
LEAD_CFG
IO_BOARD          0
 9_LEAD_DBL_DELTA_HV
IO_LINE           54
CFG_COUNT         3
4-7
5-8
6-9

#12
LEAD_CFG
IO_BOARD          0
 9_LEAD_DBL_DELTA_LV
IO_LINE           62
IO_LINE           78
CFG_COUNT         3
1-6-7
2-4-8
3-5-9
```

```
#13
LEAD_CFG
IO_BOARD
 9_LEAD_DUAL_VOLT_HV
IO_LINE           54
CFG_COUNT         3
4-7
5-8
6-9

#14
LEAD_CFG
IO_BOARD
 9_LEAD_DUAL_VOLT_LV
IO_LINE           78
IO_LINE           54
CFG_COUNT         4
1-7
2-8
3-9
4-5-6

#15
LEAD_CFG
IO_BOARD          0
 9_LEAD_DUAL_VOLT-LV_DELTA
IO_LINE           54
CFG_COUNT         3
4-7
5-8
6-9

#16
LEAD_CFG
IO_BOARD          0
12_LEAD_DUAL_VOLT_LV_DELTA
IO_LINE           62
IO_LINE           78
CFG_COUNT         3
1-6-7
2-4-8
3-5-9

#17
LEAD_CFG
IO_BOARD          0
12_LEAD_DUAL_VOLT_WYE-HV
IO_LINE           54
IO_LINE           79
CFT_COUNT         4
4-7
5-8
6-9
10-11-12
```

```
#18
LEAD_CFG
IO_BOARD          0
12_LEAD_DUAL_VOLT_WYE-LV
IO_LINE           55
IO_LINE           78
IO_LINE           79
CFG_COUNT         5
1-7
2-8
3-9
4-5-6
10-11-12

#19
LEAD_CFG
IO_BOARD          0
12_LEAD_DUAL_VOLT_DELTA_HV
IO_LINE           47
IO_LINE           54
CFG_COUNT         6
1-12
2-10-3-11
4-7
5-8
6-9

#20
LEAD_CFG
IO_BOARD          0
12_LEAD_DUAL_VOLT_DELTA_LV
IO_LINE           62
IO_LINE           78
IO_LINE           47
CFG_COUNT         3
1-6-7-12
2-4-8-10
3-5-9-11
```

Appendix A — Appendix A: Technical Specifications

Baker WinAST Automated Stator Test System

Computer

Processor: Pentium

Architecture: Industrial PC packaging

Peripherals

Display: High resolution LCD color monitor

Printer: Optional

Communications

Network interfaces are available

DC HiPot

Voltage: Programmable 100 to 5000 VDC in 50 VDC increments, +/- 3 percent accuracy.

Current: 100 uA maximum, 1 uA resolution, programmable pass/fail limit in 1 uA increments, +/- 1 uA accuracy.

Duration: Programmable in 1 second increments.

AC HiPot

Voltage: Programmable 100 to 3500 VAC in 50 VAC increments, 50/60 Hz, 60 VA or 300 VA, +/- 5 percent accuracy.

Current: 5,13,26,40,100 mA, 0.1 mA or 0.5 mA resolution, arc detection for improved fault detection, +/- 5 percent accuracy.

Duration: Programmable in one second increments.

Leakage Current Method installed:

"Total or Absolute Leakage Current"

Resistance

Autoranging

3.5 digit resolution

0.4% of full-scale accuracy in each range

0.2% of full-scale repeatability

Kelvin leads and contacts

Ambient temperature normally compensated to 25oC or user defined

Infrared temperature sensing (Optional)

Table 27: *Resistance range.*

Resistance Range	Current
2 milliohm – 200 milliohm	2 A
200 milliohm – 2 ohm	200 mA
2 ohm – 20 ohm	20 mA
20 ohm – 2 Kohm	2mA
2 Kohm – 20 Kohm	.2 mA (optional)

High-voltage Impulse (Surge)

Table 28: *Surge characteristics.*

Parameter	Description
Voltage	Programmable 500 to 5000 volts peak in 50 volt increments, +/- 3 percent accuracy.
