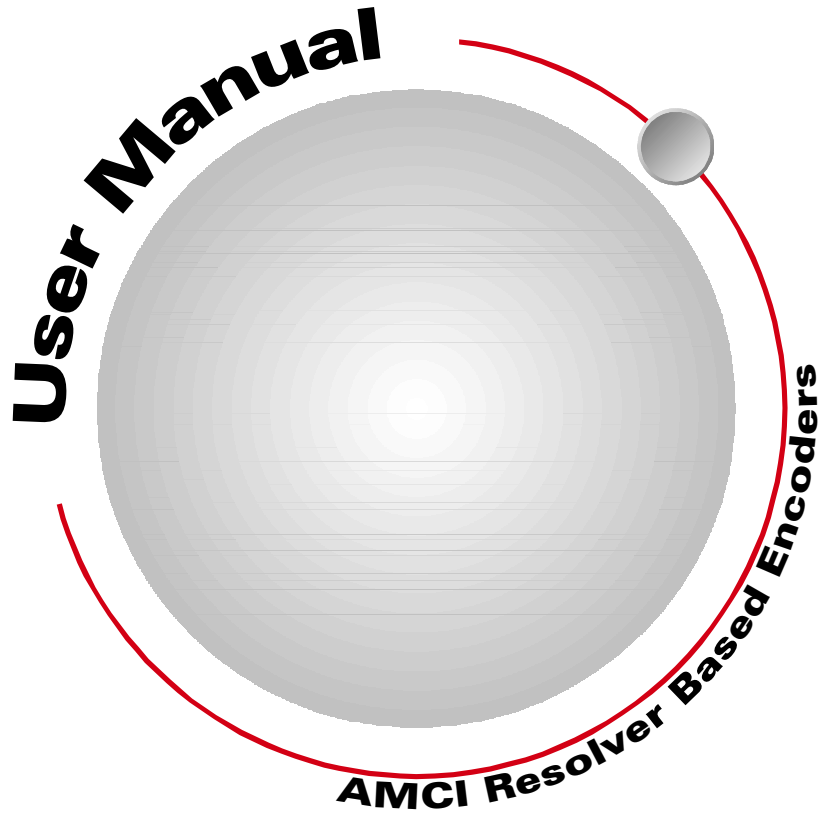
ADVANCED MICRO CONTROLS INC.

Manual #: 940-0D024

DC25
Analog Output DuraCoder



GENERAL INFORMATION

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The products and application data described in this manual are useful in a wide variety of different applications. Therefore, the user and others responsible for applying these products described herein are responsible for determining the acceptability for each application. While efforts have been made to provide accurate information within this manual, AMCI assumes no responsibility for the application or the completeness of the information contained herein.

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24 Hour technical support is available on this product. If you have internet access, start at www.amci.com. Product documentation and FAQ’s are available on the site that answer most common questions.

If you require additional technical support, call (860) 583-7271. Your call will be answered by the factory during regular business hours, Monday through Friday, 8AM - 5PM Eastern. During non-business hours an automated system will ask you to enter the telephone number you can be reached at. Please remember to include your area code. The system will page an engineer on call. Please have your product model number and a description of the problem ready before you call.

We Want Your Feedback

Manuals at AMCI are constantly evolving entities. Your questions and comments on this manual are both welcomed and necessary if this manual is to be improved. Please direct all comments to: Technical Documentation, AMCI, 20 Gear Drive, Terryville CT 06786, or fax us at (860) 584-1973. You can also e-mail your questions and comments to *techsupport@amci.com*

TABLE OF CONTENTS

Notes

ABOUT THIS MANUAL

Read this chapter to learn how to navigate through this manual and familiarize yourself with the conventions used in it. The last section of this chapter highlights the manual's remaining chapters and their target audience.

Audience

This manual explains the installation and operation of AMCI's analog output DuraCoders. It is written for the engineer responsible for incorporating the Analog DuraCoder into a design as well as the engineer or technician responsible for its actual installation. If there are any unanswered questions after reading this manual, call the factory. An applications engineer will be available to assist you.

Navigating this Manual

This manual is designed to be used in both printed and on-line forms. Its on-line form is a PDF document, which requires Adobe Acrobat Reader version 4.0+ to open it.

Bookmarks of all the chapter names, section headings, and sub-headings are in the PDF file to help you navigate through it. The bookmarks should have appeared when you opened the file. If they didn't, press the F5 key on Windows platforms to bring them up.

