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

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, Managed C++, LabVIEW®, MATLAB®, EPICS, or TANGO

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. Using an Aerotech developed proprietary linearization scheme achieves linearity better than 0.01% over the full travel range in closed-loop mode with both the QL and QLe.

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 two analog inputs and two analog outputs. 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

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Ensemble QL and QLe DESCRIPTION

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 utilitie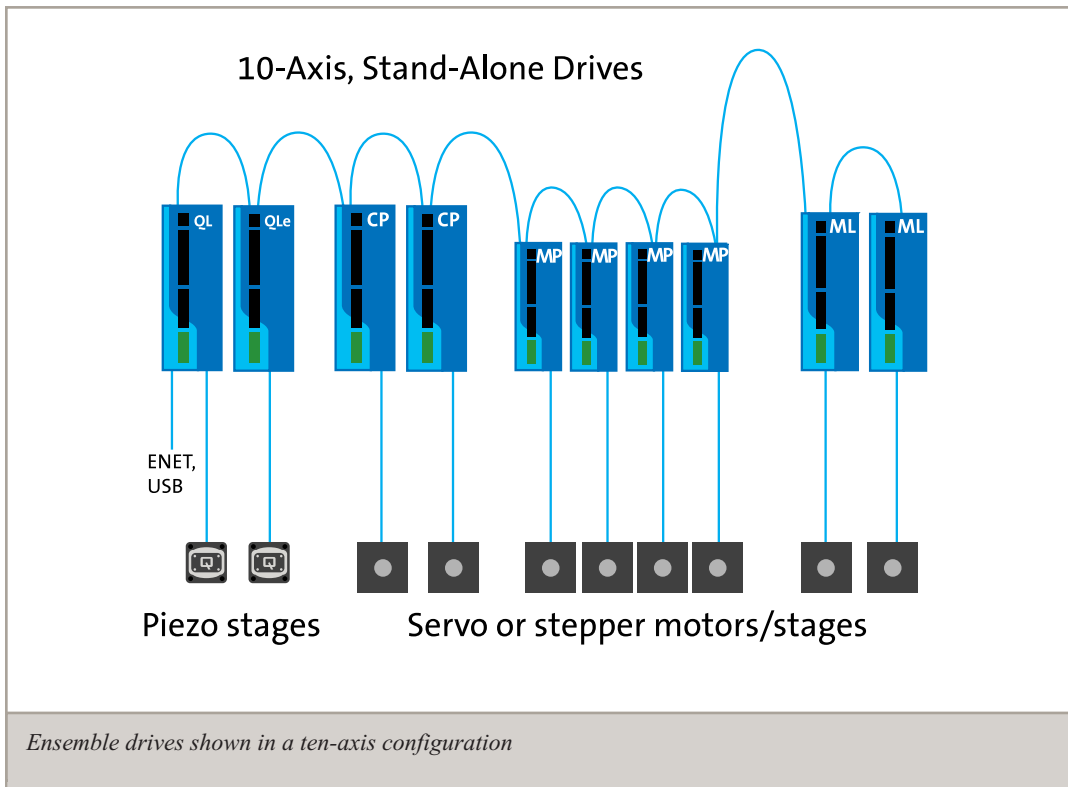s minimize startup time by allowing easy optimization of motion axes. Functional programs that can be modified and used in customer applications are included in the online Help. Pre-coded LabVIEW® VIs, AeroBasic™ programming functionality, MATLAB® library, .NET tools for C#, VB.NET and managed C++ or 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.
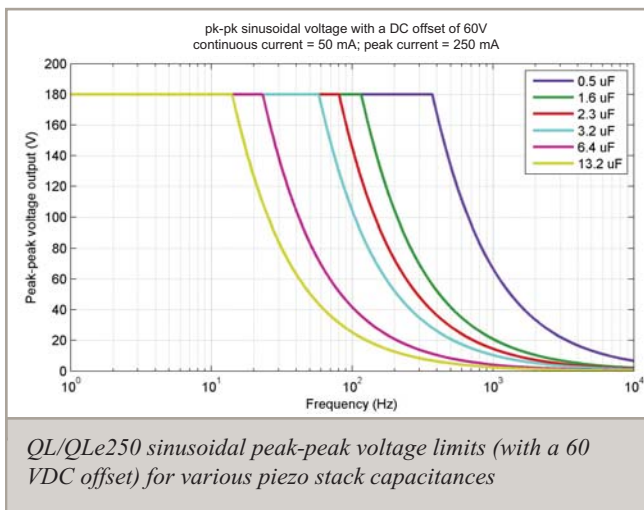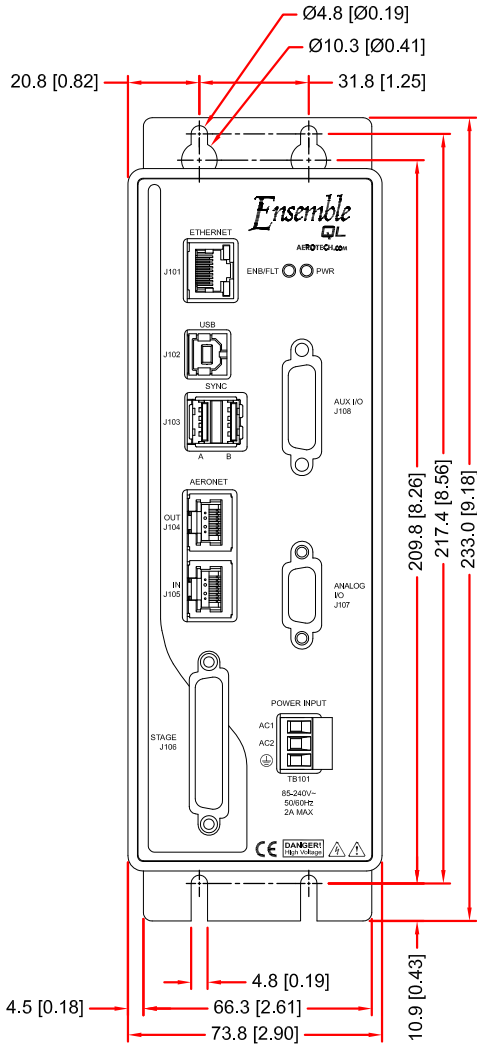
Ensemble QL and QLe DESCRIPTION

