



Serving the Industry Since 1983

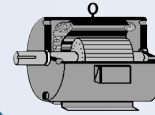
# ALL-TEST IV PRO™ 2000

## Motor Circuit Analyzer

**PREDICTIVE MAINTENANCE**  
**QUALITY CONTROL**  
**TROUBLE SHOOTING**



**LOOKING FOR TROUBLE?**



*if so... YOU WILL*  
FIND IT WITH ...

**THE ALL-TEST!**



### Using ALL-TEST PRO Greatly Increases the Profitability of Your Plant!

- Versatile – works on all types and sizes of motors-induction, synchronous, servo, DC and more.
- Sensitive – detects faults at their earliest stages, before motor failure. Detects “deep” winding faults that even a surge test will miss.
- Fast – most tests take only a minute and give you a complete picture of motor health.
- Convenient – tests can be taken from the motor control center, through hundreds of feet of cable.
- Easy to use – menu driven with on-screen prompts.
- Expert software provides fault diagnosis plus trending of all data.



# Motor Circuit Analysis Applications with The ALL-TEST IV PRO™ 2000

## Predictive Maintenance

Regular testing can identify developing faults before a failure occurs. All measurement data can be trended for predictive maintenance condition monitoring. By making proactive repairs and eliminating unscheduled down-time, plant productivity is greatly improved.

### Application Story:

A drive failure on a critical 200 HP motor was traced to poor connections using MCA. MCA was performed on 10 similar machines. Five of the machines indicated poorly crimped connections at the motor terminals. These connections would have deteriorated to the point of failure within weeks. Pro-active repairs were performed, cost avoidance of this “find” was over \$500,000.

## Quality Assurance

New motors of any size can be defective. Spares “on the shelf” are often unknowns. A 2-minute test can insure that your motor will run once you install it!

- Test new and spare motors before installing (be sure they are good, plus you have a baseline for future comparison.)
- Test motors before you put them on the shelf as spares
- Test failed motors before and after repairs (make sure you don't have a \$900 paint job!)

### Application Story:

A power plant performed a routine test on a new 50 HP motor about to be installed as a back-up bearing coolant pump. A significant phase unbalance was detected, the motor was not installed.

Further evaluation revealed that motor was a new design, the unbalance was a manufacturing defect. Had the motor been installed as the backup and been called into service, it would have tripped and failed within minutes. Potential costs would have been in excess of \$1 Million.

## Troubleshooting

When you have a motor related problem, the ALL-TEST can quickly rule the motor “in” or “out” as the source of the problem. No false positives or negatives, with the ALL-TEST you know exactly what the problem is or isn't!

### Application story:

A 300 HP motor was drawing significantly unbalanced current. Motor Circuit Analysis was performed at the MCC indicating no problems with the motor, cables, or connections.

Examination of other components in the circuit identified a blown power factor correction capacitor (The ALL-TEST IV PRO 2000 also tests capacitors). The capacitor was much easier and less expensive to replace than the motor. Without the ALL-TEST, this plant would have replaced the motor, only to find the problem was not solved.

How much money would this save in your plant?

## The ALL-TEST IV PRO 2000 finds the faults you can't see with any other instrument.

- Turn-to-turn, coil-to-coil, and phase-to-phase faults
- Open phases
- Burned or contaminated windings
- Poor connections
- Broken/cracked rotor bars and rotor casting voids
- Rotor eccentricity
- Grounded windings
- Cable faults



*Testing spare motors to confirm their status insures against installing a faulty motor.*



*Portable and easy to use, the ALL-TEST Pro is right at home on the plant floor. No need for a cart when you're testing motors!*

# ALL-TEST IV PRO™ 2000

## Features

### Easy To Use

An automatic test mode is used for most tests. On screen prompts walk you through the test. In just a few minutes, anyone can learn to use it!

### On The Spot Diagnosis For Troubleshooting

ALL-TEST results are immediately displayed for field evaluation. Our quick reference guide helps you make the call on the spot. Answer the mechanical/electrical question immediately, rule the motor "in" or "out."

