APOGEE LINE

Apogee S3-120/6-S

- Internal (**S**) / external (-) auxiliary power supply
- Rated phase current (continuous)
- Rated supply voltage
- Number of output phases
- Number of outputs (**S**ingle/**D**ual)
- Drive series

Apogee drives are especially designed for high-end applications that demand ultra-low output ripple and a highly linear response.
This used to be the exclusive domain of linear amplifiers, but Prodrive Technologies uses its extensive experience in amplifier technology to introduce a PWM drive with negligible switching noise that matches linear drive performance.

Using proprietary end stage technology and a filtered output stage, the Apogee motor drives offer world-class linearity and switching noise.
Due to internal output filtering and EMI protections, the drive can operate with a minimal number of external components.

Compared with traditional analog drives, the Apogee line offers an increased system efficiency, significantly reducing the thermal load on the system.

- Integrated filtering
- Programmable PMP motion controller via MATLAB Simulink integration
- High precision Low Noise
- Wide range of connectivity options

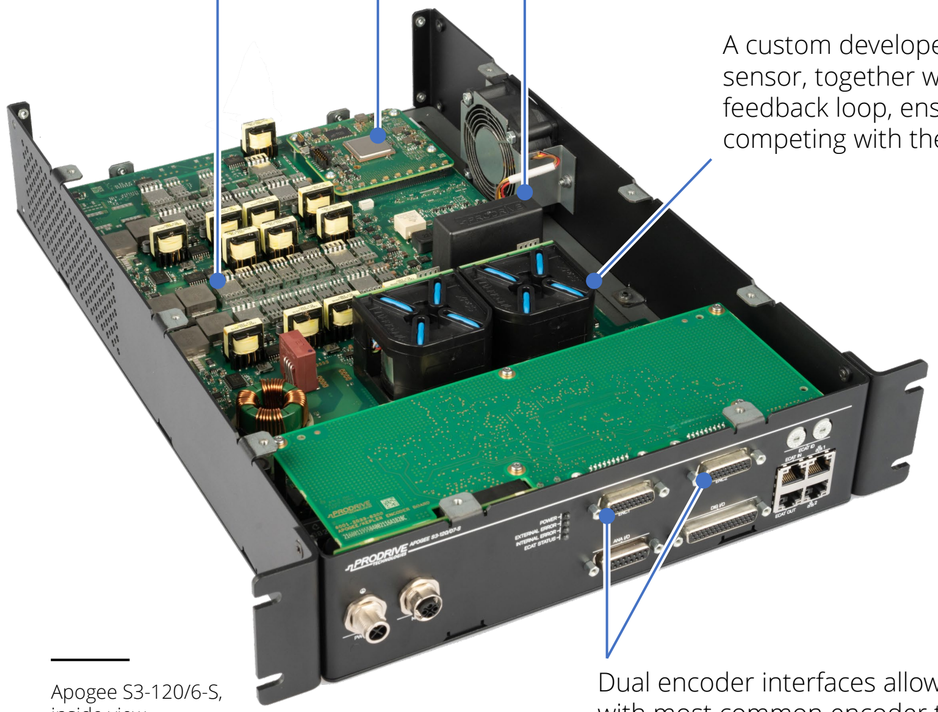
APOGEE LINE – FEATURES

Internal low-pass filtering, combined with a multilevel output stage almost completely eliminates any output ripple.

Embedded motion controller with advanced diagnostic capabilities

The Apogee line uses high stability metal foil resistors in combination with a temperature-controlled voltage reference to guarantee drift levels in the ppm range, significantly extending system level calibration intervals.