Pulse Energy	0.5 Joules maximum
Discharge Capacitor	0.4µF
Load	Greater than 100 µH
Digitizing Rate	5 Msample/second

Programmable pass/fail percentage limit based on Megger Baker Instruments's patented Error Area Ratio technique.

Rotation Direction (optional)

- Senses clockwise or counterclockwise rotation direction in windings.
- "Hall Effect Sensor" method.
- Single- and multi-phase options

Fixtures

The Baker WinAST Automatic Winding Test System can be configured with standard or customized fixturing for the testing of all windings.

Power Requirements

Table 29: *Power requirements.*

Parameter	Description
Input Voltage	230 V, 50Hz, 2A 400V, 50Hz, XA. 3~ (with Rotation test option)
Power Consumption	500 VA maximum
Overcurrent Protection	2 pole magnetic circuit breaker for mains 4 pole magnetic circuit breaker (with rotation test option)

Physical Characteristics

- Instrument Weight 425 lbs or 192.78 kg

Appendix B — Installation Acceptance Form

Baker WinAST Automatic Winding Test System

Date: ______________________________

Customer: ____

____

____

Contact: ____

Purchase Order: ____

Invoice Number: ____

Serial Number: ____

Installation site: please record this on the next page.

This acceptance form is composed of two sections – the Installation Check List and Baker WinAST training.

With a few exceptions, two days of installation and training have been paid for. For additional assistance, please contact Megger Baker Instruments to discuss the terms.

Please refer to the original quotation for Warranty Information. Specifically, please note that the warranty for any board with relay(s) is six months. For pricing or replacement boards contact:

Megger Baker Instruments

4812 McMurry Avenue

Fort Collins, CO 80525

(970) 282-1200 - FAX (970) 282-1010 – (800) 752-8272

Installation Check List

Installation was performed at ____

Installation Performed by ____

Customer Witness of Installation ______________________________________

The following items are to be checked and initialed by the customer in the presence of a Megger Baker Instruments representative.

Table 30: *Installation checklist.*

Item	Description	
1	All boxes/crates were received in good condition with no apparent shipping damage.	☐
2	Please check to indicate completion of installation of the Baker WinAST and accessories.	
	Terminal and Keyboard	☐
	Temperature Sensor	☐
	Printer and Cable	☐
	Disk Drive	☐
	Data Lock Keys	☐
	*RS232 Communication Port	☐
3	Test Fixtures were installed to customer satisfactions.	☐
4	Please check to indicate that the Baker WinAST pass the following tests:	
	AC HiPot (Arc) Test	☐
	Did tester detect an arc and terminate the HiPot Test?	☐
	Did Tester survive arcing?	☐
	DC HiPot Test	☐
	Surge Test	☐
	Resistance Test	☐
	Rotation Direction	☐
5	A manual was received with the correct documentation for this particular Baker WinAST.	☐
6	The Baker WinAST software was updated during installation.	☐
	New Software was backed up on customer and Baker service disks.	☐
	New software was stored on software engineer’s customer directory.	☐

* Denotes optional feature.

Baker WinAST Training Checklist

Table 31: *Training checklist.*

Item	Description	
1	The installer explained the basics of operating the Baker WinAST.	☐
2	The training was satisfactory on the following tests:	
	AC HiPot	☐
	Rotation Direction	☐
	DC HiPot	☐
	Surge Test	☐
	Resistance Test	☐
3	The training was satisfactory on the following test fixture.	☐
4	The software training was satisfactory.	☐
5	If applicable, the installer discussed the Spare Parts Kit.	☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐
		☐

For the Installer

Please note any comments regarding this installation.

____

____

For the Customer

Please note any comments regarding this installation. Use the back of this form if necessary.

