

Control Modes

- Indexer, Point-to-Point, PVT
- Camming, Gearing
- Position, Velocity, Torque

Command Interface

- CANopen
- ASCII and discrete I/O
- Stepper commands
- $\pm 10V$ position/velocity/torque command
- PWM velocity/torque command
- Master encoder (Gearing/Camming)

Communications

- EtherCAT
- RS-232

Feedback

Incremental

- Digital quad A/B encoder
- Analog sin/cos encoder
- Digital Halls

Absolute

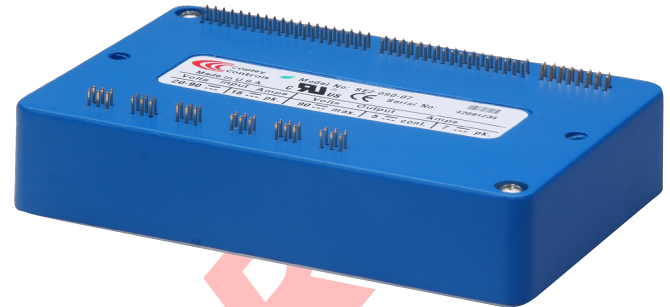
- SSI
- EnDat 2.1 & 2.2
- Hiperface
- Absolute A
- BiSS

I/O

- Digital: 20 inputs, 7 outputs
- Analog: two 16-bit inputs

Dimensions: mm [in]

- 114 x 73 x 23 [4.5 x 2.9 x 0.9]



Model	Ic	Ip	Vdc
AP2-090-06	3	6	90
AP2-090-14	7	14	90

DESCRIPTION

Accelnet AP2 is a high-performance, DC powered servo drive for position, velocity, and torque control of brushless and brush motors. Using advanced FPGA technology, the AP2 provides a significant reduction in the cost per node in multi-axis CANopen systems.

Each of the two nodes in the AP2 operates as a CANopen node using the CANopen protocol DSP-402 for motion control devices. Supported modes include: Profile Position-Velocity-Torque, Interpolated Position Mode (PVT), and Homing.

Command sources also include $\pm 10V$ analog torque/velocity/position, PWM torque/velocity, and stepper command pulses.

Feedback from a number of incremental and absolute encoders is supported.

Seventeen high-speed digital inputs with programmable functions are provided, and two low-speed inputs for motor temperature switches.

An SPI (Serial Peripheral Interface) function is supported by another high-speed input and four high-speed digital outputs. If not used for SPI, the input and outputs are programmable for other functions. Three open-drain MOSFET can drive loads powered up to 24 Vdc.

An RS-232 serial port provides a connection to Copley's CME2 software for commissioning, firmware upgrading, and saving configurations to flash memory.

Drive power is transformer-isolated DC from regulated or unregulated power supplies. An AuxHV input is provided for "keep-alive" operation permitting the drive power stage to be completely powered down without losing position information, or communications with the control system.

GENERAL SPECIFICATIONS

Test conditions: Load = Wye connected load: 2 mH + 2 Ω line-line. Ambient temperature = 25°C, +HV = HV_{max}

MODEL	AP2-090-06	AP2-090-14	
OUTPUT POWER			
Peak Current	6 (4.2)	14 (10)	Adc (Arms-sine), ±5%
Peak time		1	Sec
Continuous current	3 (2.1)	7 (5)	Adc (Arms-sine) per phase
Maximum Output Voltage			Vout = HV*0.97 - Rout*Iout
INPUT POWER			
HVmin~HVmax	+20 to +90	+20 to +90	Vdc Transformer-isolated
Ipeak	6	14	Adc (1 sec) peak
Icont	3	7	Adc continuous
Aux HV	+20 to +HV Vdc @ 500 mAdc maximum, 2.5 W		
PWM OUTPUTS			
Type	3-phase MOSFET inverter, 16 kHz center-weighted PWM, space-vector modulation		
PWM ripple frequency	32 kHz		
CONTROL MODES			
CANopen over Ethernet (CoE): Profile Position, Profile Velocity, & Profile Torque, Interpolated Position (PVT), Homing Cyclic Synchronous Position/Velocity/Torque Analog ±10 Vdc, camming, internal indexer and function generator Digital PWM/Polarity current/velocity and Step/Direction position commands Discrete I/O: camming, internal indexer and function generator			
COMMAND INPUTS			
Type	CANopen		
Signals & format	TX+, TX-, RX+, RX-; 100BaseTX		
Data protocol	CANopen Device Profile DSP-402 over CANopen (CoE)		
Address Selection	Programmable, or via digital inputs		
Analog	±10 Vdc, torque/velocity/position control		
Digital	High speed inputs for PWM/Polarity and Step/Direction		
Camming	Quad A/B digital encoder		
DIGITAL CONTROL			
Digital Control Loops	Current, velocity, position. 100% digital loop control		
Sampling rate (time)	Current loop: 16 kHz (62.5 μs), Velocity & position loops: 4 kHz (250 μs)		
Commutation	Sinusoidal, field-oriented control for brushless motors		
Modulation	Center-weighted PWM with space-vector modulation		
Bandwidths	Current loop: 2.5 kHz typical, bandwidth will vary with tuning & load inductance		
HV Compensation	Changes in bus voltage do not affect bandwidth		
Minimum load inductance	200 μH line-line		
DIGITAL INPUTS			
Number	20		
[IN1~17]	High-speed digital, 1 μs RC filter, 10 kΩ pull-up to +3.3 Vdc, 74HC14 Schmitt trigger		
[IN18]	SPI port MISO input, 47 ns RC filter, 1 kΩ pull-up to +3.3 Vdc, 74HC14 Schmitt trigger		
[IN19~20]	Motor temperature switch, 330 μs RC filter, 4.99 kΩ pull-up to +3.3 Vdc, 74HCT2G14 Schmitt trigger		
DIGITAL OUTPUTS			
Number	7		
[OUT1~3]	Open-drain MOSFET with 1 kΩ pull-up with series diode to +5 Vdc 100 mAdc max, +30 Vdc max. Functions programmable		
[OUT4~7]	SPI port MOSI, SCLK, SS1, & SS2 signals, 74AHCT125 line drivers		
FEEDBACK			
<i>Incremental:</i>			
Digital Incremental Encoder	Quadrature signals, (A, /A, B, /B, X, /X), differential (X, /X Index signals not required) 5 MHz maximum line frequency (20 M counts/sec) 26LS32 differential line receiver with 121 Ω terminating resistor between complementary inputs		
Analog Incremental Encoder	Sin/cos format (sin+, sin-, cos+, cos-), differential, 1 Vpeak-peak, ServoTube motor compatible		
<i>Absolute:</i>			
SSI	Clock (X, /X), Data (S, /S) signals		
EnDAT	Clock (X, /X), Data (S, /S), sin/cos (sin+, sin-, cos+, cos-) signals		
Absolute A	SD+, SD- signals		
BISS	MA+, MA-, SL+, SL- signals		
Encoder power	Two outputs: +5 Vdc ±2% @ 400 mAdc max each output		

