



## Drive-Rack with Motion Controller **Automation1 iXR3**

### Machine Control That Stands Alone

The Automation1 iXR3 is two solutions in one: a high-performance, six-axis drive rack with an integrated motion controller—meaning it's capable of complete machine control—and a multi-axis servo motor drive rack with configurable and field-replaceable, front-mounted amplifier cards.

The iXR3 motor circuits are driven by powerful controller cards that close the servo and current loops at 20 kHz. These cards also provide several other high-speed, low latency control features to improve the throughput and quality of your process. The iXR3 unit processes digital and analog I/O, high-speed data collection, high-speed differential outputs, position synchronized outputs and encoder multiplication functionality in real-time.

### Automation1

The iXR3 is a part of the user-friendly Automation1 motion control platform, which includes the following:

- ◆ **Development Software**
- ◆ **Controls**
- ◆ **Motor Drives**
- ◆ **Fiber-Optic HyperWire® Communication Bus**



### KEY FEATURES:

- ◆ Unlock the full **MOTION CONTROL** power of our Automation1-iSMC intelligent software-based motion controller
- ◆ Features **COMPLETE CONFIGURATION & PERFORMANCE** capability of the XR3 drive rack
- ◆ **ELIMINATE THE PC** from your control scheme
- ◆ Plug-in **AMPLIFIERS WITH DEDICATED CONTROL** cards drive brush, brushless, stepper, voice coil or piezo motors
- ◆ Enjoy up to **12 AXES OF CONTROL** by connecting more Automation1 drives over the HyperWire fiber-optic bus
- ◆ Includes PSO, the **ULTIMATE IN POSITION-BASED CONTROL** for industrial lasers, cameras & more
- ◆ Features **SAFE TORQUE OFF (STO)** functional safety (certification pending)