Ensemble IDE.

10-Axis, Stand-Alone Drives

ENET,
USB

Piezo stages   Servo or stepper motors/stages

Ensemble drives shown in a ten-axis configuration

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Ensemble QL and QLe SPECIFICATIONS

Feature	QL250	QLe250
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
Voltage Resolution	18-bit	20-bit
Cont. Power Output	10 Watts	
Peak Current Output	250 mA	
Cont. Current Output	50 mA	
Digital Inputs	(4) Optically Isolated, (2) High Speed, and (1) ESTOP	
Digital Outputs	(4) Optically Isolated	
Analog Inputs	2 total, 16-bit ±10 V differential, (1) Configurable for External Feedback or External Command Input	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	2 Total, 16-bit ± 10 V Single-Ended, (1) Configurable for Position or Voltage Monitoring	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)	
Position Synchronized Output (PSO)	Single-Axis	Three-Axis
Cap Sensor Synchronization	Yes	
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)	1.3 kg (2.8 lbs)

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

Ensemble QL250 Dimensions

Ensemble QL250

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
85-240V~
50/60Hz
2A MAX

DANGER!
High Voltage

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

203.8 [8.02]

14.5 [0.57]

10.9 [0.43]

4.8 [0.19]
4.5 [0.18]   66.3 [2.61]
73.8 [2.90]

2.3 [0.09]
157.5 [6.20]

