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Techspecs
122 South 4th Avenue • Pasco, WA 99301 • Phone: 509-544-0720 • Fax: 509-544-0868
website: www.uniwest.com • e-mail: info@uniwest.com

ETC-2000 / ETC-3000

Semi-Automated Eddy Current Scanning Systems

Technical Specifications

The modularity of ETC Systems offers extreme flexibility in adapting to diverse inspection requirements for cost-effective lean-cell inspection processes in manufacturing or overhaul of critical components.

The fully multi-axis-compatible systems are comprised of 3 fixed axes of motion (Vertical, Scanner Axis Rotary and Turntable Rotary) and freely-orientable M-axis drives. The capability of orienting the M-axes in any direction in 3D-space allows these systems to attain travel accuracies not achievable with conventional 6 or higher order robotic drive systems.

The following document outlines the minimum technical specifications of the systems and their drive characteristics.

Electrical

- Input Power Requirements: 85-265 VAC, 47-63 Hz, Single Phase, 20 Amp
  Typical: 110-240VAC, 50-60Hz, 20 Amp
- Operating Temperature Range: 0ºC to +40ºC (32ºF to +104 ºF)

Note: We highly recommend using at least a 1500 Watt Uninterruptible Power Supply (UPS) for proper shut-down in case of mains power failure and an AC-Line-Conditioner with appropriate grounding.

Measurements

The following measurements are based on system-alignment with the base platform with system drives engaged. The symbol "<" signifies "less than".

Rotational Axes ("C" and "T")

- **C – Axis (Scanner Head)**
  - Angular Position Accuracy: <0.01 degree/revolution
  - Resolution: 0.01 degree (software); <0.001 degree (physical)
  - Angular Repeatability: 0.01 degree (software)
  - Vertical Axis Perpendicularity: <0.010 in/foot (<0.8mm/m)
  - Backlash: <0.01 degree (software)
  - Backlash, encoder controlled: <0.001" at 8.4" dia. (<0.03mm at 213mm dia.)
  - Speed / Speed Error: guaranteed to 18 RPM / <1% at constant velocity
  - Total surface run-out (part-mount dependent): <0.005" at 6" dia. (<0.13mm at 152mm dia.)
    <0.010" at 26" dia. (<0.26mm at 660mm dia.)
  - Concentricity: <0.003" (<0.08mm) (part centering)
  - Positioning repeatability: <0.001" (<0.03mm) (return-to-position)

- **T – Axis (Turntable)**
  - Angular Position Accuracy: <0.01 degree/revolution
  - Resolution: 0.01 degree (software); 0.0015 degree (physical)
  - Angular Repeatability: 0.01 degree (software)
  - Vertical Axis Perpendicularity: <0.010 in/foot (<0.8mm/m)
  - Backlash: <0.01 degree (software)
  - Backlash, encoder controlled: <0.001" at 6.0"dia. (<0.03mm at 152mm dia.)
  - Speed / Speed Error: guaranteed to 50 RPM / <1% at constant velocity
  - Horizontal Parallelism: <0.010 in/foot (<0.8mm/m) (part-mount dependent)
  - Total surface run-out: <0.005" at 12" dia. (<0.13mm at 305mm dia.) (part leveling)
  - Concentricity: <0.003" at 3" dia. (<0.08mm at 76mm dia.) (part centering)
    <0.005" at 12" dia. (<0.13mm at 305mm dia.)
    (part-mount dependent)
  - Positioning repeatability: <0.001" (<0.03mm) (return-to-position)
  - Work Piece Maximum Weight: 500 pounds (226 kg)

Linear Translation Axes ("X", "R" and, "M")

- **X – Axis (Vertical)**
  - Travel Distance — 17" (431mm) minimum
  - Position Accuracy — <0.005 in/foot (<0.5mm/m)
  - Resolution — <0.001" (<0.03mm)
  - Perpendicularity (any orientation) — <0.010 in/foot (<0.8mm/m)
  - Backlash — <0.001" (<0.03mm)
  - Positioning repeatability — <0.001" (<0.03mm) (return-to-position)