## AUTOMATION1 iXR3 CONTROLLER SPECIFICATIONS

Specification	Description		
<b>Motion Controller<sup>(1)</sup></b>	Aerotech's <a href="#">Automation1-iSMC</a> Intelligent Software-Based Motion Controller (version 2.1 and above)		
<b>Maximum Axes of Control<sup>(1)</sup></b>	Up to 12 axes		
<b>Industrial Ethernet Support</b>	EtherCAT (pending)		
<b>I/O Points<sup>(1)</sup></b>	See general and controller card specifications below.		
<b>Programming Language<sup>(1)</sup></b>	AeroScript, RS-274 G-code		
<b>APIs<sup>(1)</sup></b>	<ul style="list-style-type: none"> <li>.NET (cross-platform Linux support)</li> <li>C (cross-platform Linux support)</li> <li>EPICS (cross-platform Linux support) see <a href="http://EPICS.anl.gov">EPICS.anl.gov</a></li> </ul>		
<b>Programming Tasks<sup>(1)</sup></b>	4 user tasks (standard) / 9 user tasks (optional) 1 reserved task		
<b>Position Modes</b>	Absolute, incremental, dynamic trajectory correction		
<b>Motion types<sup>(1)</sup></b>	<ul style="list-style-type: none"> <li>Linear motion</li> <li>Clockwise &amp; counterclockwise</li> <li>Jogging</li> <li>Homing</li> <li>Rapid</li> <li>Freerun</li> <li>Many more</li> </ul>		
<b>Acceleration Profiles</b>	<ul style="list-style-type: none"> <li>Linear (time &amp; rate based)</li> <li>Sine (time &amp; rate based)</li> <li>S-curve (time &amp; rate based)</li> </ul>		
<b>Velocity Profiling<sup>(1)</sup></b>	Yes		
<b>Safe Zones<sup>(1)</sup></b>	Yes		
<b>Advanced Features<sup>(1)</sup></b>	<table border="0"> <tr> <td> <ul style="list-style-type: none"> <li>Corner rounding</li> <li>Tool normalcy control</li> <li>Cutter compensation</li> <li>Programmable fixture offsets<sup>(2)</sup></li> <li>Rotation, mirroring &amp; translation transformations</li> <li>Part profile scaling</li> <li>Polar &amp; cylindrical transformations<sup>(2)</sup></li> </ul> </td> <td> <ul style="list-style-type: none"> <li>Orthogonality correction</li> <li>Electronic gearing</li> <li>EasyTune® &amp; classical tuning</li> <li>Backlash compensation</li> <li>Spindle motion</li> <li>High-speed registration</li> <li>Multi-dimensional error mapping</li> </ul> </td> </tr> </table>	<ul style="list-style-type: none"> <li>Corner rounding</li> <li>Tool normalcy control</li> <li>Cutter compensation</li> <li>Programmable fixture offsets<sup>(2)</sup></li> <li>Rotation, mirroring &amp; translation transformations</li> <li>Part profile scaling</li> <li>Polar &amp; cylindrical transformations<sup>(2)</sup></li> </ul>	<ul style="list-style-type: none"> <li>Orthogonality correction</li> <li>Electronic gearing</li> <li>EasyTune® &amp; classical tuning</li> <li>Backlash compensation</li> <li>Spindle motion</li> <li>High-speed registration</li> <li>Multi-dimensional error mapping</li> </ul>
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<b>Access Control</b>	No		
<b>Controller File System</b>	Yes (5 GB)		
<b>Supported HyperWire Drives</b>	<table border="0"> <tr> <td> <ul style="list-style-type: none"> <li>Automation1-XC6e<sup>(3)(4)</sup></li> <li>Automation1-XC4e<sup>(3)(4)</sup></li> <li>Automation1-XC2e<sup>(3)(4)</sup></li> <li>Automation1-XC4<sup>(3)(4)</sup></li> <li>Automation1-XC2<sup>(3)(4)</sup></li> </ul> </td> <td> <ul style="list-style-type: none"> <li>Automation1-XR3<sup>(3)</sup></li> <li>Automation1-XL5e<sup>(3)(4)</sup></li> <li>Automation1-XL2e<sup>(3)(4)</sup></li> <li>Automation1-SI4<sup>(3)</sup></li> <li>Automation1-XI4<sup>(3)</sup></li> </ul> </td> </tr> </table>	<ul style="list-style-type: none"> <li>Automation1-XC6e<sup>(3)(4)</sup></li> <li>Automation1-XC4e<sup>(3)(4)</sup></li> <li>Automation1-XC2e<sup>(3)(4)</sup></li> <li>Automation1-XC4<sup>(3)(4)</sup></li> <li>Automation1-XC2<sup>(3)(4)</sup></li> </ul>	<ul style="list-style-type: none"> <li>Automation1-XR3<sup>(3)</sup></li> <li>Automation1-XL5e<sup>(3)(4)</sup></li> <li>Automation1-XL2e<sup>(3)(4)</sup></li> <li>Automation1-SI4<sup>(3)</sup></li> <li>Automation1-XI4<sup>(3)</sup></li> </ul>
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<b>Communication/Configuration Connection</b>	<ul style="list-style-type: none"> <li>Ethernet</li> <li>USB</li> </ul>		

Note:

1. See the [Automation1-iSMC](#) controller page for more information.
2. May require advanced programming.
3. Contains I/O on base drive-rack.
4. Drive I/O expansion board option available with this drive.