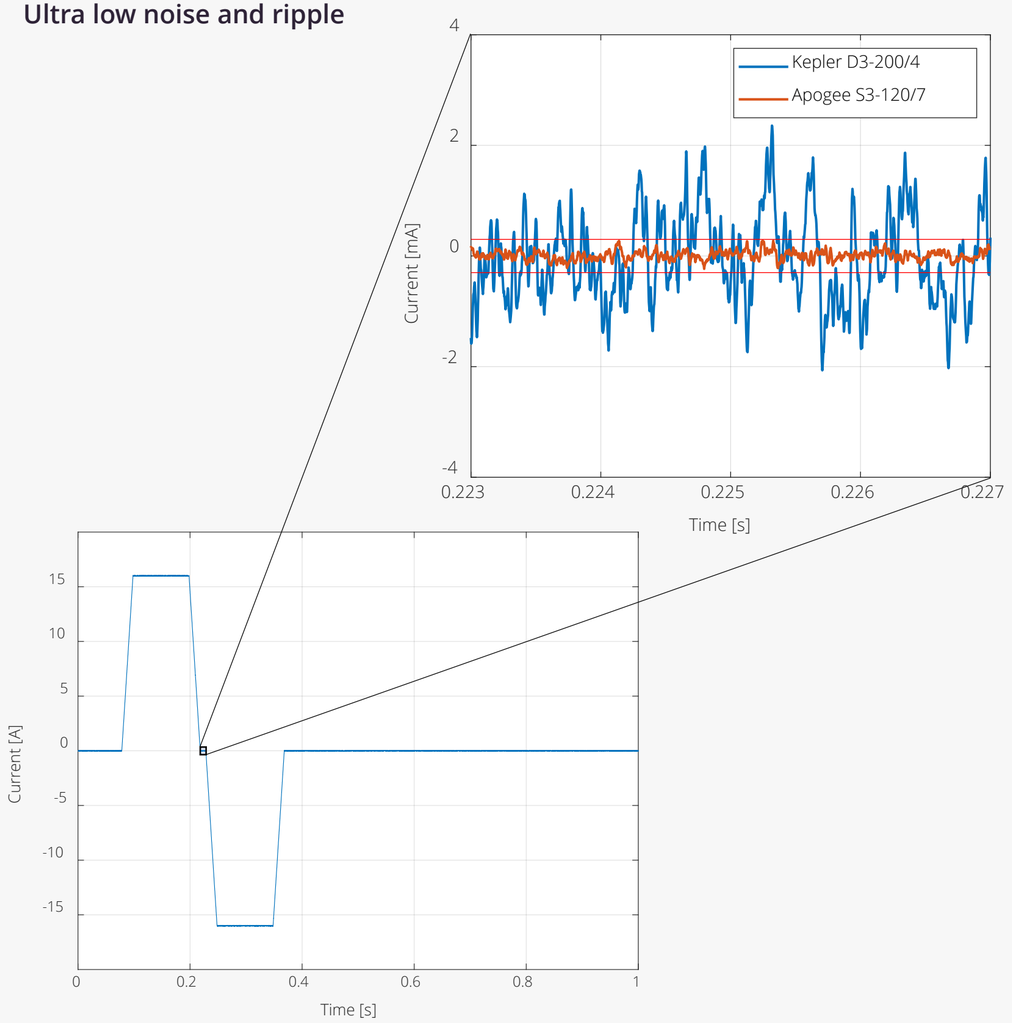
A custom developed fluxgate current sensor, together with a high-resolution feedback loop, ensures noise performances competing with the best linear amplifiers.



Apogee S3-120/6-S, inside view

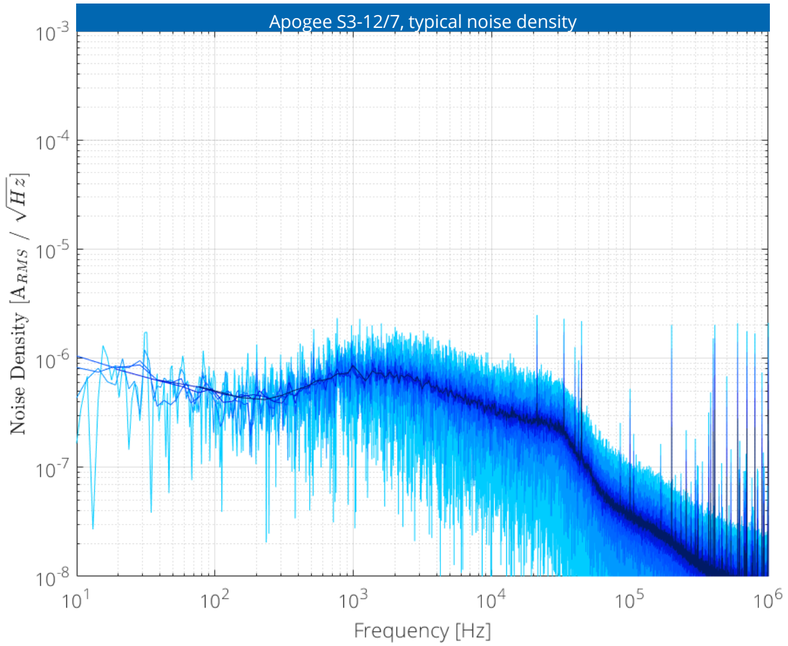
Dual encoder interfaces allow interfacing with most common encoder types