### Data Collector With Companion Software For PdM

The ALL-TEST IV has enough memory to store 500 tests (more than a day's work). Upload test results to your computer, our software provides expert diagnosis, trending, and a wide variety of printed or on screen reports.

### Convenient—Test From The Motor Control Center

Most tests on installed motors are done from the MCC, you can test through over 1000 feet of cable. Even hard to reach MCCs (overhead cranes, submersible pumps, etc) can be tested quickly and easily. In many cases you do not even need to disconnect from the drive output terminals! No need to test at the motor terminals unless a fault is indicated.

### Safe For Operators And Equipment

All tests are performed on de-energized circuits. Measurement technology is low voltage and current, and completely non-destructive. Regular and repeated testing will not affect the life of the windings.

### Quickly Evaluates The Entire Motor Circuit

A single 2 minute test evaluates the windings, cabling, and connections. Additional tests let you evaluate the rotor, and capacitors, and cabling to pinpoint the fault.

### Sensitive

Detects motor faults at their earliest stages. Even detects conditions such as deteriorating or contaminated insulation long before other technologies.

### Light Weight And Hand Held

The instrument weighs under 2 lbs, is battery powered and hand-held. No need to take a cart when you test a motor. And it can test any size motor.

### Tests All Kinds Of Motors And Coil Based Devices

- All types of motors: induction, synchronous, DC, brushless DC, servo, wound rotor, even single phase motors.
- All Components: induction windings and rotors, DC shunt and field windings, armatures, Field and rotor coils in synchronous motors.
- Transformers: Single and 3-phase, pole and pad mounted.



*Testing the electrical health of a motor/pump combination lets you make a better repair/replace decision.*



*A 2-minute test from the MCC evaluates the windings, cabling, and connections through even hundreds of feet of cable.*

# MOTOR CIRCUIT ANALYSIS

## Introduction to Motor Circuit Analysis

One of your motors has just stopped running, and your production has stopped. Is the problem mechanical or electrical? Is it the drive? Overload? Load? Connections? Capacitors? Finding the root cause could take hours.

And could you have seen it coming? Could you have identified the potential fault in advance, and corrected the issue through scheduled maintenance, and avoided the unplanned shut-down?

From the day you install a motor, it is in the process of failing. The only question is when. According to an EPRI study, almost half of all motor failures are electrical in nature (the rest are mechanical). The majority of motor faults start as shorted turns within the windings. In addition, poor connections, winding contamination, and rotor issues all lead to motor failure.



*Once your motor looks like this, it's too late!*

### Some facts about winding faults:

- They usually start in the end-turns of the windings where stress is greatest, and the insulation system is the weakest
- They start small, and escalate over time
- They sometimes progress to a ground fault
- They always end in motor failure
- You can't detect them with a Megohm meter or DMM until the motor has totally failed

### Motor Circuit Analysis (MCA)

MCA is a technology that lets you examine the electrical health of a motor through measuring multiple electrical properties of the windings. The ALL-TEST IV PRO 2000 Motor Circuit Analyzer performs 5 measurements on each of the three winding phases:

- Three separate high accuracy bridges measure winding resistance, impedance, and inductance.
- A low voltage AC signal is applied, and the resulting phase angle is measured.
- A multiple frequency current response test (I/F) is performed.
- Insulation resistance to ground is measured at either 500 or 1000 V

In a healthy motor, all of these measurements are balanced. When one or more is out of balance, you have a clear indication of where the fault most likely is. For example if all measurements except resistance are balanced, a loose connection is indicated. Unbalance in the phase angle or I/F test indicates shorted turns within the windings. You can also isolate and identify rotor faults, and eccentricity in assembled motors without run testing under load!

Extensive research and field tests have shown that the guidelines for detecting fault conditions are the same on any size and type of device—we have successfully evaluated 40,000 HP synchronous machines, tool machine servos, induction motors of all sizes and voltages, and even pad and pole mounted distribution transformers. And you can rely on the results—there are virtually no “false” positives or negatives.