## AUTOMATION1 iXR3 GENERAL SPECIFICATIONS

Description		(Option)	iXR3
Connectivity to other Automation1 drives			HyperWire
Number of Amplifiers			1 to 6 (Each amplifier requires a controller card in order to be used).
Number of Controller Cards			1 to 6
Encoder Inputs			2 per controller card.
Motor Style			Brush, Brushless, Stepper, Voice Coil
Input Current	-VL1		120 VAC, 10 A Maximum
	-VL2		240 VAC, 5 A Maximum
	-VL3		100 VAC, 10 A Maximum
	-VL4		200/208 VAC, 5 A Maximum
Bus Voltage Options	-VB1		±10 VDC (200 W Power Supply), bipolar
	-VB2		±20 VDC (200 W Power Supply), bipolar
	-VB3		±30 VDC (200 W Power Supply), bipolar
	-VB4		±40 VDC (300 W Power Supply), bipolar
	-VB5		±80 VDC (300 W Power Supply), bipolar
	-VB7		+160 VDC, unipolar
	-VB8		+320 VDC, unipolar
AC Power Input			AC input (Switch Selectable): AC Hi, AC Lo, Earth Ground ( $\pm$ ), <ul style="list-style-type: none"> <li>• 100 VAC (90-110 VAC, 50/60 Hz)</li> <li>• 120 VAC (108-132 VAC, 50/60 Hz)</li> <li>• 200/208 VAC (180-220 VAC, 50/60 Hz)</li> <li>• 240 VAC (216-264 VAC, 50/60 Hz)</li> </ul> Note: If the iXR3/XR3 contains an offline Bus power supply, the AC Input will be limited to one AC input range.
Inrush Current			32 A <sub>pk</sub>
Auxiliary Power Outputs			+5 V provided on all axis feedback connectors for encoder, Hall, and limit power. +5 V provided on I/O connectors
Protection			The AC power cord serves as the mains breaker and provides 10 A, Supplemental Protection only. Internal Bus supply fusing. Amplifier Output short circuit protection. Peak and RMS over current limit. Over Temperature shutdown. Bus supply inrush current limit during initial power-on.
Internal Shunt Resistor			40 W Continuous; 400 W Peak (5 seconds)
Safe Torque Off (STO)			Yes
Digital I/O			16x digital inputs, optically isolated 16x digital outputs, optically isolated
Position Synchronized Output (PSO)			3x PSO isolated outputs 3x PSO TTL outputs 3x PSO synchronization inputs
Data Acquisition			1x high-speed input (50 nsec latency)
Sync Ports			2
Operating Temperature			0 to 50°C
Storage Temperature			-30 to 85°C
Weight			25 kg. (55 lb.)

## AUTOMATION1 iXR3 CONTROL CARD SPECIFICATIONS

Each controller card configured on the Automation1-iXR3 includes the following options:

	-CTN	-CT1	-CT2	-CT4
<b>Current Loop Update Rate</b>	20 kHz			
<b>Servo Loop Update Rate kHz 8</b>	20 kHz			
<b>High-Speed Outputs</b>	2x high-speed RS-422 differential outputs (per controller card)			
<b>25-Pin Motor Feedback Connector<sup>(1)</sup></b>	High-speed differential inputs (encoder sin, cos and marker; absolute clk and data) CW and CCW limits Hall effect sensor inputs (A, B, and C) Analog motor temperature input (accepts digital) Brake output			
<b>9-Pin Aux Encoder Feedback Connector</b>	High-speed differential inputs (encoder sin, cos and marker; absolute clk and data)			
<b>15-Pin Analog I/O Connector</b>	2x 16-bit differential $\pm 10$ V analog input 2x 16-bit single-ended $\pm 10$ V analog output Joystick: Button A, Button B, and Interlock			
<b>5-Pin How Powered Motor Connector<sup>(1)</sup></b>	Brushless Phase A, B, and C Connections or DC Brush +/- Connections or Stepper (2 phases with return)			
<b>Primary encoder input specifications</b>	<u>Square-wave Encoder</u> 40 million counts-per-second input  <u>Absolute Encoder</u> Yes  <u>Sine-wave Encoder</u> n/a	<u>Square-wave Encoder</u> 40 million counts-per-second input  <u>Absolute Encoder</u> Yes  <u>Sine-wave Encoder</u> 2 MHz / 450 kHz (bandwidth selectable) input with up to 16,384 multiplication	<u>Square-wave Encoder</u> 40 million counts-per-second input  <u>Absolute Encoder</u> Yes  <u>Sine-wave Encoder</u> 2 MHz / 450 kHz (bandwidth selectable) input with up to 65,536 multiplication	<u>Square-wave Encoder</u> 40 million counts-per-second input  <u>Absolute Encoder</u> Yes  <u>Sine-wave Encoder</u> 2 MHz / 450 kHz (bandwidth selectable) input with up to 65,536 multiplication
<b>Auxiliary encoder input specifications</b>	<u>Square-wave Encoder</u> 40 million counts-per-second input  <u>Absolute Encoder</u> Yes  <u>Sine-wave Encoder</u> n/a	<u>Square-wave Encoder</u> 40 million counts-per-second input  <u>Absolute Encoder</u> Yes  <u>Sine-wave Encoder</u> n/a	<u>Square-wave Encoder</u> 40 million counts-per-second input  <u>Absolute Encoder</u> Yes  <u>Sine-wave Encoder</u> n/a	<u>Square-wave Encoder</u> 40 million counts-per-second input  <u>Absolute Encoder</u> Yes  <u>Sine-wave Encoder</u> 2 MHz / 450 kHz (bandwidth selectable) input with up to 65,536 multiplication
<b>Can Output Multiplied Encoder</b>	n/a	No	Yes	Yes