Ultra low noise and ripple



APOGEE LINE – PERFORMANCE SPECIFICATIONS

	Parameter	Symbol	Unit	S3-120/7	D1-120/7	Remark
Input	Supply input voltage	V_{SUPPLY}	V	2x30 to 2x60		Balanced supply
	Supply input voltage, abs. max	$V_{SUPPLY\_ABS\_MAX}$	V_{DC}	2x70		
	Peak input current	I_{SUPPLY_PEAK}	A_{PK}	max 12		
	Continous input current	I_{SUPPLY_CONT}	A_{RMS}	max 7		
	Auxiliary input voltage	V_{SUPPLY_AUX}	V	22 - 26		for version without -S suffix
	Auxiliary input current	I_{AUX_RMS}	A_{RMS}	2		
Output	Number of motor outputs	n_{MOT}	-	1	2	
	Supported motor types		-	3-phase PMSM/BLDC	voice coil	
	Peak phase current	I_{PH_PK}	A_{PK}	16,5		
	Continous phase current	I_{PH_CONT}	A_{RMS}	6,5		
	Peak phase-phase voltage range	V_{PHPH_PEAK}	V_{PK}	0 - 100		V_{SUPPLY}= 2x60VDC
			V_{RMS}	0 - 70		
	Current loop, small signal bandwidth	f_{-3dB}	kHz	6-7		-3dB, typical value
	Rated switching frequency	f_{PWM}	kHz	200		
	Output frequency	f_{MOT}	Hz	0-595		dual use limited, see note
	Electrical braking function		-	Y		shorts motor phases together
	External brake resistor		-	N		
	Internal brake resistor		-	Y	N	
Accuracy	Offset	E_{MOT_OFFSET}	% of I_{PH_PK}	<0,4		
	Offset drift	$E_{MOT\_OFFSET\_DRIFT}$	% of I_{PH_PK}	<0,1		
	Gain error	E_{MOT_GAIN}	% of I_{PH_PK}	<0,7		
	Gain error drift	$E_{MOT\_GAIN\_DRIFT}$	ppm of I_{PK}	<150		
	Non-linearity	E_{MOT_NONL}	ppm of I_{PK}	<50		
Noise	Noise (spectral density, 20Hz-10kHz)	I_{NOISE_LF}	µA/√Hz	max 1		
	Noise (rms, 1Hz-100kHz)	I_{NOISE_100kHz}	μA_{RMS}	max 10		
	Ripple	I_{MOT_RIPPLE}	μA_{RMS}	100		2mH phase inductance, ±48V
Control	Interface type		-	GbE		
				EtherCAT		
				RS422		50MBps max
	Update rate	f_{ECAT}	-	100Hz - 20kHz		
	Diagnostic interface		-	GbE		



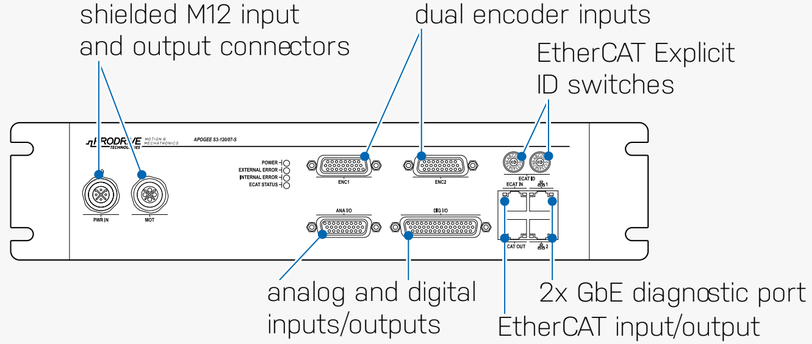
	Parameter	Symbol	Unit	S3-120/7	D1-120/7	Remark
Safety	Applicable standard		-	IEC/UL61800-5-1		TüV certified
	Pollution degree	PD	-	2		
	Overvoltage category	OVC	-	I		
	IP-protection class / enclosure type		-	IP20 / open type		
	Max operating altitude	h_{OP_max}	m	2000		above mean sea level
	STO / SBC outputs		-	-		
EMC	Applicable standard			IEC61800-3		
	Input filtering			Cat C2, 2nd env		
	Output filtering			Activly dampened LC		

Notes:
- All performance specifications are validated at an input voltage of 2 x 48V
- Dual use limited: output frequencies above 600Hz are subject to export control and require an export permit (EU 2021/821, 3A225)

