

All dimensions are in mm; Drawing not to scale.

Motor – sensor configurations

Sensor	Motor	PMSM	BLDC	DC BRUSH	STEP (2-ph)	STEP (3-ph)
Incr. Encoder		✔		✔	✔	
Incr. Encoder + Dig. Hall		✔	✔			
Digital halls only		✔				
Tacho				✔		
Open-loop (no sensor)					✔	✔
Open-loop (with step loss detection using incr. enc.)					✔	✔
Open-loop (with enc. on load)					✔	✔

Features

- Motion controller and drive in a single compact unit
- Universal solution for control of rotary and linear brushless, brushed and 2 or 3-phase step motors
- CANopen communication protocol (CiA 301v4.2, CiA 305v2.213 and 402v3.0)
- Various modes of operating supported: Position or Speed Profile, interpolated Cyclic Synchronous Position (CSP) mode, external reference mode (Position, Speed, Torque), 35 homing modes
- Motor supply: 11-50V. Logic supply: 9-36V
- Output current: 4A cont. (BLDC mode); 10A_{PEAK}, up to 100KHz PWM
- 5 opto-isolated digital inputs, 12-36V, PNP/NPN compatible: 2 for limit switches, 3 general-purpose
- 5 digital outputs, 5-36V, 0.5A, NPN open-collector: Error, 1 Motor brake [2A], 3 general-purpose [0.5A]
- Mini USB¹ & CAN-bus 2.0B interfaces
- 127 h/w addresses selectable by h/w DIP switch
- NTC/PTC analogue Motor Temperature sensor input

- Protections: short-circuit between motor phases and from motor phases to GND, over/under-voltage, over-current, I²t, control error, over temperature, communication error

Feedback Devices :

1st feedback devices supported:

- Incremental encoder interface (differential)
- Digital Hall sensor interface (single-ended and open collector)

2nd feedback devices supported:

- pulse & direction interface (differential) for external (master) digital reference
- 1 analogue input: 12-bit, 0-5V: Feedback
- 1 rotating potentiometer used as Reference
- 16k x16 SRAM memory for data acquisition
- 16k x16 E²ROM to store setup and other user data
- Operating ambient temperature: 0-40°C (over 40°C with derating)

Mating Connectors

Producer	Part No.	Connector	Description	Image
WAGO	734-104	J1	Pluggable terminal block 4-pole Pin spacing 3.5 mm	AWG 14-28
WAGO	733-108	J2	Pluggable terminal block 8-pole Pin spacing 2.5 mm	AWG 20-28
WAGO	733-112	J3 & J5	Pluggable terminal block 12-pole Pin spacing 2.5 mm	AWG 20-28
WAGO	733-106	J4	Pluggable terminal block 6-pole Pin spacing 2.5 mm	AWG 20-28
WAGO	734-105	J6	Pluggable terminal block 5-pole Pin spacing 3.5 mm	AWG 14-28

¹Mini USB cable not provided

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Connectors Description			
Pin	Name	Type	Description
J1	1	GND	Negative return (ground) of the power supply
	2	+V _{LOG}	Positive terminal of the logic supply input: 12 to 36V _{DC}
	3	+V _{MOT}	Positive terminal of the motor supply: 12 to 50V _{DC}
	4	Earth	Earth connection
J2	1	OUT0/M.BRK	5-36V 2A, digital output used for an electro-mechanical brake, NPN open-collector/TTL pull-up
	2	OUT5	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
	3	OUT4	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
	4	OUT1	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
	5	OUT2/Error	12-36V 0.5A, drive Error output, active low, NPN open-collector/TTL pull-up. Also drives the red Error LED.
	6	CAN Hi	I/O CAN-Bus positive line(dominant high)
	7	CAN Lo	I/O CAN-Bus negative line (dominant low)
	8	GND	- Return ground for I/O and CAN pins
J3	1	IN2+/LSP+	12-36V digital PNP/NPN opto-isolated input. Positive limit switch function, positive input
	2	IN2-/LSP-	12-36V digital PNP/NPN opto-isolated input. Positive limit switch function, negative input
	3	IN3+/LSN+	12-36V digital PNP/NPN opto-isolated input. Negative limit switch function, positive input
	4	IN3-/LSN-	12-36V digital PNP/NPN opto-isolated input. Negative limit switch function, negative input
	5	IN0+	12-36V general-purpose digital PNP/NPN opto-isolated positive input.
	6	IN0-	12-36V general-purpose digital PNP/NPN opto-isolated negative input.
	7	IN1+	12-36V general-purpose digital PNP/NPN opto-isolated positive input.
	8	IN1-	12-36V general-purpose digital PNP/NPN opto-isolated negative input.
	9	Ena+/IN4+	12-36V digital PNP/NPN opto-isolated input. Drive enable function, positive input
	10	Ena-/IN4-	12-36V digital PNP/NPN opto-isolated input. Drive enable function, negative input
	11	FDBK	Analogue input, 12-bit, 0-5V. Used to read an analogue position or speed feedback (as tach), or used as general purpose analogue input.
	12	GND	- Negative return (ground) of the motor supply
J4	1	GND	- Return ground
	2	Pulse+	Pulse+ differential input; has 120Ω resistor between pins 2 and 3
	3	Pulse-	Pulse- differential input; has 120Ω resistor between pins 2 and 3
	4	Dir+	Direction+ differential input; has 120Ω resistor between pins 4 and 5
	5	Dir-	Direction- differential input; has 120Ω resistor between pins 4 and 5
	6	Temp Mot	I NTC/PTC input. Used to read an analog temperature value

Pin	Name	Type	Description
1	GND	-	Return ground for sensors supply
2	A1+	I	Incr. encoder1 A+ diff. input; has 120Ω resistor between pins 2 and 3
3	A1-	I	Incr. encoder1 A- diff. input; has 120Ω resistor between pins 2 and 3
4	B1+	I	Incr. encoder1 B+ diff. input; has 120Ω resistor between pins 4 and 5
5	B1-	I	Incr. encoder1 B- diff. input; has 120Ω resistor between pins 4 and 5
6	Z1+	I	Incr. encoder1 Z+ diff. input; has 120Ω resistor between pins 6 and 7
7	Z1-	I	Incr. encoder1 Z- diff. input; has 120Ω resistor between pins 6 and 7
8	+5V _{OUT}	O	5V output supply for I/O usage
9	Hall 1	I	Digital input Hall 1 sensor
10	Hall 2	I	Digital input Hall 2 sensor
11	Hall 3	I	Digital input Hall 3 sensor
12	GND	-	Return ground for sensors supply

Pin	Name	Type	Description
1	A/A+	O	Phase A for 3-ph motors, A+ for 2-ph steppers, Motor+ for DC brush motors
2	B/A-	O	Phase B for 3-ph motors, A- for 2-ph steppers, Motor- for DC brush motors
3	C/B+	O	Phase C for 3-ph motors, B+ for 2-ph steppers
4	CR/B-	O	Chopping resistor / Phase B- for 2-ph step motors
5	Earth	-	Earth connection

Pin	Name	Type	Description
1	ID-Bit0	-	Hardware AxisID selection switches They represent the first 7 LSB bits of an 8 bit binary Axis ID number. Switch = ON(down) -> ID bit = 1 Switch = OFF(up) -> ID bit = 0
2	ID-Bit1	-	
3	ID-Bit2	-	
4	ID-Bit3	-	
5	ID-Bit4	-	
6	ID-Bit5	-	
7	ID-Bit6	-	
8	Reserved	-	Reserved

Electrical characteristics

All parameters measured under the following conditions (unless otherwise specified):


- V_{LOG} = 24 VDC; V_{MOT} = 48VDC
- Supplies start-up / shutdown sequence: -any-
- Load current (sinusoidal amplitude / continuous BLDC, DC, stepper) = 4A

Operating Conditions		Min.	Typ.	Max.	Units
Ambient temperature		0		40 ^{1,3}	°C
Ambient humidity	Non-condensing	0		90	%Rh
Altitude / pressure ²	Altitude (vs. sea level)	-0.1	0 ± 2.5 ²		Km
	Ambient Pressure	0 ²	0.75 ÷ 1	10.0	atm
Storage Conditions		Min.	Typ.	Max.	Units
Ambient temperature		-40		105	°C
Ambient humidity	Non-condensing	0		100	%Rh
Ambient Pressure		0		10.0	atm
ESD capability (Human body model)	Not powered; applies to any accessible part			±0.5	kV
	Original packaging			±15	kV
Mechanical Mounting		Min.	Typ.	Max.	Units
Airflow					natural convection ³ , closed box

¹ Operating temperature at higher temperatures is possible with reduced current and power ratings

² Udrive can be operated in vacuum (no altitude restriction), but at altitudes over 2,500m, current and power rating are reduced due to thermal dissipation efficiency.

³ In case of forced cooling (conduction or ventilation) the maximum ambient temperature can be increased substantially.