Throughout this manual you will also find ***blue text that functions as a hyperlink*** in HTML documents. Clicking on the text will immediately jump you to the referenced section of the manual. If you are reading a printed manual, most links include page numbers.

The PDF file is password protected to prevent changes to the document. You are allowed to select and copy sections for use in other documents and, if you own Adobe Acrobat version 4.05 or later, you are allowed to add notes and annotations.

Manual Conventions

Three icons are used to highlight important information in the manual:

NOTES highlight important concepts, decisions you must make, or the implications of those decisions.

CAUTIONS tell you when equipment may be damaged if the procedure is not followed properly.

WARNINGS tell you when people may be hurt or equipment may be damaged if the procedure is not followed properly.

The following table shows the text formatting conventions:

Format	Description
Normal Font	Font used throughout this manual.
Emphasis Font	Font used the first time a new term is introduced.
Cross Reference	When viewing the PDF version of the manual, clicking on the cross reference text jumps you to referenced section.

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Revision Record

This manual, 940-0D024 is the fifth release of the manual. It changes the format of the manual, adds information on the output preset pin, and specifies new shaft and mounting options. It was first released May 26, 2009.

Where to Go From Here

The table below gives a brief description of the content of each chapter to help you find the information you need to assist you in your job.

CHP NUM.	Chapter Title	Chapter Description
1	*THE ANALOG OUTPUT DURACODER*	Intended for anyone new to the Analog DuraCoder, this chapter gives a basic overview of the unit. The chapter also explains the Analog DuraCoder part numbering system.
2	*INSTALLATION*	This chapter is intended for the engineer or technician responsible for installing and wiring the Analog DuraCoder. Information in this chapter includes mechanical drawings, installation guidelines and connector pinout.

CHAPTER 1
THE ANALOG OUTPUT DURACODER

Analog DuraCoder Overview

DuraCoders are designed as direct replacements for optical encoders. Instead of being designed around a disk and optics, a DuraCoder uses a resolver as its primary shaft position sensor. Constructed in a manner similar to high precision motors, resolvers are absolute, single turn position sensors that are unsurpassed in terms of ruggedness and reliability. The resolver is an analog device whose outputs vary sinusodially as the shaft is rotated.

Originally designed for military applications over 60 years ago, resolvers have gained popularity in many industrial markets from steel mills to packaging machines. If you are interested in learning more about resolvers, check out our website at: http://www.amci.com/tutorials/tutorials-what-is-resolver.asp.

The resolver's analog signals are decoded into a 12 bit position value by electronics incorporated into the DuraCoder. This 12 bit (4096 count), absolute position value is available as an analog output. Several different voltage and current outputs are available, as well as the amount of shaft rotation needed to generate full scale output.

Figure 1.1 An Analog Output DuraCoder

The Analog DuraCoder is available in a variety of industry standard size 25 optical encoder packages. A servo mount unit with a 3/8" shaft and a side connector is shown in figure 1.1. Flange mount and end connect units are also available. If your application requires you to mount the DuraCoder to a motor, a blind shaft mounting option is also available. Finally, a face mount unit with a 5/8 inch shaft is available for applications that may be exposed to high shaft loads.

Outline drawings of all of the packing options is available in the *Outline Drawings* section of the ***INSTALLATION*** chapter, starting on page 11.

The zero position of the Analog DuraCoder can be set by pulsing a pin to DC Return on the Mill Spec Connector. This will set the output to its minimum value, which may not be zero. (On a 4 to 20mA unit, the output would be set to 4mA.).

Part Numbering System

DC25 ❐ – ❐ ❐ ❐ 1 X ❐

HOUSING
F = Square Flange
S = 2.5" Dia. Servo Mount
H = 63mm Blind Shaft Mount

BEARING SEAL
B = Nitrile (standard)
V = Viton

SHAFT DIA.
Standard Shaft
1 = 0.375" Dia.
2 = 10mm Dia.
3 = 0.250" Dia.
5 = 0.625" Dia.
Flange Mount Only
Housing = 'F'
Blind Shaft Hole
1 = 0.375" Dia
2 = 10mm Dia.
4 = 0.500" Dia
6 = 12mm Dia.