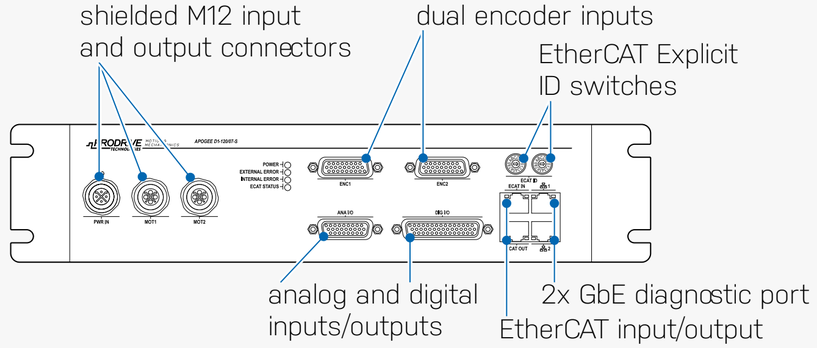
APOGEE LINE – INTERFACES

	Parameter	Symbol	Unit	S3-120/7	D1-120/7	Remark
Encoder inputs	Number of encoder inputs	n_{ENC}	-	2		
	Supported types		-	Analog Sin/Cos Digital hall Endat 2.1/2.2 Hiperface DSL (4W) SSI BiSS C		
	Max signal frequency	f_{sincos_max}	MHz	4		No missing pulses
	Maximum baudrate (digital encoders)	f_{rs422_max}	MHz	32		
	Encoder supply voltage	V_{ENCSUP}	V	5 / 10		software selectable
	Encoder supply current	I_{ENCSUP}	mA	max 500		
General purpose I/O	Isolated digital inputs		-	4 x 24V		(V_{IH}≥11V, V_{IL}≤5V, I_{IN}<15mA)
	Isolated digital outputs		-	4 x 30V / 500mA		
	Non-isolated digital inputs		-	4 x TTL		
	Non-isolated digital outputs		-	2 x 24V - 1A 2x 24V - 200mA 4x TTL output		
	Analog inputs		-	2 x ±10V diff		14bit resolution
	Analog outpus		-	2 x ±10V diff		16bit resolution
	Brake outputs		-	-		

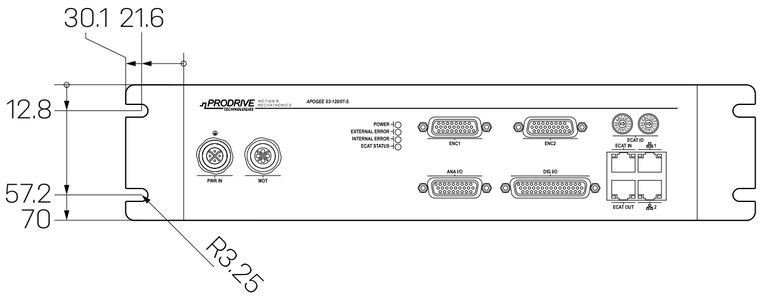
S3-120/7



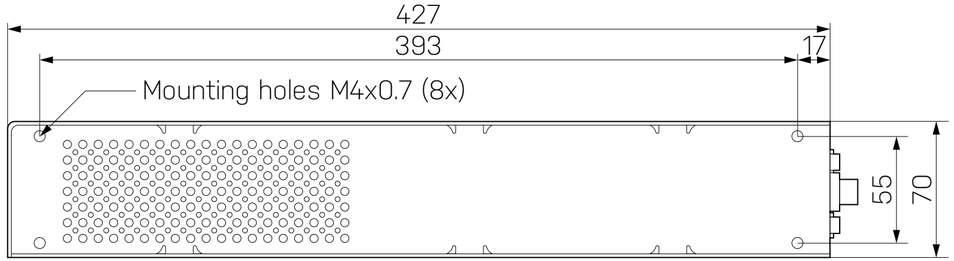
D1-120/7

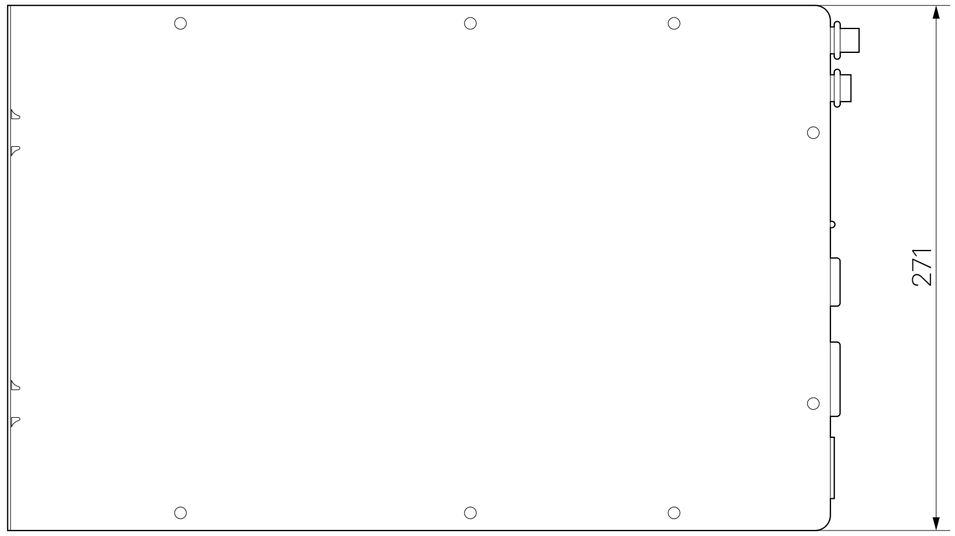


APOGEE LINE –MECHANICAL SPECIFICATIONS



	Parameter	Symbol	Unit	S3-120/7	D1-120/7	Remark
Mechanical	Width	d_W	mm	271		
	Depth	d_D	mm	442		including connectors
	Height	d_H	mm	70		
	Operating temperature range	T_{OP}	°C	10 - 40		
	Operating humidity range	h_{OP}	%	20 - 80		non-condensing
	Shock & Vibration		-	IEC60068-2-6 (Fc)		
	Lifetime		-	>10 years		
	Mass	mass	kg	6,0		typical value





KEPLER LINE

The Kepler series is designed for demanding applications requiring high linearity and a very low output current ripple. This used to be the exclusive domain of linear amplifiers, but Prodrive Technologies uses its extensive experience in amplifier technology to introduce a PWM drive with negligible switching noise that matches linear drive performance. The Kepler motor drives offer world-class linearity and switching noise. Due to internal output filtering and EMI protections, the drive can operate with a minimal number of external components.