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Environmental Characteristics		Min.	Typ.	Max.	Units
Size (Length x Width x Height)	Without mating connectors	110 x 90 x 17			mm
	With recommended mating connectors.	~4.33 x 3.54 x 0.67			inch
		110 x 110 x 19.1			mm
Weight	Without mating connectors	130			g
Efficiency		98			%
Cleaning agents	Dry cleaning is recommended	Only Water- or Alcohol- based			
Protection degree	According to IEC60529, UL508	IP20			-
Logic Supply Input (+V _{LOG})		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	9		36	V _{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters	8		40	V _{DC}
	Absolute maximum values, continuous	-0.6		42	V _{DC}
	Absolute maximum values, surge (duration ≤ 10ms) [†]	-1		+45	V
Supply current	+V _{LOG} = 12V		120		mA
	+V _{LOG} = 24V		70		
	+V _{LOG} = 40V		50		
Motor Supply Input (+V _{MOT})		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	11	48	52	V _{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters	9		55	V _{DC}
	Absolute maximum values, surge (duration ≤ 10ms) [†]	-1		63	V
Supply current	Idle		1	5	mA
	Operating	-10	±4	+10	
	Absolute maximum value, short-circuit condition (duration ≤ 10ms) [†]			18	
Motor Outputs (A/A+, B/A-, C/B+, BR/B-)		Min.	Typ.	Max.	Units
Nominal output current, continuous ¹	for DC brushed, steppers and BLDC motors with Hall-based trapezoidal control			4	A
	for PMSM motors with FOC sinusoidal control (sinusoidal amplitude value)			4	
	for PMSM motors with FOC sinusoidal control (sinusoidal effective value)			2.83	
Motor output current, peak	maximum 2.5s	-10.2		+10.2	A
Short-circuit protection threshold		±22	±26	±30	A
Short-circuit protection delay		5	10		µs
On-state voltage drop	Nominal output current; including typical mating connector contact resistance		±0.3	±0.5	V
Off-state leakage current			±0.5	±1	mA
Motor inductance (phase-to-phase)	Recommended value, for current ripple max. ±5% of full range; +V _{MOT} = 36 V	F _{PWM}			
		20 kHz	330		
		40 kHz	150		
		60 kHz	120		
		80 kHz	80		
	Minimum value, limited by short-circuit protection; +V _{MOT} = 36 V	20 kHz	120		µH
		60 kHz	40		
		40 kHz	30		
		80 kHz	15		
		100 kHz	8		
Motor electrical time-constant (L/R)	Recommended value for ±5% current measurement error	20 kHz	250		µs
		40 kHz	125		
		60 kHz	100		
		80 kHz	63		
		100 kHz	50		
Current measurement	FS = Full Scale accuracy		±4	±8	%FS

Digital Inputs – opto-isolated- (IN0, IN1, IN2/LSP, IN3/LSN, IN4) ²		Min.	Typ.	Max.	Units
Mode compliance	PNP	Connect negative pin to GND and positive pin to signal			
	NPN	Connect positive pin to supply and connect negative pin to signal			
Default state	Input floating (wiring disconnected)	Logic LOW			
Input voltage	Logic LOW	0		36	V
	Logic HIGH	5		36	
	Absolute maximum	-7		50	
Input current	Logic LOW	0		50	mA
	Logic HIGH	8	10	12	
	Absolute maximum	-20		20	
Input frequency			2		kHz
Minimum pulse			500		
ESD protection	Human body model	±15			kV
Digital Outputs (OUT0, OUT1, OUT2/Error, OUT4, OUT5)		Min.	Typ.	Max.	Units
Mode compliance	All outputs (OUT0, 1, 4, 5 OUT2/Error)	NPN 24V			
Default state	Not supplied (+V _{LOG} floating or to GND)	High-Z (floating)			
	Immediately after power-up	OUT0, OUT1	Logic "HIGH"		
	Normal operation	OUT0, OUT1, OUT2/Error	Logic "HIGH"		
Output voltage	Logic "LOW"; output current = 0.5A		0.3	0.65	V
	Logic "HIGH"; output current = 0, no load	3.6			
		V _{LOG}		5	
	Logic "HIGH", external load to +V _{LOG}	-0.5		V _{LOG} +0.5	
	Absolute maximum, continuous	-1		V _{LOG} +1	
	Absolute maximum, surge (duration ≤ 1s) [†]	-1		V _{LOG} +1	
Output current	Logic "LOW", sink current, continuous			0.5	A
				2	
	Logic "HIGH", source current; external load to GND; V _{OUT} ≥ 2.0V			3	mA
Logic "HIGH", leakage current; external load to +V _{LOG} ; V _{OUT} = V _{LOG} max = 40V		0.1			
Minimum pulse width		2			
ESD protection	Human body model	±15			kV
Digital Hall Inputs (Hall1, Hall2, Hall3)		Min.	Typ.	Max.	Units
Mode compliance		TTL / CMOS / Open-collector			
Default state	Input floating (wiring disconnected)	Logic HIGH			
Input voltage	Logic "LOW"		0	0.8	V
	Logic "HIGH"	2	5		
	Floating voltage (not connected)		4.4		
	Absolute maximum, surge (duration ≤ 1s) [†]	-10		+15	
Input current	Logic "LOW"; Pull to GND			1.2	mA
	Logic "HIGH"; Internal 4.7KΩ pull-up to +5	0	0	0	
Minimum pulse width		2			µs
ESD protection	Human body model	±5			kV

¹ @20KHz F_{PWM}

² The digital inputs are software selectable as PNP or NPN

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Feedback 1 & 2 inputs (A1+, A1-, B1+, B1-, Z1+, Z1-, P+, P-, D+, D-) ¹		Min.	Typ.	Max.	Units
Differential mode compliance	For full RS422 compliance, see ²	TIA/EIA-422-A			
Input voltage	Hysteresis	±0.06	±0.1	±0.2	V
	Differential mode	-14		+14	
	Common-mode range (A+ to GND, etc.)	-11		+14	
Input impedance, differential			120		Ω
Input frequency	Differential mode	0		10	MHz
Minimum pulse width	Differential mode	50			ns
Analog 0...5V Inputs (REF, FDBK)		Min.	Typ.	Max.	Units
Input voltage	Operational range	0		5	V
	Absolute maximum values, continuous	-16		+23	
	Absolute maximum, surge (duration ≤ 1s) [†]			±36	
Input impedance	To GND		15		kΩ
Resolution			12		bits
Integral linearity			±2		bits
Offset error			±2	±10	bits
Gain error			±1%	±3%	% FS ²
Bandwidth (-3Db)	Software selectable	0		1	kHz
ESD protection	Human body model	±2			kV

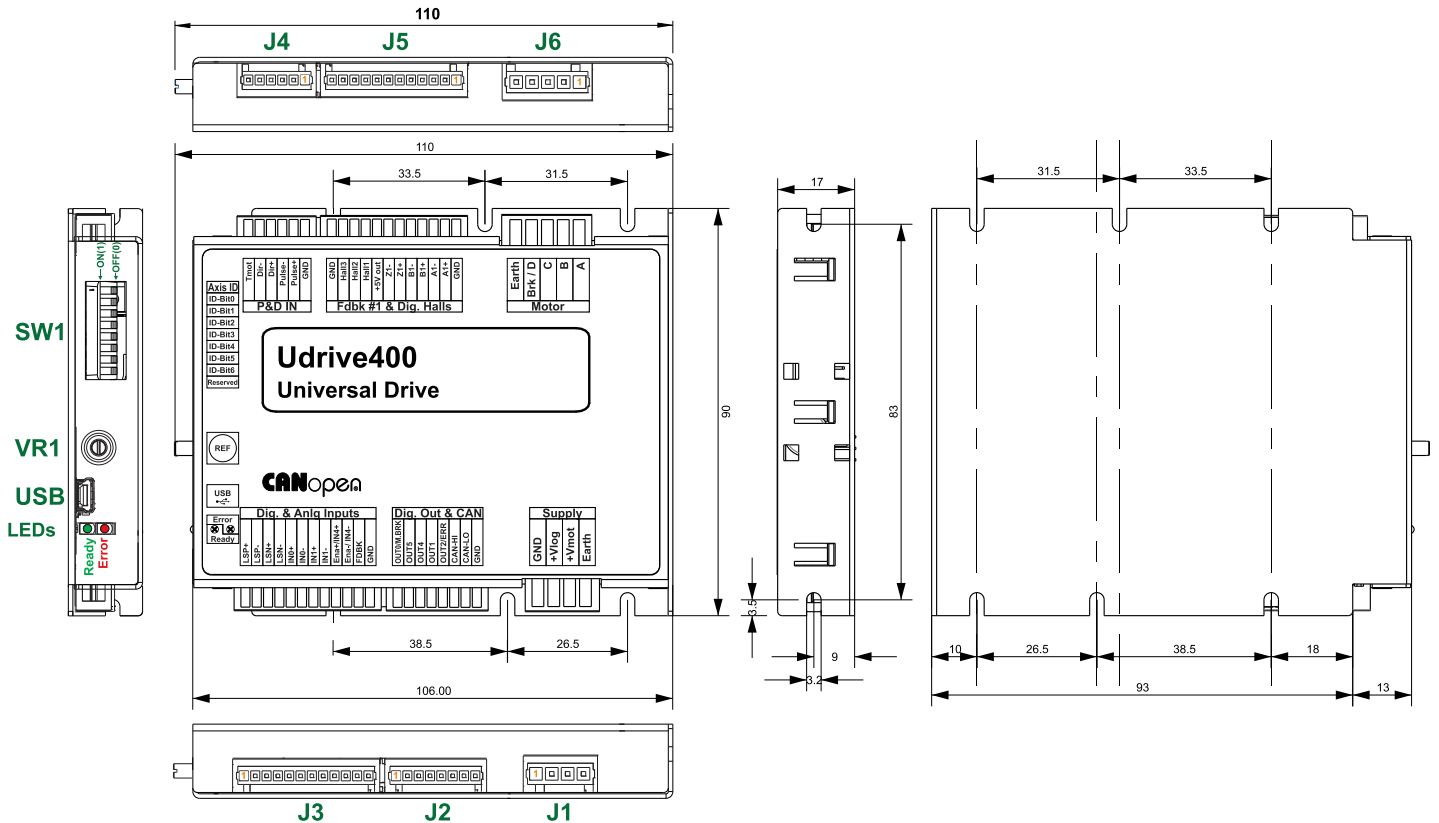
CAN-Bus		Min.	Typ.	Max.	Units
Compliance		ISO11898, CiA-301v4.2 & 402v3.0			
Bit rate	Software selectable	125		1000	Kbps
	1Mbps			25	
Bus length	500Kbps			100	m
	≤ 250Kbps			250	
Resistor	Between CAN-Hi, CAN-Lo	none on-board			
Node addressing	by hardware through SW1	1 ÷ 127 ; 255 (all bits 0)			
	by software using EasySetup	1- 255 (numbers above 127 will be considered as LSS non-configured)			
ESD protection	Human body model	±15			kV
Supply Output (+5V)		Min.	Typ.	Max.	Units
Output voltage	Current sourced = 250mA	4.8	5	5.2	V
Output current				500	mA
Short-circuit		Protected			
Over-voltage		Protected			
ESD protection	Human body model	±15			kV