1. Available with the CTN, CT1, CT2, and CT4 options.

### AUTOMATION1 iXR3 PWM AMPLIFIER SPECIFICATIONS

	XSP3-10	XSP3-20	XSP3-30
Option Code	-P1	-P2	-P3
Peak Motor Output Current (2 sec) <sup>(1)(2)</sup>	10 A <sub>pk</sub>	20 A <sub>pk</sub>	30 A <sub>pk</sub>
Continuous Current <sup>(2)</sup>	5 A	10 A	10 A
Maximum Bus Voltage	320 VDC		
Maximum Power Amplifier Bandwidth <sup>(3)</sup>	2 kHz		
PWM Switching Frequency	20 kHz		
Minimum Load Inductance	0.1 mH @ 160 VDC bus (1.0 mH @320 VDC bus)		
Heat Sink Temperature (maximum allowable)	75°C (All Amplifiers)		

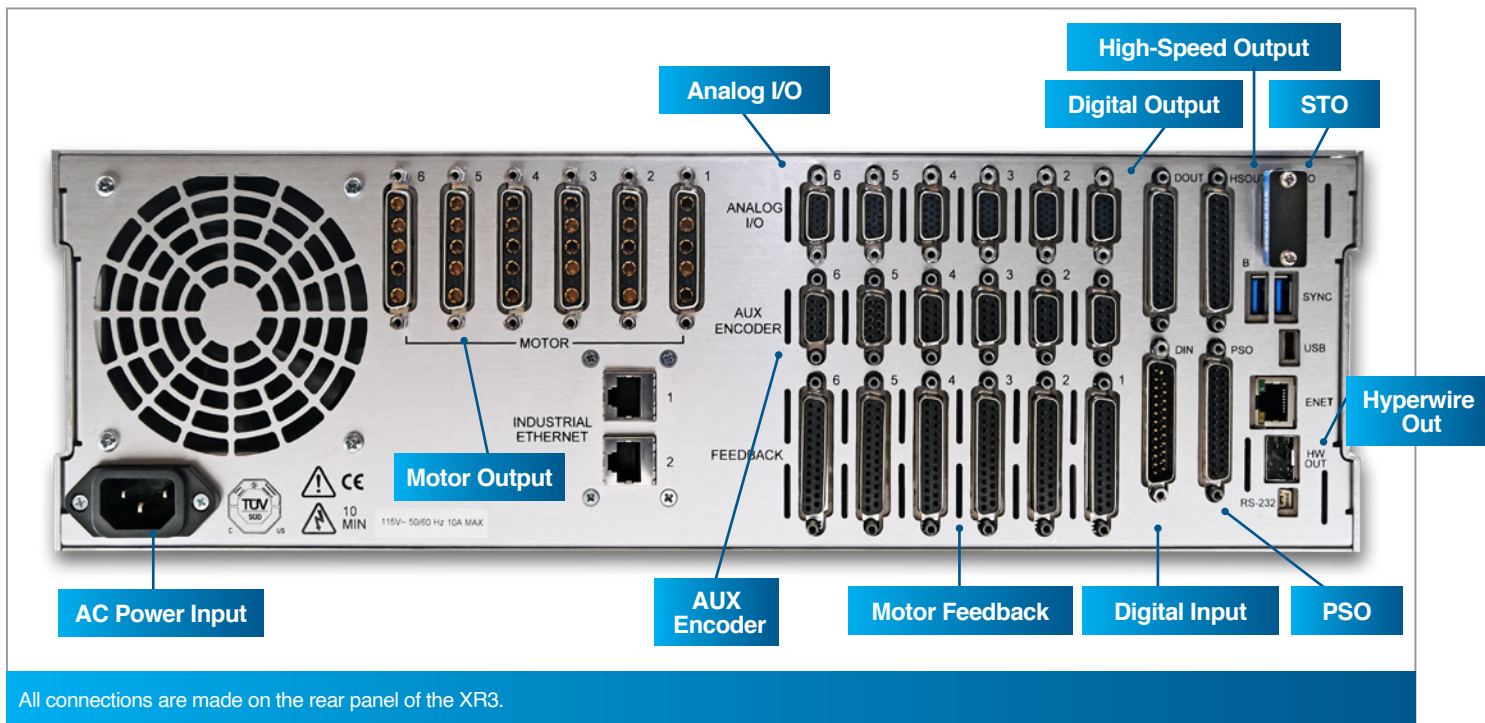
1. AC voltage, Bus supply / load may result in significantly lower maximum peak currents.
2. Peak and continuous output current are load dependent. The controller will limit its output current based on velocity and motor resistance.
3. Selectable through parameters.