Kepler drives have an integrated Prodrive Motion Platform (PMP) motion controller. PMP is a highly flexible platform that is being used in many applications, ranging from personal transportation solutions to semiconductor industry. The PMP tooling ensures fast and effortless commissioning, while motion applications benefit from a powerful API and real-time control.

Kepler D3-200/4-S

- Internal (**S**) / external (-) auxiliary power supply
- Rated phase current (continuous)
- Rated supply voltage
- Number of output phases
- Number of outputs (**S**ingle/**D**ual)
- Drive series

Integrated filtering

Programmable PMP motion controller via MATLAB Simulink integration

High precision Low Noise

Wide range of connectivity options

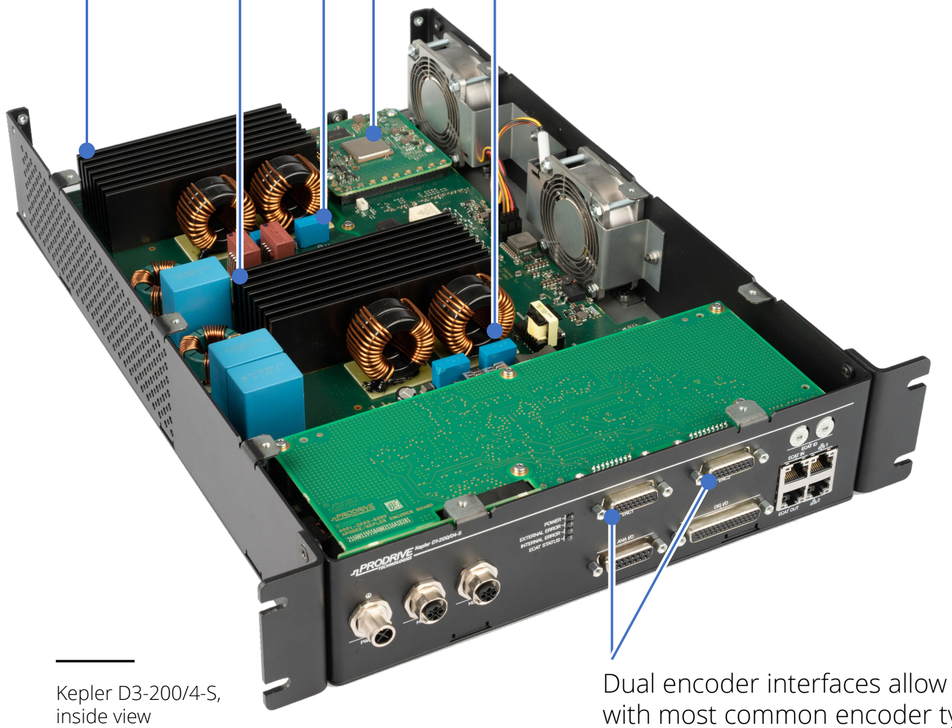
KEPLER LINE – FEATURES

Dual, high performance 200kHz power stages with Integrated thermal solution

High resolution (18b), high bandwidth (800kHz) current measurement circuit

Embedded motion controller with advanced diagnostic capabilities

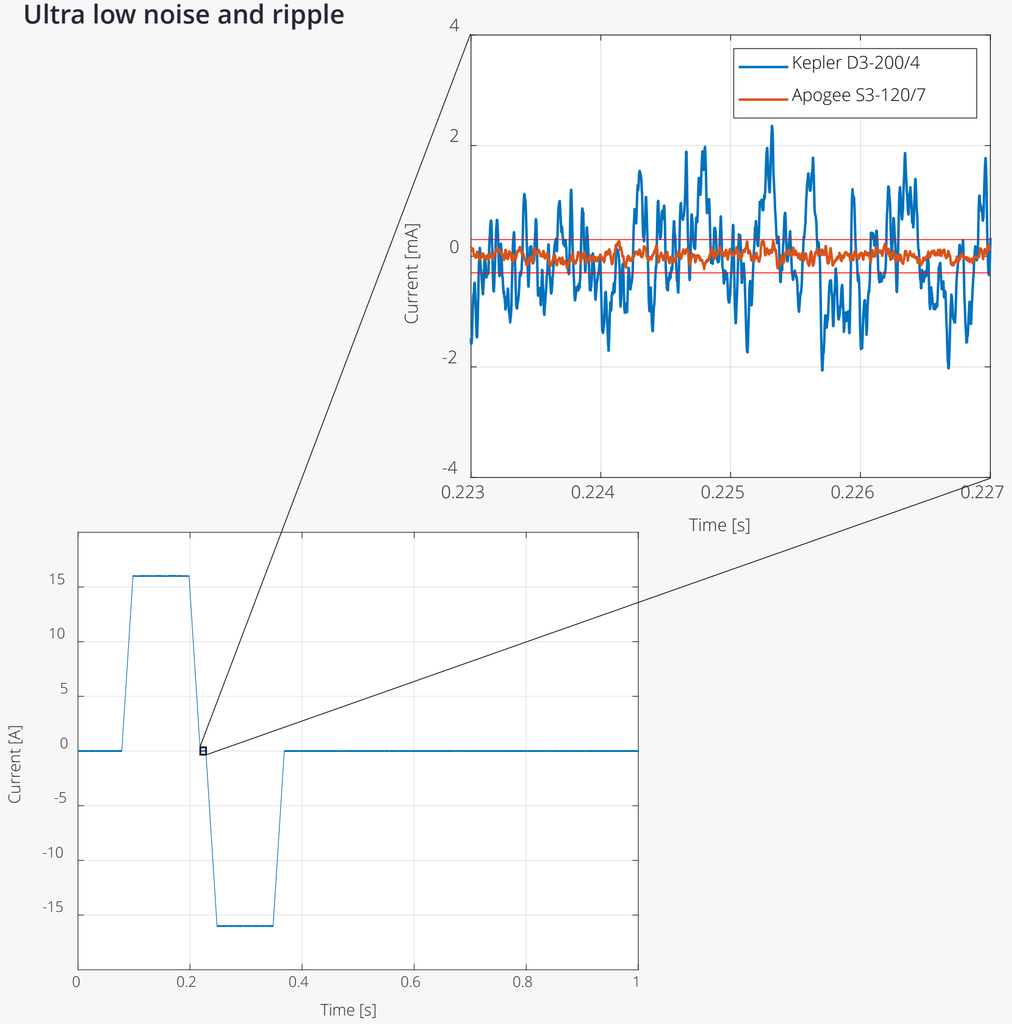
Actively dampened low pass filters almost completely eliminate any output ripple.



Kepler D3-200/4-S, inside view

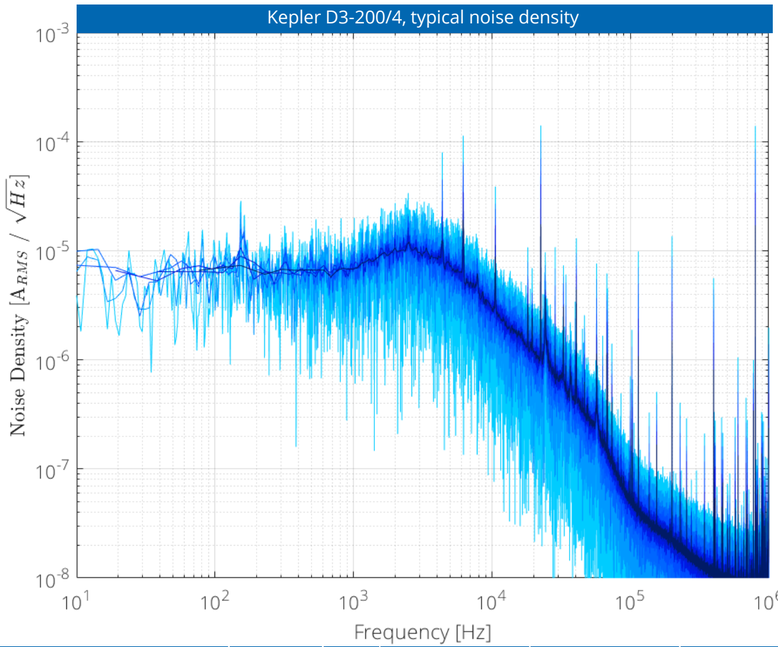
Dual encoder interfaces allow interfacing with most common encoder types

