

# CP-500 Series Hollow Shaft Encoders



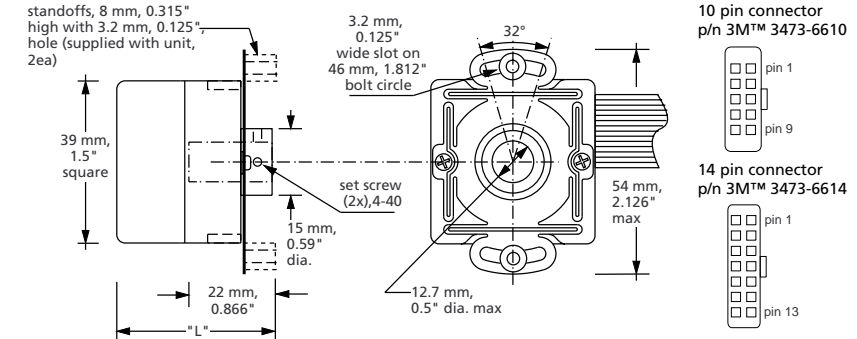
## Description:

The CP-500 series hollow shaft encoder is a small, rugged device, with a package form factor of a 39 mm stepper motor. Maximum possible shaft size is 11mm with set-screw mount, 12.7 mm with "end of shaft" mounting. The commutating versions (CP-5X5 series) are specifically designed to commutate brushless DC motors. The encoder light source is a single light emitting diode, servo controlled for constant light output over time and temperature, the sensor is a monolithic silicon array.

The package supports a wide variety of electronics: incremental, incremental with three bits absolute, as well as 8 and 10 bits absolute. The sine/cosine versions allow a high degree of interpolation because of the low distortion waveform for extremely accurate positioning and speed control. The CP-500 sine/cosine version is BB™ ADS 7833 and VeCon chip compatible.

## Options:

- custom linecounts and index configurations
- custom cable and spring bolt circle configurations (spring with 44mm bolt circle for 50 mm dia. motors available)
- the CP-550 and CP-550-8GC support a 6.35 mm, 0.25" max dia. shaft extension through the back, end slotted.
- available for motor cavity mount without cover and 14 pin PCB mount connector
- absolute accuracy and sinewave distortion plots



standoffs, 8 mm, 0.315" high with 3.2 mm, 0.125" hole (supplied with unit, 2ea)

3.2 mm, 0.125" wide slot on 46 mm, 1.812" bolt circle

32°

54 mm, 2.126" max

15 mm, 0.59" dia.

set screw (2x), 4-40

12.7 mm, 0.5" dia. max

22 mm, 0.866" "L"

39 mm, 1.5" square

10 pin connector p/n 3M™ 3473-6610

14 pin connector p/n 3M™ 3473-6614

shaft inner diameter: 12.7 mm, .5" max.  
shaft loading: 20 N axial, 40 N radial (4 lbs and 8 lbs resp.)  
starting torque: 0.1 Ncm @ 20°C max  
shaft rotation: continuous, reversible  
slew speed: 160 rev/sec<sup>2</sup>  
bearings: ABEC 5

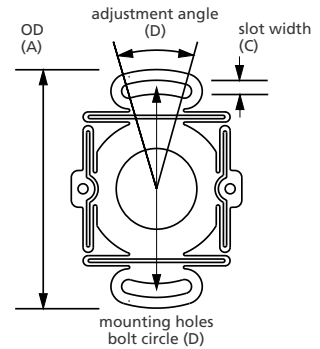
shaft material: 416 stainless  
base material: aluminum (diecast)  
cover: aluminum / plastic optional  
bearing life: manufacturer's specs  
moment of inertia: 1.7 gcm<sup>2</sup>  
weight: approx. 0.2 kg

temperature: operating: -20°C to +100°C  
temperature CP-555: operating: -20°C to +125°C  
shock: 50 G's @ 11 ms  
vibration: 5-2,000 Hz @ 20 G's  
humidity: 98% without condensation  
protection: IP 64 optional (w/o shaft extension)