DURACODER TYPE
V = Absolute Analog Voltage
C = Absolute Analog Current

OUTPUT CODING
DuraCoder Type = "V"
1 = 0 to 5Vdc
2 = 0 to 10Vdc
4 = ±10Vdc
DuraCoder Type = "C"
1 = 4 to 20mA
2 = 0 to 20mA

CONNECTOR
S = Side
E = End
FL = Integral Cable

OUTPUT PERIOD
K = 360° Output Signal Period
L = 180° Output Signal Period
M = 90° Output Signal Period
N = 45° Output Signal Period

Figure 1.2 Part Numbering System

Output Waveforms

Output Period

The figure below shows the four available Output Periods when you order an AMCI Analog DuraCoder. The Output Period can be viewed as the amount of rotation needed to achieve full scale output.

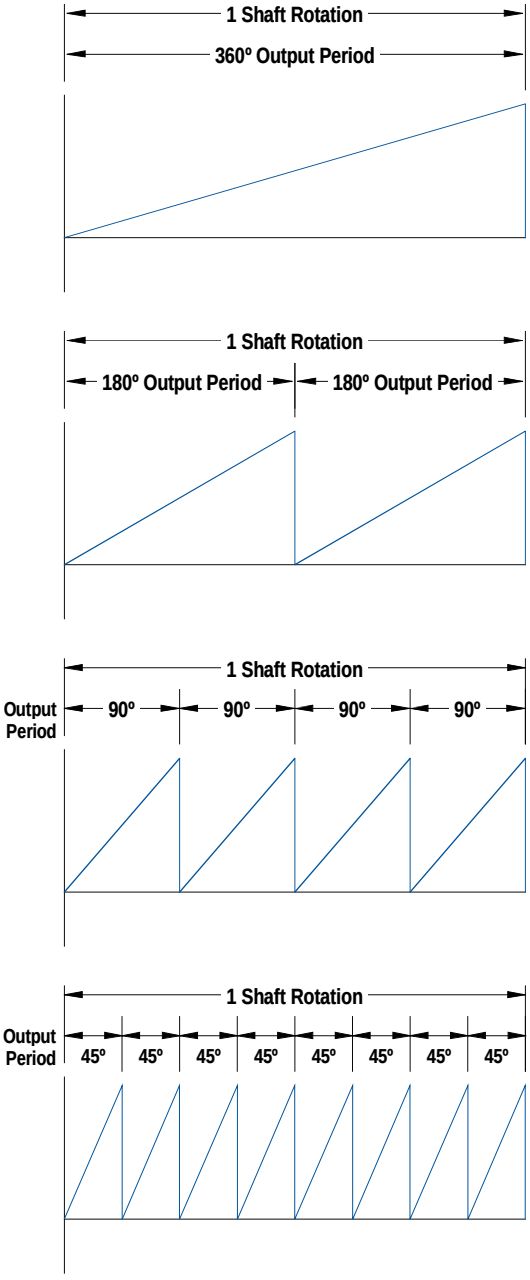


Figure 1.3 Output Periods

Voltage Output Waveforms

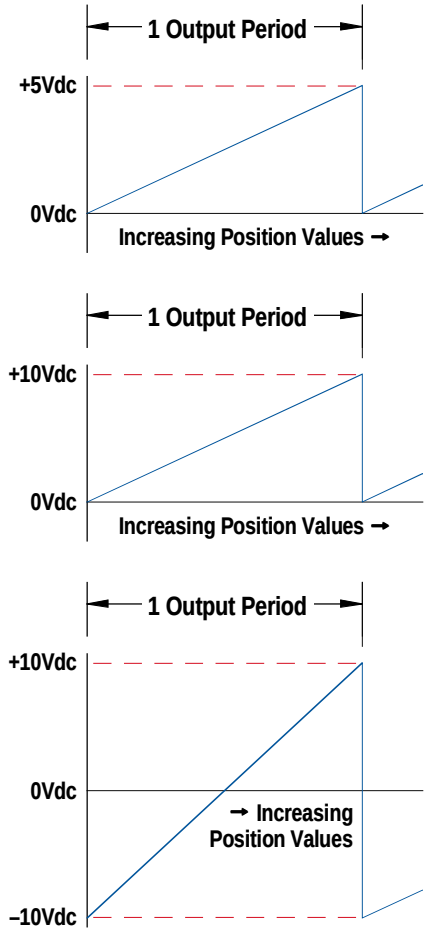


Figure 1.4 Available Voltage Outputs

Current Output Waveforms

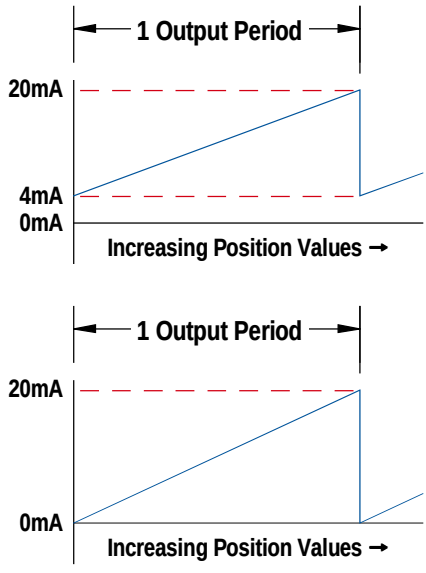


Figure 1.5 Available Current Outputs

Electrical Specifications

Operating Voltage
4.5Vdc to 30Vdc

Power Requirements
1.8 W max.
58mA @ 24Vdc optimal

Position Resolution
12 bit (4,096 counts) for 360° Output Period
11 bit (2,048 counts) for 180º Output Period
10 bit (1,024 counts) for 90º Output Period
9 bit (512 counts) for 45º Output Period

Position Update Time
20 microseconds

Max. Output Settling Time
5 milliseconds when switching between minimum and maximum output