RS-232 PORT

Signals	RxD, TxD, Gnd for operation as a DTE device
Mode	Full-duplex, DTE serial port for drive setup and control, 9,600 to 115,200 Baud
Protocol	ASCII or Binary format

MOTOR CONNECTIONS (PER AXIS)

Phase U, V, W	PWM outputs to 3-phase ungrounded Wye or delta connected brushless motors, or DC brush motors
Hall U, V, W	Digital Hall signals, single-ended, 1 μ s RC filter, 10 k Ω pull-up to +5 Vdc, 74HC14 Schmitt trigger
Digital Incremental Encoder	Quadrature signals, (A, /A, B, /B, X, /X), differential (X, /X Index signals not required) 5 MHz maximum line frequency (20 M counts/sec)
Analogue Incremental Encoder	Sin/cos format (sin+, sin-, cos+, cos-), differential, 1 V _{peak-peak} X or S input may be firmware configured to latch position or time
Heidenhain EnDat 2.2	Serial data and clock signals (DATA, /DATA, CLK, /CLK), differential; optionally sin/cos signals
Heidenhain EnDat 2.2, SSI	Serial data and clock signals (DATA, /DATA, CLK, /CLK), differential
BISS	MA+, MA-, SL+, SL-
Nikon A	SD+, SD-
Hall & encoder power	+5 Vdc \pm 2% @ 400 mAdc max, current limited to 750 mAdc @ +1 Vdc if output overloaded
Motemp [IN19~20]	Motor overtemperature switch input. Active level programmable, 4.99 k Ω pull-up to +3.3 Vdc Programmable to disable drive when motor over-temperature condition occurs

PROTECTIONS

HV Overvoltage	+HV > HV _{max}	Drive outputs turn off until +HV < HV _{max} (See Input Power for HV _{max})
HV Undervoltage	+HV < +20 Vdc	Drive outputs turn off until +HV > +20 Vdc
Drive over temperature	Heat plate > 70°C.	Drive outputs turn off
Short circuits		Output to output, output to ground, internal PWM bridge faults
I ² T Current limiting		Programmable: continuous current, peak current, peak time
Motor over temperature		Digital inputs programmable to detect motor temperature switch
Feedback Loss		Inadequate analog encoder amplitude or missing incremental encoder signals

MECHANICAL & ENVIRONMENTAL

Size mm [in]	114 x 73 x 23 [4.5 x 2.9 x 0.9]
Weight	<tbid> Ambient temperature
Humidity	0 to 95%, non-condensing
Vibration	2 g peak, 10~500 Hz (sine), IEC60068-2-6
Shock	10 g, 10 ms, half-sine pulse, IEC60068-2-27
Contaminants	Pollution degree 2
Environment	IEC68-2: 1990
Cooling	Heat sink and/or forced air cooling required for continuous power output

AGENCY STANDARDS CONFORMANCE

In accordance with EC Directive 2004/108/EC (EMC Directive)

EN 55011: 2007	CISPR 11:2003/A2:2006 Industrial, Scientific, and Medical (ISM) Radio Frequency Equipment – Electromagnetic Disturbance Characteristics – Limits and Methods of Measurement Group 1, Class A
EN 61000-6-1: 2007	Electromagnetic Compatibility (EMC) – Part 6-1: Generic Standards – Immunity for residential, Commercial and Light-industrial Environments

In accordance with EC Directive 2006/95/EC (Low Voltage Directive)

IEC 61010-1:2001	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use
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Underwriters Laboratory Standards

UL 61010-1, 2nd Ed.: 2004	Safety Requirements for Electrical Equipment for Measurement, Control and Laboratory Use
UL File Number E249894	

MASTER ORDERING GUIDE

AP2-090-06	Accelnet AP2 servo drive, 3/6 A, 90 Vdc
AP2-090-14	Accelnet AP2 servo drive, 7/14 A, 90 Vdc

DIMENSIONS