## AVAILABLE SPRINGS:

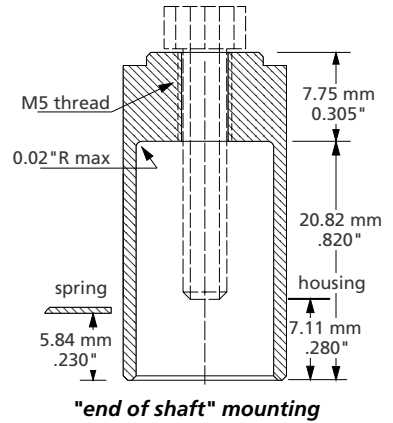
spring#	dimension			
	A	B	C	D
-01 (mm)	49.1	44	3.2	32°
-02 (mm)*	54	46	3.2	32°
-02 (inch)*	2.126	1.812	0.125	32°
-03 (mm)	75	64	5	90°
-04 (inch)	2.7	2.385	0.135	90°

(\*) default spring

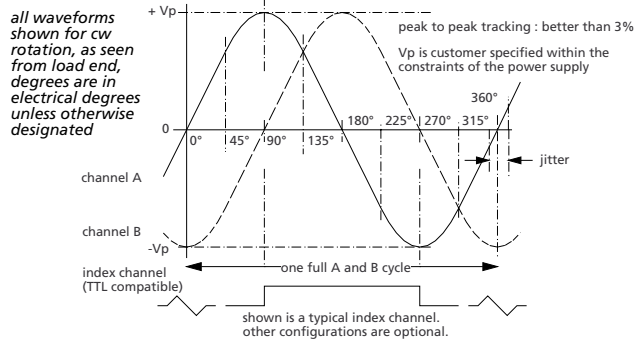


## MOUNTING CONFIGURATIONS:

- 1/ "set screw" mounting (default): recommended shaft length: 22 mm, 0.86" maximum, 9 mm, 0.350" minimum over mounting surface.
- 2/ "end of shaft" mounting: M4 screw, hex head recommended for mounting on stepped shaft or directly on the inner race of the motor bearing. M5 threading provided for extraction of encoder. The M4 screw can be inserted through an access hole in the encoder. This mounting does not need "side access" as for the set-screws and also has the advantage of inherently better centering of the encoder. For lower profile, the shaft part extending beyond the encoder housing can be deleted, contact the factory for details.



## CP-500, Incremental, Sine/Cosine



## Electrical Data:

power supply: consult factory

output format: incremental  
cycles/revolution: 100, 200, 256, 360, 500, 600, 1000, 1024, 2048, 2500 std.

frequency response: 150 kHz min. @ 85 °C  
overall length: L<sub>max</sub> = 39 mm

## Ordering Information:

CP-500-(linecount)-(1)+shaft diameter  
(1): configuration designator(3 alpha's), default amplitude: ± 0.5 V centered at Vref.

Please contact the factory for different amplitudes and power supplies (e.g. 0-5V power supply with built-in Vref of 2.5 V). A wide range of other output amplitudes and offsets are available.

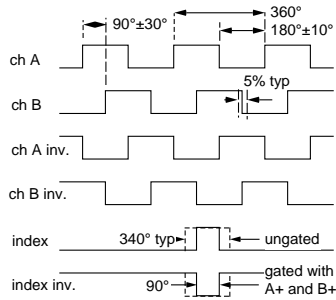
## Pinout standard ± 12 V unit (10 pin connector):

- 1 ground
- 2 channel A
- 3 n/c
- 4 -12 Vdc
- 5 n/c
- 6 channel B
- 7 n/c
- 8 + 12 Vdc
- 9 V reference input (servo ground)
- 10 index

# CP-500 Series Hollow Shaft Encoders

## CP-550, Incremental, Digital

all waveforms shown for cw rotation, as seen from load end, degrees are in electrical degrees unless otherwise designated