- **R – Axis (ETC-2132, ETC-2167) (Horizontal Motion only; for Systems pre-2006)**
  - Travel Distance — 5.7" (144 mm) minimum
  - Position Accuracy — <0.005 in/foot (<0.5mm/m)
  - Resolution — <0.001" (<0.03mm)
  - Straightness — <0.010 in/foot (<0.8mm/m)
  - Backlash — <0.001" (<0.03mm)
  - Positioning Repeatability — <0.005" (<0.13mm) (return-to-position)

- **M-Axis (ETC-2236) (Motion in any direction depending on fixturing)**
  - Travel Distance — 9" (228 mm) minimum
  - Position Accuracy — <0.005 in/foot (<0.5mm/m)
  - Resolution — <0.001" (<0.03mm)
  - Straightness / Parallelism — <0.003 in/foot (<0.3mm/m) to rail; <0.010 in/ft (<0.8mm/m) to base
  - Backlash — < 0.001" (<0.03mm)
  - Positioning Repeatability — < 0.001" (<0.03mm) (return-to-position)

- **M-Axis (ETC-2447) (Motion in any direction depending on fixturing)**
  - Travel Distance — 15" (380 mm) minimum
  - Position Accuracy — <0.005 in/foot (<0.5mm/m)
  - Resolution — <0.001" (<0.03mm)
  - Straightness / Parallelism — <0.003 in/foot (<0.3mm/m) to rail; <0.010 in/ft (<0.8mm/m) to base
  - Backlash — < 0.001" (<0.03mm)
  - Positioning Repeatability — < 0.001" (<0.03mm) (return-to-position)

- **M-Axis (ETC-2225) (Motion in any direction depending on fixturing)**
  - Travel Distance — 21" (533 mm) minimum
  - Position Accuracy — <0.005 in/foot (<0.5mm/m)
  - Resolution — <0.001" (<0.03mm)
  - Straightness — <0.005 in/foot (<0.5mm/m) to rail
  - Backlash — <0.001" (<0.03mm)
  - Position Repeatability — <0.001" (<0.03mm) (return-to-position)

Interface Modules (Base Platforms)

- **ETC – 4003 (small base, limited weight)**
  - Work Piece Minimum Diameter — 0.1” (2.5mm)
  - Work Piece Maximum Diameter — 32” (812mm)
  - Work Piece Maximum Weight — 200 pounds (90 kg)
  - Vertical Positioning — 22” (558mm) including translation axis
  - Platform — At ground level; stationary

- **ETC – 4004 (large base, ground-level)**
  - Work Piece Minimum Diameter — 0.1” (2.5mm)
  - Work Piece Maximum Diameter — 52” (1320mm)
  - Work Piece Maximum Weight — 500 pounds (226 kg)
  - Vertical Positioning — 32” (812mm) including translation axis
  - Platform — At ground level; stationary

- **ETC – 4006 (large base, elevated)**
  - Work Piece Minimum Diameter — 0.1” (2.5mm)
  - Work Piece Maximum Diameter — 52” (1320mm)
  - Work Piece Maximum Weight — 500 pounds (226 kg)
  - Vertical Positioning — 32” (812mm) including translation axis
  - Platform — 27” (685mm) above ground; mobile, with lockable wheels; with instrument rack.

Note: The above weight limits are part-mount dependent minima. By selecting appropriate materials and thicknesses of part-mounts higher weight-limits can be attained. All above measurements values depend on system configuration, age of system and alignment accuracies set during calibration.

