Electric Motor Test Systems
Comprehensive Test Solutions for all kinds of Electric Motors
Customisable for application specific End-of-Line and In-Process Testing requirements

Crest Technology is a pioneering company in the field of Test & Measurement which specializes in designing and manufacturing speciality test solutions for Motor Manufacturers, Power Sector, Metros & Railways, Battery Industry, and Test & Certification Labs.

Crest has an experience of developing test systems for End-of-Line and In-Process Testing for various kinds of motors. We also have an in-house facility for custom designing precision mechanical test fixtures according to the shape and size of the motors to be tested. Depending on the motor type, a vast suite of tests are available right from torque-speed characteristics and current and voltage measurements which are common for almost all types of motors, to a specific type of tests which are applicable only to a particular motor type. These tests help the manufacturer to determine that the manufactured motors conform to the specified performance parameters and are free from any manufacturing defects.
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**Electric Motor Test Systems**

- **Currents**
  - No load current
  - Starting current
  - Full load current
  - Locked rotor current
  - Phase currents
  - Current undulation

- **Voltages**
  - Starting voltage
  - Capacitor voltage
  - Generated voltage
  - Phase voltages
  - Back emf

- **Resistances**
  - Stator winding resistance
  - Rotor winding resistance
  - Insulation resistance

- **Winding inductance**

- **Torque**
  - Pull-in torque
  - Pull-out torque
  - Pull-up torque
  - Detent torque
  - Rated torque
  - Peak torque
  - Breakdown torque
  - Stall torque
  - Holding torque
  - Switching torque
  - Friction torque
  - Ripple torque
  - Locked rotor torque
  - Torque constant

- **Power**
  - Input power
  - Output power
  - Power factor
  - Efficiency
  - Copper loss
  - Bearing friction and windage loss

- **Speed**
  - Torque speed characteristics
  - Current speed characteristics
  - Voltage speed characteristics
  - RPM, RPS

- **Frequency**
  - Running frequency
  - Slip frequency

- **Direction of rotation**

- **Step angle**

- **Linear travel**

- **Noise measurement**

- **Vibrations measurement**

- **Locked rotor test**

- **Temperature rise test**

- **HV test**

- **Encoder parameters**
  - Jitter
  - Phase error
  - Mechanical error
  - Frequency
  - Duty cycle

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**Types of Motors We Test**

- **AC motors**
  - AC synchronous motors
  - AC induction motors
  - AC traction motors and gearbox

- **DC motors**
  - Permanent magnet DC motors (or brushed DC motors)
  - Miniature brushed DC motors
  - Brushless DC motors (BLDC)

- **Stepper motors**
  - Unipolar stepper motors
  - Bipolar stepper motors
  - Disc magnet motors

- **Linear actuators**

- **Universal motors**

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**A List of Tests & Measurements We Perform**
1-phase/3-phase AC Induction Motor Test System

The AC Induction Motor Test System is used for assessing the performance and performing quality analysis on AC Induction motors by using a regenerative load, optical encoder and reaction torque sensor/load cell arrangement. The system makes use of a PMDC motor as a generator which acts as a load and a sophisticated regenerative module that feeds the generated power back to the motor under test. This technology ensures that the system consumes very little power from the mains supply even during the full load test. It makes use of a reliable and robust production-class hardware for accurately measuring various parameters by performing a number of tests sequentially. A precision machined mechanical fixture is used for securing the motor to have minimal axial misalignments with the measuring hardware. All measurements are made by the system according to the parameters selected by the user and the test results are displayed on a PC for evaluation.

Measurements
- Torque
- Speed
- Current
- Voltage
- Input power
- Output power
- Efficiency
- Power factor
- Copper loss
- Bearing friction and windage loss

Brushed DC Motor Test System

The Brushed DC Motor Test System is used for assessing the performance and performing quality analysis on Brushed DC motors by using a regenerative load, optical encoder and reaction torque sensor/load cell arrangement. The system makes use of a PMDC motor as a generator which acts as a load and a sophisticated regenerative module that feeds the generated power back to the motor under test. This technology ensures that the system consumes very little power from the mains supply even during the full load test. It makes use of a reliable and robust production-class hardware for accurately measuring various parameters by performing a number of tests sequentially. A precision machined mechanical fixture is used for securing the motor to have minimal axial misalignments with the measuring hardware. All measurements are made by the system according to the parameters selected by the user and the test results are displayed on a PC for evaluation.

