

Ndrive Series

Digital Servo Amplifiers

Wide output power range from 10 A peak to 150 A peak at 320 VDC

2- or 3-phase AC line input or DC input

CE approval

PWM and linear power stages

Digital current, velocity, and position loops for improved motion stability

Optional integrated encoder multiplier for higher throughput and reduced wiring

Flexible design provides ability to drive brushless and DC brush-type servomotors as well as stepping motors

Encoder or resolver feedback

The Ndrive family of digital servo amplifiers are the high performance discrete drive options for the Automation 3200 motion system. Capable of driving brushless and DC brush-type servomotors, and stepper motors, the Ndrive amplifiers perform both current loop and servo loop closure to ensure the highest level of positioning performance and rate stability.

The Ndrives are built using high performance DSPs, allowing them to perform complex calculations in real time. This processing capability allows Ndrives to sample the digital current loop and servo loop at a rate of 20 kHz. The Ndrive amplifiers also handle both digital and analog I/O, laser firing, and encoder multiplication.

In order to provide the capability for increased I/O counts for PLC-type applications, the Ndrive HP and Ndrive HL have an optional dedicated Ethernet port to communicate with I/O modules from third-party vendors.



Ndrive HP



Ndrive HL



Ndrive CP



Ndrive CL



Ndrive MP

Standard options for the Ndrive include on-board encoder multiplication, three-axis position synchronized output (PSO), brake relay, additional I/O, absolute encoder interface, and separate logic supply inputs for “keep-alive” operation. The Ndrive HP, Ndrive HL, Ndrive CP, and Ndrive CL accept AC input power while the Ndrive MP accepts DC power input.

The Ndrive HL, a linear power amplifier, is available for low noise and ultra-high performance applications. This amplifier is ideal for high bandwidth requirements and maintains superb linearity with zero crossover distortion.

Also included in the Ndrive family is the Ndrive CP, a high performance PWM amplifier for cost-sensitive applications, and the Ndrive CL, which is a high performance linear amplifier for cost-sensitive applications. The Ndrive CP and CL maintain the same level of sophisticated control architecture while eliminating support for optional features.

Ndrive Series COMPARISON



Ndrive HP
Width: 99 mm
Height: 232.4 mm



Ndrive HL
Width: 206.9 mm
Height: 234.3 mm



Ndrive CP
Width: 63.5 mm
Height: 198.2 mm



Ndrive CL
Width: 103.7 mm
Height: 265.2 mm



Ndrive MP
Width: 41.1 mm
Height: 141.2 mm

Ndrive Comparison Chart	Ndrive HP	Ndrive HL	Ndrive CP	Ndrive CL	Ndrive MP
PC Interface	FireWire®	FireWire®	FireWire®	FireWire®	FireWire®
Current Output, Peak	10-150 A	10-20 A	10-30 A	10 A	10 A
Current Output, Continuous	5-75 A	5-10 A	5-15 A	5 A	5 A
Bus Voltage	10-320 V	40-80 V	10-320 V	40 V	10-80 V
Amplifier Type	PWM	Linear	PWM	Linear	PWM
Input Type	2 or 3 Phase AC	2 Phase AC	2 Phase AC	2 Phase AC	DC
Motor Style	Brush, Brushless, Stepper	Brush, Brushless, Stepper	Brush, Brushless, Stepper	Brush, Brushless, Stepper	Brush, Brushless, Stepper
Base I/O	4-DO/6-DI 1-AO/1-AI	4-DO/6-DI 1-AO/1-AI	4-DO/6-DI 1-AO/1-AI	4-DO/6-DI 1-AO/1-AI	1-AI
Additional I/O (Additional to Base I/O)	8-DO/8-DI 1-AO/1-AI	8-DO/8-DI 1-AO/1-AI	16-DO/16-DI 1-AO/1-AI	16-DO/16-DI 1-AO/1-AI	8-DO/8-DI 1-AO/1-AI
ESTOP Input	Yes	Yes	Yes	Yes	Yes
Brake Input Capable	Yes	Yes	Yes	Yes	Yes
Single Axis PSO ⁽¹⁾	Yes	Yes	Yes	Yes	Yes
Dual Axis PSO ⁽¹⁾	Yes	Yes	No	No	No
Triple Axis PSO ⁽¹⁾	Yes	Yes	No	No	No
Ethernet Capable for Third-Party I/O	Yes	Yes	No	No	No
Auxiliary Keep Alive	Yes	Yes	Yes	Yes	Yes

Notes:

1. PSO not available on Ndrive CP/MP when using integral MXU

The Ndrive MP is the smallest amplifier in the Ndrive family. With an overall package measuring under two inches wide and six inches in height, the Ndrive MP is ideal for applications with ultra-compact space requirements.

Any combination of Ndrive amplifiers can be used together on the FireWire® network to allow the system to be customized as needed.

Ndrive HP Series SPECIFICATIONS

Ndrive HP	Units	10	20	30	50	75	100	150	
Output Voltage ⁽¹⁾	VDC	10-320 ⁽²⁾							
Peak Output Current (1 sec)	A _{pk}	10	20	30	50	75	100	150	
Continuous Output Current ⁽³⁾	A _{pk}	5	10	15	25	37	50	75	
Power Amplifier Bandwidth	kHz	Selectable Through Software							
PWM Switching Frequency	kHz	20							
Minimum Load Inductance	mH	0.1 @ 160 VDC (1.0 mH @ 320 VDC)							
Operating Temperature	°C	0 to 50							
Storage Temperature	°C	-30 to 85							
Weight	kg (lb)	2.36 (5.2)			6.64 (14.6)			11.06 (24.4)	
Maximum Shunt Regulator Dissipation	W	40 (Optional)		40	440	440	440	440	
Power Input	VAC	Single- or Three-Phase 7-240 VAC, 50-60 Hz ⁽⁴⁾							
Encoder Input Frequency	kHz	200 kHz Amplified Sine (For Onboard Multipliers), 40 MHz TTL Square Wave							
Current Loop Update Rate	kHz	20 kHz							
Servo Loop Update Rate	kHz	1 to 20 kHz							
Keep Alive/Auxiliary Power Supply ⁽⁵⁾	—	Optional							
Brake Output	—	Optional							
Position Synchronized Output	—	Single Axis Standard, Two/Three Axis Optional							
Digital Inputs	—	6 Optically-Isolated (2 High Speed)							
Digital Outputs	—	4 Optically-Isolated							
Analog Inputs	—	One 16-bit Differential							
Analog Outputs	—	One 18-bit Single-Ended							
Additional I/O ⁽⁶⁾	—	8/8 Digital; 1/1 Analog							
MXH	—	Up to x2048							
Ethernet	—	Optional							
Emergency Stop Sense Input (ESTOP) ⁽⁷⁾	—	Yes							
Resolver Interface	—	Optional ⁽⁸⁾							
Shared Bus for Regen	—	No						Yes	

Notes:

- Output voltage dependent on input voltage.
- 10-120 VDC bus requires external transformer and auxiliary power option for logic power.
- Peak value of the sine wave; rms current for AC motors is 0.707(A_{pk}).
- Optional three-phase input available on Ndrive HP models.
- Auxiliary power option requires single phase 115-240 VAC 50-60 Hz.
- Requires IO option.
- Requires external relay to remove AC power.
- One- or two-channel input.