### AUTOMATION1 iXR3 LINEAR AMPLIFIER SPECIFICATIONS

	XSL3-10-40 <sup>(5)(6)(7)(8)</sup>
Option Code	-L1
Continuous Output Current, $\pm 40V$ bus (A <sub>pk</sub> ) <sup>(2)(3)(4)</sup>	1.5 A   2.0 A
Peak Current (A <sub>pk</sub> )	10 A <sub>pk</sub> <sup>(1)</sup>
Maximum Continuous Total Power Dissipation <sup>(3)(4)</sup>	120 W   160 W
Peak Amplifier Power Dissipation per phase	400 W
Effective Heatsink Thermal Resistance	0.42°C/W   0.31°C/W
Maximum Transistor Temperature	75°C
Time to reach maximum temperature at maximum continuous power	20 minutes

1. This specification depends on the motor supply voltage, the motor speed, and motor resistance. Contact an Aerotech sales engineer for more information.
2. This specification assumes that an AC or DC motor type with a 0  $\Omega$  winding resistance is used.
3. The first number is for a stationary AC or DC motor. The second number is for an AC motor that is in motion.
4. The specification will de-rate when the ambient temperature exceeds 25°C.
5. The XSL3 amplifier has circuitry that will limit peak power to protect itself from damage. In the Status Utility, the Power Limiting bit under Drive Status monitors the condition of the circuitry. If the circuit is open, the Power Limiting bit will show as "ON".
6. All linear amplifier (XSL3-10-40) specifications assume that the fan tray is installed, the fans are set to full-speed mode, and the ambient temperature is 25°C.
7. The transistor temperature can be up to 25°C higher than the heat sink temperature that is shown in the Status Utility. Set the AverageCurrentFault parameter to ensure that the heat sink power dissipation is not exceeded.
8. Aerotech recommends that you do not use high-current stepper motors with the XSL3-10-40 linear amplifier because of high-power dissipation. Contact Aerotech for additional information.

## AUTOMATION1 iXR3 SPECIFICATIONS



PWM and linear amplifiers available in the same form factor.



### Controller Configuration

To configure and load the motion controller on the iXR3 drive, please configure and order an Automation1-iSMC intelligent controller with your iXR3 drive. The Automation1-iSMC configuration should include the iXR3 as the "hardware platform."

### Automation1 iXR3

**Automation1-iXR3** Automation1-iXR3 - 3U, 19" Multi-Axis Servo Drive Rack with Motion Controller

#### Line Voltage

- VL1 120 VAC Input
- VL2 240 VAC Input
- VL3 100 VAC Input
- VL4 200/208 VAC Input

*Notes: Line voltages VL2 and VL4 are not available with bus voltage selection VB7. Line voltages VL1 and VL3 are not available with bus voltage VB8.*