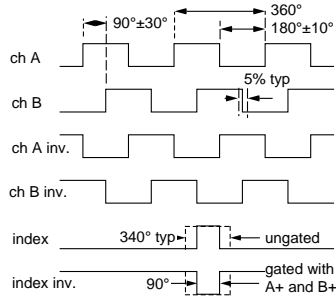
**Electrical Data:**  
 power supply: +5Vdc  $\pm 10\%$  @ 50 mA max (no load)  
 output format: incremental  
 cycles/revolution: 100, 200, 256, 360, 500, 600, 1000, 1024, 2048, 2500, 4096 std.  
 frequency response: 150 kHz min. @ 85 °C  
 linedriver output: 26LS31, EIA std. RS 422 and DIN 66259 compatible  
 TTL output: 74LS04  
 open collector output: LM 339, 6 mA max. sink  
 overall length:  $L_{max} = 39$  mm

**pinout linedrivers:**  
 1 + 5Vdc  
 2 + 5Vdc  
 3 channel A inv.  
 4 channel A  
 5 channel B inv.  
 6 channel B  
 7 index channel  
 8 ground  
 9 index channel inv.  
 10 ground

**pinout TTL:**  
 channel A  
 + 5 Vdc  
 ground  
 ground  
 ground  
 + 5 Vdc  
 channel B  
 n/c  
 index channel

**Ordering Information:**  
 CP-550-(linecount)-(1)-(2)+shaft diameter  
 (1): linedriver=L, TTL=T, open collector=O  
 (2): gated index (A+ and B+)=G

## CP-560, Incremental, Linedriver 5V to 30V

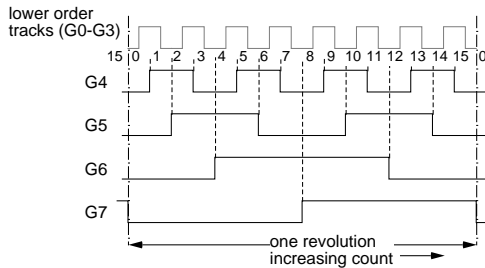


**Electrical Data:**  
 power supply:  $V_{in} = +4.75$  Vdc to 30 Vdc @ 50 mA max (no load)  
 output format: incremental  
 cycles/revolution: 100, 200, 256, 360, 500, 600, 1000, 1024, 1728, 2048, 2500.  
 frequency response: 150 kHz min. @ 85 °C  
 output: EIA std. RS 422 and DIN 66259 (part 3) compatible  
 output @  $V_{in}=4.75$  V:  $V_{lo} = 0.5$  V@20 mA sink  
                                    $V_{hi} = 2.5$  V@20 mA source  
 output @  $V_{in}=30$  V:  $V_{lo} = 0.5$  V@20 mA sink  
                                    $V_{hi} = 27$  V@20 mA source  
 overall length:  $L_{max} = 39$  mm

**pinout :**  
 1 +  $V_{in}$   
 2 channel A  
 3 channel A inv.  
 4 channel B  
 5 channel B inv.  
 6 index channel  
 7 index channel inv.  
 8 ground  
 9 n/c  
 10 n/c

**Ordering Information:**  
 CP-560-(linecount)-(1)+shaft diameter  
 (1): gated index (A+ and B+)=G

## CP-550-08GC, Absolute, 8 bit Gray Code



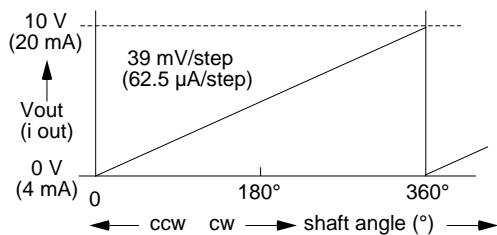
**Electrical Data:**  
 power supply: +5Vdc  $\pm 10\%$  @ 50 mA max (no load)  
                   + 24 Vdc  $\pm 10\%$  @ 70 mA max (option)  
 output format: 8 bit parallel, Gray code  
 frequency response: 100 kHz min. wordrate  
                           output: LM 339, with pullup resistor, 6 mA max. sink  
 overall length:  $L_{max} = 39$  mm