[†] Stresses beyond values listed under "absolute maximum ratings" may cause permanent damage to the device. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

¹ All differential input pins have internal 120Ω termination resistors connected across

² "FS" stands for "Full Scale"

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Motor – sensor configurations

Sensor \ Motor	PMSM	BLDC	DC BRUSH	STEP (2-ph)	STEP (3-ph)
Incr. Encoder	✔		✔	✔	
Incr. Encoder + Dig. Hall	✔	✔			
Digital halls only	✔				
Tacho			✔		
Open-loop (no sensor)				✔	✔
Open-loop (with step loss detection using incr. enc.)				✔	✔
Open-loop (with enc. on load)				✔	✔

- **Features**
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- Motor supply: 11-50V. Logic supply: 9-36V
- Output current: 8A cont. (BLDC mode); 21A_{PEAK}, up to 100KHz PWM
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- 5 digital outputs, 5-36V, 0.5A, NPN open-collector: Error, 1 Motor brake [2A], 3 general-purpose [0.5A]
- Mini USB¹ & CAN-bus 2.0B interfaces
- 127 h/w addresses selectable by h/w DIP switch
- NTC/PTC analogue Motor Temperature sensor input

- Protections: short-circuit between motor phases and from motor phases to GND, over/under-voltage, over-current, I²t, control error, over temperature, communication error
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 - Incremental encoder interface (differential)
 - Digital Hall sensor interface (single-ended and open collector)
- 2nd feedback devices supported:
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- 1 analogue input: 12-bit, 0-5V: Feedback
- 1 rotating potentiometer used as Reference
- 16k x16 SRAM memory for data acquisition
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WAGO	733-106	J4	Pluggable terminal block 6-pole Pin spacing 2.5 mm	AWG 20-28
WAGO	734-105	J6	Pluggable terminal block 5-pole Pin spacing 3.5 mm	AWG 14-28

¹Mini USB cable not provided

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Connectors Description			
Pin	Name	Type	Description
J1	1	GND	Negative return (ground) of the power supply
	2	+V _{LOG}	Positive terminal of the logic supply input: 11 to 36V _{DC}
	3	+V _{MOT}	Positive terminal of the motor supply: 11 to 50V _{DC}
	4	Earth	Earth connection
J2	1	OUT0/M.BRK	5-36V 2A, digital output used for an electro-mechanical brake, NPN open-collector/TTL pull-up
	2	OUT5	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
	3	OUT4	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
	4	OUT1	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
	5	OUT2/Error	12-36V 0.5A, drive Error output, active low, NPN open-collector/TTL pull-up. Also drives the red Error LED.
	6	CAN Hi	I/O CAN-Bus positive line(dominant high)
	7	CAN Lo	I/O CAN-Bus negative line (dominant low)
	8	GND	- Return ground for I/O and CAN pins
J3	1	IN2+/LSP+	12-36V digital PNP/NPN opto-isolated input. Positive limit switch function, positive input
	2	IN2-/LSP-	12-36V digital PNP/NPN opto-isolated input. Positive limit switch function, negative input
	3	IN3+/LSN+	12-36V digital PNP/NPN opto-isolated input. Negative limit switch function, positive input
	4	IN3-/LSN-	12-36V digital PNP/NPN opto-isolated input. Negative limit switch function, negative input
	5	IN0+	12-36V general-purpose digital PNP/NPN opto-isolated positive input.
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	7	IN1+	12-36V general-purpose digital PNP/NPN opto-isolated positive input.
	8	IN1-	12-36V general-purpose digital PNP/NPN opto-isolated negative input.
	9	Ena+/IN4+	12-36V digital PNP/NPN opto-isolated input. Drive enable function, positive input
	10	Ena-/IN4-	12-36V digital PNP/NPN opto-isolated input. Drive enable function, negative input
	11	FDBK	Analogue input, 12-bit, 0-5V. Used to read an analogue position or speed feedback (as tach), or used as general purpose analogue input.
	12	GND	- Negative return (ground) of the motor supply
J4	1	GND	- Return ground
	2	Pulse+	Pulse+ differential input; has 120Ω resistor between pins 2 and 3
	3	Pulse-	Pulse- differential input; has 120Ω resistor between pins 2 and 3
	4	Dir+	Direction+ differential input; has 120Ω resistor between pins 4 and 5
	5	Dir-	Direction- differential input; has 120Ω resistor between pins 4 and 5
	6	Temp Mot	NTC/PTC input. Used to read an analog temperature value

Pin	Name	Type	Description
1	GND	-	Return ground for sensors supply
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3	A1-	I	Incr. encoder1 A- diff. input; has 120Ω resistor between pins 2 and 3
4	B1+	I	Incr. encoder1 B+ diff. input; has 120Ω resistor between pins 4 and 5
5	B1-	I	Incr. encoder1 B- diff. input; has 120Ω resistor between pins 4 and 5
6	Z1+	I	Incr. encoder1 Z+ diff. input; has 120Ω resistor between pins 6 and 7
7	Z1-	I	Incr. encoder1 Z- diff. input; has 120Ω resistor between pins 6 and 7
8	+5V _{OUT}	O	5V output supply for I/O usage
9	Hall 1	I	Digital input Hall 1 sensor
10	Hall 2	I	Digital input Hall 2 sensor
11	Hall 3	I	Digital input Hall 3 sensor
12	GND	-	Return ground for sensors supply

Pin	Name	Type	Description
1	A/A+	O	Phase A for 3-ph motors, A+ for 2-ph steppers, Motor+ for DC brush motors
2	B/A-	O	Phase B for 3-ph motors, A- for 2-ph steppers, Motor- for DC brush motors
3	C/B+	O	Phase C for 3-ph motors, B+ for 2-ph steppers
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Pin	Name	Type	Description
1	ID-Bit0	-	Hardware AxisID selection switches They represent the first 7 LSB bits of an 8 bit binary Axis ID number. Switch = ON(down) -> ID bit = 1 Switch = OFF(up) -> ID bit = 0
2	ID-Bit1	-	
3	ID-Bit2	-	
4	ID-Bit3	-	
5	ID-Bit4	-	
6	ID-Bit5	-	
7	ID-Bit6	-	
8	Reserved	-	Reserved

Electrical characteristics

All parameters measured under the following conditions (unless otherwise specified):


- V_{LOG} = 24 VDC; V_{MOT} = 48VDC
- Supplies start-up / shutdown sequence: -any-
- Load current (sinusoidal amplitude / continuous BLDC, DC, stepper) = 4A

Operating Conditions		Min.	Typ.	Max.	Units
Ambient temperature		0		40 ^{1,3}	°C
Ambient humidity	Non-condensing	0		90	%Rh
Altitude / pressure ²	Altitude (vs. sea level)	-0.1	0 ± 2.5 ²		Km
	Ambient Pressure	0 ²	0.75 ÷ 1	10.0	atm
Storage Conditions		Min.	Typ.	Max.	Units
Ambient temperature		-40		105	°C
Ambient humidity	Non-condensing	0		100	%Rh
Ambient Pressure		0		10.0	atm
ESD capability (Human body model)	Not powered; applies to any accessible part			±0.5	kV
	Original packaging			±15	kV
Mechanical Mounting		Min.	Typ.	Max.	Units
Airflow					natural convection ³ , closed box

¹ Operating temperature at higher temperatures is possible with reduced current and power ratings

² Udrive can be operated in vacuum (no altitude restriction), but at altitudes over 2,500m, current and power rating are reduced due to thermal dissipation efficiency.

³ In case of forced cooling (conduction or ventilation) the maximum ambient temperature can be increased substantially.