REC. MTG. HDWR.: M4 [#8]
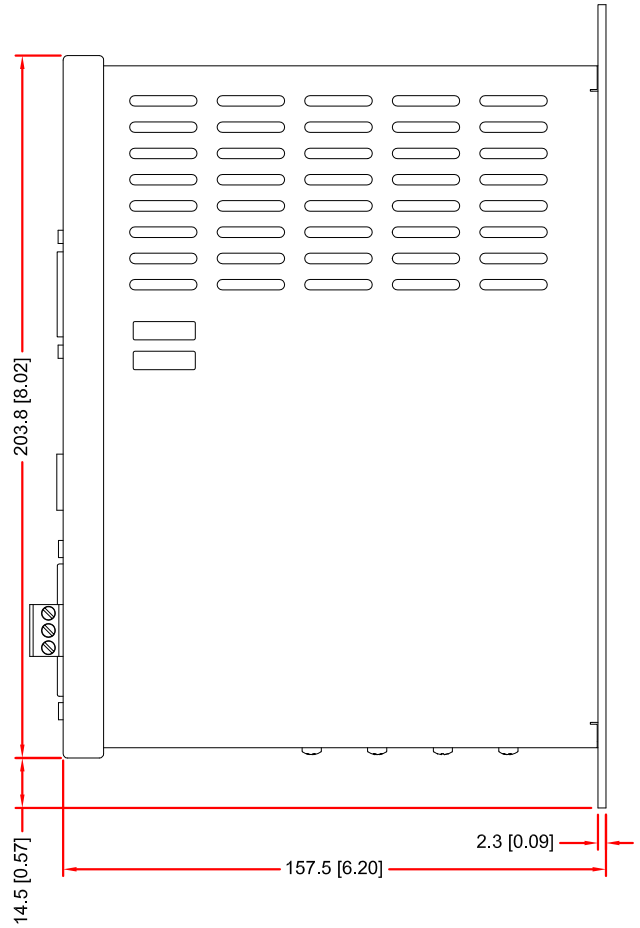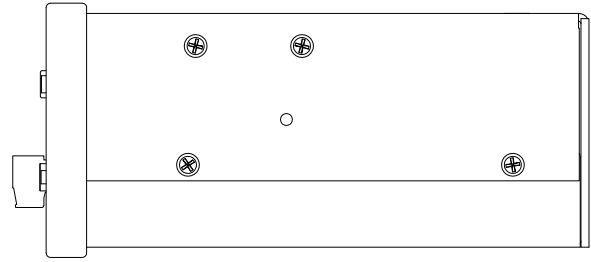
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Ensemble QLe250 Dimensions

Ensemble QLe250

Ø4.8 [Ø0.19]
Ø10.3 [Ø0.41]
20.8 [0.82]
31.8 [1.25]

Ensemble
QLe
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ETHERNET
J101
ENB/FLT   PWR