Measurements
- Torque
- Speed
- Current
- Voltage
- Input power
- Output power
- Efficiency
- Copper loss
- Bearing friction and windage loss
The Universal Motor Test System is used for assessing the performance and performing quality analysis on Universal motors by using an electronically controlled brake, optical encoder and reaction torque sensor/load cell arrangement. The selection of measurement components is done keeping in mind the high RPM and low torque nature of universal motors. The system also has built-in selectable AC and DC power supplies. It makes use of a reliable and robust production-class hardware for accurately measuring various parameters by performing a number of tests sequentially. A precision machined mechanical fixture is used for securing the motor to have minimal axial misalignments with the measuring hardware. All measurements are made by the system according to the parameters selected by the user and the test results are displayed on a PC for evaluation.

**Measurements**
- Torque
- Speed
- Acceleration
- Current
- Voltage
- Direction of rotation

The Miniature PMDC Motor Test System is useful for assessing the performance and performing quality analysis on Miniature High-Performance Brushed PMDC motors. It makes use of a reliable and robust production-class hardware for accurately measuring various electrical and physical parameters by performing a number of tests sequentially. All measurements are made by the system according to the parameters selected by the user and the test results are displayed on a PC for evaluation.

**Measurements**
- Torque
- Torque constant
- Speed
- Voltage
- Current
- Current undulation at rated voltage
- Rotor winding resistance
- Direction of rotation

*Additional parameters can be measured as per the requirement*

The Stepper Motor and AC Synchronous Motor Test System is used for assessing the performance and performing quality analysis on Stepper and AC Synchronous motors by using an electronically controlled brake, optical encoder and reaction torque sensor/load cell arrangement. It makes use of a reliable and robust production-class hardware for accurately measuring various parameters by performing a number of tests sequentially. A precision machined mechanical fixture is used for securing the motor to have minimal axial misalignments with the measuring hardware. All measurements are made by the system according to the parameters selected by the user and the test results are displayed on a PC for evaluation.

**Measurements**
- Torque
- Speed
- Current
- Voltage
- Direction of rotation
Stepper Motor Step Angle Measurement System

The Step Angle Measurement System is used for measuring the step angle of Unipolar and Bipolar Stepper Motors. It makes use of a reliable and robust production-class hardware for accurately measuring the step-angle using a high-resolution Hall-effect sensor. A precision machined mechanical fixture is used for securing the motor to have minimal axial misalignments with the measuring hardware. All measurements are made by the system according to the parameters selected by the user and the test results are displayed on a PC for evaluation.

**Measurements**
- Step angle of Stepper Motor in CW and CCW
- Scatter in step angle in CW and CCW

BLDC Motor Test System

The Brushless DC (BLDC) Motor Test System is an End-of-Line Test System which performs a number of mechanical and electrical tests on BLDC motors. This test system is capable of testing 2-wire, 3-wire, 6-wire, 8-wire and 9-wire BLDC Motors ranging from 6 V to 48 V. Test parameters related to a large variety of BLDC Motors can be pre-programmed using a PC and stored in the memory and relevant parameters can be loaded when testing a motor of a particular type and rating. The system is capable of testing motors running as high as 40,000 RPM in real time.

**Measurements**
- Torque
- Torque constant
- Speed
- Current
- Voltage
- Resistance
- Inductance
- Back emf
- Thermistor voltage
- Enable/Disable logic
- Direction of rotation
- RPM
- Encoder PPR (up to 99,999 PPR)
- Phase error on A & B pulses
- Encoder current
- RPM

Additional parameters can be measured as per the requirement

Linear Actuator Test System

The Linear Actuator Test System is an End-of-Line Test System for measuring the stroke length of Linear Actuators under a specified load using precision length gauges. It makes use of a built-in power supply and driving circuit for driving the Linear Actuator. A pneumatic arrangement for raising and lowering the brass weights (load) onto the motor shaft is provided. Reliable and robust production-class hardware is used for accurately measuring the output of the length gauges. All measurements are made by the system according to the parameters selected by the user and the test results are displayed on a PC for evaluation.

**Measurements**
- Linear travel
- Displacement vs angular rotation characteristics
- Backlash
- Hysteresis
Features of EOL Test Systems

**Hardware**
- PC-based fully automatic test systems
- Fully modular with option of NI DAQ or any other third-party hardware platforms
- Built-in power supplies with drivers to drive motors of specified ratings with stable and reproducible testing conditions
- A precision-machined mechanical fixture for securing the motor to have minimal axial misalignments with the measuring hardware
- Provision for connecting external capacitor, resistor, and external power supplies, if required
- LED Indications for showing test in progress, test pass, test fail, and system status
- Barcode scanning facility can be provided

**Software**
- Windows-based software running on a touch-screen PC to program test parameters, carry out measurements, collect results, view graphs for detailed analysis, and generate reports which can be stored in excel format
- All test parameters and conditions for a motor type are stored in a pre-programmed database
- The software has facility to check and validate individual parameters of a test item at any instance of time
- Test certificate can be stored and printed as per the manufacturer’s format
- Special Engineering Mode, which is useful for debugging and new motor development

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**Motor Generated Voltage (GV) Tester**

The Motor GV Tester helps to measure the winding resistance and generated voltage of fully assembled Brushed DC, Unipolar Steppers, Bipolar Steppers, and AC Synchronous motors. The motors can be tested in a clockwise and anti-clockwise direction at specified RPMs. The system has a very simple and easy to operate user interface with an LCD screen for displaying test results. Bellow couplings of various sizes are provided so that the full range of motors can be tested. Additionally, there are BNC connectors provided on the front panel of the system for connecting an oscilloscope and viewing the graphs of various windings.