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Environmental Characteristics		Min.	Typ.	Max.	Units
Size (Length x Width x Height)	Without mating connectors	110 x 90 x 17			mm
	With recommended mating connectors.	~4.33 x 3.54 x 0.67			inch
		110 x 110 x 19.1			mm
Weight	Without mating connectors	130			g
Efficiency		98			%
Cleaning agents	Dry cleaning is recommended	Only Water- or Alcohol- based			
Protection degree	According to IEC60529, UL508	IP20			-
Logic Supply Input (+V _{LOG})		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	9		36	V _{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters	8		40	V _{DC}
	Absolute maximum values, continuous	-0.6		42	V _{DC}
	Absolute maximum values, surge (duration ≤ 10ms) †	-1		+45	V
Supply current	+V _{LOG} = 12V		120		mA
	+V _{LOG} = 24V		70		
	+V _{LOG} = 40V		50		
Motor Supply Input (+V _{MOT})		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	11	48	52	V _{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters	9		55	V _{DC}
	Absolute maximum values, surge (duration ≤ 10ms) †	-1		63	V
Supply current	Idle		1	5	mA
	Operating	-22	±8	+22	
	Absolute maximum value, short-circuit condition (duration ≤ 10ms) †			37	
Motor Outputs (A/A+, B/A-, C/B+, BR/B-)		Min.	Typ.	Max.	Units
Nominal output current, continuous ¹	for DC brushed, steppers and BLDC motors with Hall-based trapezoidal control			8	A
	for PMSM motors with FOC sinusoidal control (sinusoidal amplitude value)			8	
	for PMSM motors with FOC sinusoidal control (sinusoidal effective value)			5.67	
Motor output current, peak	maximum 2.5s	-21.4		+21.4	A
Short-circuit protection threshold		±22	±26	±30	A
Short-circuit protection delay		5	10		µs
On-state voltage drop	Nominal output current; including typical mating connector contact resistance		±0.3	±0.5	V
Off-state leakage current			±0.5	±1	mA
Motor inductance (phase-to-phase)	Recommended value, for current ripple max. ±5% of full range; +V _{MOT} = 36 V	F _{PWM}			
		20 kHz	330		
		40 kHz	150		
		60 kHz	120		
		80 kHz	80		
	Minimum value, limited by short-circuit protection; +V _{MOT} = 36 V	20 kHz	120		µH
		60 kHz	40		
		40 kHz	30		
		80 kHz	15		
		100 kHz	8		
Motor electrical time-constant (L/R)	Recommended value for ±5% current measurement error	20 kHz	250		µs
		40 kHz	125		
		60 kHz	100		
		80 kHz	63		
		100 kHz	50		
Current measurement	FS = Full Scale accuracy		±4	±8	%FS

Digital Inputs – opto-isolated- (IN0, IN1, IN2/LSP, IN3/LSN, IN4) ²		Min.	Typ.	Max.	Units
Mode compliance	PNP	Connect negative pin to GND and positive pin to signal			
	NPN	Connect positive pin to supply and connect negative pin to signal			
Default state	Input floating (wiring disconnected)	Logic LOW			
Input voltage	Logic LOW	0		36	V
	Logic HIGH	5		36	
	Absolute maximum	-7		50	
Input current	Logic LOW	0		50	mA
	Logic HIGH	8	10	12	
	Absolute maximum	-20		20	
Input frequency			2		kHz
Minimum pulse			500		
ESD protection	Human body model	±15			kV
Digital Outputs (OUT0, OUT1, OUT2/Error, OUT4, OUT5)		Min.	Typ.	Max.	Units
Mode compliance	All outputs (OUT0, 1, 4, 5 OUT2/Error)	NPN 24V			
Default state	Not supplied (+V _{LOG} floating or to GND)	High-Z (floating)			
	Immediately after power-up	OUT0, OUT1	Logic "HIGH"		
	Normal operation	OUT0, OUT1, OUT2/Error	Logic "HIGH"		
Output voltage	Logic "LOW"; output current = 0.5A		0.3	0.65	V
	Logic "HIGH"; output current = 0, no load		V _{LOG}	5	
	Logic "HIGH", external load to +V _{LOG}	-0.5		V _{LOG} +0.5	
	Absolute maximum, continuous	-1		V _{LOG} +1	
	Absolute maximum, surge (duration ≤ 1s) †	-1		V _{LOG} +1	
Output current	Logic "LOW", sink current, continuous			0.5	A
				2	
	Logic "HIGH", source current; external load to GND; V _{OUT} ≥ 2.0V			3	mA
Logic "HIGH", leakage current; external load to +V _{LOG} ; V _{OUT} = V _{LOG} max = 40V		0.1			
Minimum pulse width		2			
ESD protection	Human body model	±15			kV
Digital Hall Inputs (Hall1, Hall2, Hall3)		Min.	Typ.	Max.	Units
Mode compliance		TTL / CMOS / Open-collector			
Default state	Input floating (wiring disconnected)	Logic HIGH			
Input voltage	Logic "LOW"		0	0.8	V
	Logic "HIGH"	2	5		
	Floating voltage (not connected)		4.4		
	Absolute maximum, surge (duration ≤ 1s) †	-10		+15	
Input current	Logic "LOW"; Pull to GND			1.2	mA
	Logic "HIGH"; Internal 4.7KΩ pull-up to +5	0	0	0	
Minimum pulse width		2			µs
ESD protection	Human body model	±5			kV

¹ @20KHz F_{PWM}

² The digital inputs are software selectable as PNP or NPN

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Feedback 1 & 2 inputs (A1+, A1-, B1+, B1-, Z1+, Z1-, P+, P-, D+, D-) ¹		Min.	Typ.	Max.	Units
Differential mode compliance	For full RS422 compliance, see ²	TIA/EIA-422-A			
Input voltage	Hysteresis	±0.06	±0.1	±0.2	V
	Differential mode	-14		+14	
	Common-mode range (A+ to GND, etc.)	-11		+14	
Input impedance, differential			120		Ω
Input frequency	Differential mode	0		10	MHz
Minimum pulse width	Differential mode	50			ns
Analog 0...5V Inputs (REF, FDBK)		Min.	Typ.	Max.	Units
Input voltage	Operational range	0		5	V
	Absolute maximum values, continuous	-16		+23	
	Absolute maximum, surge (duration ≤ 1s) [†]			±36	
Input impedance	To GND		15		kΩ
Resolution			12		bits
Integral linearity			±2		bits
Offset error			±2	±10	bits
Gain error			±1%	±3%	% FS ²
Bandwidth (-3Db)	Software selectable	0		1	kHz
ESD protection	Human body model	±2			kV

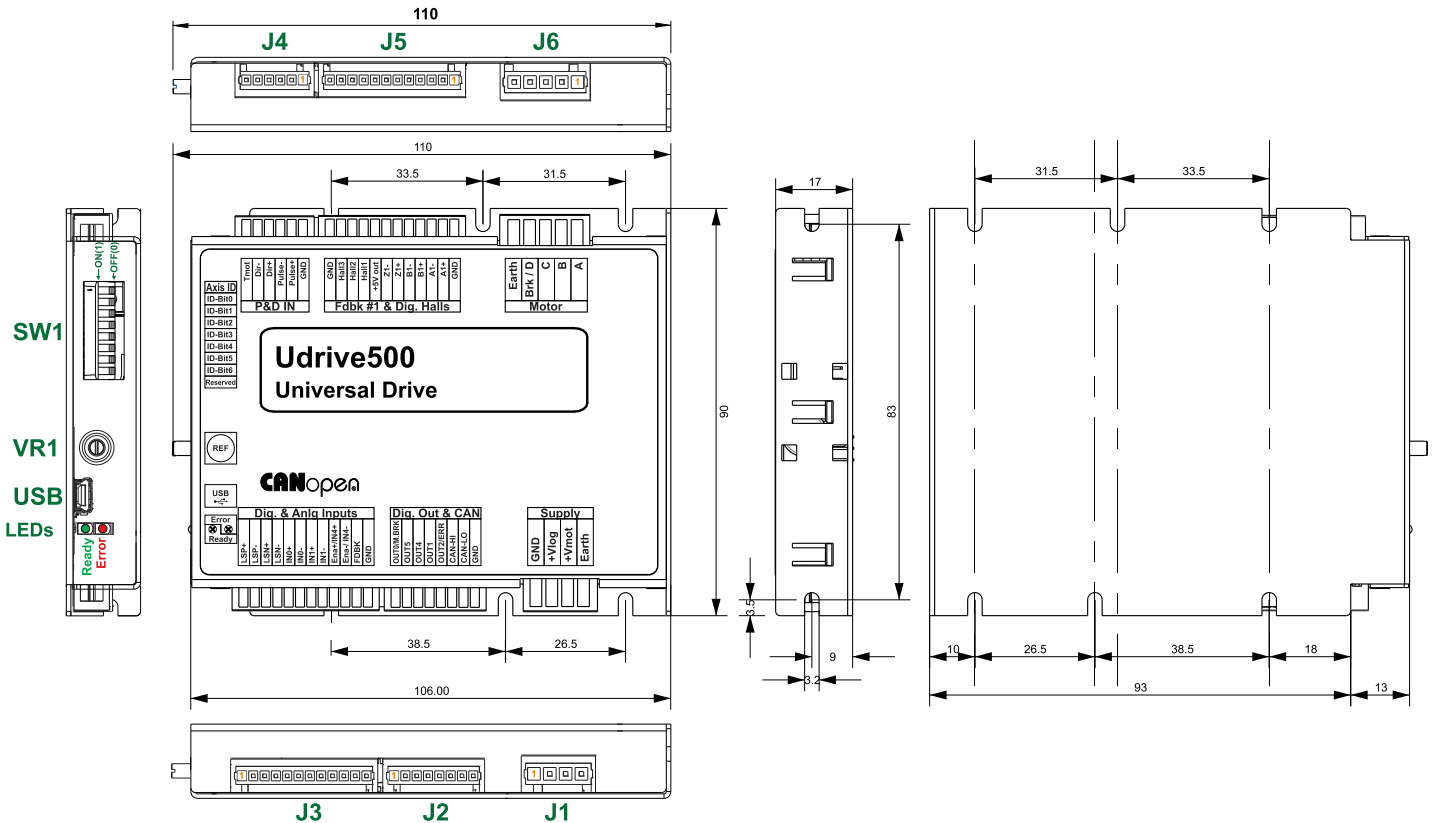
CAN-Bus		Min.	Typ.	Max.	Units
Compliance		ISO11898, CiA-301v4.2 & 402v3.0			
Bit rate	Software selectable	125		1000	Kbps
	1Mbps			25	
	500Kbps			100	
Bus length	≤ 250Kbps			250	m
Resistor	Between CAN-Hi, CAN-Lo	none on-board			
Node addressing	by hardware through SW1	1 ÷ 127 ; 255 (all bits 0)			
	by software using EasySetup	1- 255 (numbers above 127 will be considered as LSS non-configured)			
ESD protection	Human body model	±15			kV
Supply Output (+5V)		Min.	Typ.	Max.	Units
Output voltage	Current sourced = 250mA	4.8	5	5.2	V
Output current				500	mA
Short-circuit		Protected			
Over-voltage		Protected			
ESD protection	Human body model	±15			kV

[†] Stresses beyond values listed under "absolute maximum ratings" may cause permanent damage to the device. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

¹ All differential input pins have internal 120Ω termination resistors connected across

² "FS" stands for "Full Scale"

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All dimensions are in mm; Drawing not to scale.