Ndrive HL SPECIFICATIONS

Ndrive HL	Units	10-40	20-40	10-80
Output Voltage ⁽¹⁾	VDC	±40	±40	±80
Peak Output Current (1 sec) ⁽⁶⁾	A _{pk}	10	20	10
Continuous Output Current ^(2,8)	A _{pk}	5	10	5
Power Amplifier Bandwidth	kHz	Selectable Through Software		
Minimum Load Inductance	mH	0		
Operating Temperature	°C	0 to 50		
Storage Temperature	°C	-30 to 85		
Weight	kg (lb)	10.36 (22.8)		
Maximum Shunt Regulator Dissipation	W	N/A		
Power Input	VAC	Single-Phase 7-240 VAC, 50-60 Hz		
Encoder Input Frequency	kHz	200 kHz Amplified Sine (For Onboard Multipliers), 40 MHz TTL Square Wave		
Current Loop Update Rate	kHz	20 kHz		
Servo Loop Update Rate	kHz	1 to 20 kHz		
Keep Alive/Logic Power Input ⁽⁴⁾	—	Optional		
Brake Output	—	Optional		
Position Synchronized Output	—	Single Axis Standard, Two/Three Axis Optional		
Digital Inputs	—	6 Optically-Isolated (2 High Speed)		
Digital Outputs	—	4 Optically-Isolated		
Analog Inputs	—	One 16-bit Differential		
Analog Outputs	—	One 18-bit Single-Ended		
Additional I/O ⁽⁵⁾	—	8/8 Digital; 1/1 Analog		
MXH	—	Up to x2048		
Ethernet	—	Optional		
Emergency Stop Sense Input (ESTOP) ⁽⁶⁾	—	Yes		
Resolver Interface	—	Optional ⁽⁷⁾		

Notes:

- Output voltage dependent upon input voltage.
- Peak value of the sine wave; rms current for AC motors is $0.707(A_{pk})$.
- 10-120 VDC bus requires external transformer and auxiliary power option for logic power.
- Auxiliary power option requires single phase 115-240 VAC 50-60 Hz.
- Requires IO option.
- Requires external relay to remove AC power.
- One- or two-channel input.
- Load dependent.

Ndrive CP, CL, and MP SPECIFICATIONS

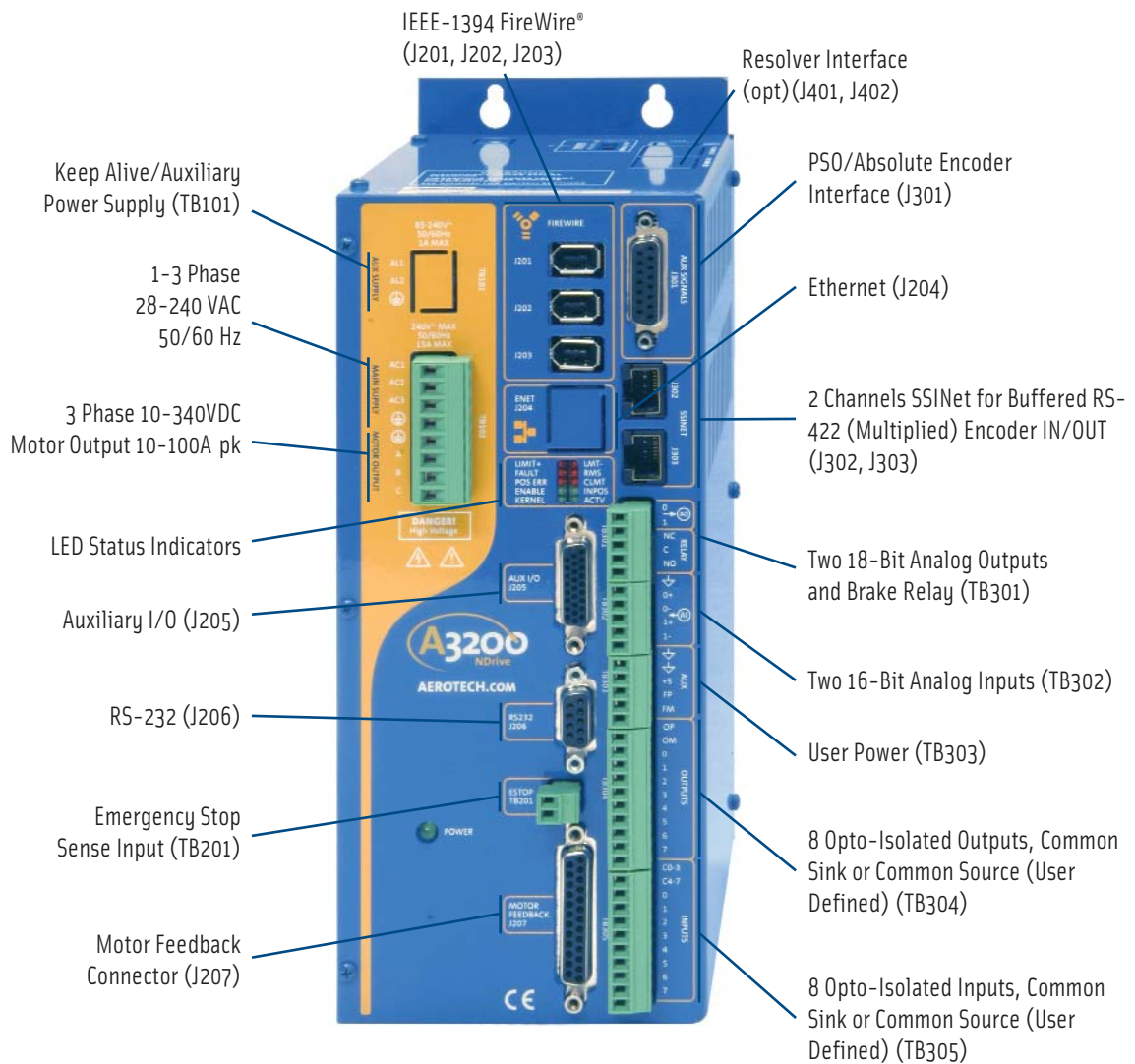
Ndrive CP, CL, and MP	Units	CP10	CP20	CP30	CL	MP10
Output Voltage ⁽¹⁾	VDC	10-320 ⁽²⁾	10-320 ⁽²⁾	10-320 ⁽²⁾	40 V	10-80
Peak Output Current (2 sec)	A _{pk}	10	20	30	10	10
Continuous Output Current ⁽³⁾	A _{pk}	5	10	15	5	5
Power Amplifier Bandwidth	kHz	Selectable Through Software				
PWM Switching Frequency	kHz	20			N/A	20
Minimum Load Inductance	mH	0.1 @ 160 VDC (1.0 mH @ 320 VDC)				0.1 @ 80 VDC
Operating Temperature	°C	0 to 50				
Storage Temperature	°C	-30 to 85				
Weight	kg (lb)	1.64 (3.6)			3.54 (7.8)	0.45 (1.0)
Maximum Shunt Regulator Dissipation	W	40 (Optional)			N/A	N/A
Power Input	VAC	Single-Phase 7-240 VAC, 50-60 Hz			56 VAC Motor Supply (center tapped transformer; two 28 VAC windings); 85-240 VAC Logic Supply	10-80 VDC Motor Supply; 24-80 VDC Logic Supply
Encoder Input Frequency	kHz	400 kHz Amplified Sine (For Onboard Multipliers), 40 MHz TTL Square Wave				
Current Loop Update Rate	kHz	20 kHz				
Servo Loop Update Rate	kHz	8 to 20 kHz				
Keep Alive/Logic Power Input	—	Optional ⁽⁴⁾			Yes	Yes
Brake Output	—	Optional				
Position Synchronized Output ^(5,6)	—	Single Axis Only				
Digital Inputs	—	6 Optically-Isolated (2 High Speed)				N/A
Digital Outputs	—	4 Optically-Isolated				N/A
Analog Inputs	—	One 12-bit Differential			One 16-bit	One 12-bit Differential
Analog Outputs	—	One 16-bit Single-Ended				N/A
Additional I/O ⁽⁷⁾	—	16/16 Digital; 1/1 Analog				8/8 Digital; 1/1 Analog
MXU	—	Up to x1024			Up to x4096	Up to x1024
Ethernet	—	N/A				
Emergency Stop Sense Input (ESTOP) ⁽⁸⁾	—	Yes				
Resolver Interface	—	N/A				

Notes:

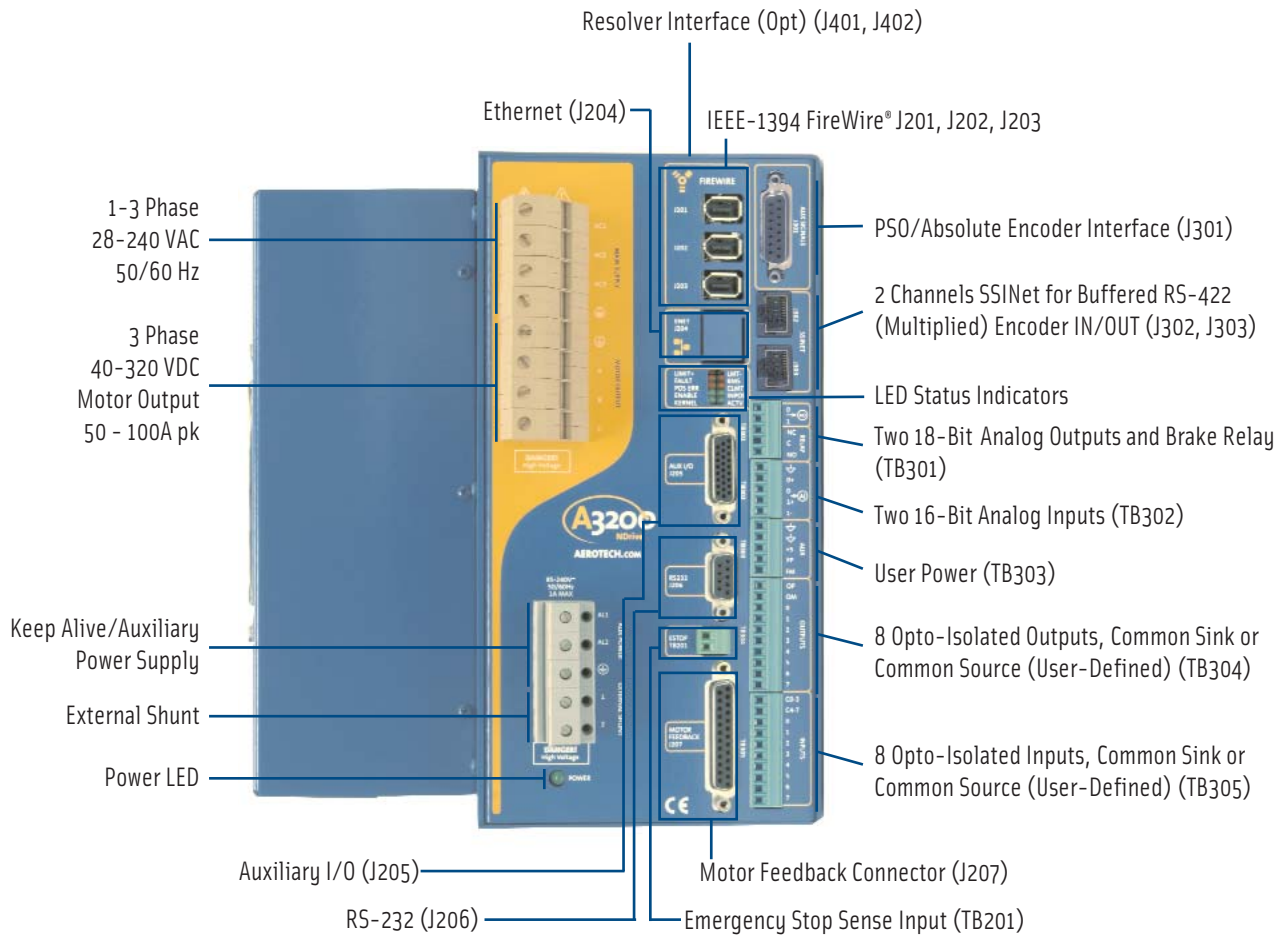
- Output voltage dependent upon input voltage.
- 10-120 VDC bus requires external transformer and auxiliary power option for logic power.
- Peak value of the sine wave; rms current for AC motors is 0.707(A_{pk}).
- Ndrive CP auxiliary power option requires single phase 115-240 VAC 50-60 Hz.
- Not available with MXU option.
- Requires IO board with Ndrive MP.
- Requires IO option.
- Requires external relay to remove AC power.