**pinout:**

1 G4	6 G2
2 G6	7 + 5Vdc
3 G0 (lsb)	8 G5
4 G3	9 G7 (msb)
5 ground	10 G1

**Ordering Information:**  
 CP-550-08GC-(1)-(2)+shaft diameter  
 (1): R= with pull-ups, blank if no pullups  
 (2): 5 = 5 Vdc. 24 = 24 Vdc power supply

## CP-550-08AN, Absolute, Analog



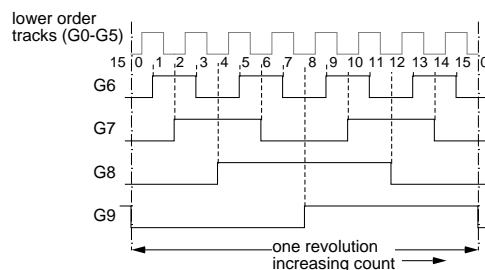
**Electrical Data:**  
 power supply  $V_{in}$ : 12.6 Vdc to 16.6 Vdc @ 100 mA max  
 voltage output  $V_{out}$ : 0 - 10 V standard,  
 current output  $I_{out}$ : 4 - 20 mA (optional)  
                           resolution: 8 bits (256 steps)  
                           stability:  $\pm 0.2\%$   
 direction control input: TTL/CMOS (5 V)  
                           cw rotation of shaft for increasing  $V_{out}$  or  $I_{out}$  at direction control = "0" (low)  
 overall length:  $L_{max} = 45$  mm

**pinout:**

1 n/c	6 power ground
2 + $V_{in}$	7 $I_{out}$
3 n/c	8 n/c
4 n/c	9 $V_{out}$
5 direction control	10 $I_{out}$ return

**Ordering Information:**  
 CP-550-08AN-(1)+shaft diameter  
 (1): blank= $V_{out}$  only,  $I_{out}$  and  $I_{out}$

## CP-550-10GC, Absolute, 10 bit Gray Code



**Electrical Data:**  
 power supply: +5Vdc  $\pm 10\%$  @ 100 mA max (no load)  
 output format: 10 bit parallel, Gray code,  
 frequency response: 50 kHz min. wordrate  
                           output: standard TTL/CMOS  
 overall length:  $L_{max} = 45$  mm

**pinout (14 pin connector):**

1 G1
2 G8
3 G6
4 G7
5 ground
6 G5
7 + 5Vdc
8 G0 (lsb)
9 G9 (msb)
10 G3
11 G4
12 G2
13 n/c
14 G9 inverted

**Ordering Information:**  
 CP-550-10GC + shaft diameter

# CP-500 Series Hollow Shaft Encoders

## CP-515, Hollow Shaft Encoder, VeCon & ADS 7833 Chip Compatible



### Description:

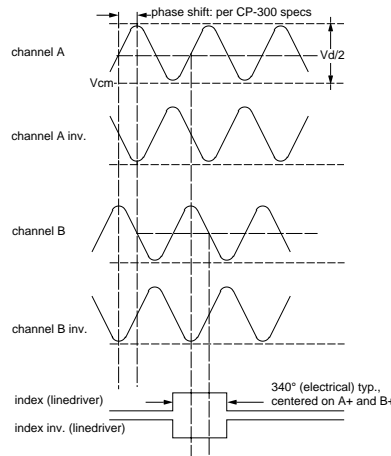
The CP-515 hollow shaft encoder is a special version commutating encoders specifically designed to be compatible with the VeCon motion controller system as well as with the Burr-Brown™ simultaneous A to D converter array chip. Discrete commutation signals are provided for use with brushless DC motors to improve the commutation accuracy over that of "Hall" switches.

The encoder light source is a single light emitting diode, servo controlled for constant light output over time and temperature, the sensor is a monolithic silicon array.