____

____

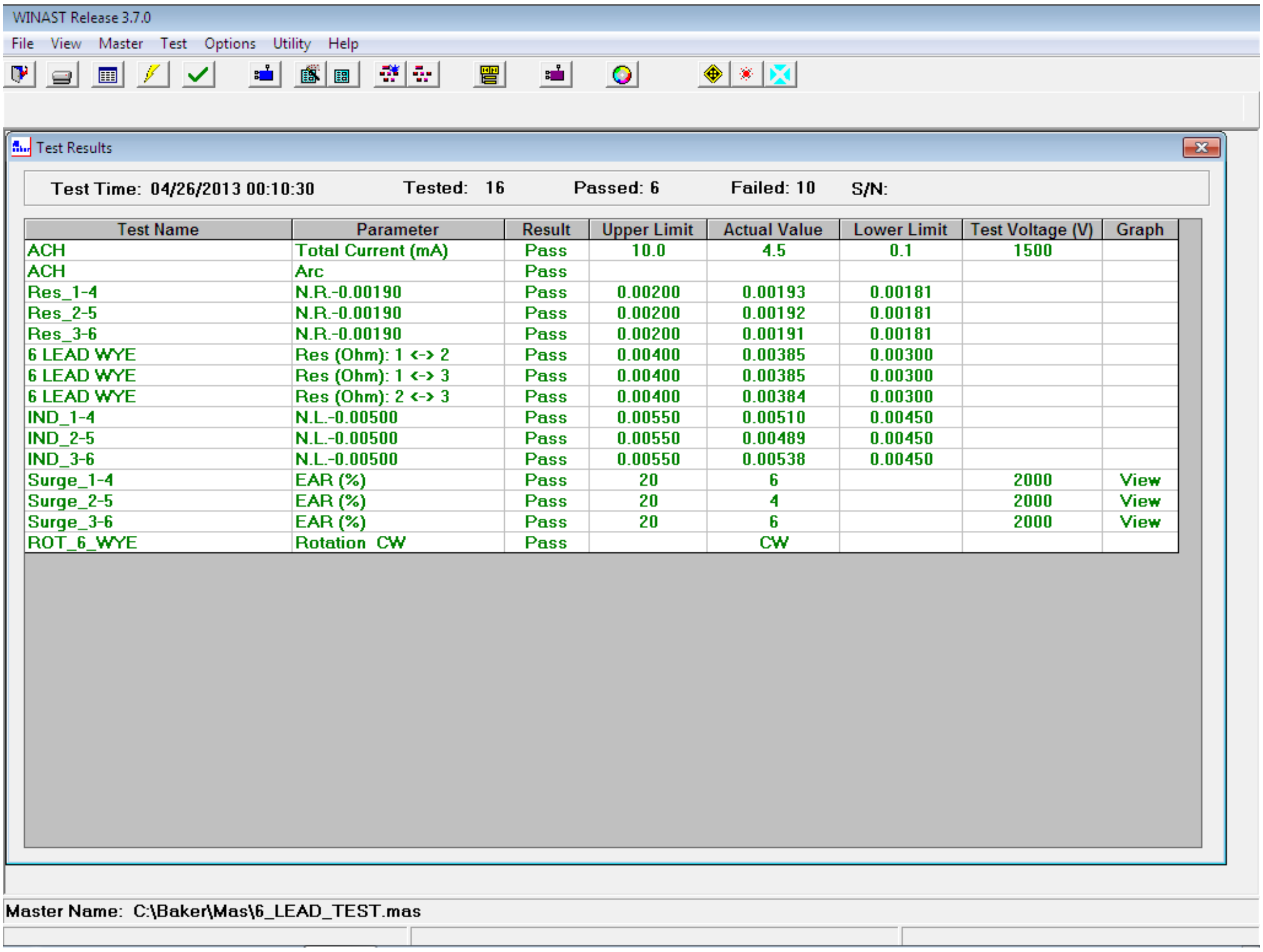
This installation of Baker WinAST Serial Number: ____________________ was completed (date)____________

by ***Megger Baker Instruments Representative*** ________________________________

Customer Signature ______________________________________

Appendix C — Baker WinAST Inductance test

The inductance test is an optional feature of the Windows 7-based Baker WinAST, and is available along with the conventional tests (AC HiPot, DC HiPot, Resistance, Surge, Rotation, and Flux Mapping) using the same test leads from the Baker WinAST unit. It serves as yet another means of electrically testing motor insulation for weaknesses and faults in a motor manufacturing (or repair) quality assurance program.