Ndrive HP10/20/30 COMPONENTS

Ndrive HP10/20/30 with Optional I/O

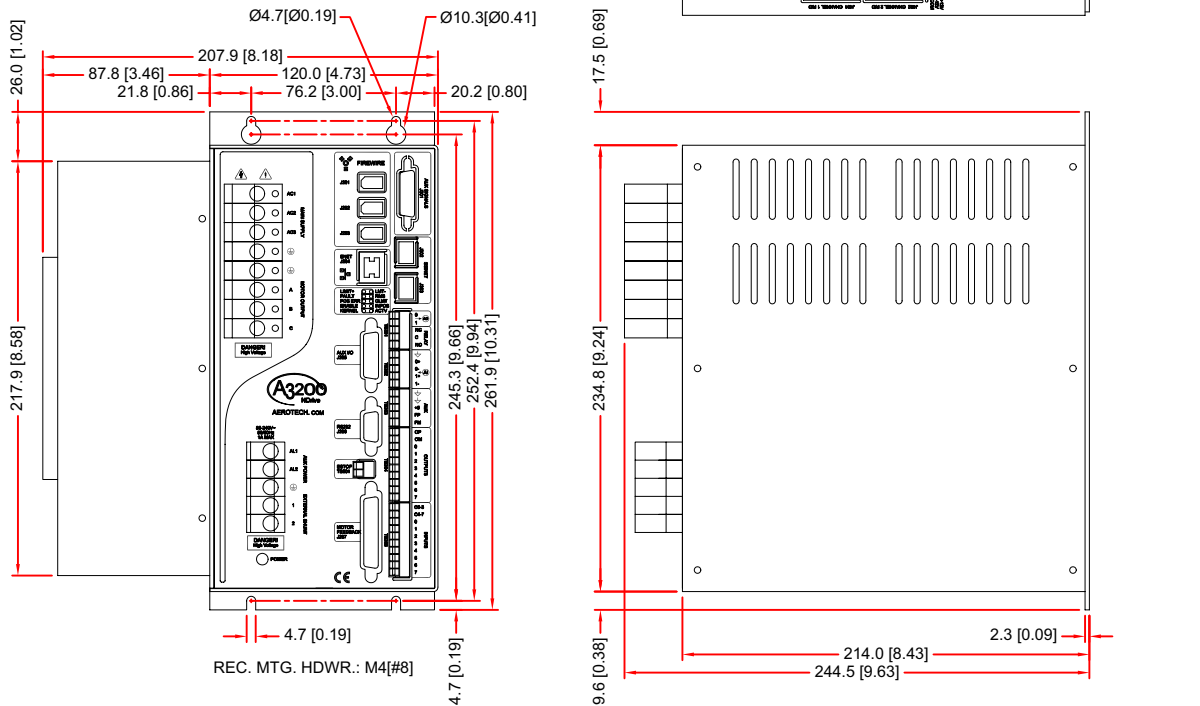


Ndrive HP50/75/100 with Optional I/O

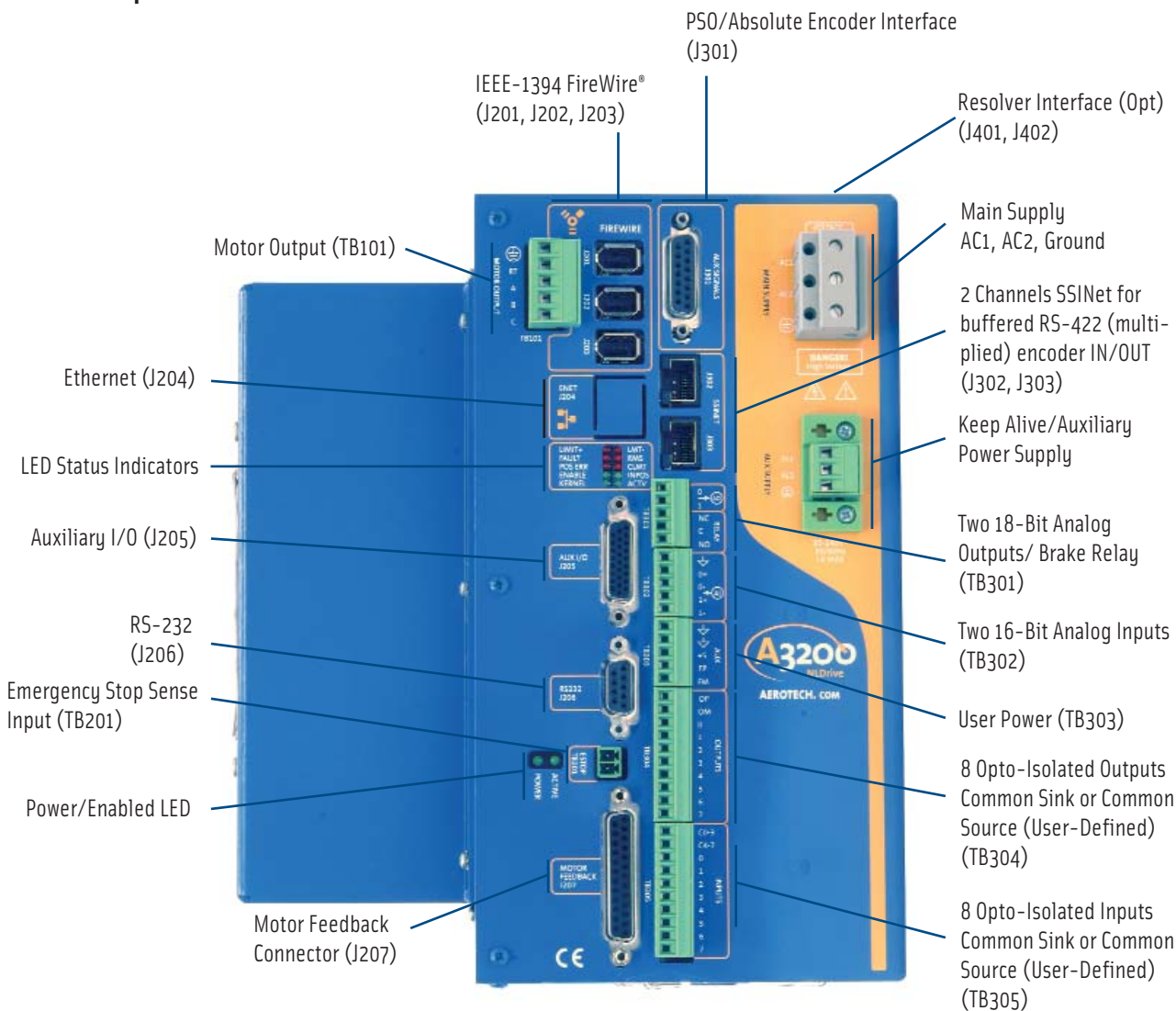


Ndrive HP50/75/100 DIMENSIONS

Ndrive HP50/75/100 with Optional I/O

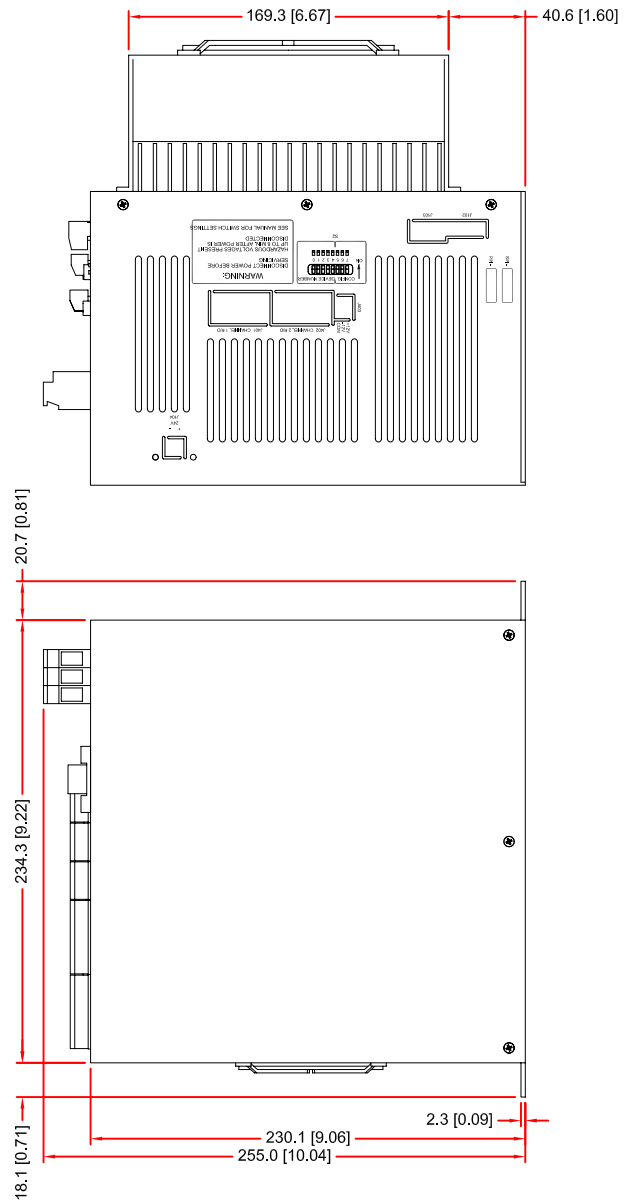
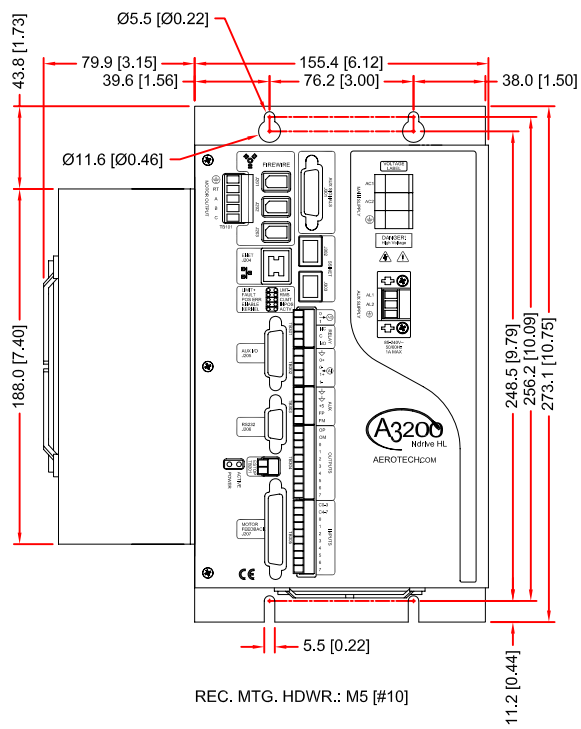