### Options:

- custom linecounts, pole counts and index configurations
- custom cable and spring configurations
- available for motor cavity mount without cover and 14 pin PCB mount connector
- absolute accuracy and sinewave distortion plots
- available with a 10 pin (no complementary digital signals) or 14 pin (full complementary digital signals) connector

### Output Waveforms, Incremental Channels



### Electrical Data:

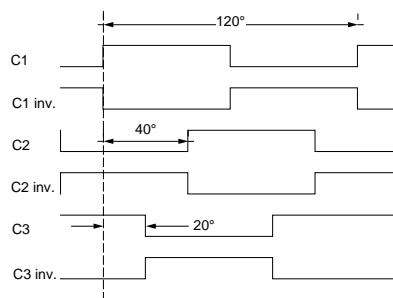
power supply : + 5Vdc±10% @ 100 mA max (no load)  
 output format: incremental + absolute  
 frequency response: 150 kHz min. @ 85 °C  
 index & commutation channel outputs: linedriver, 26LS31,EIA std. RS 422 and DIN 66259 compatible  
 A and B out: per TIL 084 op-amp specs  
 Vd/2 = 0.5V  
 overall length: L<sub>max</sub> = 39 mm with cover

### Pinout:

pin #	10 pin
1	+ 5V
2	ground
3	C3
4	ch. A
6	ch. A inv.
7	index
8	C1
9	ch. B inv.
10	ch. B

### Output Waveforms, Commutation Channels

(mechanical degrees, 6 pole shown. The index signal coincides with the rising edge of C1)



### Ordering Information:

CP-515-(1)-(2)-(3)-(4)-shaft size (mm or")  
 (1) = linecount / rev.  
 (2) = polecount  
 (3) = desired gain: 0,1  
 (4) = connector: 10=10 pin, 14 = 14 pin

### Standard Linecounts / Polecounts:

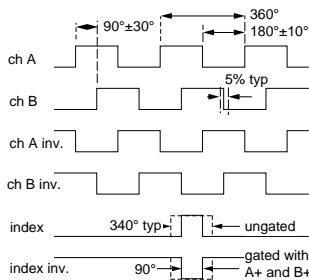
c/r:	polecount:
512	6, 8
1000	6
1024	4, 6 & 8
2048	4, 6 & 8
4096	6, 8

### Temperature Considerations:

The commutating encoders are specifically designed to be mounted inside or on the endbell of brushless DC motors. When mounted inside, the encoders will work as specified up to a cavity temperature of 130°C, corresponding to a motor temperature of 110°C. Externally mounted encoders with aluminum covers will handle a motor temperature 125°C at 25°C ambient.  
 MTBF: encoder @ 125°C = 15,000 hrs  
 encoder @ 85°C = 150,000 hrs (internal encoder temperature)

## CP-555/565, Incremental, Commutating

### Output Waveforms, Incremental Channels



### Electrical data:

supply CP-555: + 5Vdc±10% @ 150 mA max (no load)  
 supply CP-565: + 5VDC through + 30 Vdc @ 150 mA max (no load) + 5Vdc±10% @ 100 mA max (no load)  
 output format: incremental + absolute  
 output CP-555: EIA std. RS 422 and DIN 66259 (part 3) compatible  
 output CP565 @ Vin=4.75V: V<sub>o</sub> 0.5 V@20 mA sink  
 V<sub>hi</sub> 2.5V@20 mA source  
 @ Vin=30 V: V<sub>o</sub> 0.5 V@20 mA sink  
 V<sub>hi</sub> 27 V@20 mA source  
 frequency response: 150 kHz min. @ 85 °C  
 overall length: L<sub>max</sub> = 39 mm

### Ordering information:

square wave output, 5 Vdc supply:  
 CP-555-(1)-(2)-(3)  
 square wave output, 5 Vdc - 30 Vdc:  
 CP-565-(1)-(2)-(3)

