

# RQA 125/ATS

## Rotor Quality Analyzer



### Features

- Fully automatic testing and hand-ling of test rotors.
- 100% QC monitoring with short feed back loop in case of manufacturing problems.
- For integration to automated manufacturing lines.
- Facilitates inter-active SPC - In-process Monitoring and Correction.
- Quick payback on investment due to enormous cost savings.
- Easy set-up for different type of rotors to be tested.
- RQA Software including Statistics and Zoom package.

### Introduction

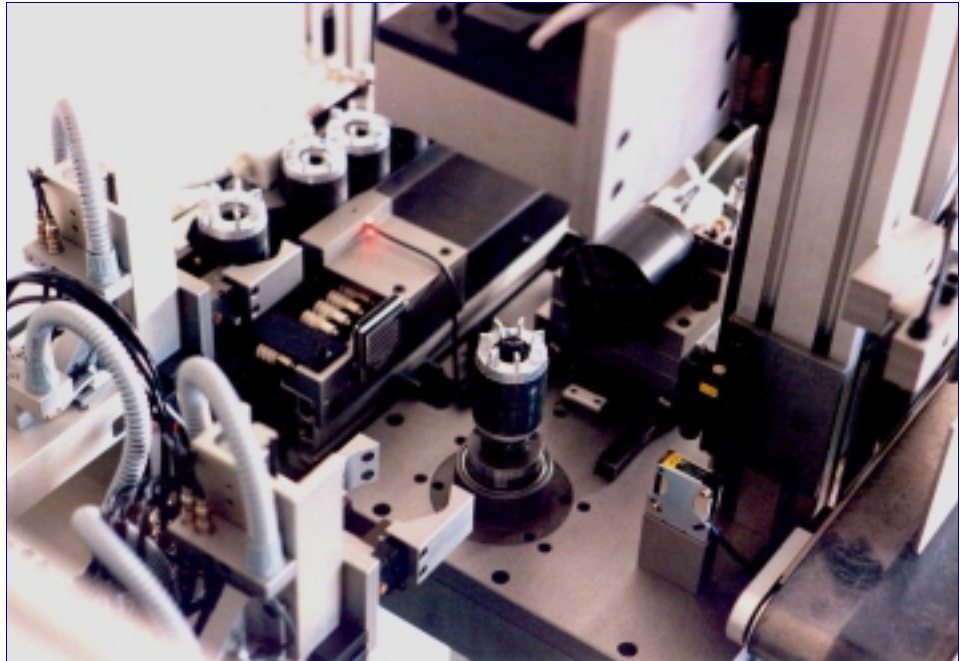
Computer controlled evaluation technique for rotor quality control in an industrial environment. This Fully-Automated system automatically feeds test rotors into the inductive and power measurement test cell with a 3-axis dual arm handling system. Once a rotor has been loaded into the test cell, all measurements and result evaluations are conducted, processed, evaluated, and stored for statistical evaluation. Good and bad rotors are automatically separated after the *Automatic Handling System (AHS)* removes the tested rotor from the test cell.

These testing procedures are used for the detection of the following quality problems:

- Broken or interrupted rotor bars as well as no connection to the short circuit rings.
- Missing material in the rotor bar (incomplete injection) or air enclosures (porosity) as well as poor connections to the end rings.
- Deviation of the rotor bar angle relevant to the axis (skew).
- Changes in the consistency of the aluminum alloy and/or the iron core.
- A short circuit between two or more rotor bars (soldering).
- Faults in the end rings.
- Resistance errors ( $R_2'$ ) in the rotor as a whole, and/or in the end rings.
- Reactance errors ( $X_2'$ ) in the magnetic conductivity of the rotor core.

## System Description

The RQA125/ATS Rotor Quality Analyzer is an automated tester for squirrel cache die cast rotors including feeding, handling and good/bad separation of rotors - designed for 100% QC testing in automated manufacturing lines. It is consisting of the automated test station and a 19" measuring and control cabinet. The automated test station combines all of the mechanical elements of the



inductive and power measurements and the 3-axis rotor handling system. Once parameter tolerances have been selected and mechanical settings made, this unit runs completely automatically without operator intervention. The feeding of rotors into the Automatic Handling System (AHS) is facilitated via a continuous slip grid conveyor and a single pass separation unit with built in rotor temperature measurement station. Rotors are removed via a regular conveyor belt where the reject rotors are automatically separated.

A user-friendly safety enclosure with access doors on either side guarantees for operator security. A control panel built into the front side of the enclosure allows for selection of automatic/manual mode and manual controls of the complete station with single step feature for set-up. The fully automated test station is specifically designed for testing rotors without shafts according to customer specifications. The required tooling needs to be clarified and quoted separately.

An electrical cabinet mounted in the frame of the test station is integrating all electrical supply and control components, PLC, variable frequency drive as well as interfacing to the measuring and control cabinet.

The Control Cabinet is containing an industrial PC, opto-isolated I/O modules, data acquisition card, power meter and all other required interfacing components. It is also housing the 15" VGA monitor and a fold out keyboard.

The computer is responsible for the accept/reject judgment of rotors according to a pre-programmed set of parameter tolerances. Computer controlled evaluation ensures absolute accuracy and consistency in both the measurement and evaluation process. The measuring and control unit is housed inside an industrial enclosure with an IP55 protection rating.