Ndrive HL with Optional I/O



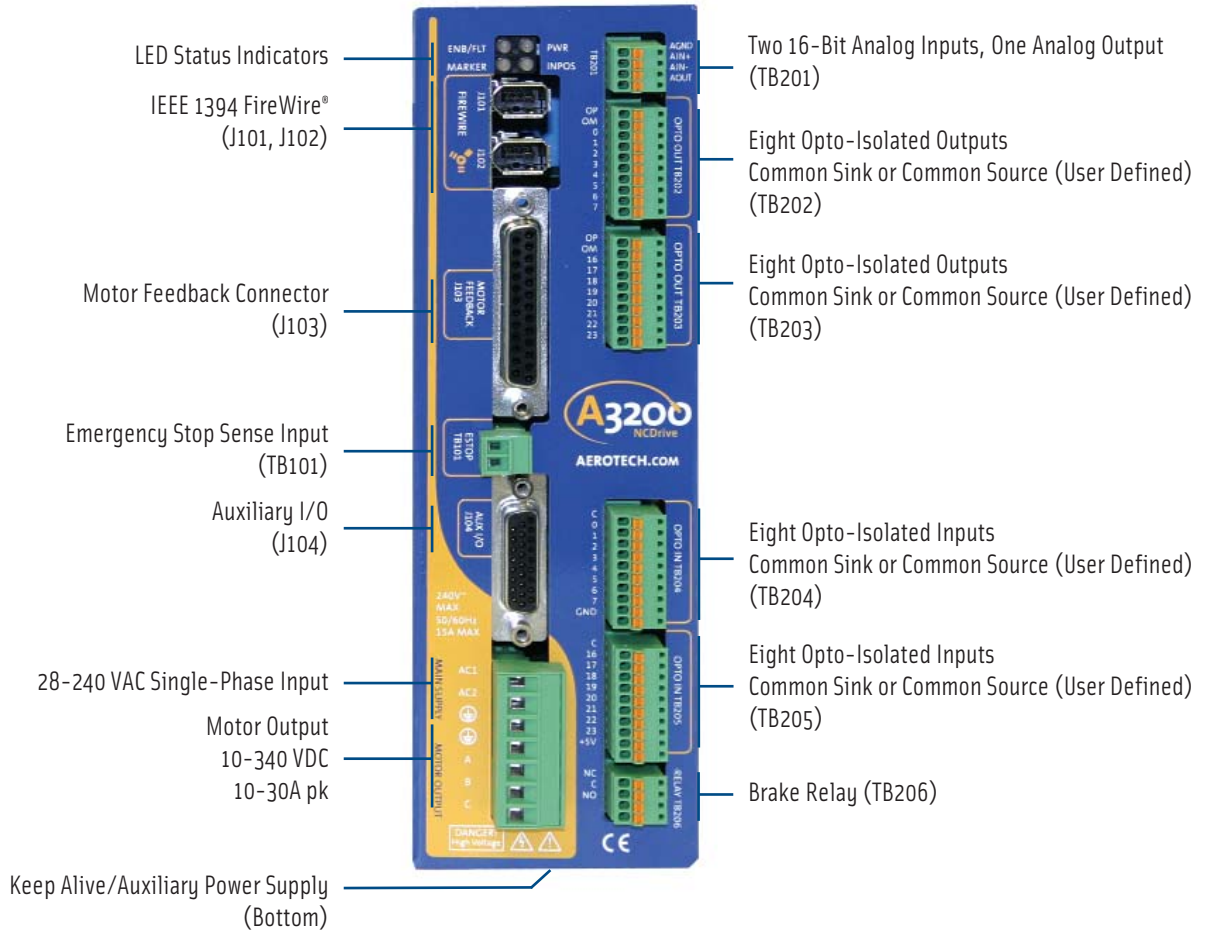
Ndrive HL DIMENSIONS

Ndrive HL with Optional I/O and Resolver



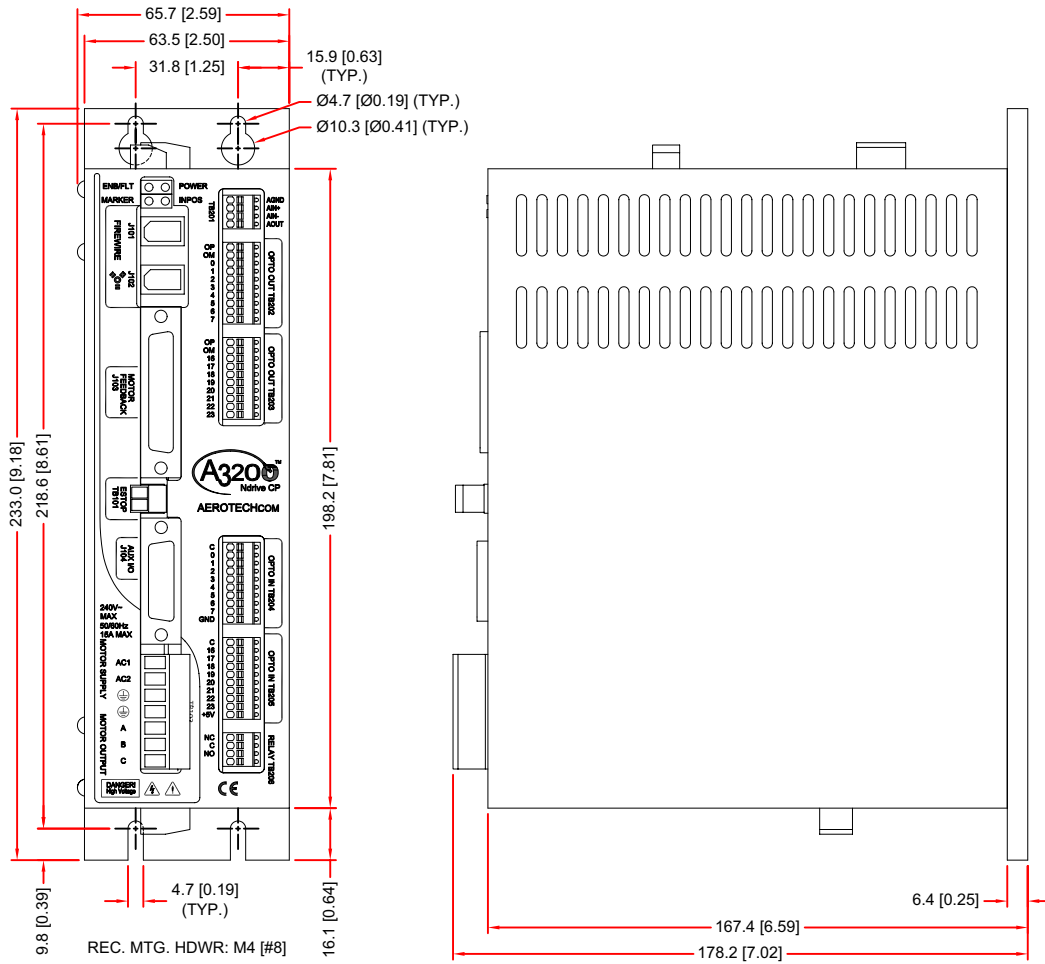
Ndrive CP COMPONENTS