Test Name	Parameter	Result	Upper Limit	Actual Value	Lower Limit	Test Voltage (V)	Graph
ACH	Total Current (mA)	Pass	10.0	4.5	0.1	1500	
ACH	Arc	Pass					
Res_1-4	N.R.-0.00190	Pass	0.00200	0.00193	0.00181		
Res_2-5	N.R.-0.00190	Pass	0.00200	0.00192	0.00181		
Res_3-6	N.R.-0.00190	Pass	0.00200	0.00191	0.00181		
6 LEAD WYE	Res (Ohm): 1 <-> 2	Pass	0.00400	0.00385	0.00300		
6 LEAD WYE	Res (Ohm): 1 <-> 3	Pass	0.00400	0.00385	0.00300		
6 LEAD WYE	Res (Ohm): 2 <-> 3	Pass	0.00400	0.00384	0.00300		
IND_1-4	N.L.-0.00500	Pass	0.00550	0.00510	0.00450		
IND_2-5	N.L.-0.00500	Pass	0.00550	0.00489	0.00450		
IND_3-6	N.L.-0.00500	Pass	0.00550	0.00538	0.00450		
Surge_1-4	EAR (%)	Pass	20	6		2000	View
Surge_2-5	EAR (%)	Pass	20	4		2000	View
Surge_3-6	EAR (%)	Pass	20	6		2000	View
ROT_6_WYE	Rotation CW	Pass		CW			

Fig 56: *Baker WinAST Inductance test results example.*

The measure of inductance in mH is accomplished by incorporating a laboratory quality LCR meter. Four-wire measurement leads are multiplexed through the Baker WinAST hardware to enable a four-wire measurement at the leads of the coil under test. This approach allows very low inductances (in the range of 5 uH) to be measured. Communication with the LCR meter is performed via a dynamic COM port assignment of an RS232 cable using the Baker WinAST's software application. The Baker WinAST inductance test is capable of testing on 2–12 leads of a customer's stator.

The application is designed to be user friendly. Setup of a master test is very similar to the resistance setup, using a lead map with the value displayed in mH. A balance test similar to the resistance balance test is provided. Test results are included in the standard output format of the Baker WinAST. Both statistical and total data are stored in xml format.

