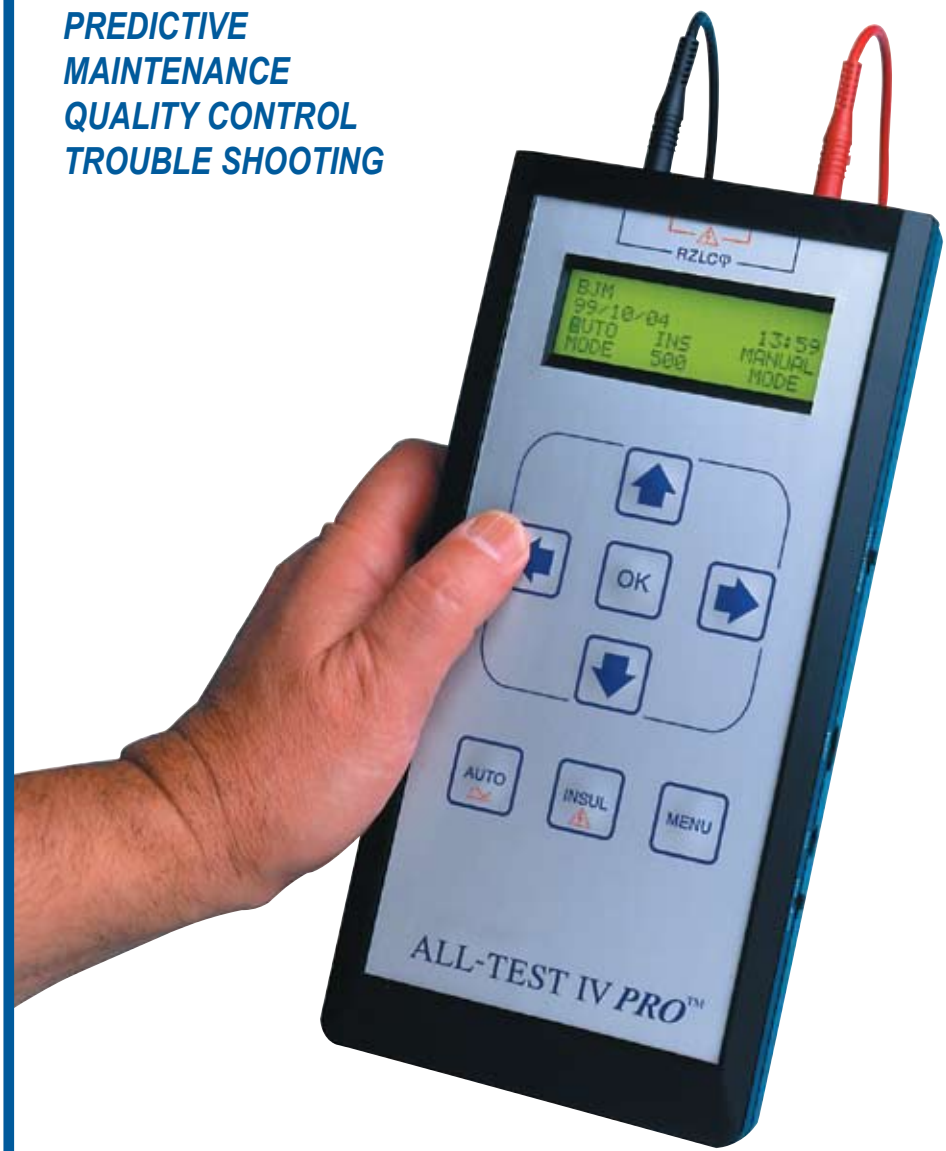
ALL-TEST IV *PRO*™

Motor Circuit Analyzer

PREDICTIVE
MAINTENANCE
QUALITY CONTROL
TROUBLE SHOOTING



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.
- Fast – testing only takes a few minutes and will 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.

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

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.

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

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.

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

Troubleshooting

If the motor system quits running, the ALL-TEST IV *PRO*™ evaluates the connections, cable and motor right from the starter, VFD, or disconnect. Takes the guess-work out of determining if you have a Mechanical or Electrical problem.

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*™ also tests capacitors). The capacitor was much easier and less expensive to replace than the motor. Without the ALL-TEST *PRO*®, 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*™ finds the faults you can't see with any other hand-held 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

ALL-TEST IV *PRO*™

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 IV *PRO*™ 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 *PRO*™ 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 motors (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.

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 virtually 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 electrical 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*™ Motor Circuit Analyzer performs 5 measurements on each of the three winding phases:

- Winding resistance, impedance, and inductance is measured
- 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 3 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 instrument for electrical motor evaluation!

TREND™

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

- **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*™**
- **Gives you built-in report generator**
- **TREND™ is included with the ALL-TEST IV *PRO*™ and it is compatible with our flagship software package, EMCAT *PRO*™**

TREND™ combines with your ALL-TEST IV *PRO*™ 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.