Ndrive CP with Optional I/O



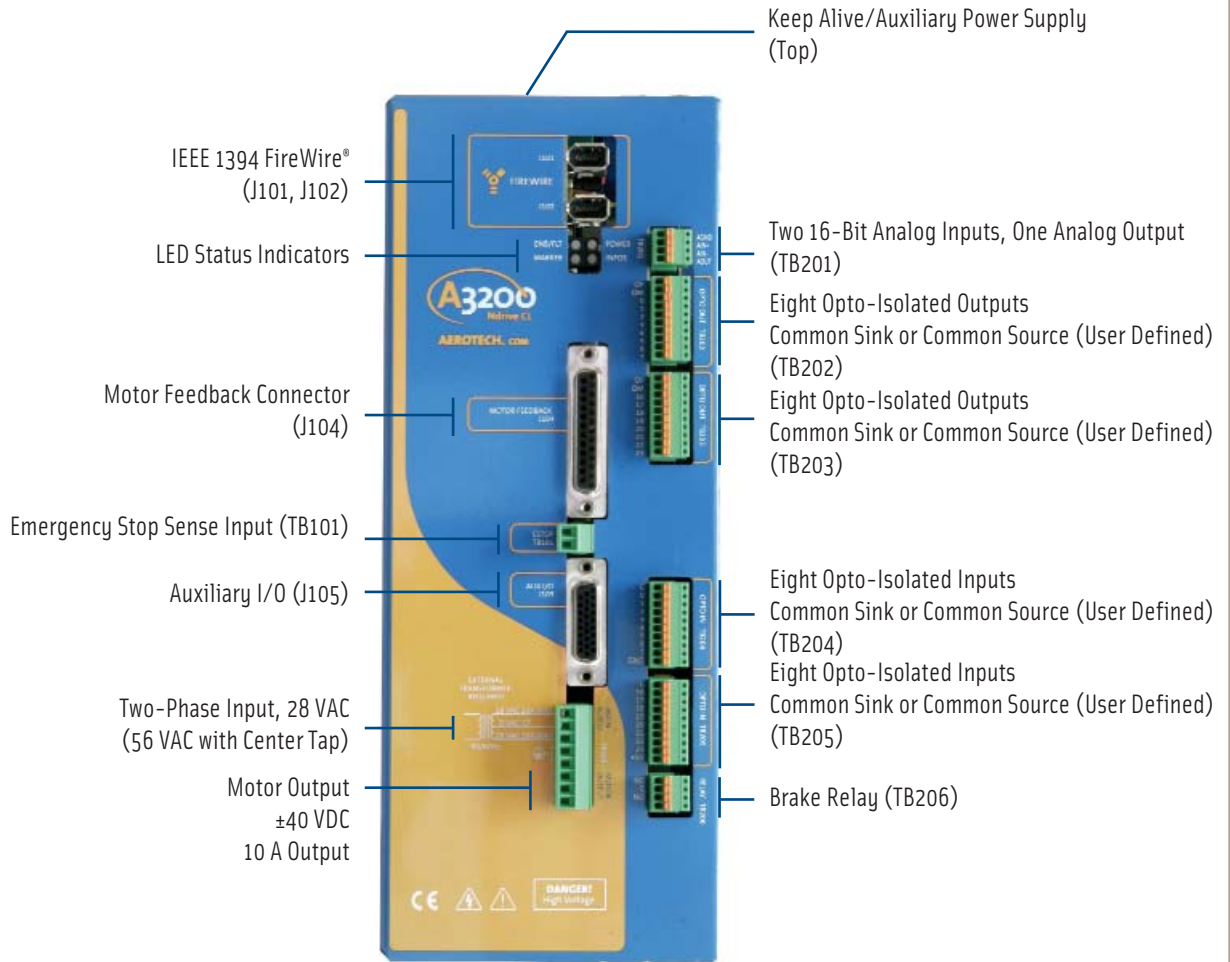
Ndrive CP DIMENSIONS

Ndrive CP with Optional I/O



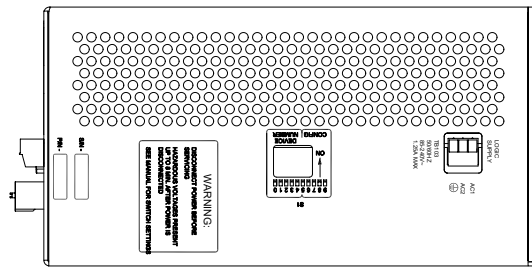
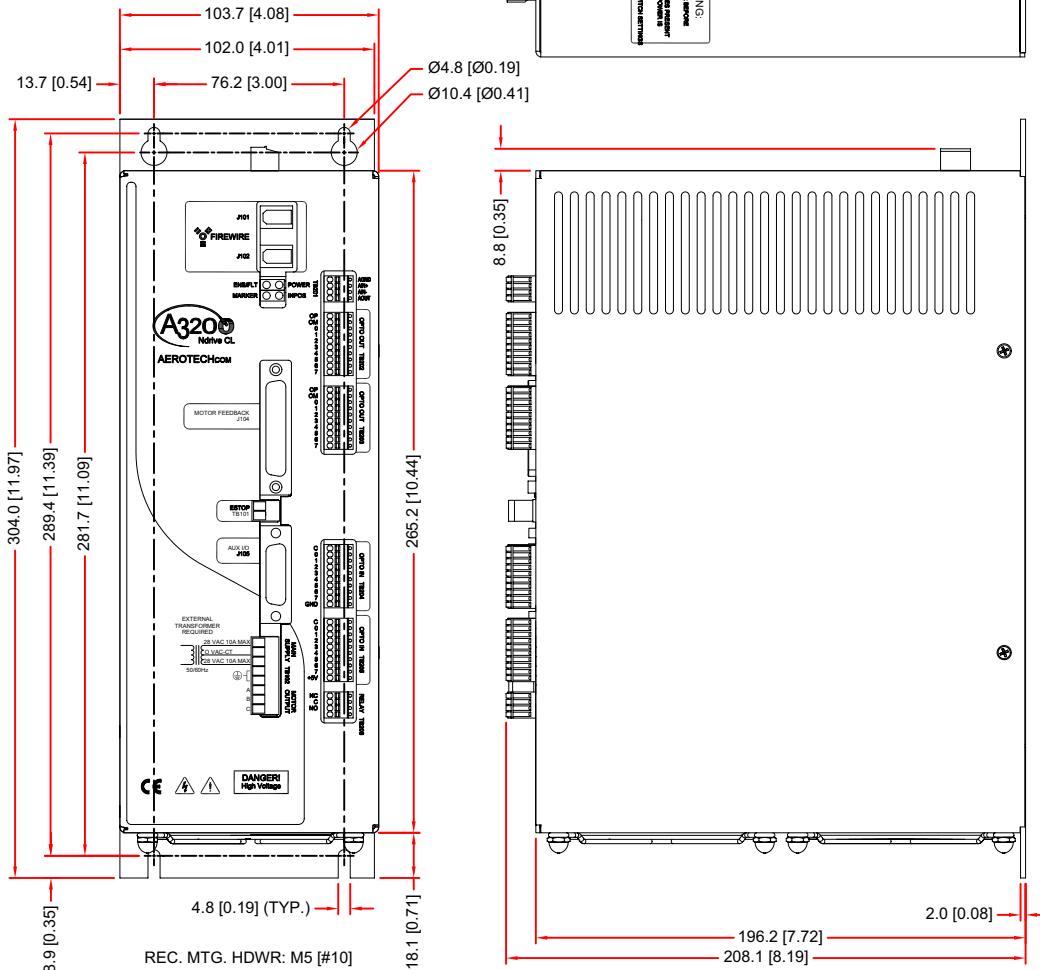
Ndrive CL COMPONENTS