Direction of Increasing Counts
Default CCW looking at shaft

Can be set to CW increasing by shorting a pin to DC Return.

Zero Position:
Can be set on any Analog DuraCoder by pulsing pin J on the Mill Spec connector to DC Return.

Environmental Specifications

Operating Temperature
-40°F to +185°F (-40°C to +85°C)

Shock
50g, 11 millisecond duration

Vibration
20g, 5 to 2000Hz

Enclosure Rating
IP67

Approximate Weight
2.0 lbs. (0.91 Kg) 0.625" shafts
1.4 lbs. (0.65 Kg) All other shafts

Mechanical Specifications

Package Style
2.5 inch aluminum housing with flange, servo, or blind shaft mounting

Connector Location
Side or End

Housing
Powder coated aluminum

Shaft
0.250", 0.375", 0.625", or 10mm

Blind Shaft with 0.375", 0.500", 10mm or 12 mm hole

Max. Starting Torque @ 25°C
2.0 oz-in: 0.250", 0.375", and 10mm shafts
6.0 oz-in: All blind shafts
6.0 oz-in: 0.625" shaft

Moment of Inertia (oz-in-sec^2)
6.00 X 10^{-4}: 0.250", 0.375", and 10mm shafts
7.00 X 10^{-4}: All blind shafts
8.50 X 10^{-4}: 0.625" shaft

Max. Operating Speed
6000 RPM

Max. Shaft Loading (0.625" shaft)
Axial: 50 lbs. (222 N)
Radial: 100 lbs. (445 N)
As specified max. loads, bearing life is 2X10^9 revolutions min.

Max. Shaft Loading (All other shafts)
Axial: 20 lbs. (222 N)
Radial: 40 lbs. (445 N)
As specified max. loads, bearing life is 2X10^9 revolutions min.