USB
J102

SYNC
J103
A   B

AUX I/O
J108

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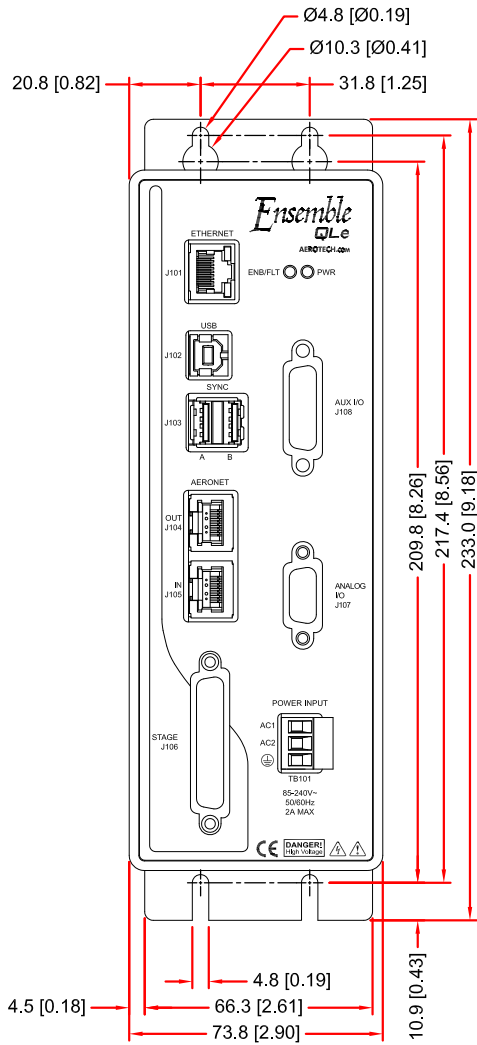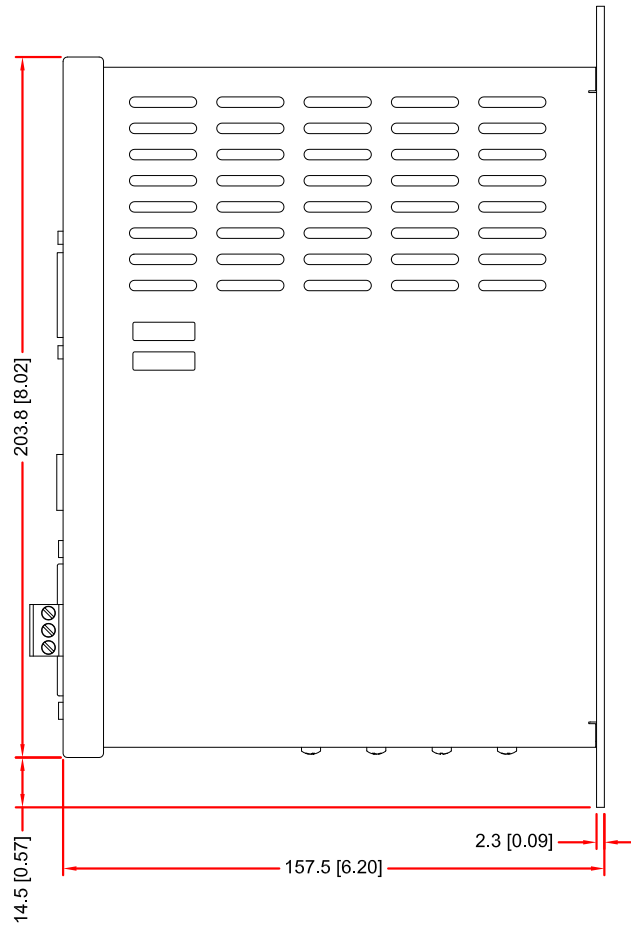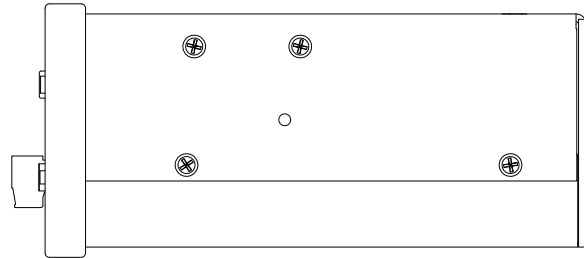
Ensemble QL and QLe ORDERING INFORMATION

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, two 16-bit analog inputs, and two 16-bit analog outputs.
	• Single-axis Position Synchronized Output (PSO) standard
	•10/100 base T Ethernet port; 1 USB 2.0 port
Ensemble QLe250-C	High-performance networkable, standalone panel-mount piezo drive with capacitive sensor feedback, 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).
	• 3-axis Position Synchronized Output (PSO) standard
	• 10/100 base T Ethernet port; 1 USB 2.0 port

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.
-MOTION DESIGNER	Motion Designer 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.
-LABVIEW	LabVIEW® VI samples
-MATLAB	Includes MATLAB® library for motion, parameters, and data collection.