Motor – sensor configurations

Sensor \ Motor	PMSM	BLDC	DC BRUSH	STEP (2-ph)	STEP (3-ph)
Incr. Encoder	✔		✔	✔	
Incr. Encoder + Dig. Hall	✔	✔			
Digital halls only	✔				
Tacho			✔		
Open-loop (no sensor)				✔	✔
Open-loop (with step loss detection using incr. enc.)				✔	✔
Open-loop (with enc. on load)				✔	✔

Features

- Motion controller and drive in a single compact unit
- Universal solution for control of rotary and linear brushless, brushed and 2 or 3-phase step motors
- CANopen communication protocol (CiA 301v4.2, CiA 305v2.213 and 402v3.0)
- Various modes of operating supported: Position or Speed Profile, interpolated Cyclic Synchronous Position (CSP) mode, external reference mode (Position, Speed, Torque), 35 homing modes
- Motor supply: 11-90V. Logic supply: 9-36V
- Output current: 6A cont. (BLDC mode); 21A_{PEAK}, up to 100KHz PWM
- 5 opto-isolated digital inputs, 12-36V, PNP/NPN compatible: 2 for limit switches, 3 general-purpose
- 5 digital outputs, 5-36V, 0.5A, NPN open-collector: Error, 1 Motor brake [2A], 3 general-purpose [0.5A]
- Mini USB¹ & CAN-bus 2.0B interfaces
- 127 h/w addresses selectable by h/w DIP switch
- NTC/PTC analogue Motor Temperature sensor input

- Protections: short-circuit between motor phases and from motor phases to GND, over/under-voltage, over-current, I²t, control error, over temperature, communication error

Feedback Devices :

1st feedback devices supported:

- Incremental encoder interface (differential)
- Digital Hall sensor interface (single-ended and open collector)

2nd feedback devices supported:

- pulse & direction interface (differential) for external (master) digital reference
- 1 analogue input: 12-bit, 0-5V: Feedback
- 1 rotating potentiometer used as Reference
- 16k x16 SRAM memory for data acquisition
- 16k x16 E²ROM to store setup and other user data
- Operating ambient temperature: 0-40°C (over 40°C with derating)

Mating Connectors

Producer	Part No.	Connector	Description	Image
WAGO	734-104	J1	Pluggable terminal block 4-pole Pin spacing 3.5 mm	AWG 14-28
WAGO	733-108	J2	Pluggable terminal block 8-pole Pin spacing 2.5 mm	AWG 20-28
WAGO	733-112	J3 & J5	Pluggable terminal block 12-pole Pin spacing 2.5 mm	AWG 20-28
WAGO	733-106	J4	Pluggable terminal block 6-pole Pin spacing 2.5 mm	AWG 20-28
WAGO	734-105	J6	Pluggable terminal block 5-pole Pin spacing 3.5 mm	AWG 14-28

¹Mini USB cable not provided

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Connectors Description			
Pin	Name	Type	Description
J1	1	GND	Negative return (ground) of the power supply
	2	+V _{LOG}	Positive terminal of the logic supply input: 11 to 36V _{DC}
	3	+V _{MOT}	Positive terminal of the motor supply: 11 to 90V _{DC}
	4	Earth	Earth connection
J2	1	OUT0/M.BRK	5-36V 2A, digital output used for an electro-mechanical brake, NPN open-collector/TTL pull-up
	2	OUT5	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
	3	OUT4	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
	4	OUT1	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
	5	OUT2/Error	12-36V 0.5A, drive Error output, active low, NPN open-collector/TTL pull-up. Also drives the red Error LED.
	6	CAN Hi	I/O CAN-Bus positive line(dominant high)
	7	CAN Lo	I/O CAN-Bus negative line (dominant low)
	8	GND	- Return ground for I/O and CAN pins
J3	1	IN2+/LSP+	12-36V digital PNP/NPN opto-isolated input. Positive limit switch function, positive input
	2	IN2-/LSP-	12-36V digital PNP/NPN opto-isolated input. Positive limit switch function, negative input
	3	IN3+/LSN+	12-36V digital PNP/NPN opto-isolated input. Negative limit switch function, positive input
	4	IN3-/LSN-	12-36V digital PNP/NPN opto-isolated input. Negative limit switch function, negative input
	5	IN0+	12-36V general-purpose digital PNP/NPN opto-isolated positive input.
	6	IN0-	12-36V general-purpose digital PNP/NPN opto-isolated negative input.
	7	IN1+	12-36V general-purpose digital PNP/NPN opto-isolated positive input.
	8	IN1-	12-36V general-purpose digital PNP/NPN opto-isolated negative input.
	9	Ena+/IN4+	12-36V digital PNP/NPN opto-isolated input. Drive enable function, positive input
	10	Ena-/IN4-	12-36V digital PNP/NPN opto-isolated input. Drive enable function, negative input
	11	FDBK	Analogue input, 12-bit, 0-5V. Used to read an analogue position or speed feedback (as tach), or used as general purpose analogue input.
	12	GND	- Negative return (ground) of the motor supply
J4	1	GND	- Return ground
	2	Pulse+	Pulse+ differential input; has 120Ω resistor between pins 2 and 3
	3	Pulse-	Pulse- differential input; has 120Ω resistor between pins 2 and 3
	4	Dir+	Direction+ differential input; has 120Ω resistor between pins 4 and 5
	5	Dir-	Direction- differential input; has 120Ω resistor between pins 4 and 5
	6	Temp Mot	I NTC/PTC input. Used to read an analog temperature value

Pin	Name	Type	Description
1	GND	-	Return ground for sensors supply
2	A1+	I	Incr. encoder1 A+ diff. input; has 120Ω resistor between pins 2 and 3
3	A1-	I	Incr. encoder1 A- diff. input; has 120Ω resistor between pins 2 and 3
4	B1+	I	Incr. encoder1 B+ diff. input; has 120Ω resistor between pins 4 and 5
5	B1-	I	Incr. encoder1 B- diff. input; has 120Ω resistor between pins 4 and 5
6	Z1+	I	Incr. encoder1 Z+ diff. input; has 120Ω resistor between pins 6 and 7
7	Z1-	I	Incr. encoder1 Z- diff. input; has 120Ω resistor between pins 6 and 7
8	+5V _{OUT}	O	5V output supply for I/O usage
9	Hall 1	I	Digital input Hall 1 sensor
10	Hall 2	I	Digital input Hall 2 sensor
11	Hall 3	I	Digital input Hall 3 sensor
12	GND	-	Return ground for sensors supply

Pin	Name	Type	Description
1	A/A+	O	Phase A for 3-ph motors, A+ for 2-ph steppers, Motor+ for DC brush motors
2	B/A-	O	Phase B for 3-ph motors, A- for 2-ph steppers, Motor- for DC brush motors
3	C/B+	O	Phase C for 3-ph motors, B+ for 2-ph steppers
4	CR/B-	O	Chopping resistor / Phase B- for 2-ph step motors
5	Earth	-	Earth connection

Pin	Name	Type	Description
1	ID-Bit0	-	Hardware AxisID selection switches They represent the first 7 LSB bits of an 8 bit binary Axis ID number. Switch = ON(down) -> ID bit = 1 Switch = OFF(up) -> ID bit = 0
2	ID-Bit1	-	
3	ID-Bit2	-	
4	ID-Bit3	-	
5	ID-Bit4	-	
6	ID-Bit5	-	
7	ID-Bit6	-	
8	Reserved	-	Reserved

Electrical characteristics

All parameters measured under the following conditions (unless otherwise specified):


- V_{LOG} = 24 VDC; V_{MOT} = 48VDC
- Supplies start-up / shutdown sequence: -any-
- Load current (sinusoidal amplitude / continuous BLDC, DC, stepper) = 4A

Operating Conditions		Min.	Typ.	Max.	Units
Ambient temperature		0		40 ^{1,3}	°C
Ambient humidity	Non-condensing	0		90	%Rh
Altitude / pressure ²	Altitude (vs. sea level)	-0.1	0 ± 2.5 ²		Km
	Ambient Pressure	0 ²	0.75 ÷ 1	10.0	atm
Storage Conditions		Min.	Typ.	Max.	Units
Ambient temperature		-40		105	°C
Ambient humidity	Non-condensing	0		100	%Rh
Ambient Pressure		0		10.0	atm
ESD capability (Human body model)	Not powered; applies to any accessible part			±0.5	kV
	Original packaging			±15	kV
Mechanical Mounting		Min.	Typ.	Max.	Units
Airflow					natural convection ³ , closed box

¹ Operating temperature at higher temperatures is possible with reduced current and power ratings

² Udrive can be operated in vacuum (no altitude restriction), but at altitudes over 2,500m, current and power rating are reduced due to thermal dissipation efficiency.

