Ensemble® QL and QLe

Networked Panel-Mount Piezo Drive

- Networkable with any Ensemble drive to control up to ten axes of piezo and/or servo motor stages
- Single or Multi-axis Position Synchronized Output (PSO) for real-time triggering of events
- Available with high-precision (to 20-bit) sensor resolution for capacitive sensor feedback
- Thermally-stable feedback circuit design option
- Configurable analog input (to 18-bit) for external feedback sensor integration or command generation
- Advanced control features such as learning control, harmonic cancellation and command shaping improve tracking error and overall process throughput
- Ethernet and USB 2.0 communication interfaces
- Advanced Windows®-based remote diagnostics, tuning, and programming interface software
- Program in AeroBasic™ using Aerotech's IDE or create custom remote interfaces with Microsoft .NET including C#, VB.NET, C++/CLI, LabVIEW®, MATLAB®, EPICS, or TANGO
- CE approved; follows the 2011/65/EU RoHS 2 Directive
- OEM versions available

The Ensemble QL/QLe™ panel-mount nanopositioning piezo drive family is designed for seamless use with the Ensemble family of drives and controllers. The QL/QLe connects to any Ensemble controller network enabling coordinated motion between piezo stages and servo axes at much higher rates than other controller or drive products. This power, versatility, and affordability make the Ensemble QL/QLe drives ideal for applications ranging from the most demanding fundamental scientific research to advanced OEM machine systems.

The Ensemble QL and QLe provide multi-axis functionality in a discrete single-axis, panel-mount package.

Featuring a dual-core 456 MHz, double-precision, floating-point DSP, the QL/QLe drives provide extreme processing power over a wide variety of applications including point-to-point motion, linear and circular interpolation, multi-axis error correction, and autofocusing. High-speed interrupts and data logging capabilities provide a real-time link to external systems. The QL/QLe also offers high-speed positioning latching capability and single-axis (QL) or multi-axis (QLe) position synchronized output (PSO) for generation of pulses based on actual position feedback in applications ranging from laser firing to data acquisition system triggering.

Ultra-Precision Feedback Options

Using the latest technology and high-resolution A/D and D/A converters, the QLe enables sub-nanometer positioning resolution at high bandwidths. The QLe capacitive sensor feedback circuitry provides ultra-low noise performance over the full travel range. In applications requiring less than maximum positioning resolution, the QL drive offers lower-resolution A/D and D/A converters providing the benefits of high-speed feedback and command generation at a more economical price point. The QLe employs a proprietary capacitive sensor feedback circuit resulting in industry-leading thermal stability and exceptional long-term holding stability. An Aerotech developed linearization method achieves linearity better than 0.01% over the full travel range in closed-loop mode with both the QL and QLe.

Ensemble QL and QLe DESCRIPTION

I/O Options

In addition to the four optically-isolated digital inputs, two high-speed digital inputs and four optically-isolated digital outputs, both the Ensemble QL and QLe are equipped with analog inputs and outputs (one each for QL, two each for QLe). For ultra-precise applications, the QLe offers an 18-bit analog input that can be programmatically configured to accept an external feedback sensor or position command. This analog input also allows the high-voltage power amplifier to be controlled directly by an external low-level analog input. Also, the QLe has one 20-bit analog output that can be programmatically configured for position or voltage monitoring at very high resolutions. The QL drive offers the same analog input/output functionality at 16-bit resolutions.

Advanced Software and Control Features

The Ensemble software uses advanced PID servo loops with advanced feedforward and multiple integrators coupled with eight programmable filters to supply the user with all necessary tools needed to optimize motion performance. Additional software options such as the Dynamic Controls Toolbox and Motion Designer packages make available a host of advanced, yet easy-to-use, tools that can improve tracking errors and provide faster step-and-settle times. These tools include Learning Control, Harmonic Cancellation, Command Shaping, and Cross-Axis Feedforward.

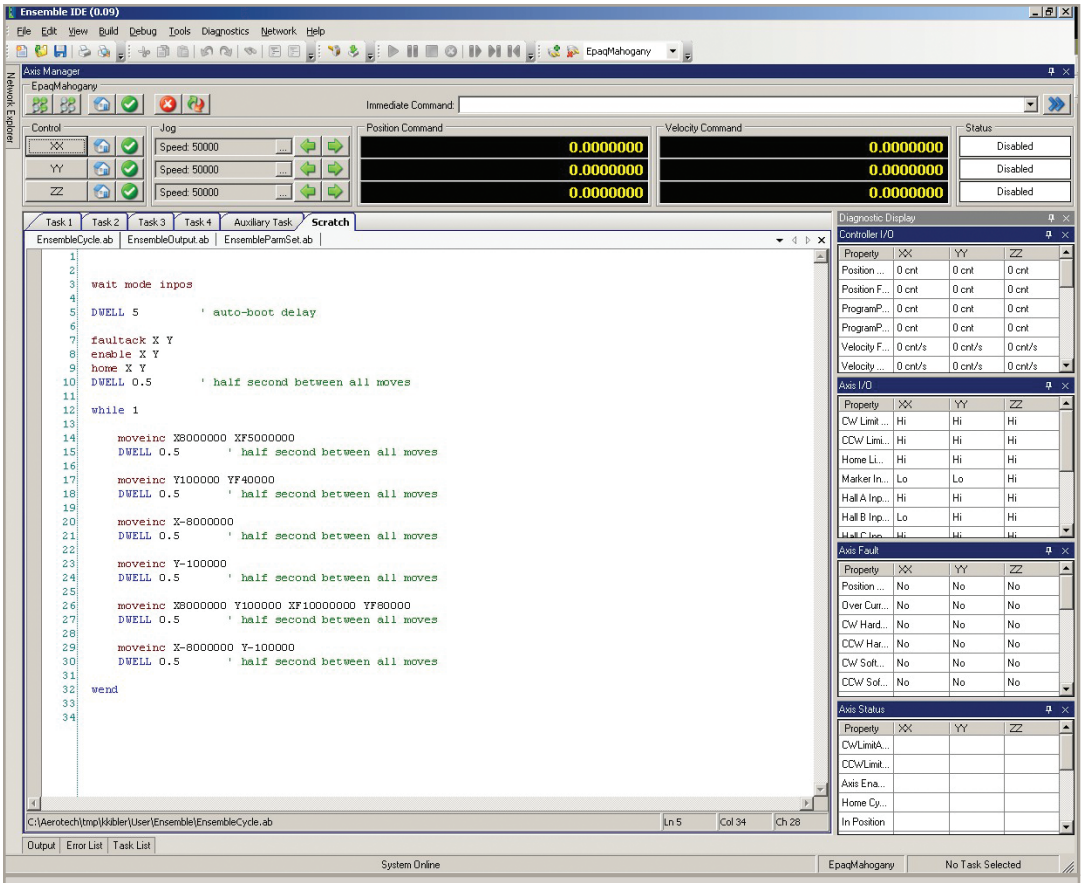
Powerful Programming and Software Drivers

The Ensemble GUI Integrated Development Environment software allows monitoring and control of all aspects of the positioning system regardless of complexity. Advanced tuning utilities minimize startup time by allowing easy optimization of motion axes. Functional programs that can be modified and used in customer applications are included in the online Help. Pre-coded LabVIEW® VIs, AeroBasic™ programming functionality, MATLAB® library, .NET tools for C#, VB.NET and C++/CLI or C make the Ensemble even easier to use. See the Ensemble Control home page for detailed information on software capabilities and ordering options.

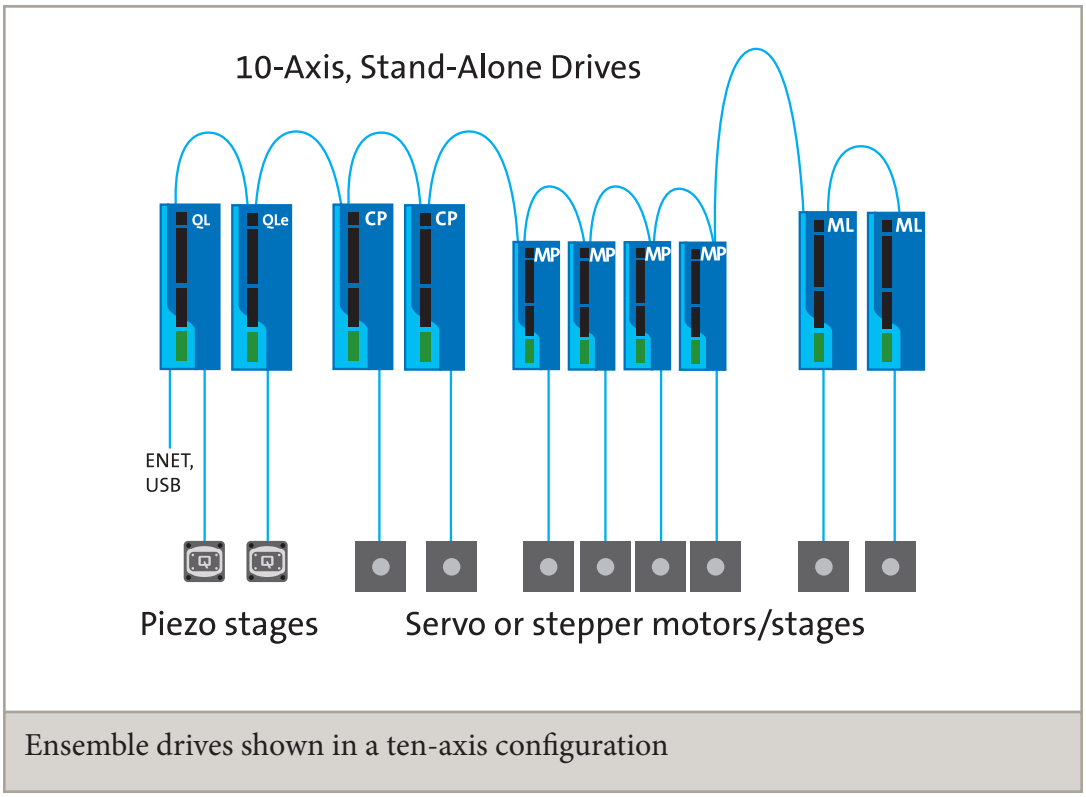
Automatic Parameter Configuration

Aerotech's piezo stages include our time-saving "FlashConfig" feature that stores all of the parametric information required to operate the stage. Upon plug-in, the Ensemble QL/QLe automatically identifies the connected stage. All operation parameters, including axis calibration data and software parameters, are uploaded into the Ensemble QL/QLe. This ensures faster setup and avoids errors that can result in substandard performance. "FlashConfig" provides true "plug and play" operation of your Aerotech stage.

Ensemble QL and QLe DESCRIPTION



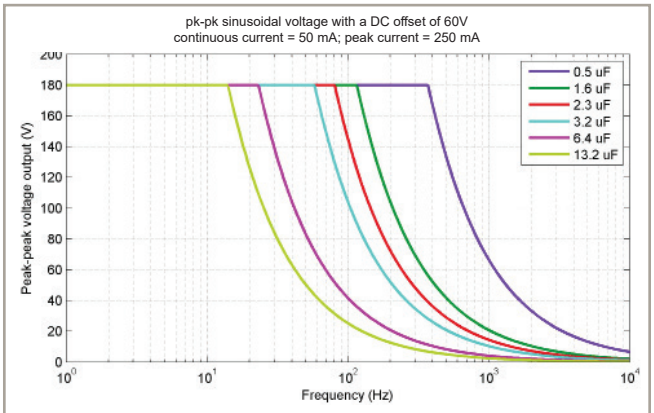
Ensemble IDE.



Ensemble drives shown in a ten-axis configuration

Ensemble QL and QLe SPECIFICATIONS

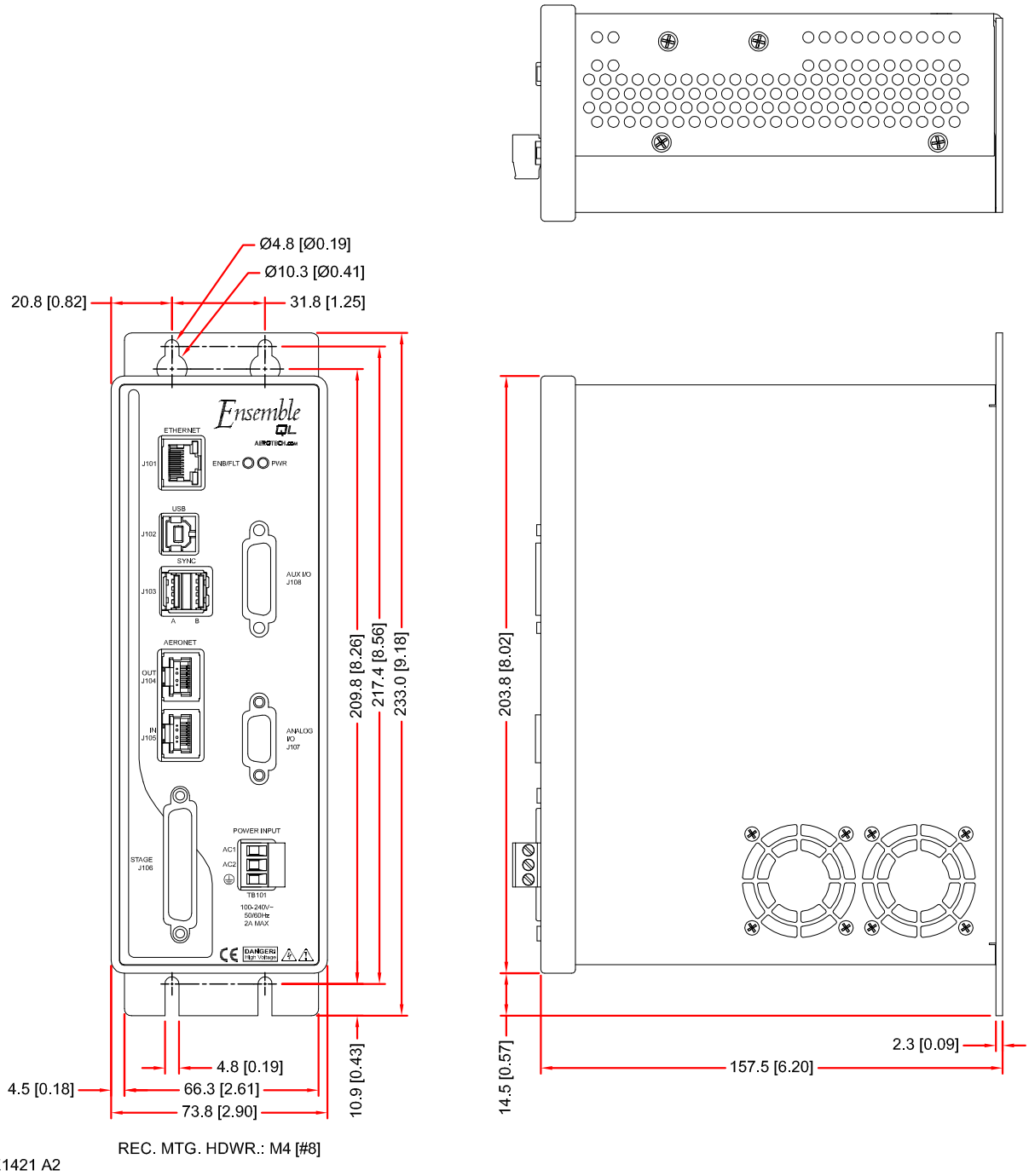
Feature	QL250	QL500	QLe250	QLe500
Package Type	Panel-Mount			
Processor	Dual-Core 456 MHz, Double-Precision, Floating Point DSP			
Power Supply	100-240 VAC; 50/60 Hz			
Voltage Output	-30 to +150 V			
Sensor Type	Capacitive Sensor			
Sensor Resolution	17-bit		20-bit	
Cont. Power Output	10 Watts			
Peak Current Output	250 mA	500 mA	250 mA	500 mA
Cont. Current Output	50 mA	130 mA	50 mA	130 mA
Digital Inputs	(4) Optically Isolated, (2) High Speed, and (1) ESTOP			
Digital Outputs	(4) Optically Isolated			
Analog Inputs	Qty. 1, 16-bit ±10 V differential		2 Total, ±10 V Differential (1) 16-bit General Purpose, (1) 18-bit High-Resolution Configurable for External Feedback or External Command Input	
Analog Outputs	Qty. 1, 16-bit ± 10 V Single-Ended		2 Total, ± 10 V Single-Ended (1) 16-bit General Purpose, (1) 20-bit High-Resolution Configurable for Position or Voltage Monitoring	
High-Speed Data Capture	Yes (50 ns Latency)			
Thermal Stability	Standard		Enhanced	
Position Synchronized Output (PSO)	Single-Axis		Two-Axis	
Communication Interfaces	10/100 Base T Ethernet, USB 2.0			
Servo Loop Update	20 kHz			
Programming Environment	Multi-Tasking AeroBasic™			
Weight	1.3 kg (2.8 lbs)			
Standards	CE approved, NRTL safety certification, EU 2015/863 RoHS 3 directive			



QL/QLe250 sinusoidal peak-peak voltage limits (with a 60 VDC offset) for various piezo stack capacitances

Ensemble QL250 Dimensions

Ensemble QL250



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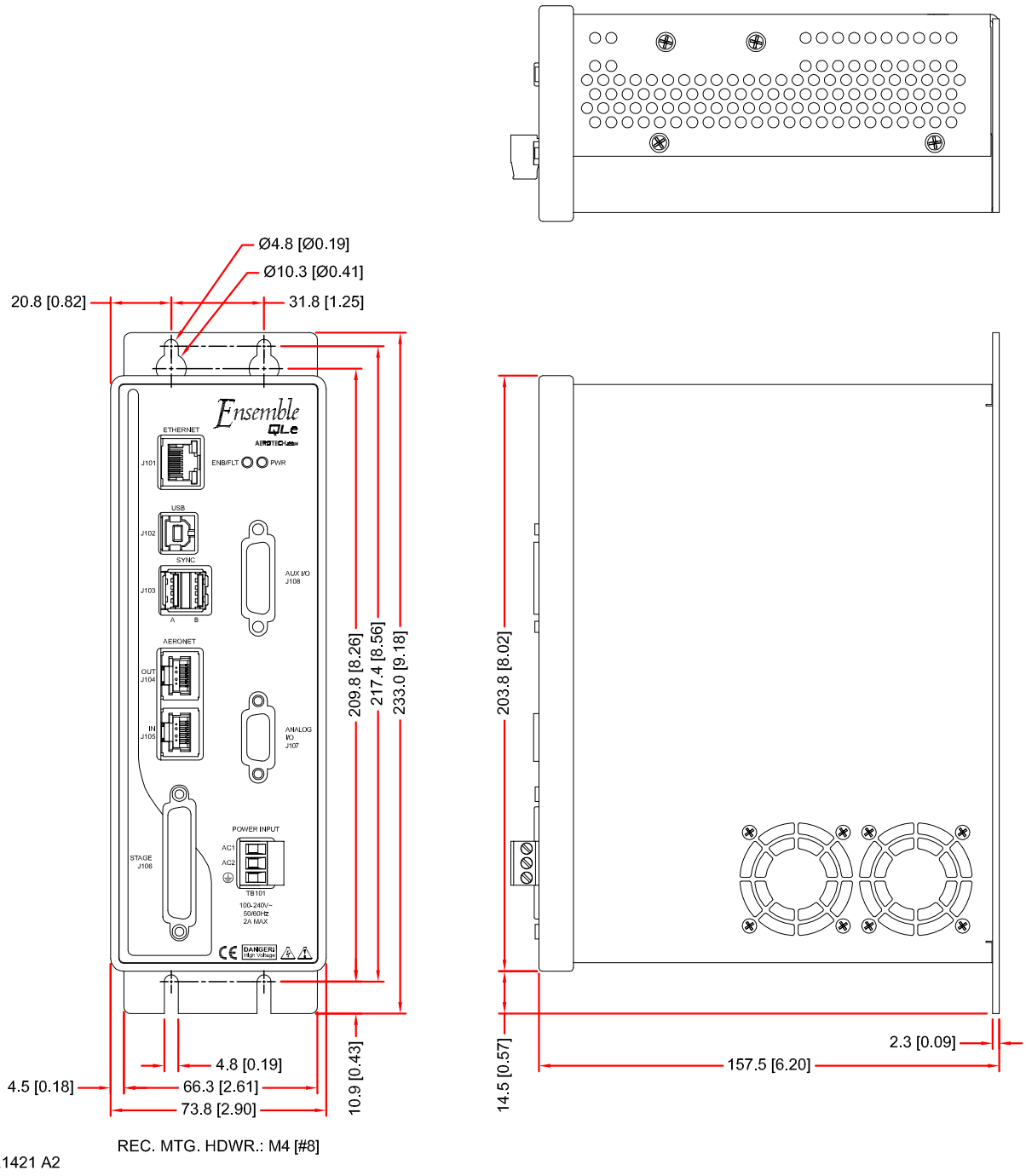
Ensemble QLe250 Dimensions

Ensemble QLe250



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Ensemble QL and QLe ORDERING INFORMATION

Performance Grade (Required)

QL	Base Performance, Capacitance Sensor Feedback
QLe	High Performance, Capacitance Sensor Feedback

Current (Required)

250	250 mA Peak, 50 mA Cont Current, -30 to +150 V Output
500	500 mA Peak, 130 mA Cont Current, -30 to +150 V Output

Feedback (Required)

-C	Capacitance Sensor

Dynamic Controls Toolbox (Required)

-DCT	Dynamic Controls Toolbox