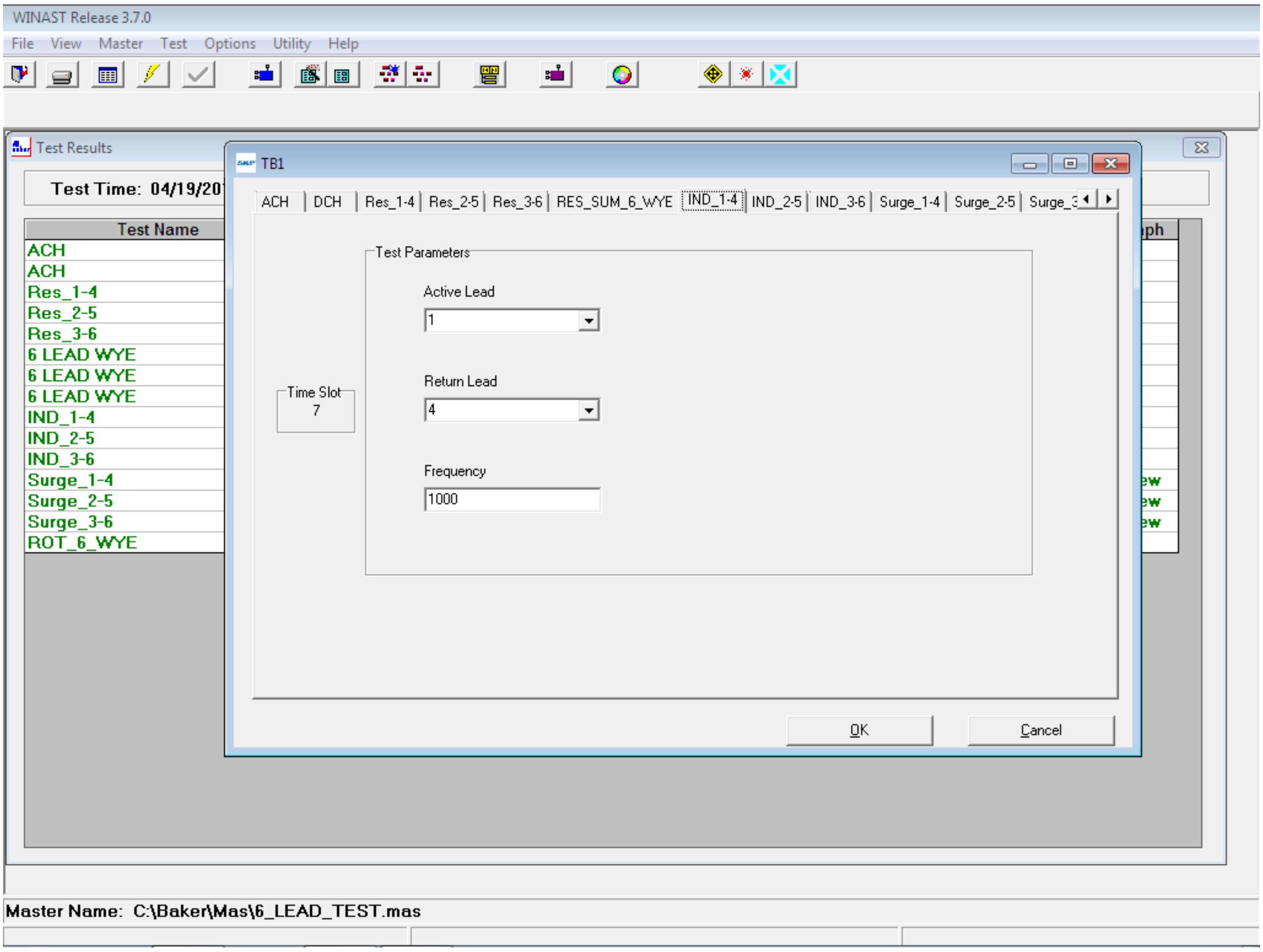


Fig 57: *Setting up an inductance test.*

An inductance multiplexer board performs multiplexing of the four inductance meter wires out to the proper leads. The board is controlled by a dynamic COM port assignment RS232 cable and the analyzer's software. The analog signals are isolated from the Baker WinAST's computer boards. They are read by the analyzer's inductance meter and captured by the analyzer's software via RS232 protocol.

The following is a technical report of how the Baker WinAST is designed to measure 4-wire inductance through multiplexed leads. The L-force (inductance force) output of the inductance-capacitance-resistance (LCR) meter is protected by being routed through a high-voltage isolation relay to the Baker WinAST test bus. The return H-force is connected to the high-voltage return. L-sense and H-sense leads are connected to feedback leads of the test cable to the requested coil leads. This senses the analog signals to the LCR meter from the test lead multiplex boards, the Baker WinAST backplane board, and the inductance multiplex board. Coaxial cables in the system reduce noise interference.

The Baker WinAST application software sends controls via RS232 protocol to the inductance multiplex board to properly route the analog signals. A troubleshooting software program, along with the standard mantest.exe, is included with the Baker WinAST, however both of these programs are independent of the Baker WinAST software application.

To use the troubleshooting application, you should be familiar with the hardware design of the Baker WinAST. Test lead and feedback lead assignments are performed by selecting discrete digital outputs that are determined by the Baker WinAST's configuration and stator testing design.