Notes

Flange Mount Outline Drawings

End Connector

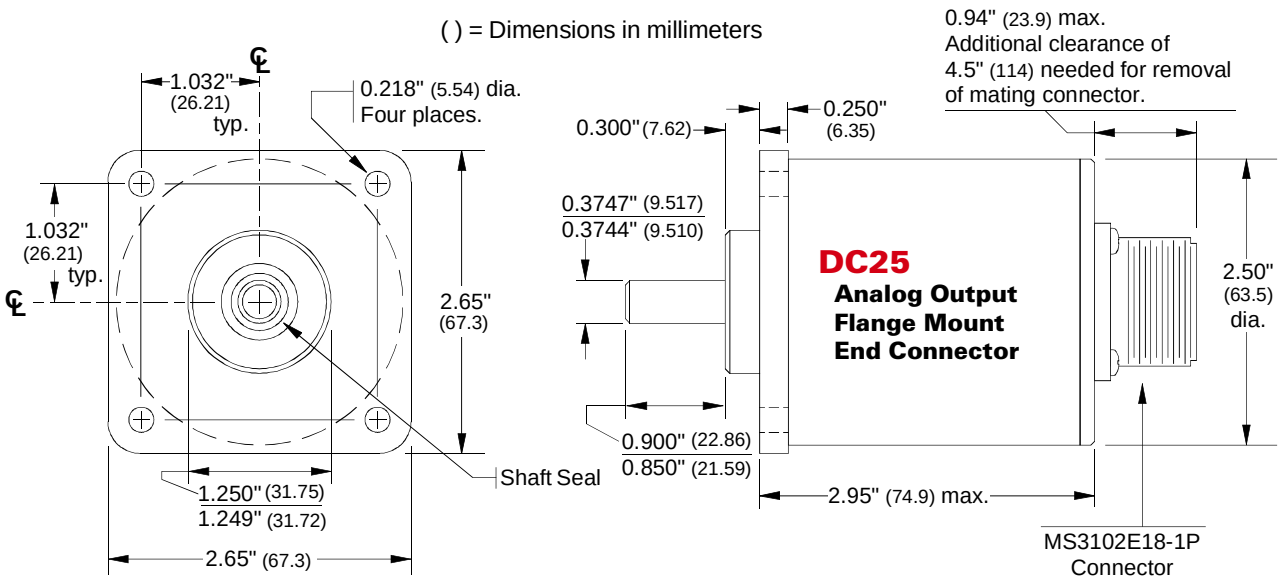


Figure 2.1 Flange Mount, End Connect Outline Drawing

Side Connector

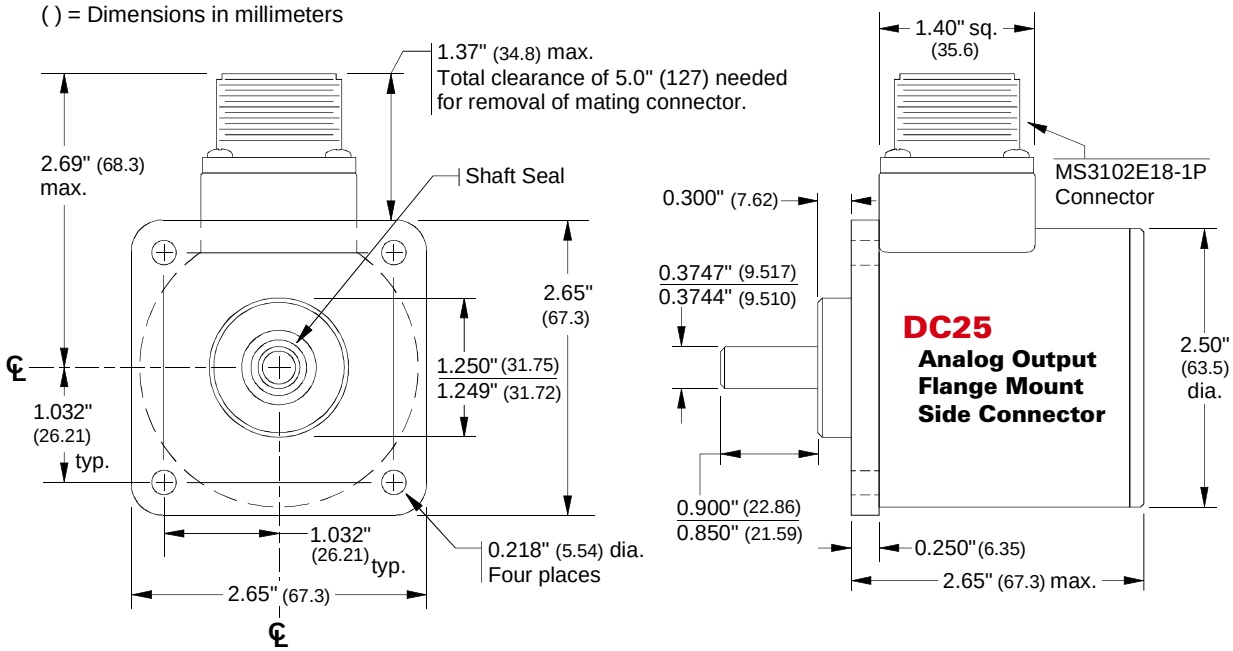
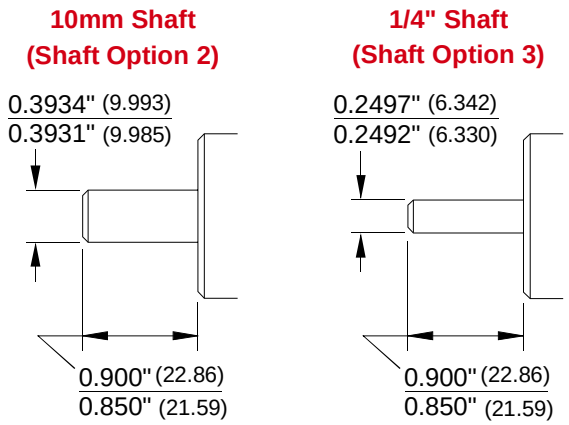