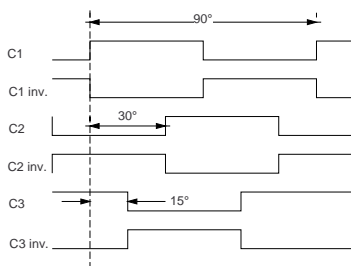
- (1) = linecount / rev.
- (2) = polecount
- (3): gated index (A+ and B+)=G

### Standard linecounts/polecounts:

c/r:	polecount:
360	6
512	6, 8
1000	6
1024	4, 6 & 8
2048	4, 6 & 8
4096	6, 8

### Output Waveforms, Commutation Channels

(mechanical degrees, 8 pole shown. The index signal coincides with the rising edge of C1)



### Pinout (14 pin connector):

pin #	14 pin
1	+ Vcc
2	ground
3	C3 inv.
4	C3
5	C2
6	C2 inv
7	ch A
8	ch A inv.
9	index
10	index inv.
11	C1
12	C1 inv.
13	ch B inv.
14	ch B

### \*Temperature Considerations:

The commutating encoders are specifically designed to be mounted inside or on the endbell of brushless DC motors. When mounted inside, the encoders will work as specified up to a cavity temperature of 130°C, corresponding to a motor temperature of 110°C. Externally mounted encoders with aluminum covers will handle a motor temperature 125°C at 25°C ambient.  
 MTBF: encoder @ 125°C = 15,000 hrs  
 encoder @ 85°C = 150,000 hrs (internal encoder temperature)

# CP-500 Series Hollow Shaft Encoders

## CP-545, Absolute & Incremental



### Options:

- custom linecounts
- custom cable and spring configurations
- available for motor cavity mount without cover and 14 pin PCB mount connector
- absolute accuracy and sinewave distortion plots

### Mechanical Data:

- shaft inner diameter: 0.5" nominal
- shaft loading: 8 lbs radial, 4 lbs axial
- starting torque: 0.1 Ncm @ 20°C max
- shaft rotation: continuous, reversible
- slew speed: 160 rev/sec<sup>2</sup>
- bearings: ABEC 5
- shaft material: 416 stainless
- base material: aluminum (diecast)
- cover: aluminum / plastic optional
- bearing life: manufacturer's specs
- moment of inertia: 1.7 gcm<sup>2</sup>
- weight: approx. 0.2 kg

### Allowable host shaft movement:

- axial: ± 0.050"
- radial: ± 0.005" (TIR)

### Description:

The CP-545 hollow shaft encoder is a special version commutating encoder specifically designed to be compatible with the VeCon motion controller system as well as with the Burr-Brown™ simultaneous A to D converter array chip. Commutation signals are provided in the form of a sine/cosine signal that occurs once per revolution, equivalent to a resolver signal. This signal can be resolved into absolute position information to be used for any polecount motor commutation.

The encoder light source is a single light emitting diode, servo controlled for constant light output over time and temperature, the sensor is a monolithic silicon array.

pcb position	signal designation	cable colors
1	R + (index)	violet
2	R - (index inverse)	blue
3	A +, high count	brown
4	A -, high count	orange
5	B +, high count	yellow
6	B -, high count	green
7	common	black
8	+ 5Vdc input	red
9	D -, one c/r	brown/white
10	D +, one c/r (2 Vdc)	grey
11	C +, one c/r	black/white
12	C -, one c/r (2 Vdc)	white
n/c	cable shield (not connected)	cable shield

### Electrical Data:

- power supply: + 5Vdc±10% @ 100 mA max @ no load
- incremental signals: 1 Vpp with Rt=120 k load,
- index signals: 0.5V differential with Rt=120
- commutation signals: 1 Vpp with Rt=1 K load, frequency: one cycle per revolution 3 dB @150 kHz

### Environmental Data:

- temperature: operating: -20°C to +115°C
- shock: 50 G's @ 11 ms
- vibration: 5-2,000 Hz @ 20 G's
- humidity: 98% without condensation
- protection: IP 64 optional

### Ordering Information:

- CP-545-(1)-+shaft size (mm or ")
- (1) = linecount / rev.
- standard linecounts: 1024, 2048