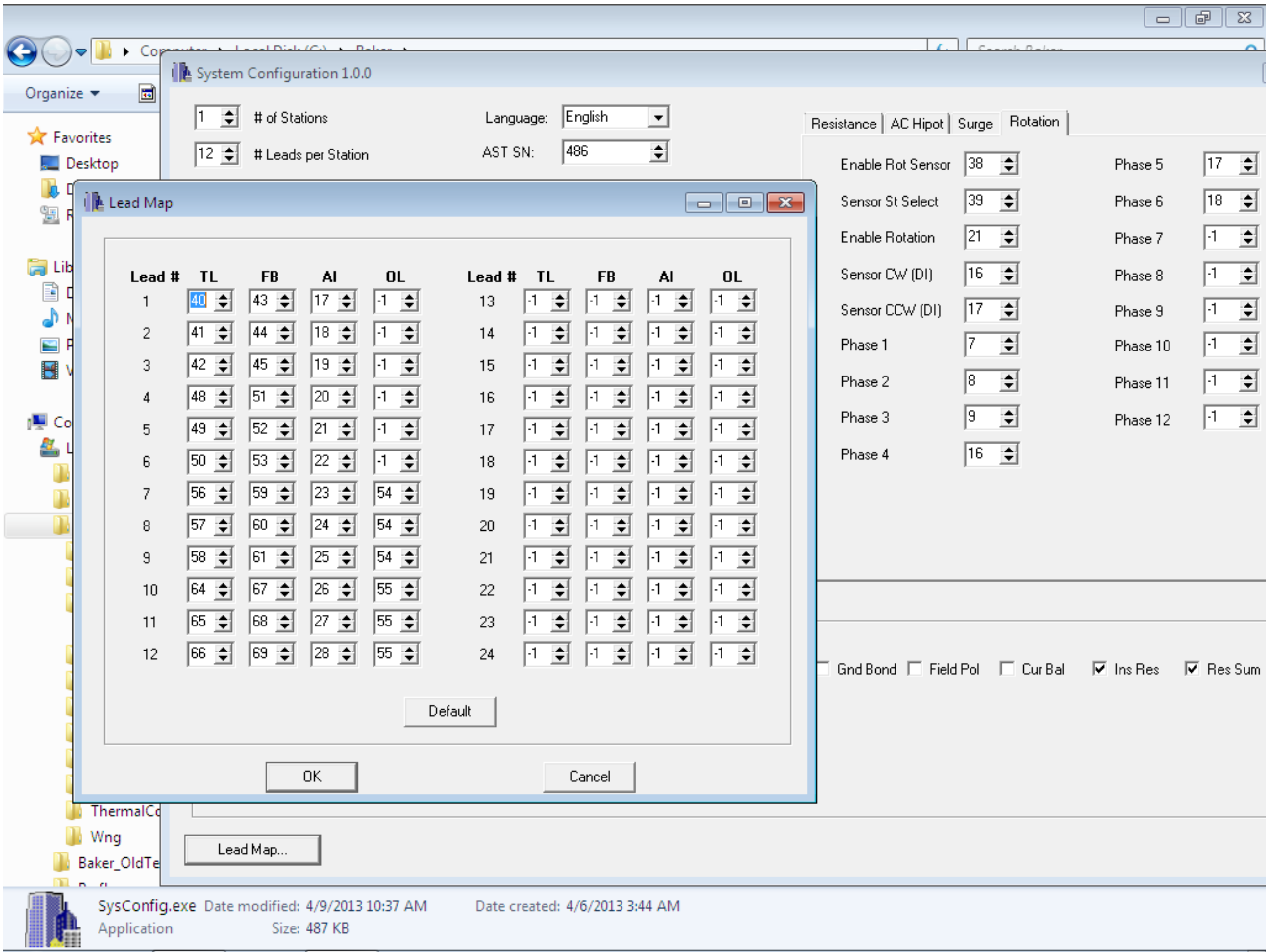


Fig 58: *Inductance test lead map.*

The lead map for a typical Baker WinAST unit is shown above. The lead map is used to assign the proper leads for tests when they are set up in the parameter file. The analog number is important to the inductance as it helps to program the inductance multiplex board for proper lead assignment. A block diagram of the Baker WinAST multiplexing system is shown below.