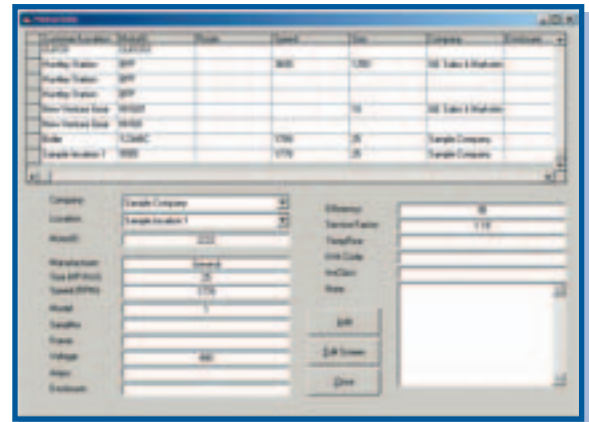
Most tests are done from the motor control center, through cable runs of 1000 feet or more. All tests are low voltage and totally non destructive, so there is no danger of damaging sensitive equipment. A test takes less than 5 minutes, and can show you turn, coil, and phase-to-phase faults, open phases, poor connections, contaminated or burned windings, grounded windings and connections—or a motor that is perfectly healthy.

**There is no more powerful tool for electrical motor evaluation!**

# TREND 2003™

## Trending and diagnostic software for the ALL-TEST IV PRO™ 2000

- Makes it easy to organize and manage motors and test-records
- Provides trending and diagnostics for 3-phase motors
- Sets up complete databases for plant and motor nameplate data
- Interfaces with ALL-TEST IV PRO 2000
- Gives you built-in report generator
- TREND 2003 is included with the ALL-TEST IV PRO 2000 and it is compatible with our flagship software package, EMCAT™



TREND 2003 combines with your ALL-TEST IV PRO 2000 to create a powerful tool for troubleshooting and managing 3-phase motors.

The database is designed to collect and organize nameplate information of your motors. For a manufacturing site, records can be grouped by building or process; for a service organization, you can group them by customer name and location.

### Motor Diagnostics for Troubleshooting

TREND 2003 takes the guesswork out of interpreting test data. It provides a tabular and graphic view of the results, applies proprietary algorithms and automatically diagnoses likely motor faults on the screen. A built in report generator is included for printer output.

### Motor Trending for Predictive Maintenance

For condition monitoring, all measurements can be trend-graphed. Increasing unbalances give you advance notice of deteriorating conditions. Planning for repairs and avoiding unscheduled down-time saves money and aggravation.

### Scheduling and Work-order management

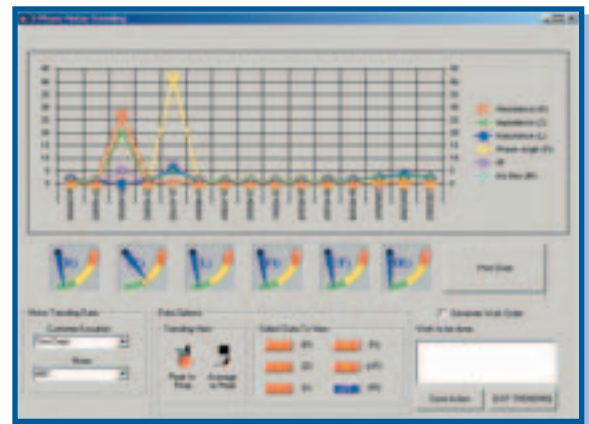
TREND 2003 allows you to schedule route based testing, generate work orders, and record completed work. We even let you record test data from other technologies like infrared and ultrasound to create a complete test and maintenance report.

### Upgrade from TREND 2000

If you have been using our original TREND 2000 software, you can upgrade to TREND 2003 for a nominal fee. All test-data files can be directly imported, analyzed, and trended. Contact the factory for details.