Figure 2.2 Flange Mount, Side Connect Outline Drawing

Flange Mount Outline Drawings (continued)

Alternate Shafts



() = Dimensions in mm

Figure 2.3 Flange Mount Alternate Shafts

Shaft Loading

Limit shaft loading to the following values. These values statistically yield an L10 life of $2X10^9$ revolutions. (Statistically, only 10% of the bearings will have failed after $2X10^9$ revolutions.) Shaft loading has an exponential effect on bearing life. The bearings will statistically last longer if you can limit shaft loading below the given values. Consider using the 5/8" shaft DuraCoder from AMCI if your shaft loading is expected to be greater than the values given below. Outline drawings for the 5/8" shaft DuraCoders start on page 17.

Radial Load	Axial Load
40 lbs. (178 N)	20 lbs. (88 N)

Table 2.1 Flange Mount Shaft Loading

Servo Mount Outline Drawings

End Connector

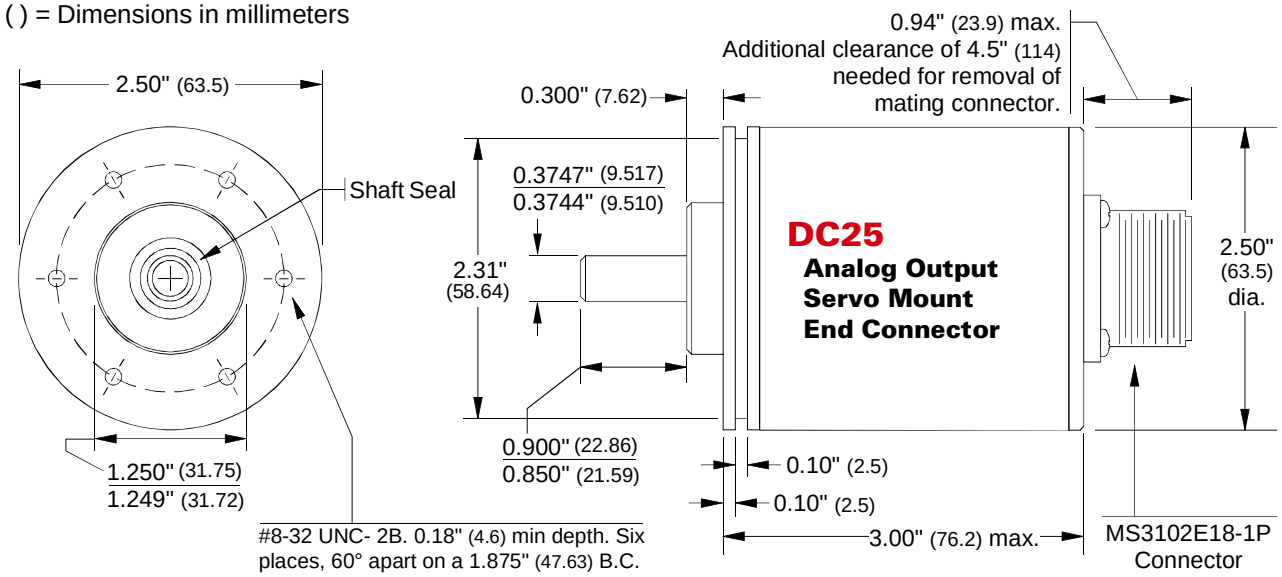


Figure 2.4 Servo Mount, End Connect Outline Drawing