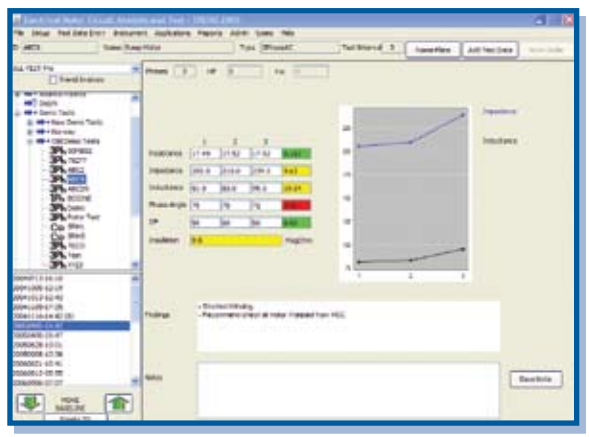
Motor Diagnostics for Troubleshooting
TREND™ takes the guesswork out of interpreting test data. It provides a tabular and graphic view of the results, applies proprietary algorithms and automatically diagnoses likely motor faults on the screen. A built in report generator is included for printer output.

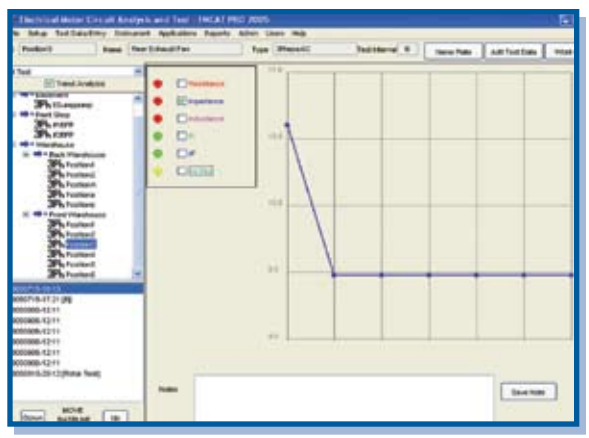
Motor Trending for Predictive Maintenance
For condition monitoring, all measurements can be trend-graphed. Increasing unbalances give you advance notice of deteriorating conditions. Planning for repairs and avoiding unscheduled down-time saves money and aggravation.

Scheduling and Review
For scheduling purposes, TREND™ allows you to review motors to be tested by date and then record completed work. You can even record test data from other technologies like infrared.

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

Upgradeable to EMCAT *PRO*™
Our EMCAT *PRO*™ motor management software adds diagnostics and trending for DC motors and Transformers as well as a powerful rotor diagnostic tool. TREND™ can be easily upgraded to EMCAT *PRO*™.





EMCAT PRO™ *Rotor Test*

Electric Motor Circuit Analysis Tool (EMCAT *PRO*™ Sotware)

EMCAT *PRO*™ is our flagship software package for motor management. Designed with input from our largest users, it expands on the capabilities of TREND™.

- Expanded diagnostics and trending to include DC motors, transformers, and single-phase motors.
- Rotor diagnostic module.
- Modular interface capability with CMMS programs.
- EMCAT *PRO*™ Enterprise network version.

Specifications:	
Resistance:	1 to 999 Ω [1]
Impedance:	1 to 999 Ω [2]
Inductance:	1 to 9999mH [3]
Phase Angle:	9-90 degrees (whole number)
Current/Frequency Response (I/F):	0-99% (whole number)
Capacitance:	0.2 µF to 200 µF
Insulation Resistance:	0.1 to >99 MΩ, 500 and 1000V test voltages
Measurement Repeatability:	+-1% for all parameters except as noted below Phase Angle- +-1 degree Current/Frequency Response (I/F) +-1 digit Capacitance- +-5% Insulation Resistance- +-5%
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

[1] Auto & Manual mode displays from 0.001 to 999
[2] Manual mode displays from 0.001 to 999
[3] Manual mode displays from 0.001 to 9999mH

Each ALL-TEST IV *PRO* includes:

Case, Charger, Test Leads,
PC Interface Cable, and TREND™ software.

Optional Accessories

- **ATF11 Armature Text 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 *PRO* Software:** Comprehensive software for diagnostics and trending of AC motors, DC Motors, single phase motors, and transformers.

ATPRO-115E or - 230E The ALL-TEST *PRO*® Professional System

Our most comprehensive package for off-line diagnostics and predictive maintenance. It combines the basic troubleshooting and real-time rotor test of the ALL-TEST *PRO*® 31, the analytical and trending power of the ALL-TEST IV *PRO*™, and the motor management capabilities of the EMCAT *PRO*™ software. EMCAT *PRO*™ software supports AC and DC motors of all types, as well as coils, transformers, and even single phase motors. Used together, these tools deliver unparalleled capability to both new and established predictive, preventive and reliability based maintenance programs.

Includes: ALL-TEST IV *PRO*™ analyzer, ALL-TEST *PRO*® 31, manuals and guidebooks, leads, chargers, cases, EMCAT *PRO*™ software (requires Windows XP or greater), Condition Calculator™software, an ATF-11 armature test fixture and an M2000 training motor.

ATPOL II – ALL-TEST *PRO*® OL II (On-line testing) adds the power of Electrical Signature Analysis and Power Analysis to the Professional System (see above).

Specifications subject to change without notification.

ALL-TEST *Pro*, LLC

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