Ultra low noise and ripple



KEPLER LINE – PERFORMANCE SPECIFICATIONS

	Parameter	Symbol	Unit	D1-200/4	D3-200/4	Remark
Input	Supply input voltage	V_{SUPPLY}	V	2x30 to 2x100		Balanced supply
	Supply input voltage, abs. max	$V_{SUPPLY\_ABS\_MAX}$	V_{DC}	2x110		
	Peak input current	I_{SUPPLY_PEAK}	A_{PK}	max 21		
	Continous input current	I_{SUPPLY_CONT}	A_{RMS}	max 9		
	Auxiliary input voltage	V_{SUPPLY_AUX}	V	22 - 26		for version without -S suffix
	Auxiliary input current	I_{AUX_RMS}	A_{RMS}	2		
Output	Number of motor outputs	n_{MOT}	-	2	2	
	Supported motor types		-	voice coil	3-phase PMSM/BLDC	
	Peak phase current	I_{PH_PK}	A_{PK}	20		
	Continous phase current	I_{PH_CONT}	A_{RMS}	4,0		
	Peak phase-phase voltage range	V_{PHPH_PEAK}	V_{PK}	0 - 180		V_{SUPPLY}= 2x60VDC
			V_{RMS}	0 - 120		
	Current loop, small signal bandwidth	f_{-3dB}	kHz	3-4		-3dB, typical value
	Rated switching frequency	f_{PWM}	kHz	200		
	Output frequency	f_{MOT}	Hz	0-595		dual use limited, see note
	Electrical braking function		-	Y		shorts motor phases together
	External brake resistor		-	N		
	Internal brake resistor		-	N	Y	
Accuracy	Offset	E_{MOT_OFFSET}	% of I_{PH_PK}	<0,25		
	Offset drift	$E_{MOT\_OFFSET\_DRIFT}$	% of I_{PH_PK}	<0,07		
	Gain error	E_{MOT_GAIN}	% of I_{PH_PK}	<0,82		
	Gain error drift	$E_{MOT\_GAIN\_DRIFT}$	ppm of I_{PK}	<1500		
	Non-linearity	E_{MOT_NONL}	ppm of I_{PK}	<550		
Noise	Noise (spectral density, 20Hz-10kHz)	I_{NOISE_LF}	µA/√Hz	max 20		
	Noise (rms, 1Hz-100kHz)	I_{NOISE_100kHz}	μA_{RMS}	max 200		
	Ripple	I_{MOT_RIPPLE}	μA_{RMS}	350		2mH phase inductance, ±48V
Control	Interface type		-	GbE		
				EtherCAT		
				RS422		50MBps max
	Update rate	f_{ECAT}	-	100Hz - 20kHz		
	Diagnostic interface		-	GbE		



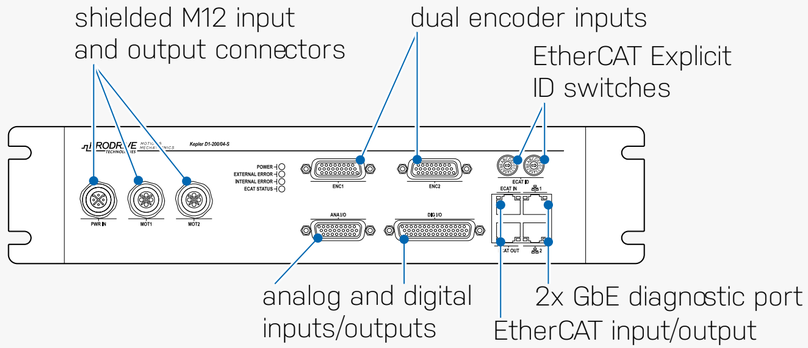
	Parameter	Symbol	Unit	D1-200/4	D3-200/4	Remark
Safety	Applicable standard		-	IEC/UL61800-5-1		TüV certified
	Pollution degree	PD	-	2		
	Overvoltage category	OVC	-	I		
	IP-protection class / enclosure type		-	IP20 / open type		
	Max operating altitude	h_{OP_max}	m	2000		above mean sea level
	STO / SBC outputs		-	-		
EMC	Applicable standard			IEC61800-3		
	Input filtering			Cat C2, 2nd env		
	Output filtering			Activly dampened LC		

Notes:
- All performance specifications are validated at an input voltage of 2 x 48V
- Dual use limited: output frequencies above 600Hz are subject to export control and require an export permit (EU 2021/821, 3A225)