Controller System

- Processor — Minimum 2.2 GHz Quad-Core or higher processor
- Hard Drive — Minimum 160 GB
- Video — Minimum 256 MB, dual-screen display capability
- Memory — Minimum 1 GB
- OS — Microsoft Windows XP Pro
- Monitor — 19 inch LCD Flat Screen, Color
- Accessories — DVD Read/Writer; Keyboard; Mouse
- Housing — Rack-Mount
- I/O — Ethernet Port; Serial Ports
- Data Acquisition — PCI multi-channel DAQ card (Nidaq 6032E or equivalent)
- Software — All Software Required for Scanner Operation, Data Acquisition, Display, and Storage

Signal Path (using US-454A instrument)

- Frequency Response 100 Hz to 10 MHz
- Probe Drive
  - Input Resistance 1000±100 Ohm
  - Output Resistance 9.5±2.5 Ohm
  - Maximum Input Voltage 8 Volt peak-to-peak, with a 50 Ohm to 1 kOhm load
  - Gain -0.1 dB to -3.0 dB
- Buffered Probe Drive
  - Input Resistance 1000±100 Ohm
  - Output Resistance 145-172 Ohm
  - Maximum Input Voltage 8 Volt peak-to-peak , with a 50 Ohm to 1 kOhm load
  - Gain -0.1 dB to -3.0 dB
- Receive Signals (Receive 1 and Receive 2)
  - Input Resistance 1000±100 Ohm
  - Output Resistance: 61±6 Ohm
  - Maximum Input Voltage 4 Volt peak-to-peak, with 50 Ohm to 1 kOhm load
  - Max. Difference Voltage 0.5 Volts (Receive 1 to Receive 2)
  - Gain -0.1 dB to -3.0 dB
  - Total Drive/Receive Gain -0.1 dB to -5.0 dB

Please refer to individual data sheets for more detail on:

US-454A - single channel instrument with 4-Frequencies and encoder input; portable
EddyView Series - single channel instrument, single frequency (Premium Version)

Alternative instruments:
US-525 - instrument with up to 8 independent channels, synchronized
US-454 - single channel instrument; portable
US-450 - single channel instrument [discontinued October 15, 2014]

ETC Drive Specifications

- **M-Axis (Horizontal Drive / angled depending on fixturing)**
  Pittman 9234 Series
  Maximum Voltage: 24 VDC; Torque: 6.1 oz-in
  Amplifier operation at 20 VDC, 6 A
  Maximum current during automatic drive: 1.3 A
  Maximum current with joystick: 0.3 A
  Direct coupling to lead-screw: Diameter 0.375 inch, 16 TPI
  Maximum velocity (automatic drive): 4 inch/sec (102 mm/s)
  Normal programmed velocity: 0.25 - 1 inch/sec (6 – 25 mm/s)
  Joystick velocity: 2.8 inch/sec (71 mm/s)

- **C-Axis (Circular/Rotational Drive)**
  Pittman 23000 Series
  Maximum Voltage: 170 VDC; Torque: 100.3 oz-in
  Amplifier operation at 20 VDC, 15 A
  Maximum current during automatic drive: 2 A (variable)
  Maximum current with joystick: 0.5 A (variable)
  Gear-coupling ratio: 91:1
  Maximum velocity (automatic drive): 108 degree/sec (18 rpm)
  Normal programmed velocity: 6 - 60 degree/sec (1 - 10 rpm)
  Joystick velocity: 14.4 degree/sec (2.4 rpm)

- **X-Axis (Vertical Drive)**
  Pittman 23000 Series
  Maximum Voltage: 170 VDC; Torque: 100.3 oz-in
  Amplifier operation at 20 VDC, 15 A
  Maximum current during automatic drive: 5 A (variable)
  Maximum current with joystick: 2 A (variable)
  Direct coupling to lead-screw: Diameter 0.625 inch, 10 TPI
  Maximum velocity (automatic drive): 12 inch/sec (305 mm/s)
  Normal programmed velocity: 0.25-1 inch/sec (6 – 25 mm/s)
  Joystick velocity: 1.4 inch/sec (36 mm/s)

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