#### Bus Voltage 1

- VB1 +/- 10 VDC (200 W Power Supply ), Bipolar
- VB2 +/- 20 VDC (200 W Power Supply ), Bipolar
- VB3 +/- 30 VDC (200 W Power Supply ), Bipolar
- VB4 +/- 40 VDC (300 W Power Supply ), Bipolar
- VB5 +/- 80 VDC (300 W Power Supply ), Bipolar
- VB7 160 VDC Unipolar
- VB8 320 VDC Unipolar

*Note: Bus voltages options are limited based upon other configuration selections.*

#### Bus Voltage 2

- VB0 Not Wired
- VB1 +/- 10 VDC (200 W Power Supply ), Bipolar
- VB2 +/- 20 VDC (200 W Power Supply ), Bipolar
- VB3 +/- 30 VDC (200 W Power Supply ), Bipolar
- VB4 +/- 40 VDC (300 W Power Supply ), Bipolar
- VB5 +/- 80 VDC (300 W Power Supply ), Bipolar
- VB6 Future +150 VDC / -30 VDC Piezo
- VB7 160 VDC Unipolar
- VB8 320 VDC Unipolar

*Note: Bus voltages options are limited based upon other configuration selections.*

#### Split Bus

- SB0 Axis 1-6 Bus Voltage 1 (/SPLIT BUS 1-6
- SB1 Axis 1 Bus Voltage 1, Axis 2-6 Bus Voltage 2
- SB2 Axis 1-2 Bus Voltage 1, Axis 3-6 Bus Voltage 2
- SB3 Axis 1-3 Bus Voltage 1, Axis 4-6 Bus Voltage 2
- SB4 Axis 1-4 Bus Voltage 1, Axis 5-6 Bus Voltage 2
- SB5 Axis 1-5 Bus Voltage 1, Axis 6 Bus Voltage 2

### Controller Cards

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- CT0 No Controller Card
- CTN Controller Card without Multiplier
- CT1 Controller Card with MX1 Multiplier
- CT2 Controller Card with MX2 Multiplier
- CT4 Controller Card with MX4 Multiplier

### Amplifier Cards

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- 0 No Amplifier
- P1 XSP3-10 Amplifier
- P2 XSP3-20 Amplifier
- P3 XSP3-30 Amplifier
- L1 XSL3e-10-40 Amplifier

*Note: Linear amplifier option L1 requires bus voltage VB1, VB2 or VB4 and requires cooling option C1 or C2.*

### Cooling

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- C0 Built-In Fan Pulls Cooling Air from Left Side
- C1 Perforated Covers Above and Below Amp
- C2 1U-High Fan Tray for Cooling

*Note: For C1 option, refer to the hardware manual for the external cooling requirements.*

### Line Cord

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- LC0 No Line Cord
- LC1 USA 120 VAC Compatible Line Cord
- LC2 USA 240 VAC Compatible Line Cord
- LC3 German Compatible Line Cord
- LC4 U.K. Compatible Line Cord
- LC5 Israel Compatible Line Cord
- LC6 India Compatible Line Cord
- LC7 Australia Compatible Line Cord

### PSO

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- PSO0 One-axis PSO Firing (Default)
- PSO2 Two-axis PSO Firing
- PSO3 Three-axis PSO Firing

*Note: Up to 3 independent PSO outputs can be programmed and used. Each independent PSO output requires an independent controller card.*

### Internal Shunt (Optional)

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- SI1 Internal Shunt, First Bus
- SI2 Internal Shunt, Second Bus
- SI3 Internal Shunt, First and Second Bus

*Note: Internal shunts not available for all voltage bus options.*



### **Integration (Required)**

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Aerotech offers both standard and custom integration services to help you get your system fully operational as quickly as possible. The following standard integration options are available for this system. Please consult Aerotech if you are unsure what level of integration is required, or if you desire custom integration support with your system.