**Measurements**
- Generated voltage (GV)
- Winding resistance

**Features**
- Can measure Motor GV as well as Winding Resistance
- Motor is driven at a servo-controlled RPM
- Setting for varying the RPM
- Variable resistance setting
- Compact bench top construction
- Simple analog user interface with LCD display for displaying Motor GV and Winding Resistance
- The system is constructed in a modular design and all the assemblies are provided with plug-in connectors for easy maintenance.

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**Encoder Test System**

The Encoder Test System is useful for measuring the performance and performing quality analysis for standalone and motor mounted Encoders. It uses a reliable and robust, production-class, embedded hardware for accurately measuring various electrical and physical parameters of encoder performance by performing a number of tests. A powerful multi-processor logic ensures high-speed measurements which are essential to check Motor and Encoder parameters in real time. If a tachometer is fitted on the motor, the system can also the GV parameters. All measurements made by the system are according to the test conditions selected by the user.

**Measurements**
- Encoder PPR (up to 99,999 PPR)
- Duty cycle of A & B pulses
- Phase error on A & B pulses
- Mechanical error
- Jitter
- Duration of Z pulse
- Encoder current
- Frequency
- RPM
- Direction of rotation

**Features**
- Built-in power supply of suitable rating
- 4-line LCD to show all the results in one view
- Report generation
- Built-in EEPROM programming hardware to load the error compensation table for MR-type (Magneto Restrictive) encoders can be provided
- Can be provided with Windows-based software for test control and waveforms storage and analysis facility
- Dual mode operation: tester & simulator
In-process Testing (IPT) Equipment

Motor Winding Resistance Tester

The Motor Winding Resistance Tester is used for measuring the values of individual windings of rotors of permanent magnet DC motors. The system automatically measures the resistance of each winding in a sequence and compares the results with pre-set limits to decide Pass/Fail criteria of the motor. It can carry out tests in Loop Mode or Cross Mode. It is a universal test system, capable of testing any motor having up to 13 windings. The system is supplied with a custom test fixture which helps to perform tests and maintain test integrity.

Miniature Gearbox Tester

The Miniature Gearbox Tester is used to find errors in mechanical assembly of miniature gearboxes used in PMDC motors. Ten different types of gearboxes can be tested using this instrument. The errors in mechanical assembly of driving motor coupled to the gearbox result in small changes in motor current, which are measured by using a highly sensitive Hall-effect sensor.

Motor Magnet Polarity Detector

The Motor Magnet Polarity Detector is a simple productivity aid which ensures that the polarity marked on the motor matches with the direction of rotation of the motor. It is based on a highly sensitive Hall-effect sensor that is capable of reading the weak magnetic field which is leaked to the outer surface of the motor body. This detection is useful for aligning the brush end-cap with respect to the magnetic pole pieces residing inside the body of the motor. An LED is used to indicate that the alignment is correct.
The Direction Check Unit is, essentially, a useful productivity aid which can verify whether the shaft of the motor is rotating in the correct direction or not. The unit consists of a disc which is rotated by means of the shaft of the motor being tested. Depending on the direction of rotation of the disc, the unit detects whether the shaft of the motor is rotating in the correct direction or not. In case the shaft is rotating in the opposite direction, the Fail LED glows and a buzzer is sounded. There is a provision in the unit to set the passing criterion of the motor as clockwise or counter-clockwise.

The RMB Core Open-Short Tester is a simple productivity aid for identifying short circuits in the commutator segments that may have occurred during moulding and turning processes. The system is supplied with a custom test fixture with special spring-loaded test probes which help to make contact with the commutator segments at multiple locations. A test voltage of 100V DC is applied across adjacent segments. The system detects a short circuit condition when the current flowing through voltage source exceeds a predetermined value. The system is also capable of detecting short circuits between the shaft and the segments.