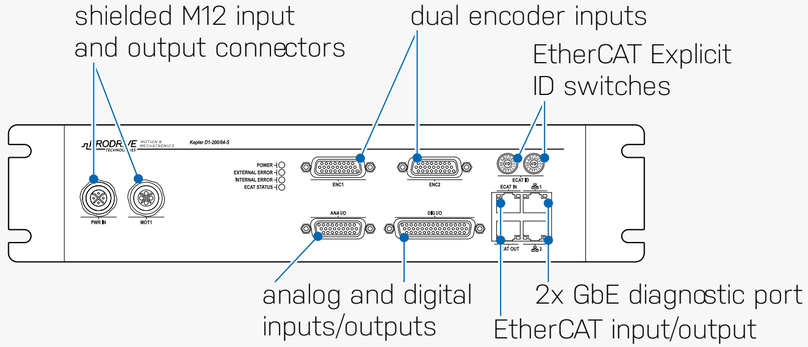
KEPLER LINE – INTERFACES

	Parameter	Symbol	Unit	D1-200/4	D3-200/4	Remark
Encoder inputs	Number of encoder inputs	n_{ENC}	-	2		
	Supported types		-	Analog Sin/Cos Digital hall Endat 2.1/2.2 Hiperface DSL (4W) SSI BiSS C		
	Max signal frequency	f_{sincos_max}	MHz	4		No missing pulses
	Maximum baudrate (digital encoders)	f_{rs422_max}	MHz	32		
	Encoder supply voltage	V_{ENCSUP}	V	5 / 10		software selectable
	Encoder supply current	I_{ENCSUP}	mA	max 500		
General purpose I/O	Isolated digital inputs		-	4 x 24V		(V_{IH}≥11V, V_{IL}≤5V, I_{IN}<15mA)
	Isolated digital outputs		-	4 x 30V / 500mA		
	Non-isolated digital inputs		-	4 x TTL		
	Non-isolated digital outputs		-	2 x 24V - 1A 2x 24V - 200mA 4x TTL output		
	Analog inputs		-	2 x ±10V diff		14bit resolution
	Analog outpus		-	2 x ±10V diff		16bit resolution
	Brake outputs		-	-		

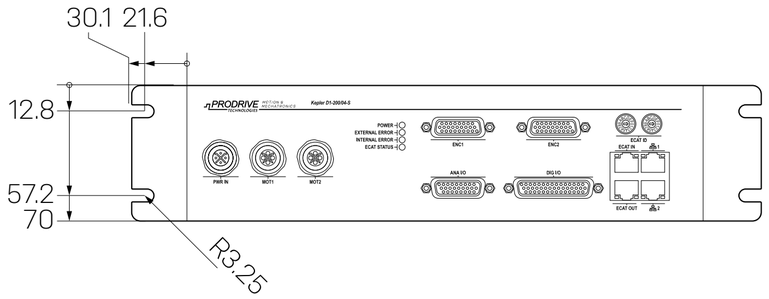
S3-120/7

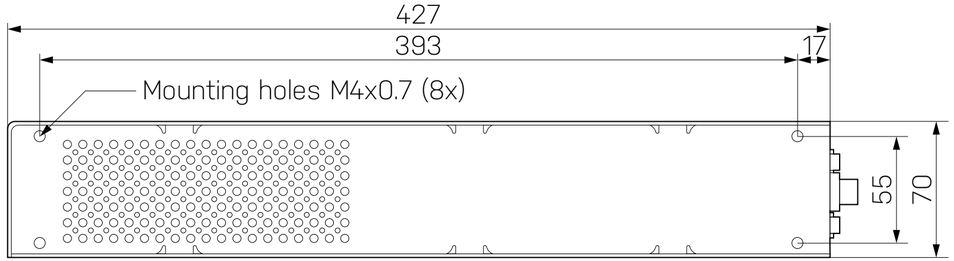


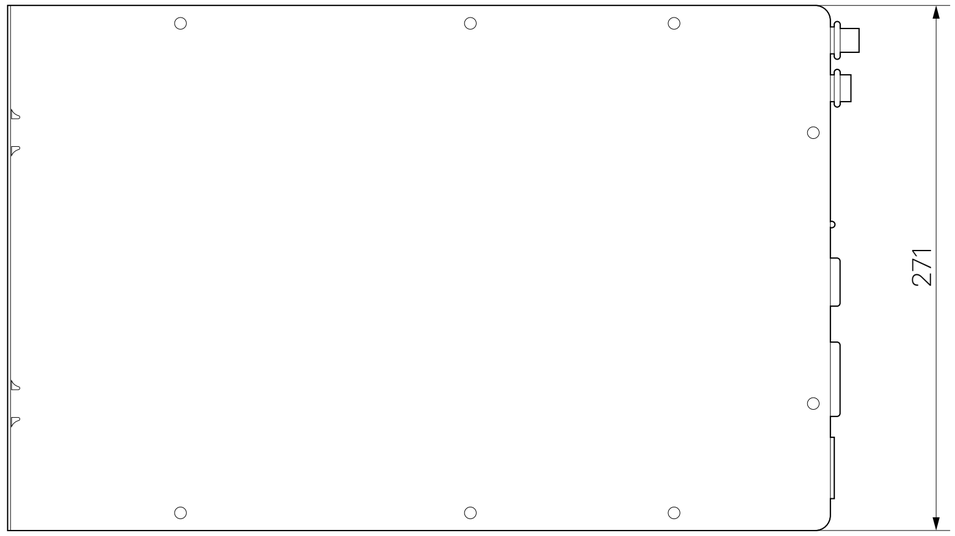
D1-120/7



KEPLER LINE – MECHANICAL SPECIFICATIONS







	Parameter	Symbol	Unit	D1-200/4 | D3-200/4	Remark
Mechanical	Width	d_W	mm	271	
	Depth	d_D	mm	442	including connectors
	Height	d_H	mm	70	
	Operating temperature range	T_{OP}	°C	10 - 40	
	Operating humidity range	h_{OP}	%	20 - 80	non-condensing
	Shock & Vibration		-	IEC60068-2-6 (Fc)	
	Lifetime		-	>10 years	
	Mass	mass	kg	7,0	typical value