³ In case of forced cooling (conduction or ventilation) the maximum ambient temperature can be increased substantially.

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Environmental Characteristics		Min.	Typ.	Max.	Units
Size (Length x Width x Height)	Without mating connectors	110 x 90 x 17			mm
	With recommended mating connectors.	~4.33 x 3.54 x 0.67			inch
		110 x 110 x 19.1			mm
Weight	Without mating connectors	130			g
Efficiency		98			%
Cleaning agents	Dry cleaning is recommended	Only Water- or Alcohol- based			
Protection degree	According to IEC60529, UL508	IP20			-
Logic Supply Input (+V _{LOG})		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	9		36	V _{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters	8		40	V _{DC}
	Absolute maximum values, continuous	-0.6		42	V _{DC}
	Absolute maximum values, surge (duration ≤ 10ms) [†]	-1		+45	V
Supply current	+V _{LOG} = 12V		120		mA
	+V _{LOG} = 24V		70		
	+V _{LOG} = 40V		50		
Motor Supply Input (+V _{MOT})		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	11	90	92	V _{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters	9		95	V _{DC}
	Absolute maximum values, surge (duration ≤ 10ms) [†]	-1		102	V
Supply current	Idle		1	5	mA
	Operating	-22	±10	+22	
	Absolute maximum value, short-circuit condition (duration ≤ 10ms) [†]			37	
Motor Outputs (A/A+, B/A-, C/B+, BR/B-)		Min.	Typ.	Max.	Units
Nominal output current, continuous ¹	for DC brushed, steppers and BLDC motors with Hall-based trapezoidal control			6	A
	for PMSM motors with FOC sinusoidal control (sinusoidal amplitude value)			6	
	for PMSM motors with FOC sinusoidal control (sinusoidal effective value)			4.26	
Motor output current, peak	maximum 2.5s	-21.4		+21.4	A
Short-circuit protection threshold		±22	±26	±30	A
Short-circuit protection delay		5	10		µs
On-state voltage drop	Nominal output current; including typical mating connector contact resistance		±0.3	±0.5	V
Off-state leakage current			±0.5	±1	mA
Motor inductance (phase-to-phase)	Recommended value, for current ripple max. ±5% of full range; +V _{MOT} = 36 V	F _{PWM}			
		20 kHz	330		
		40 kHz	150		
		60 kHz	120		
		80 kHz	80		
	Minimum value, limited by short-circuit protection; +V _{MOT} = 36 V	20 kHz	120		µH
		60 kHz	40		
		40 kHz	30		
		80 kHz	15		
		100 kHz	8		
Motor electrical time-constant (L/R)	Recommended value for ±5% current measurement error	20 kHz	250		µs
		40 kHz	125		
		60 kHz	100		
		80 kHz	63		
		100 kHz	50		
Current measurement	FS = Full Scale accuracy		±4	±8	%FS

Digital Inputs – opto-isolated- (IN0, IN1, IN2/LSP, IN3/LSN, IN4) ²		Min.	Typ.	Max.	Units
Mode compliance	PNP	Connect negative pin to GND and positive pin to signal			
	NPN	Connect positive pin to supply and connect negative pin to signal			
Default state	Input floating (wiring disconnected)	Logic LOW			
Input voltage	Logic LOW	0		36	V
	Logic HIGH	5		36	
	Absolute maximum	-7		50	
Input current	Logic LOW	0		50	mA
	Logic HIGH	8	10	12	
	Absolute maximum	-20		20	
Input frequency			2		kHz
Minimum pulse			500		
ESD protection	Human body model	±15			kV
Digital Outputs (OUT0, OUT1, OUT2/Error, OUT4, OUT5)		Min.	Typ.	Max.	Units
Mode compliance	All outputs (OUT0, 1, 4, 5 OUT2/Error)	NPN 24V			
Default state	Not supplied (+V _{LOG} floating or to GND)	High-Z (floating)			
	Immediately after power-up	OUT0, OUT1	Logic "HIGH"		
	Normal operation	OUT0, OUT1, OUT2/Error	Logic "HIGH"		
Output voltage	Logic "LOW"; output current = 0.5A		0.3	0.65	V
	Logic "HIGH"; output current = 0, no load		V _{LOG}	5	
	Logic "HIGH", external load to +V _{LOG}	-0.5		V _{LOG} +0.5	
	Absolute maximum, continuous	-1		V _{LOG} +1	
	Absolute maximum, surge (duration ≤ 1s) [†]	-1		V _{LOG} +1	
Output current	Logic "LOW", sink current, continuous			0.5	A
				2	
	Logic "HIGH", source current; external load to GND; V _{OUT} ≥ 2.0V			3	mA
Logic "HIGH", leakage current; external load to +V _{LOG} ; V _{OUT} = V _{LOG} max = 40V		0.1			
Minimum pulse width		2			
ESD protection	Human body model	±15			kV
Digital Hall Inputs (Hall1, Hall2, Hall3)		Min.	Typ.	Max.	Units
Mode compliance		TTL / CMOS / Open-collector			
Default state	Input floating (wiring disconnected)	Logic HIGH			
Input voltage	Logic "LOW"		0	0.8	V
	Logic "HIGH"	2	5		
	Floating voltage (not connected)		4.4		
	Absolute maximum, surge (duration ≤ 1s) [†]	-10		+15	
Input current	Logic "LOW"; Pull to GND			1.2	mA
	Logic "HIGH"; Internal 4.7KΩ pull-up to +5	0	0	0	
Minimum pulse width		2			µs
ESD protection	Human body model	±5			kV

¹ @20KHz F_{PWM}

² The digital inputs are software selectable as PNP or NPN

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Feedback 1 & 2 inputs (A1+, A1-, B1+, B1-, Z1+, Z1-, P+, P-, D+, D-) ¹		Min.	Typ.	Max.	Units
Differential mode compliance	For full RS422 compliance, see ²	TIA/EIA-422-A			
Input voltage	Hysteresis	±0.06	±0.1	±0.2	V
	Differential mode	-14		+14	
	Common-mode range (A+ to GND, etc.)	-11		+14	
Input impedance, differential			120		Ω
Input frequency	Differential mode	0		10	MHz
Minimum pulse width	Differential mode	50			ns
Analog 0...5V Inputs (REF, FDBK)		Min.	Typ.	Max.	Units
Input voltage	Operational range	0		5	V
	Absolute maximum values, continuous	-16		+23	
	Absolute maximum, surge (duration ≤ 1s) [†]			±36	
Input impedance	To GND		15		kΩ
Resolution			12		bits
Integral linearity			±2		bits
Offset error			±2	±10	bits
Gain error			±1%	±3%	% FS ²
Bandwidth (-3Db)	Software selectable	0		1	kHz
ESD protection	Human body model	±2			kV

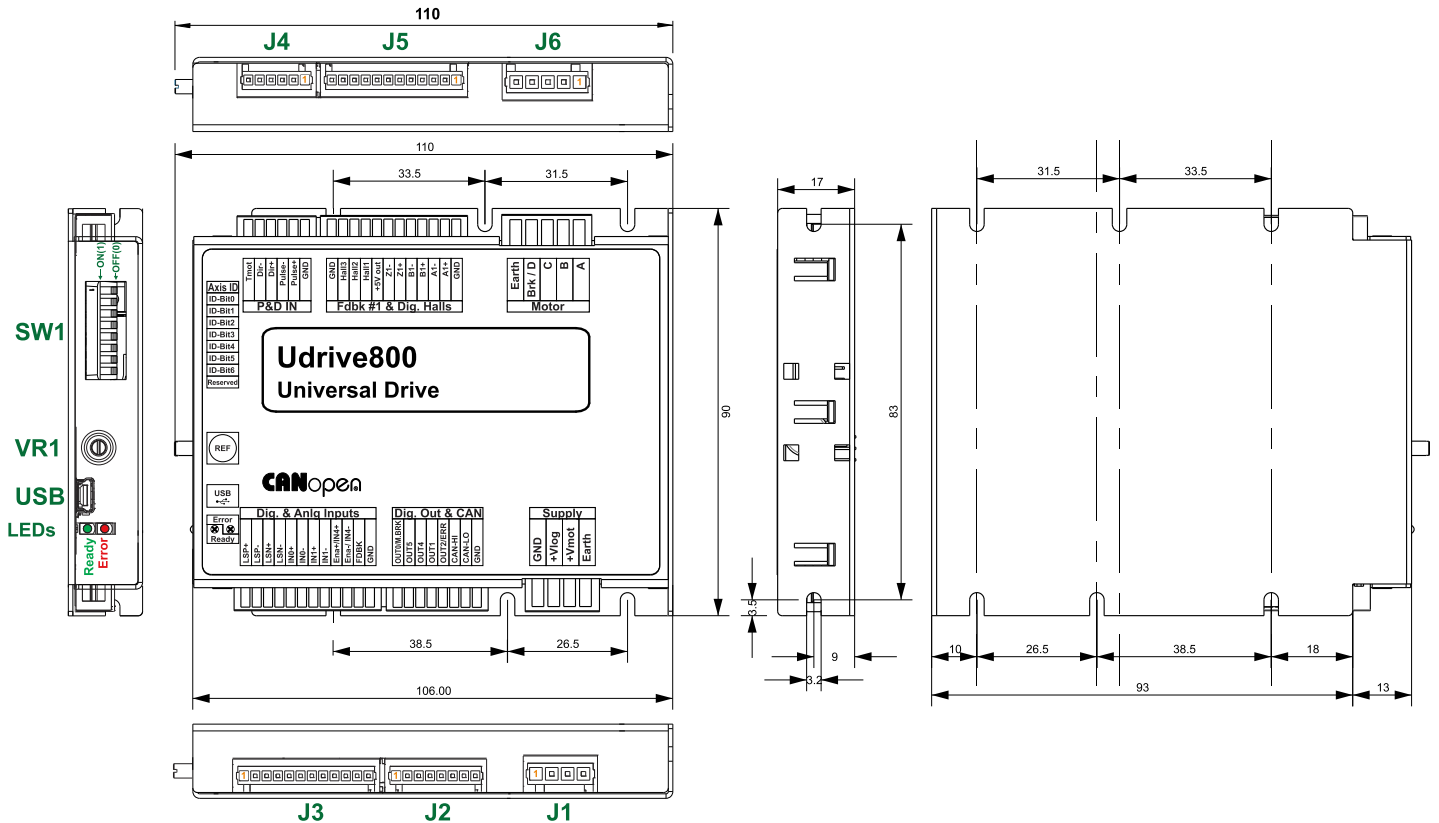
CAN-Bus		Min.	Typ.	Max.	Units
Compliance		ISO11898, CiA-301v4.2 & 402v3.0			
Bit rate	Software selectable	125		1000	Kbps
	1Mbps			25	
	≤ 250Kbps			250	
Bus length				100	m
				250	
Resistor	Between CAN-Hi, CAN-Lo	none on-board			
Node addressing	by hardware through SW1	1 ÷ 127 ; 255 (all bits 0)			
	by software using EasySetup	1- 255 (numbers above 127 will be considered as LSS non-configured)			
ESD protection	Human body model	±15			kV
Supply Output (+5V)		Min.	Typ.	Max.	Units
Output voltage	Current sourced = 250mA	4.8	5	5.2	V
Output current				500	mA
Short-circuit		Protected			
Over-voltage		Protected			
ESD protection	Human body model	±15			kV