Ndrive CL with Optional I/O



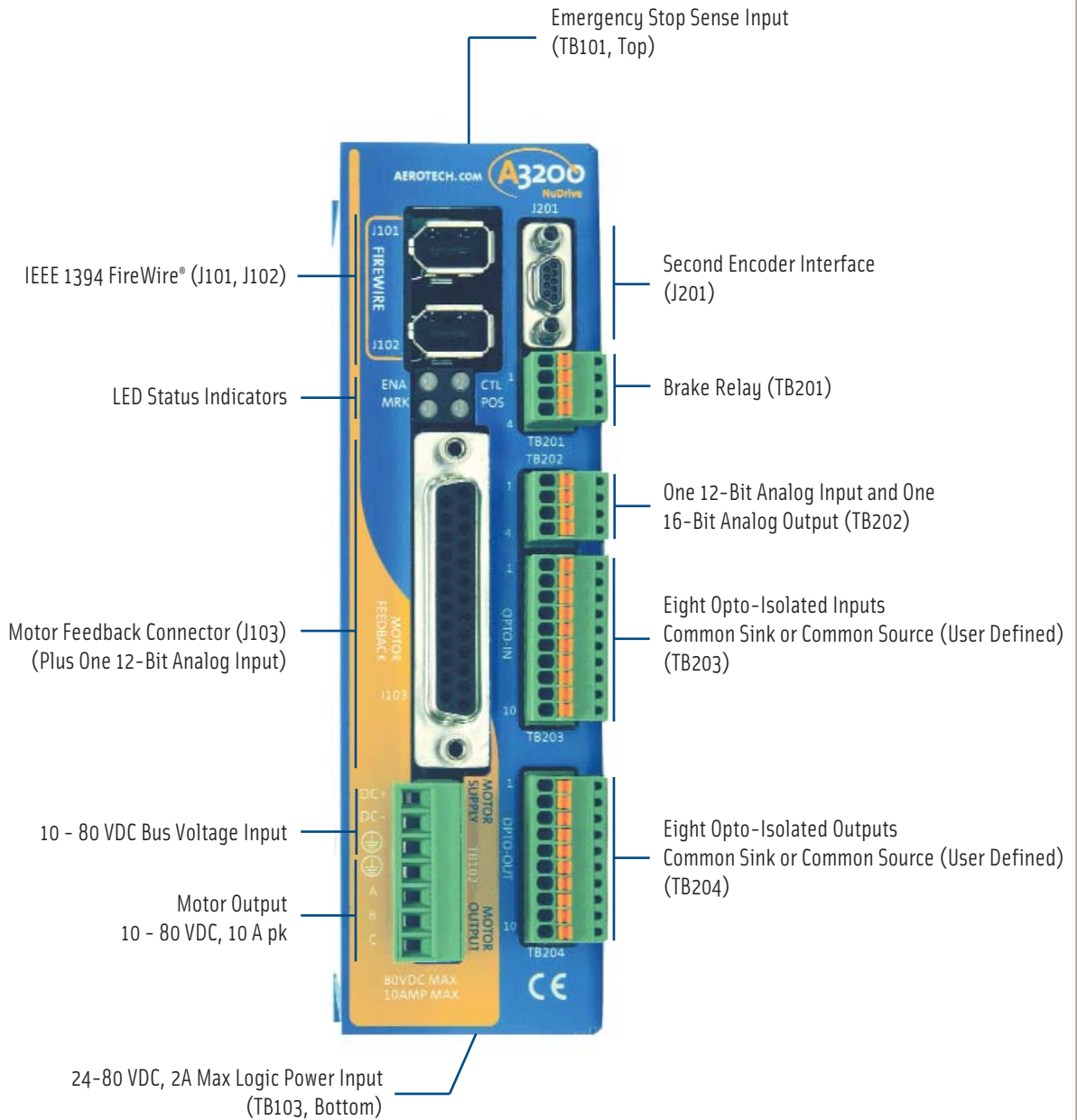
Ndrive CL DIMENSIONS

Ndrive CL with Optional I/O



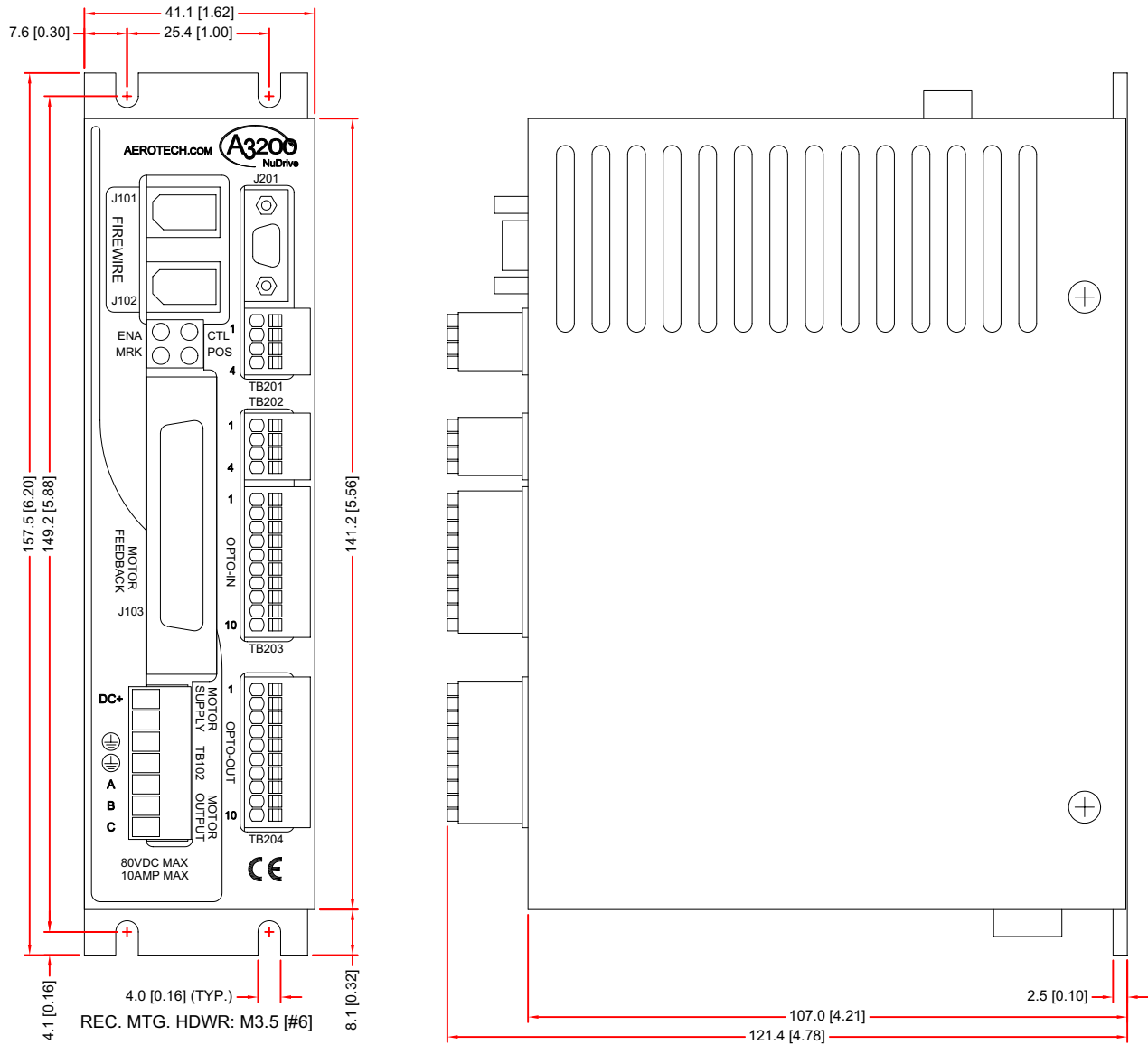
Ndrive MP10 COMPONENTS

Ndrive MP10 with Optional I/O



Ndrive MP10 DIMENSIONS

Ndrive MP10 with Optional I/O



Ndrive Series ORDERING INFORMATION

Ordering Example

Ndrive HP	20	-ENET	RDP1-10K	-AUXPWR
Base	Output Current	Control Option	Resolver Options	Power Stage Option
Ndrive HP	10	-IO		-S
	20	-IOH	RDP1-10K	-EXTSHUNT
	30	-DUALPSO	RDP1-7.5K	-AUXPWR
	50	-TRIPLEPSO	RDP1-5K	-HS
	75	-PSOPTO2	RDP2-10K	-3P
	100	-PSOPTO3	RDP2-7.5K	-FAN-115
	150	-PSOPTO4	RDP2-5K	-FAN-230
		-MXH		
		-ENET		
Ndrive HL	10-40-X	-IO	RDP1-10K	
	20-40-X	-IOH	RDP1-7.5K	
	10-80-X	-DUALPSO	RDP1-5K	-AUXPWR
		-TRIPLEPSO	RDP2-10K	
		-PSOPTO2	RDP2-7.5K	
		-PSOPTO3	RDP2-5K	
		-PSOPTO4		
		-MXH		
		-ENET		
Ndrive CP	10	-IO		-S
	20	-MXU		
	30			
Ndrive CL	10	-IO		
		-MXU		
Ndrive MP	10	-IO		
		-MXU		

NDRIVE HP (PWM)

NDRIVE HP10	10 A peak, 5 A continuous, 115/240 VAC input, PWM digital drive with FireWire interface; supports brush and brushless motors; includes: four opto-isolated digital outputs (sinking only); six opto-isolated digital inputs (sinking or sourcing); one 18-bit analog output; one 16-bit differential analog input; single-axis PSO capability; two quadrature encoder input channels; ESTOP sense input
NDRIVE HP20	20 A peak, 10 A continuous, 115/240 VAC input, PWM digital drive with FireWire interface; supports brush and brushless motors; includes: four opto-isolated digital outputs (sinking only); six opto-isolated digital inputs (sinking or sourcing); one 18-bit analog output; one 16-bit differential analog input; single-axis PSO capability; two quadrature encoder input channels; ESTOP sense input
NDRIVE HP30-S	30 A peak, 15 A continuous, 115/240 VAC, input digital drive with FireWire interface; supports brush and brushless motors; includes: four opto-isolated digital outputs (sinking only); six opto-isolated digital inputs (sinking or sourcing); one 18-bit analog output; one 16-bit differential analog input; single-axis PSO capability; two quadrature encoder input channels; ESTOP sense input; 100 watt internal shunt resistor
NDRIVE HP50-S	50 A peak, 25 A continuous, 115/240 VAC input, digital drive with FireWire interface; supports brush and brushless motors; includes: four opto-isolated digital outputs (sinking only); six opto-isolated digital inputs (sinking or sourcing); one 18-bit analog output; one 16-bit differential analog input; single-axis PSO capability; two quadrature encoder input channels; ESTOP sense input; 400 watt internal shunt resistor
NDRIVE HP75-S	75 A peak, 37 A continuous, 115/240 VAC input, digital drive with FireWire interface; supports brush and brushless motors; includes: four opto-isolated digital outputs (sinking only); six opto-isolated digital inputs (sinking or sourcing); one 18-bit analog output; one 16-bit differential analog input; single-axis PSO capability; two quadrature encoder input channels; ESTOP sense input; 400 watt internal shunt resistor
NDRIVE HP100-S	100 A peak, 50 A continuous, 115/240 VAC input, digital drive with FireWire interface; supports brush and brushless motors; includes: four opto-isolated digital outputs (sinking only); six opto-isolated digital inputs (sinking or sourcing); one 18-bit analog output; one 16-bit differential analog input; single-axis PSO capability; two quadrature encoder input channels; ESTOP sense input; 400 watt internal shunt resistor
NDRIVE HP150-S	150 A peak, 75 A continuous, 115/240 VAC input, digital drive with FireWire interface; supports brush and brushless motors; includes: four opto-isolated digital outputs (sinking only); six opto-isolated digital inputs (sinking or sourcing); one 18-bit analog output; one 16-bit differential analog input; single-axis PSO capability; two quadrature encoder input channels; ESTOP sense input; 400 watt internal shunt resistor

Ndrive Series ORDERING INFORMATION

NDRIVE HL (Linear)

NDRIVE HL10-40-x	10 A peak, 5 A continuous, ± 40 VDC bus linear digital drive with FireWire interface; supports brush and brushless motors; includes: four opto-isolated digital outputs (sinking only); six opto-isolated digital inputs (sinking or sourcing); one 18-bit analog output; one 16-bit differential analog input; single-axis PSO capability; two quadrature encoder input channels; ESTOP sense input
NDRIVE HL20-40-x	20 A peak, 10 A continuous, ± 40 VDC bus linear digital drive with FireWire interface; supports brush and brushless motors; includes: four opto-isolated digital outputs (sinking only); six opto-isolated digital inputs (sinking or sourcing); one 18-bit analog output; one 16-bit differential analog input; single-axis PSO capability; two quadrature encoder input channels; ESTOP sense input
NDRIVE HL10-80-x	10 A peak, 5 A continuous, ± 80 VDC bus linear digital drive with FireWire interface; supports brush and brushless motors; includes: four opto-isolated digital outputs (sinking only); six opto-isolated digital inputs (sinking or sourcing); one 18-bit analog output; one 16-bit differential analog input; single-axis PSO capability; two quadrature encoder input channels; ESTOP sense input

NDRIVE HL Line Voltage (-x) Options

-A	115 VAC input
-B	230 VAC input
-C	100 VAC input
-D	200/208 VAC input

NDRIVE HP/HL Control Options

-IO	Expansion board with 8 opto-isolated inputs (sinking or sourcing) and 8 outputs (sinking or sourcing); two 18-bit analog outputs; two 16-bit differential analog inputs; SSINET; absolute encoder interface and brake relay; includes HCPL2601 opto-isolator
-IOH	High power expansion board with 8 opto-isolated inputs (sinking or sourcing) and 8 outputs (sinking or sourcing) rated at 1 A per channel; two 18-bit analog outputs; two 16-bit differential analog inputs; SSINET; absolute encoder interface and brake relay; includes HCPL2601 opto-isolator
-DUALPSO	Two-axis PSO firing; second encoder input through AUX connection on NDRIVE or through SSINET on IO board; includes HCPL2601 opto-isolator
-TRIPLEPSO	Three-axis PSO firing; requires IO option to provide connections for three axes of encoder feedback; includes HCPL2601 opto-isolator
-PSOPTO2	Opto-isolator for PSO; requires IO/IOH option (<+15 V, high speed, low current, 6N136)
-PSOPTO3	Opto-isolator for PSO; requires IO/IOH option (<+30 V, low speed, high current, 4N33)
-PSOPTO4	Opto-isolator for PSO; requires IO/IOH option (TIL117-M, 40 kHz, 5-25 VDC, 50 mA)
-MXH	Programmable encoder multiplier up to x2048; supports single/dual-axis PSO and real-time encoder quadrature output
-ENET	10/100 BASE-T Ethernet port

NDRIVE HP/HL Resolver Options

RDP1-10K	Ndrive 1-channel resolver to digital feedback card with dynamic resolution switching capability; 10 kHz carrier frequency
RDP1-7.5K	Ndrive 1-channel resolver to digital feedback card with dynamic resolution switching capability; 7.5 kHz carrier frequency
RDP1-5K	Ndrive 1-channel resolver to digital feedback card with dynamic resolution switching capability; 5 kHz carrier frequency
RDP2-10K	Ndrive 2-channel resolver to digital feedback card with dynamic resolution switching capability; 10 kHz carrier frequency
RDP2-7.5K	Ndrive 2-channel resolver to digital feedback card with dynamic resolution switching capability; 7.5 kHz carrier frequency
RDP2-5K	Ndrive 2-channel resolver to digital feedback card with dynamic resolution switching capability; 5 kHz carrier frequency

Ndrive Series ORDERING INFORMATION

NDRIVE HP/HL Power Stage Options

-S	100 W internal shunt resistor network Note: Not valid with NdriveHL
-EXTSHUNT	2-pin connector for external shunt. External shunt not provided Note: Only valid with NdriveHP50/75/100
-HS	Heat sink with fins Note: Not valid with Ndrive HL; standard on Ndrive HP50/75/100
-3P	3-phase AC input, standard on Ndrive HP50/75/100 Note: Not valid with Ndrive HL
-FAN-115	115 VAC external cooling fan Note: Only valid with Ndrive HP50/75; included on Ndrive HP100
-FAN-230	230 VAC external cooling fan Note: Only valid with Ndrive HP50/75; included on Ndrive HP100

NDRIVE CP (PWM)

NDRIVE CP10	10 A peak, 5 A continuous, 115/240 VAC, input PWM digital drive with FireWire interface; supports brush and brushless motors; includes: four opto-isolated digital outputs (sinking or sourcing); six opto-isolated digital inputs (sinking or sourcing); one 16-bit analog output; one 12-bit differential analog input; single-axis PSO capability; two quadrature encoder input channels; ESTOP sense input
NDRIVE CP20	20 A peak, 10 A continuous, 115/240 VAC, input PWM digital drive with FireWire interface; supports brush and brushless motors; includes: four opto-isolated digital outputs (sinking or sourcing); six opto-isolated digital inputs (sinking or sourcing); one 16-bit analog outputs; one 12-bit differential analog input; single-axis PSO capability; two quadrature encoder input channels; ESTOP sense input
NDRIVE CP30-S	30 A peak, 15 A continuous, 115/240 VAC input, PWM digital drive with FireWire interface; supports brush and brushless motors; includes: four opto-isolated digital outputs (sinking or sourcing); six opto-isolated digital inputs (sinking or sourcing); two 16-bit analog outputs; one 12-bit differential analog input; single-axis PSO capability; two quadrature encoder input channels; ESTOP sense input; 40 W internal shunt resistor

NDRIVE CP Control Options

-IO	Expansion board with 16 opto-isolated inputs (sinking or sourcing); 16 outputs (sinking or sourcing); one 12-bit analog input; one 16-bit analog output and brake relay
-MXU	Programmable encoder multiplier up to x1024; no real-time output

NDRIVE CP Power Stage Options

-S	100 W internal shunt resistor network
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NDRIVE CL (Linear)

NDRIVE CL10-40	10 A peak, 5 A continuous, ± 40 VDC input linear digital drive with FireWire interface; supports brush and brushless motors; includes: four opto-isolated digital outputs (sinking or sourcing); six opto-isolated digital inputs (sinking or sourcing); one 16-bit analog output; one 12-bit differential analog input; single-axis PSO capability; two quadrature encoder input channels; ESTOP sense input
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NDRIVE CL Control Options

-IO	Expansion board with 16 opto-isolated inputs (sinking or sourcing); 16 outputs (sinking or sourcing); one 12-bit analog input; one 16-bit analog output and brake relay
-MXU	Programmable encoder multiplier up to x1024; no real-time output

NDRIVE MP (PWM)

NDRIVE MP10	10 A peak, 5 A continuous, 10-80 VDC input, PWM digital drive with FireWire interface; supports brush and brushless motors; includes: single-axis PSO capability (requires I/O board); 1 quadrature encoder input channel; ESTOP sense input; 24-80 VDC logic power input
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NDRIVE MP Control Options

-IO	Expansion board with 8 opto-isolated inputs (sinking or sourcing); 8 outputs (sinking or sourcing); one 12-bit analog input; one 16-bit analog output and brake relay; PSO output
-MXU	Programmable encoder multiplier up to x1024; no real-time output