## Advanced Testing Software

- User friendly menu-driven software for automatic Accept/Reject evaluation of rotors according to user selected parameter tolerance levels.
- Automatic set-up of all measurement and evaluation procedures (parameter tolerances) via the selection and retrieval of the *Master Parameter File* (reference rotor),
- Automatic learn feature to establish new *Master Parameter Files* for additional type of rotors to be tested.
- Mechanical set-up specifications for rotor type tested via the *Master Information Menu*.
- Temperature compensation of resistance values to 20 °C.
- Automatic fault classification into different error types

Error I - Broken or interrupted rotor bars

Error II - Minimum amplitude

Error III - Maximum amplitude

Error IV - Deviation of amplitudes

Error V - Slope error

Error VI - Over-all evaluation error

Error VII - Resistance (R2') error

Error VIII - Reactance (X2') error

- Integrated counter for the total number of tested and failed rotors, and a complete record of the specific type and frequency of fault errors is recorded.
- Complete statistics package to facilitate a complete and thorough analysis of both rotor quality and productions capability via the SPC concepts of in-process monitoring and correction on either an audit or 100% QC basis. Presentation of the statistics is facilitated with histograms and chronological occurrence charts for all different parameter tolerances.

- Interactive parameter tolerance functions via a "what if" approach in combination with the present and recommended  $C_p$  and  $C_{pk}$  values.
- Zoom function for rejected rotors automatically records all measurement results including the inductive waveform for more thorough analysis of the fault mechanism.
- Printout for Statistics and Zoom on external printer - not included in the scope of supply.

### Operation and Test Station set-up procedures

- Select the appropriate rotor type from the *Master Parameter File*. All evaluation parameters are set with the rotor type selection.
- Access the *Information Menu* to review all the mechanical settings for the selected rotor type.
- Adjust settings according to *Information Menu* including:
  - type and size of expandable mandrel.
  - type and height of the power measurement stator, utilizing the quick change stator plates and vertical position ruler.
  - forward position of the inductive sensor (with built in micro-meter).
- Establish file name and path for the desired accumulation of statistical data.
- Ensure supply of rotors to the input conveyor and initialize automated testing.
- The complete test cycle is performed automatically within 8 sec.

Complete change over time to different rotor type is less than 5 min.

## Technical Data

<b>Rotor Quality Analyzer Model</b>	<b>RQA 125/ATS</b>
<b>Maximum rotor dimensions</b>	outside Ø 70mm, stack length 80mm - without shaft, flat bottom ending !
<b>Loading of test rotors</b>	automatically via slip grid conveyor, dual arm 3-axis handler and regular conveyor with separation of good/reject rotors
<b>Testing cycle / time</b>	Fully automatic / minimum 8 seconds including handling
<b>Testing methods</b>	Inductive test for rotor bar analysis and resistance/reactance test for general quality and performance
<b>Industrial PC</b>	Industrial PC min. 400Mhz, HD 10GB, Floppy Disk, CD-ROM, A/D Data Acquisition Card, Optically Isolated I/O Board
<b>Automatic controls by</b>	PLC
<b>Rotor clamping mechanism</b>	modular Precision Dual-conic Expandable Arbor Rotation Mechanism for rotors without shaft - custom made items
<b>Rotor rotation for test by</b>	Variable frequency drive and reluctance synchrone motor
<b>Pneumatic activation of</b>	Rotor Clamping, Movement of Inductive Sensor and Movement of Measuring Stator on mechanical slide with precision linear guides
<b>Rotor temperature measurement</b>	Rotor Temp. Measurement Station with PT100 built into single pass separation unit
<b>Measuring stator</b>	Moulded measuring stator with built in temp. sensor and quick change connector, mounted to special holding plates with precision guiding bolts for exact placement - required for each rotor family. Supplied on extra cost - original stators according to Deltatronic specification to be supplied by customer. Adjustable position of mechanical slide for positioning of stator towards test rotor
<b>Inductive sensor</b>	With exchangable Pole Shoes to match different rotor stack length, auto angle adjustment via software and stepper motor, adjustable gap towards the test rotor (micrometer)
<b>Operator security</b>	interlock contacts in access doors for protection, emergency STOP button
<b>Pneumatic system</b>	with water separator, pressure gauge, soft start facility and monitoring of minimum pressure, control valves Requested Supply: Dry pressured air, minimum 6 bar
<b>Electrical Supply</b>	Single phase 230V, 50/60 Hz or 110V, 50/60Hz to be specified with purchase order
<b>Dimensions approx.</b>	Test Station: Width 1.500mm, depth 1.100mm, height 1.820mm Control Cabinet: Width 610mm, width 620mm, height 1700mm
<b>Packing (box for air freight)</b>	Test Station: length 160cm, width 120cm, height 200cm Control Cabinet: length 200cm, width 80cm, height 80cm
<b>Weight approx.</b>	net 680 kg, gross 850 kg

Due to the Company's continuous research program, the information above may change at any time without previous notification.  
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**EURO-TESTS**  
 Les bureaux de Sèvres, 2 rue Troyon  
 92316 SEVRES cedex - FRANCE  
 Tel +33 (0)1 41 14 83 31 Fax +33 (0)1 41 14 83 01  
 eMail [information@euro-tests.com](mailto:information@euro-tests.com)  
 Web [www.euro-tests.com](http://www.euro-tests.com)