The Rotor GV Tester is used for testing the uniformity of magnetization of rotors used in Stepper and AC Synchronous motors. The shaft of the rotor is coupled to a driving motor through a collet arrangement. A precision machined test fixture with pneumatic control is used for loading the rotor and running the test. The rotor is driven at a typical, servo-controlled RPM of 1500 or 1800. The operator manually selects the direction of rotation and RPM. A set of push-wheel switches is provided for setting the GV Limit. There is a quick connect arrangement for making electrical connections with the stator coil that is used for testing the rotors. The stator coils which are secured on a moving slide are inserted into the rotating rotor. Digital voltmeters are used for displaying the GV values.
Motor Drivers and Power Sources

AC Synchronous Motor Driver with Power Source

The AC Synchronous Motor Driver has a variable AC power source and a control circuit to drive AC Synchronous motors of all specifications. The AC Synchronous Motor Driver is available in benchtop configuration but can also be provided in a 3U chassis-mount construction. The operator can set the values for operating voltage, operating frequency, internal capacitor, and direction of rotation, depending on the specifications of the motor. There is also a provision for connecting external capacitors, resistors, and power supply.

Stepper Motor Driver with Power Source

The Stepper Motor Driver has a variable DC power supply and a control circuit to drive Unipolar and Bipolar motors of all specifications. The Stepper Motor Driver is available in benchtop configuration but can also be provided in a 6U chassis-mount construction. The operator can set the values for operating voltage and PPS rate, and select the direction of rotation, motor type (unipolar/bipolar), and drive (half step/full step/ wave drive), depending on the specifications of the motor. There is also a provision for connecting an external power supply. Additionally, chopper drive, indexer, and microstepping can be offered if required as add-ons to the standard configuration.

Sine-Cosine Driver

The Sine-Cosine Driver is used to drive Bipolar Stepper motors and Disc Magnet motors for evaluating the noise and vibration performance of the motors used in critical applications. The signal generation and amplification stages of the Sine-Cosine Driver are based on pure analog circuitry which results in a very low harmonic distortion output. The driver uses two independent high-compliance adjustable current sources for driving the Bipolar Stepper and Disc Magnet motor windings. The driver output frequency is also adjustable for precise noise and resonance evaluation at speeds of 10 to 4000 RPM. The RMS current for each phase and the frequency are displayed on independent digital displays. Necessary indications and protections are provided to prevent the driver amplifiers from getting damaged due to an overload condition.

Features of Motor Drivers

- Easy to operate with simple manual controls
- Built-in power supplies for stable and reproducible testing conditions
- Electrical connections are made using quick connect arrangement
- Provision for connecting external capacitor and resistor, if applicable
- Provision for connecting an external power supply
- Provision for connecting an oscilloscope
- Individual displays for showing various setting values
- Easy to maintain compact bench top construction
The Motor Burn-in Station is a fully-computerized turnkey solution for performing burn-in on various types of motors. The burn-in process ensures smoother commutation and improves the motor life. It is also useful for detecting the motors with bad centering, cracked magnets, defective bearing assemblies, etc.

The Motor Burn-in Station is developed on an embedded platform with a Windows-based PC software for programming the burn-in parameters, controlling the burn-in process, and monitoring the status of each channel. The system consists of an acoustic enclosure with air inlet and exhaust ports for providing uniform air circulation. Built-in power supplies with drives suitable for testing motors of the specified type and rating ensure unmatched performance. The system has all the necessary protections and safety interlocks for safe operation.

**Features**
- Fully-computerized system with Window-based software for programming burn-in parameters, setting limits, and monitoring status of each channel
- Display of individual motor current and temperature in the software during the burn-in process
- Facility for generating test reports through the software
- Specially designed acoustic enclosure having fresh air circulation
- Built-in power supplies and drivers suitable for the specified motor type and ratings.
- Status LEDs and alarms for indicating burn-in status and fault conditions

![Motor Burn-in Station Diagram](image)

**Hardware Options**
- Embedded-based
- PLC-based
- NI-based
- Third-party hardware integration

**Construction**
- Table-top
- In-line
- Workstation
- 19" rack

**RPM sensor type**
- Optical encoder
- Tacho generator
- Slot wheel
- Proximity
- Angle encoder

**Coupling type**
- Collet
- Bellows
- Beam
- K-type
- Jaw

**Source type**
- 1-phase
- 3-phase
- DC
- VFD
- Unipolar stepper
- Bipolar stepper
- Sine/cosine
- Synchronous
- BLDC

**Load type**
- Magnetic particle
- Hysteresis
- Eddy current
- DC generator

**Motor type**
- AC induction
- AC synchronous
- Universal
- Brushed DC
- Miniature brushed DC
- BLDC
- Stepper
- Disc magnet

**Power type**
- 110 V AC
- 230 V AC
- 415 V AC

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![Motor Burn-in Station Diagram](image)
Our other areas of application:

- LV, MV, HV and EHV Switchgear
- Automotive EOL Applications
- Miniature Motors
- Electromechanical Relays
- Electronics of Metro Trains and Railways
- Batteries of all types
- Machine vision