### Upgradeable to EMCAT

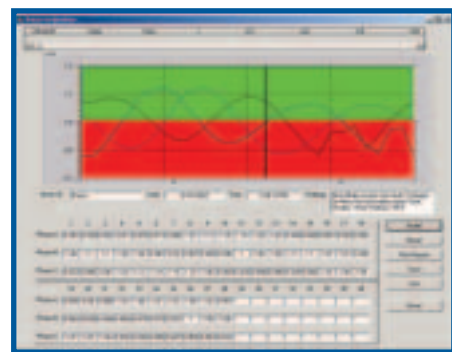
Our EMCAT motor management software adds diagnostics and trending for DC motors and Transformers as well as a powerful rotor diagnostic and grading system. TREND 2003 can be easily upgraded to EMCAT.



### Electric Motor Circuit Analysis Tool (EMCAT Software)

EMCAT is our flagship software package for motor management. Designed with input from our largest users, it expands on the capabilities of Trend 2003.

- Expanded diagnostics and trending to include DC motors, transformers, and single-phase motors.
- Full rotor diagnostic module with a trendable "grade" for rotor health
- Modular interface capability with CMMS programs
- Future upgrade to LAN configuration



## Specifications:

Resistance:	0.001 to 999 $\Omega$ displayed*
Impedance:	0.001 to 999 $\Omega$ displayed*
Inductance:	0.001 to 9.999 H
Phase Angle	0-90 degrees
Current/Frequency Response (I/F)	-100% to + 100%
Capacitance:	0.01 $\mu$ F to 200 $\mu$ F
Insulation Resistance:	0 to >99 M $\Omega$ , 500 and 1000V test voltages
Measurement Accuracy	$\pm$ 1% for all parameters
Test Frequency	100, 200, 400, 800 Hz
Display:	3-line alphanumeric LCD with backlight
Size	4.8 x 9.92 x 2" (122 x 252 x 50 mm)
Weight	1.7 lb/0.75 kg
Power	Internal NiMH rechargeable battery pack

\*Higher measurement values can be displayed on the computer

**Each Unit Includes:** Case, Charger, Test Leads, PC Interface Cable, and Trend 2003 software

### Optional Accessories

- **ATF11 Armature Test Fixture:** for bar-to-bar testing of DC motor armatures in disassembled motors
- **M2000 Training Motor:** A 1/3 HP 3-phase motor with known switch-selectable faults.
- **EMCAT Software:** Comprehensive software for diagnostics and trending of AC motors, DC Motors, single phase motors, and transformers.
- **Motor Circuit Analysis Book** *Motor Circuit Analysis: Theory, Application and Energy Analysis* by Dr. Howard W. Penrose, Ph.D., an essential tool for the motor circuit analyst.

### Packages

**ALL-TEST PRO Advanced Analysis Kit:** For enhanced capability in 3-phase motor diagnostics, select the Advanced Analysis Kit. Each ALL-TEST PRO Advanced Analysis Kit Includes: ALL-TEST IV PRO 2000 analyzer, ALL-TEST PRO 31 or ALL-TEST III, manuals and guidebooks, leads, chargers, cases, Trend 2003 software, the *Motor Circuit Analysis: Theory, Application and Energy Analysis* book, an ATF-11 and an M2000 training motor. Used together, these tools offers highly accurate test results and analysis.

**ALL-TEST PRO Professional Kit:** For maximum capability in motor Predictive Maintenance, diagnostics and management, select the Professional Kit. It expands on the capabilities of the Advance Analysis kit through the addition of EMCAT software. Used together, these tools deliver unparalleled capability to both new and established Predictive, Preventive and Reliability based Maintenance Programs.

**NEW!** ALL-TEST PRO OL (on-line testing) adds the power of Motor Circuit Signature and Power Quality Control to the Professional Kit (see above).



ATF11



M2000 Motor



EMCAT Software



Motor Circuit Analysis Book



#### ALL-TEST Pro, a Division of BJM Corp.

123 Spencer Plains Rd.  
 Old Saybrook, CT 06475  
 Tel 800 442-2562  
 860 399-5937  
 Fax 860 399-7784  
 Web www.alltestpro.com

#### Represented by: