Ensemble® QL andQLe

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

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.

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.

10-Axis, Stand-Alone Drives

ENET, USB

Piezo stages   Servo or stepper motors/stages

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
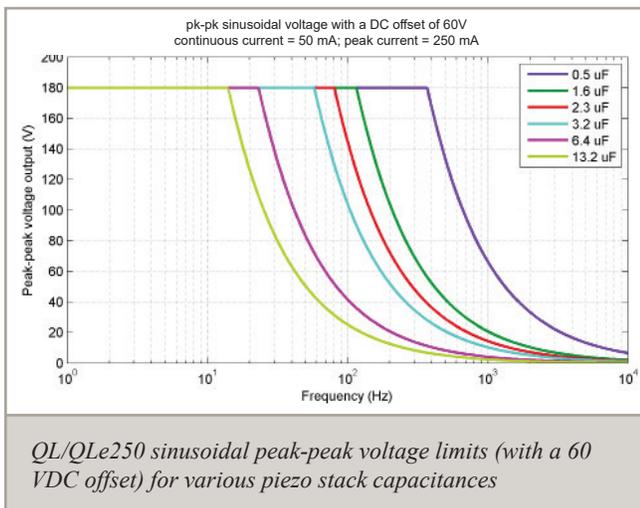
Ensemble QL250 Dimensions

Ensemble QL250
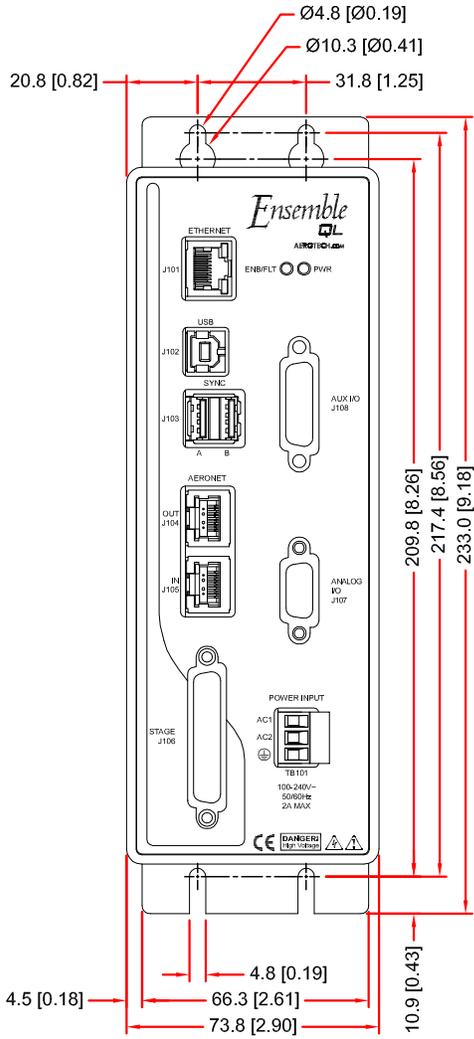
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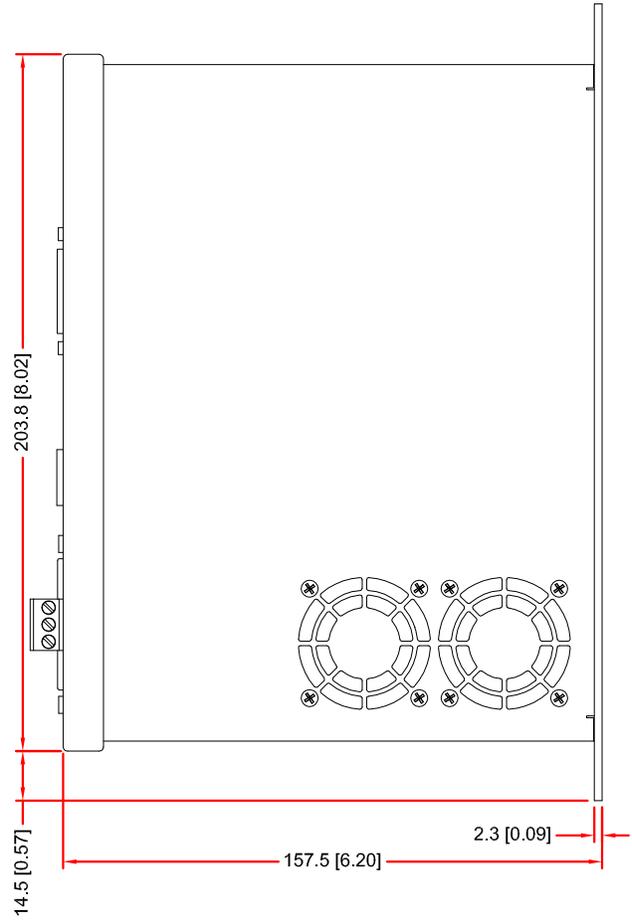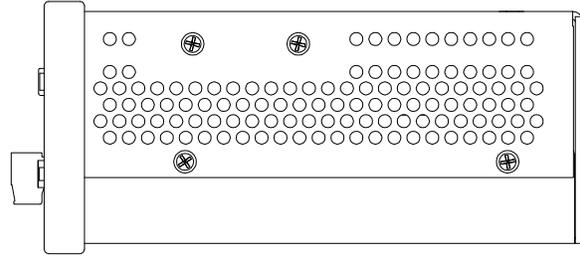
Ensemble QLe250 Dimensions

Ensemble QLe250

Ø4.8 [Ø0.19]
Ø10.3 [Ø0.41]

20.8 [0.82]
31.8 [1.25]

ETHERNET
J101
ENB/FLT   PWR

USB
J102

SYNC
J103
A   B

AUX I/O
J108

AERONET
OUT
J104

IN
J105

ANALOG
I/O
J107

STAGE
J106

POWER INPUT
AC1
AC2

TB101
100-240V~
50/60Hz
2A MAX

DANGER
High Voltage

209.8 [8.26]
217.4 [8.56]
233.0 [9.18]

203.8 [8.02]

10.9 [0.43]

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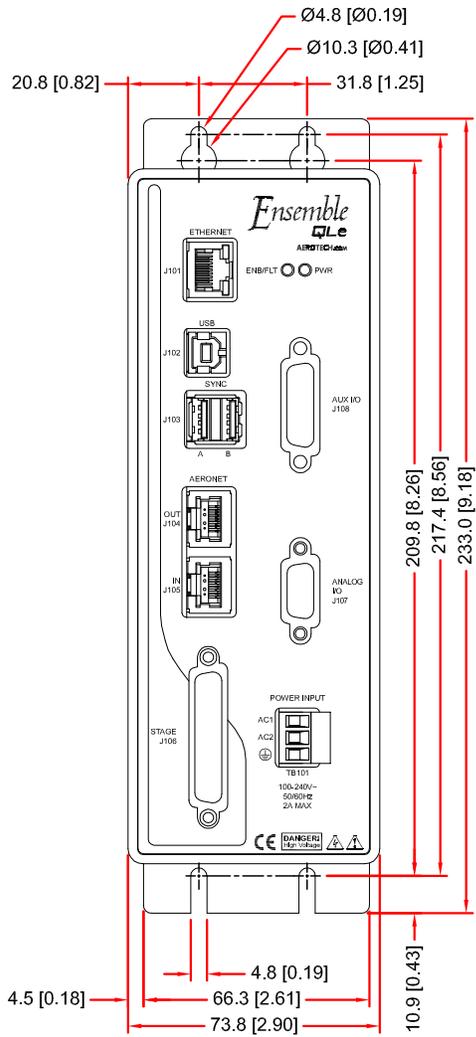
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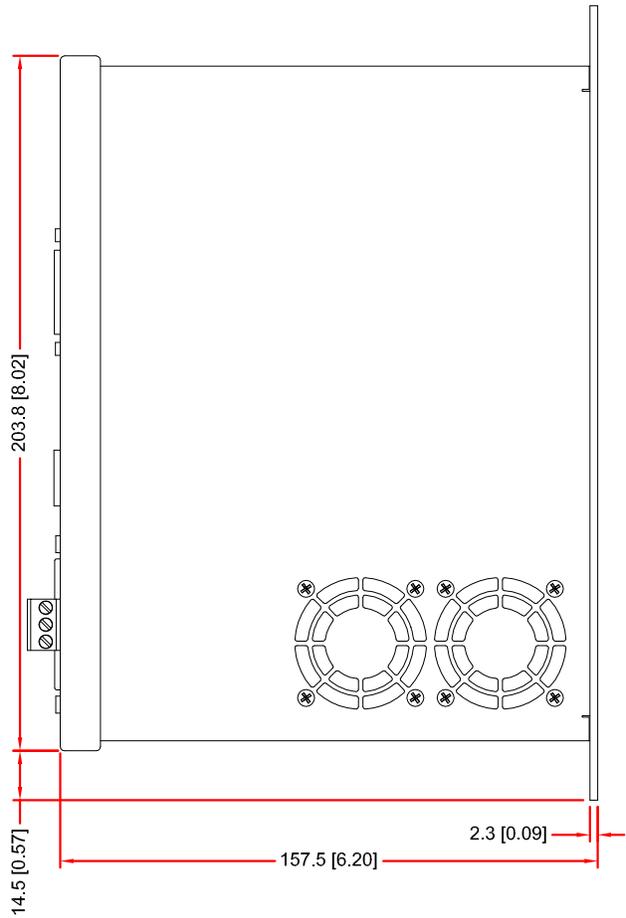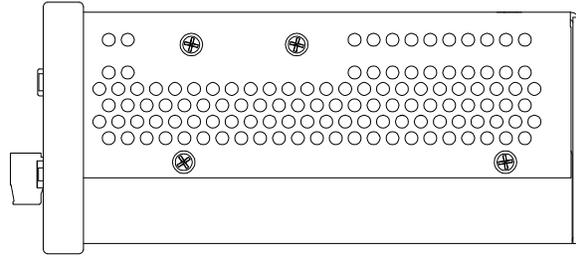
Ensemble QL and QLe ORDERING INFORMATION

Ensemble QL and QLe Panel-Mount Piezo Drive

Ensemble QL250-C	Cost-effective networkable, standalone panel-mount piezo drive with capacitive sensor feedback, 250 mA peak current, 50 mA continuous current, -30 to +150 V output • Configurable input/outputs; 4 opto-isolated inputs, two high-speed digital inputs, 4 opto-isolated outputs, one 16-bit analog input, and one 16-bit analog output. • Single-axis Position Synchronized Output (PSO) standard • 10/100 base T Ethernet port; 1 USB 2.0 port • Motion Designer software is used to graphically generate and edit motion profiles that execute on the controller, providing the ability to import, run and evaluate motion profiles (trajectories). Included in the Motion Designer software is learning control that reduces tracking errors by as much as 1000 times.
Ensemble QLe250-C	High-performance networkable, standalone panel-mount piezo drive with capacitive sensor feed back, 250 mA peak current, 50 mA continuous current, -30 to +150 V output. Features include: • High-precision 20-bit sensor resolution for cap sensor feedback in closed-loop. • Configurable input/outputs; 4 opto-isolated inputs, two high-speed digital inputs, 4 opto-isolated outputs, two analog inputs (1 18-bit, 1 16-bit), and two analog outputs (1 20-bit, 1 16-bit). • 2-axis Position Synchronized Output (PSO) standard • 10/100 base T Ethernet port; 1 USB 2.0 port • Motion Designer software is used to graphically generate and edit motion profiles that execute on the controller, providing the ability to import, run and evaluate motion profiles (trajectories). Included in the Motion Designer software is learning control that reduces tracking errors by as much as 1000 times.

Ensemble Software Options

-DYNAMIC CONTROLS TOOLBOX	The Dynamic Controls Toolbox provides control algorithms that increase system performance such as settle time, accuracy, in-position stability, and/or velocity stability.
-LABVIEW	LabVIEW® VI samples
-MATLAB	Includes MATLAB® library for motion, parameters, and data collection.

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