[†] Stresses beyond values listed under "absolute maximum ratings" may cause permanent damage to the device. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

¹ All differential input pins have internal 120Ω termination resistors connected across

² "FS" stands for "Full Scale"

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All dimensions are in mm; Drawing not to scale.

Motor – sensor configurations

Sensor \ Motor	PMSM	BLDC	DC BRUSH	STEP (2-ph)	STEP (3-ph)
Incr. Encoder	✔		✔	✔	
Incr. Encoder + Dig. Hall	✔	✔			
Digital halls only	✔				
Tacho			✔		
Open-loop (no sensor)				✔	✔
Open-loop (with step loss detection using incr. enc.)				✔	✔
Open-loop (with enc. on load)				✔	✔

- **Features**
- Motion controller and drive in a single compact unit
- Universal solution for control of rotary and linear brushless, brushed and 2 or 3-phase step motors
- CANopen communication protocol (CiA 301v4.2, CiA 305v2.213 and 402v3.0)
- Various modes of operating supported: Position or Speed Profile, interpolated Cyclic Synchronous Position (CSP) mode, external reference mode (Position, Speed, Torque), 35 homing modes
- Motor supply: 11-90V. Logic supply: 9-36V
- Output current: 10A cont. (BLDC mode); 21A_{PEAK}, up to 100KHz PWM
- 5 opto-isolated digital inputs, 12-36V, PNP/NPN compatible: 2 for limit switches, 3 general-purpose
- 5 digital outputs, 5-36V, 0.5A, NPN open-collector: Error, 1 Motor brake [2A], 3 general-purpose [0.5A]
- Mini USB¹ & CAN-bus 2.0B interfaces
- 127 h/w addresses selectable by h/w DIP switch
- NTC/PTC analogue Motor Temperature sensor input

- Protections: short-circuit between motor phases and from motor phases to GND, over/under-voltage, over-current, I²t, control error, over temperature, communication error
- Feedback Devices :
 - 1st feedback devices supported:
 - Incremental encoder interface (differential)
 - Digital Hall sensor interface (single-ended and open collector)
 - 2nd feedback devices supported:
 - pulse & direction interface (differential) for external (master) digital reference
- 1 analogue input: 12-bit, 0-5V: Feedback
- 1 rotating potentiometer used as Reference
- 16k x16 SRAM memory for data acquisition
- 16k x16 E²ROM to store setup and other user data
- Operating ambient temperature: 0-40°C (over 40°C with derating)

Mating Connectors

Producer	Part No.	Connector	Description	Image
WAGO	734-104	J1	Pluggable terminal block 4-pole Pin spacing 3.5 mm	AWG 14-28
WAGO	733-108	J2	Pluggable terminal block 8-pole Pin spacing 2.5 mm	AWG 20-28
WAGO	733-112	J3 & J5	Pluggable terminal block 12-pole Pin spacing 2.5 mm	AWG 20-28
WAGO	733-106	J4	Pluggable terminal block 6-pole Pin spacing 2.5 mm	AWG 20-28
WAGO	734-105	J6	Pluggable terminal block 5-pole Pin spacing 3.5 mm	AWG 14-28

¹Mini USB cable not provided

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Connectors Description			
Pin	Name	Type	Description
J1	1	GND	Negative return (ground) of the power supply
	2	+V _{LOG}	Positive terminal of the logic supply input: 11 to 36V _{DC}
	3	+V _{MOT}	Positive terminal of the motor supply: 11 to 90V _{DC}
	4	Earth	Earth connection
J2	1	OUT0/M.BRK	5-36V 2A, digital output used for an electro-mechanical brake, NPN open-collector/TTL pull-up
	2	OUT5	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
	3	OUT4	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
	4	OUT1	5-36V 0.5A, general-purpose digital output, NPN open-collector/TTL pull-up
	5	OUT2/Error	12-36V 0.5A, drive Error output, active low, NPN open-collector/TTL pull-up. Also drives the red Error LED.
	6	CAN Hi	I/O CAN-Bus positive line(dominant high)
	7	CAN Lo	I/O CAN-Bus negative line (dominant low)
	8	GND	- Return ground for I/O and CAN pins
J3	1	IN2+/LSP+	12-36V digital PNP/NPN opto-isolated input. Positive limit switch function, positive input
	2	IN2-/LSP-	12-36V digital PNP/NPN opto-isolated input. Positive limit switch function, negative input
	3	IN3+/LSN+	12-36V digital PNP/NPN opto-isolated input. Negative limit switch function, positive input
	4	IN3-/LSN-	12-36V digital PNP/NPN opto-isolated input. Negative limit switch function, negative input
	5	IN0+	12-36V general-purpose digital PNP/NPN opto-isolated positive input.
	6	IN0-	12-36V general-purpose digital PNP/NPN opto-isolated negative input.
	7	IN1+	12-36V general-purpose digital PNP/NPN opto-isolated positive input.
	8	IN1-	12-36V general-purpose digital PNP/NPN opto-isolated negative input.
	9	Ena+/IN4+	12-36V digital PNP/NPN opto-isolated input. Drive enable function, positive input
	10	Ena-/IN4-	12-36V digital PNP/NPN opto-isolated input. Drive enable function, negative input
	11	FDBK	Analogue input, 12-bit, 0-5V. Used to read an analogue position or speed feedback (as tach), or used as general purpose analogue input.
	12	GND	- Negative return (ground) of the motor supply
J4	1	GND	- Return ground
	2	Pulse+	Pulse+ differential input; has 120Ω resistor between pins 2 and 3
	3	Pulse-	Pulse- differential input; has 120Ω resistor between pins 2 and 3
	4	Dir+	Direction+ differential input; has 120Ω resistor between pins 4 and 5
	5	Dir-	Direction- differential input; has 120Ω resistor between pins 4 and 5
	6	Temp Mot	NTC/PTC input. Used to read an analog temperature value

Pin	Name	Type	Description
1	GND	-	Return ground for sensors supply
2	A1+	I	Incr. encoder1 A+ diff. input; has 120Ω resistor between pins 2 and 3
3	A1-	I	Incr. encoder1 A- diff. input; has 120Ω resistor between pins 2 and 3
4	B1+	I	Incr. encoder1 B+ diff. input; has 120Ω resistor between pins 4 and 5
5	B1-	I	Incr. encoder1 B- diff. input; has 120Ω resistor between pins 4 and 5
6	Z1+	I	Incr. encoder1 Z+ diff. input; has 120Ω resistor between pins 6 and 7
7	Z1-	I	Incr. encoder1 Z- diff. input; has 120Ω resistor between pins 6 and 7
8	+5V _{OUT}	O	5V output supply for I/O usage
9	Hall 1	I	Digital input Hall 1 sensor
10	Hall 2	I	Digital input Hall 2 sensor
11	Hall 3	I	Digital input Hall 3 sensor
12	GND	-	Return ground for sensors supply

Pin	Name	Type	Description
1	A/A+	O	Phase A for 3-ph motors, A+ for 2-ph steppers, Motor+ for DC brush motors
2	B/A-	O	Phase B for 3-ph motors, A- for 2-ph steppers, Motor- for DC brush motors
3	C/B+	O	Phase C for 3-ph motors, B+ for 2-ph steppers
4	CR/B-	O	Chopping resistor / Phase B- for 2-ph step motors
5	Earth	-	Earth connection