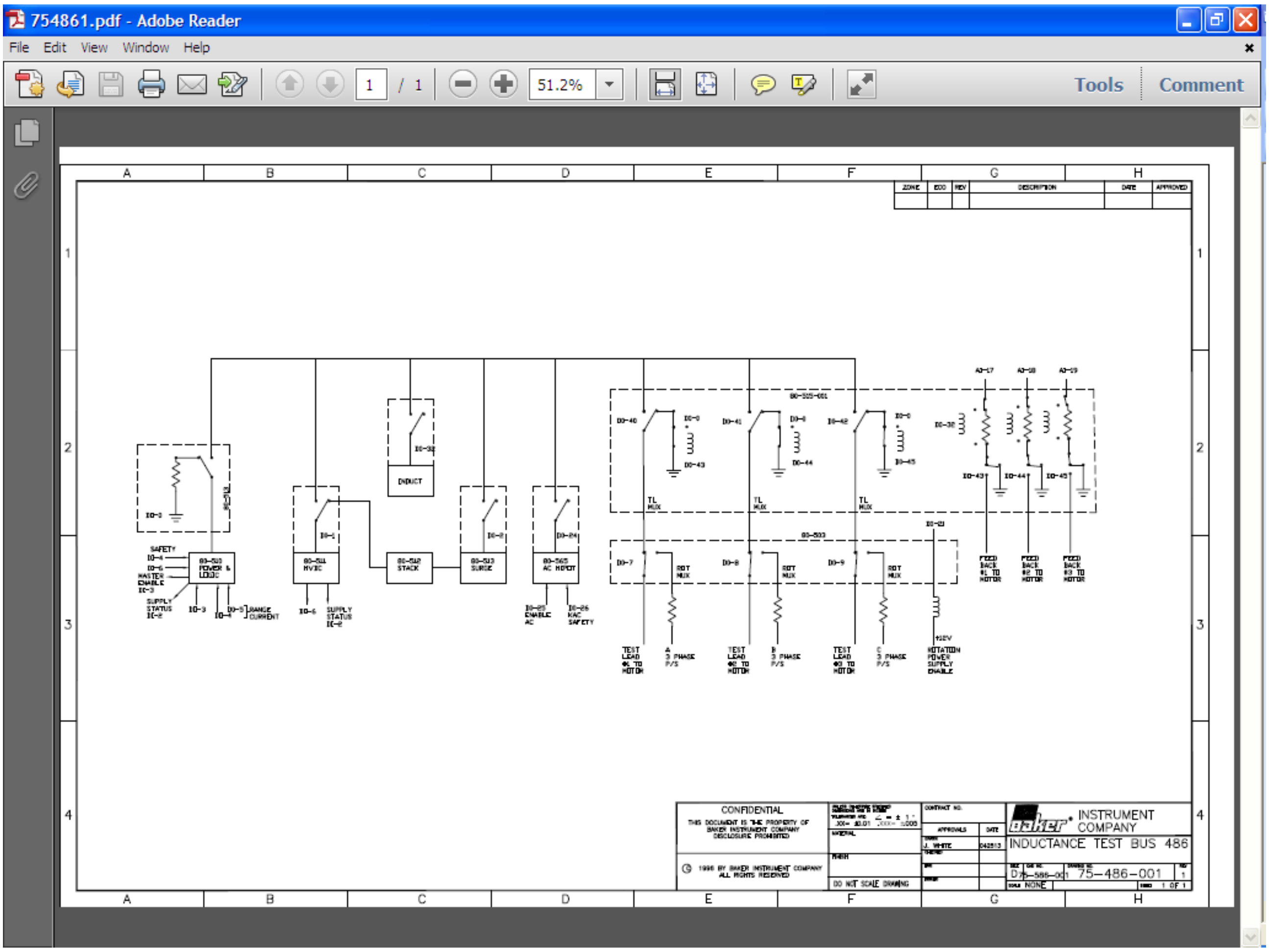


Fig 59: *Block diagram of the Baker WinAST multiplexing system.*

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