**-TAS    Integration - Test as system**

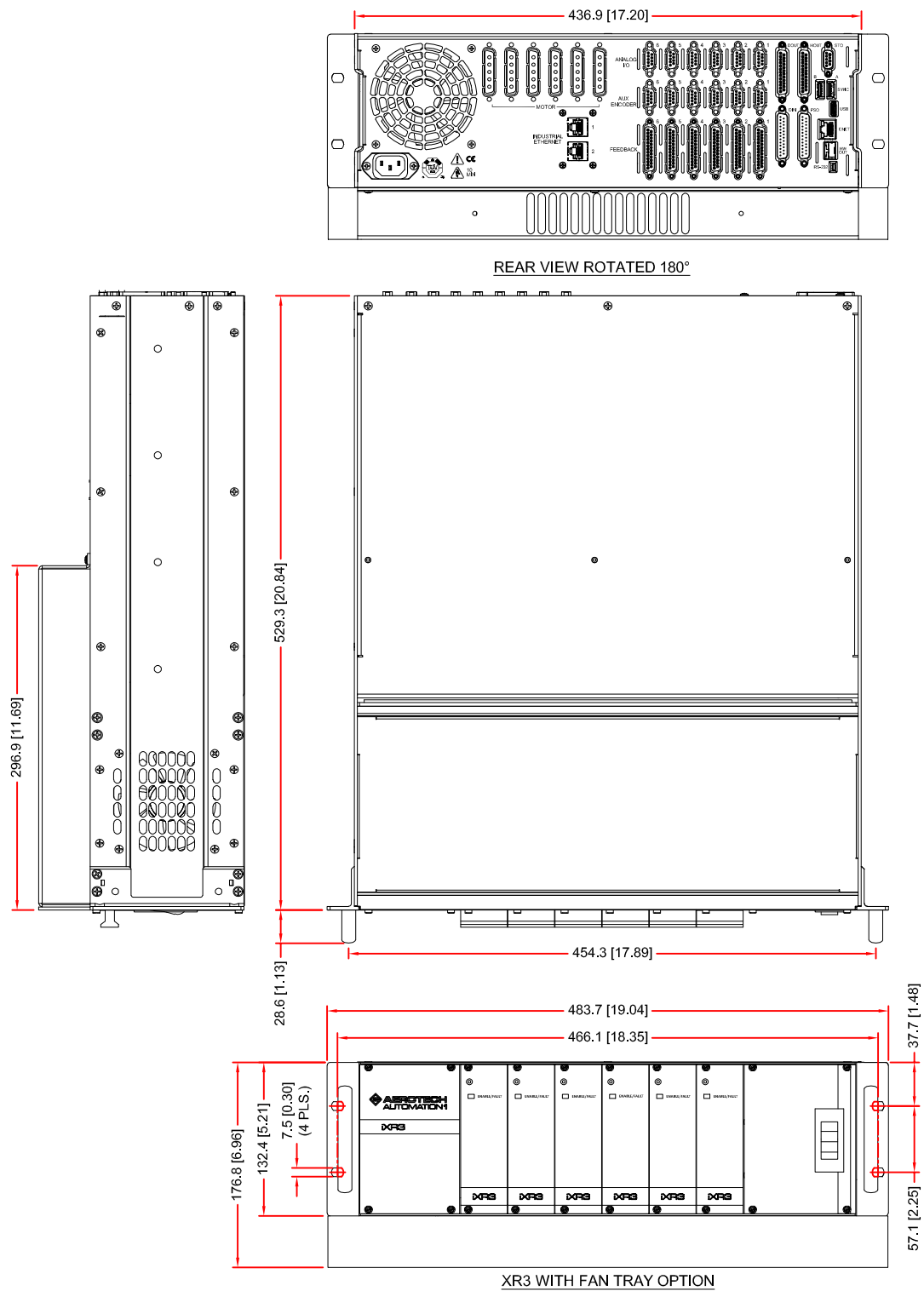
Testing, integration, and documentation of a group of components as a complete system that will be used together (ex: drive, controller, and stage). This includes parameter file generation, system tuning, and documentation of the system configuration.

**-TAC    Integration - Test as components**

Testing and integration of individual items as discrete components that ship together. This is typically used for spare parts, replacement parts, or items that will not be used together. These components may or may not be part of a larger system.

## AUTOMATION1 iXR3 DIMENSIONS

### AUTOMATION1-iXR3, Rack-Mounted



## AUTOMATION1 iXR3 DIMENSIONS

### AUTOMATION1-iXR3, Rack-Mounted with Drawer Slides