Pin	Name	Type	Description
1	ID-Bit0	-	Hardware AxisID selection switches They represent the first 7 LSB bits of an 8 bit binary Axis ID number. Switch = ON(down) -> ID bit = 1 Switch = OFF(up) -> ID bit = 0
2	ID-Bit1	-	
3	ID-Bit2	-	
4	ID-Bit3	-	
5	ID-Bit4	-	
6	ID-Bit5	-	
7	ID-Bit6	-	
8	Reserved	-	Reserved

Electrical characteristics

All parameters measured under the following conditions (unless otherwise specified):


- V_{LOG} = 24 VDC; V_{MOT} = 48VDC
- Supplies start-up / shutdown sequence: -any-
- Load current (sinusoidal amplitude / continuous BLDC, DC, stepper) = 4A

Operating Conditions		Min.	Typ.	Max.	Units
Ambient temperature		0		40 ^{1,3}	°C
Ambient humidity	Non-condensing	0		90	%Rh
Altitude / pressure ²	Altitude (vs. sea level)	-0.1	0 ± 2.5 ²		Km
	Ambient Pressure	0 ²	0.75 ÷ 1	10.0	atm
Storage Conditions		Min.	Typ.	Max.	Units
Ambient temperature		-40		105	°C
Ambient humidity	Non-condensing	0		100	%Rh
Ambient Pressure		0		10.0	atm
ESD capability (Human body model)	Not powered; applies to any accessible part			±0.5	kV
	Original packaging			±15	kV
Mechanical Mounting		Min.	Typ.	Max.	Units
Airflow					natural convection ³ , closed box

¹ Operating temperature at higher temperatures is possible with reduced current and power ratings

² Udrive can be operated in vacuum (no altitude restriction), but at altitudes over 2,500m, current and power rating are reduced due to thermal dissipation efficiency.

³ In case of forced cooling (conduction or ventilation) the maximum ambient temperature can be increased substantially.

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Environmental Characteristics		Min.	Typ.	Max.	Units
Size (Length x Width x Height)	Without mating connectors	110 x 90 x 17			mm
	With recommended mating connectors.	~4.33 x 3.54 x 0.67			inch
Weight	Without mating connectors	130			g
	Efficiency	98			%
Cleaning agents	Dry cleaning is recommended	Only Water- or Alcohol- based			
Protection degree	According to IEC60529, UL508	IP20			-
Logic Supply Input (+V _{LOG})		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	9		36	V _{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters	8		40	V _{DC}
	Absolute maximum values, continuous	-0.6		42	V _{DC}
	Absolute maximum values, surge (duration ≤ 10ms) †	-1		+45	V
Supply current	+V _{LOG} = 12V		120		mA
	+V _{LOG} = 24V		70		
	+V _{LOG} = 40V		50		
Motor Supply Input (+V _{MOT})		Min.	Typ.	Max.	Units
Supply voltage	Nominal values	11	90	92	V _{DC}
	Absolute maximum values, drive operating but outside guaranteed parameters	9		95	V _{DC}
	Absolute maximum values, surge (duration ≤ 10ms) †	-1		102	V
Supply current	Idle		1	5	mA
	Operating	-22	±10	+22	
	Absolute maximum value, short-circuit condition (duration ≤ 10ms) †			37	
Motor Outputs (A/A+, B/A-, C/B+, BR/B-)		Min.	Typ.	Max.	Units
Nominal output current, continuous ¹	for DC brushed, steppers and BLDC motors with Hall-based trapezoidal control			10	A
	for PMSM motors with FOC sinusoidal control (sinusoidal amplitude value)			10	
	for PMSM motors with FOC sinusoidal control (sinusoidal effective value)			7.09	
Motor output current, peak	maximum 2.5s	-21.4		+21.4	A
Short-circuit protection threshold		±22	±26	±30	A
Short-circuit protection delay		5	10		µs
On-state voltage drop	Nominal output current; including typical mating connector contact resistance		±0.3	±0.5	V
Off-state leakage current			±0.5	±1	mA
Motor inductance (phase-to-phase)	Recommended value, for current ripple max. ±5% of full range; +V _{MOT} = 36 V	F _{PWM}			
		20 kHz	330		
		40 kHz	150		
		60 kHz	120		
		80 kHz	80		
	Minimum value, limited by short-circuit protection; +V _{MOT} = 36 V	20 kHz	120		µH
		60 kHz	40		
		40 kHz	30		
Motor electrical time-constant (L/R)	Recommended value for ±5% current measurement error	20 kHz	250		µs
		40 kHz	125		
		60 kHz	100		
		80 kHz	63		
		100 kHz	50		
Current measurement	FS = Full Scale accuracy		±4	±8	%FS

Digital Inputs – opto-isolated- (IN0, IN1, IN2/LSP, IN3/LSN, IN4) ²		Min.	Typ.	Max.	Units
Mode compliance	PNP	Connect negative pin to GND and positive pin to signal			
	NPN	Connect positive pin to supply and connect negative pin to signal			
Default state	Input floating (wiring disconnected)	Logic LOW			
Input voltage	Logic LOW	0		36	V
	Logic HIGH	5		36	
	Absolute maximum	-7		50	
Input current	Logic LOW	0		50	mA
	Logic HIGH	8	10	12	
	Absolute maximum	-20		20	
Input frequency			2		kHz
Minimum pulse			500		
ESD protection	Human body model	±15			kV
Digital Outputs (OUT0, OUT1, OUT2/Error, OUT4, OUT5)		Min.	Typ.	Max.	Units
Mode compliance	All outputs (OUT0, 1, 4, 5 OUT2/Error)	NPN 24V			
Default state	Not supplied (+V _{LOG} floating or to GND)	High-Z (floating)			
	Immediately after power-up	OUT0, OUT1	Logic "HIGH"		
	Normal operation	OUT0, OUT1, OUT2/Error	Logic "HIGH"		
Output voltage	Logic "LOW"; output current = 0.5A		0.3	0.65	V
	Logic "HIGH"; output current = 0, no load		V _{LOG}	5	
	Logic "HIGH", external load to +V _{LOG}	-0.5		V _{LOG} +0.5	
	Absolute maximum, continuous	-1		V _{LOG} +1	
	Absolute maximum, surge (duration ≤ 1s) †	-1		V _{LOG} +1	
Output current	Logic "LOW", sink current, continuous			0.5	A
				2	
	Logic "HIGH", source current; external load to GND; V _{OUT} ≥ 2.0V			3	mA
Logic "HIGH", leakage current; external load to +V _{LOG} ; V _{OUT} = V _{LOG} max = 40V		0.1			
Minimum pulse width		2			
ESD protection	Human body model	±15			kV
Digital Hall Inputs (Hall1, Hall2, Hall3)		Min.	Typ.	Max.	Units
Mode compliance		TTL / CMOS / Open-collector			
Default state	Input floating (wiring disconnected)	Logic HIGH			
Input voltage	Logic "LOW"		0	0.8	V
	Logic "HIGH"	2	5		
	Floating voltage (not connected)		4.4		
	Absolute maximum, surge (duration ≤ 1s) †	-10		+15	
Input current	Logic "LOW"; Pull to GND			1.2	mA
	Logic "HIGH"; Internal 4.7KΩ pull-up to +5	0	0	0	
Minimum pulse width		2			µs
ESD protection	Human body model	±5			kV

¹ @20KHz F_{PWM}

² The digital inputs are software selectable as PNP or NPN

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Feedback 1 & 2 inputs (A1+, A1-, B1+, B1-, Z1+, Z1-, P+, P-, D+, D-) ¹		Min.	Typ.	Max.	Units
Differential mode compliance	For full RS422 compliance, see ²	TIA/EIA-422-A			
Input voltage	Hysteresis	±0.06	±0.1	±0.2	V
	Differential mode	-14		+14	
	Common-mode range (A+ to GND, etc.)	-11		+14	
Input impedance, differential			120		Ω
Input frequency	Differential mode	0		10	MHz
Minimum pulse width	Differential mode	50			ns
Analog 0...5V Inputs (REF, FDBK)		Min.	Typ.	Max.	Units
Input voltage	Operational range	0		5	V
	Absolute maximum values, continuous	-16		+23	
	Absolute maximum, surge (duration ≤ 1s) [†]			±36	
Input impedance	To GND		15		kΩ
Resolution			12		bits
Integral linearity			±2		bits
Offset error			±2	±10	bits
Gain error			±1%	±3%	% FS ²
Bandwidth (-3Db)	Software selectable	0		1	kHz
ESD protection	Human body model	±2			kV

CAN-Bus		Min.	Typ.	Max.	Units
Compliance		ISO11898, CiA-301v4.2 & 402v3.0			
Bit rate	Software selectable	125		1000	Kbps
	1Mbps			25	
	≤ 250Kbps			250	
Bus length				100	m
				250	
Resistor	Between CAN-Hi, CAN-Lo	none on-board			
Node addressing	by hardware through SW1	1 ÷ 127 ; 255 (all bits 0)			
	by software using EasySetup	1- 255 (numbers above 127 will be considered as LSS non-configured)			
ESD protection	Human body model	±15			kV
Supply Output (+5V)		Min.	Typ.	Max.	Units
Output voltage	Current sourced = 500mA	4.8	5	5.2	V
Output current				500	mA
Short-circuit		Protected			
Over-voltage		Protected			
ESD protection	Human body model	±15			kV

[†] Stresses beyond values listed under "absolute maximum ratings" may cause permanent damage to the device. Exposure to absolute-maximum-rated conditions for extended periods may affect device reliability.

¹ All differential input pins have internal 120Ω termination resistors connected across

² "FS" stands for "Full Scale"

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