Side Connector

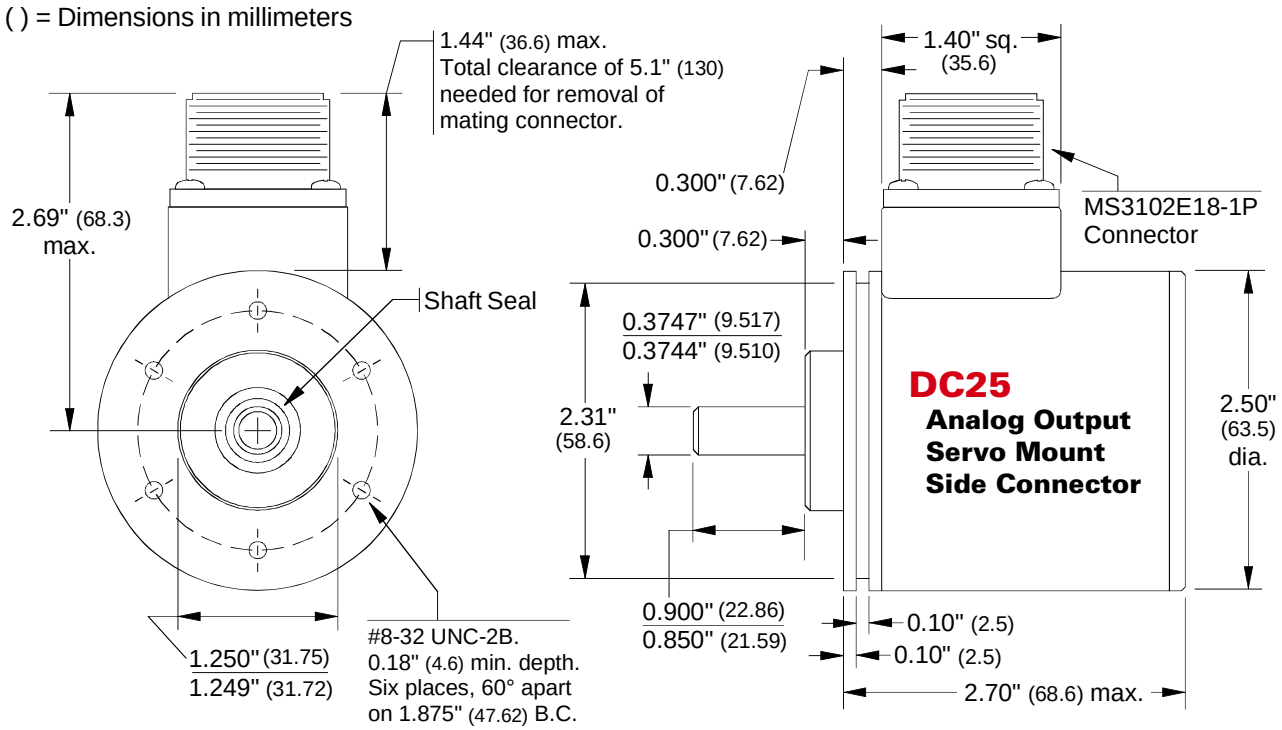
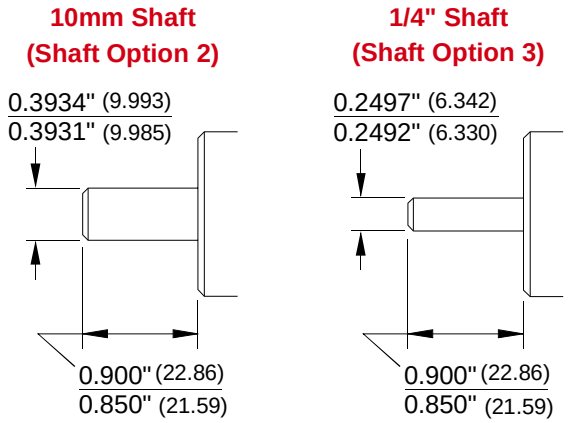


Figure 2.5 Servo Mount, Side Connect Outline Drawing

Servo Mount Outline Drawings (continued)

Alternate Shafts



() = Dimensions in mm

Figure 2.6 Servo Mount Alternate Shafts

Shaft Loading

Limit shaft loading to the following values. These values statistically yield an L10 life of $2X10^9$ revolutions. (Statistically, only 10% of the bearings will have failed after $2X10^9$ revolutions.) Shaft loading has an exponential effect on bearing life. The bearings will statistically last longer if you can limit shaft loading below the given values. Consider using the 5/8" shaft DuraCoder from AMCI if your shaft loading is expected to be greater than the values given below. Outline drawings for the 5/8" shaft DuraCoders start on page 17.

Radial Load	Axial Load
40 lbs. (178 N)	20 lbs. (88 N)

Table 2.2 Servo Mount Shaft Loading

Blind Shaft Mount Outline Drawings

End Connector

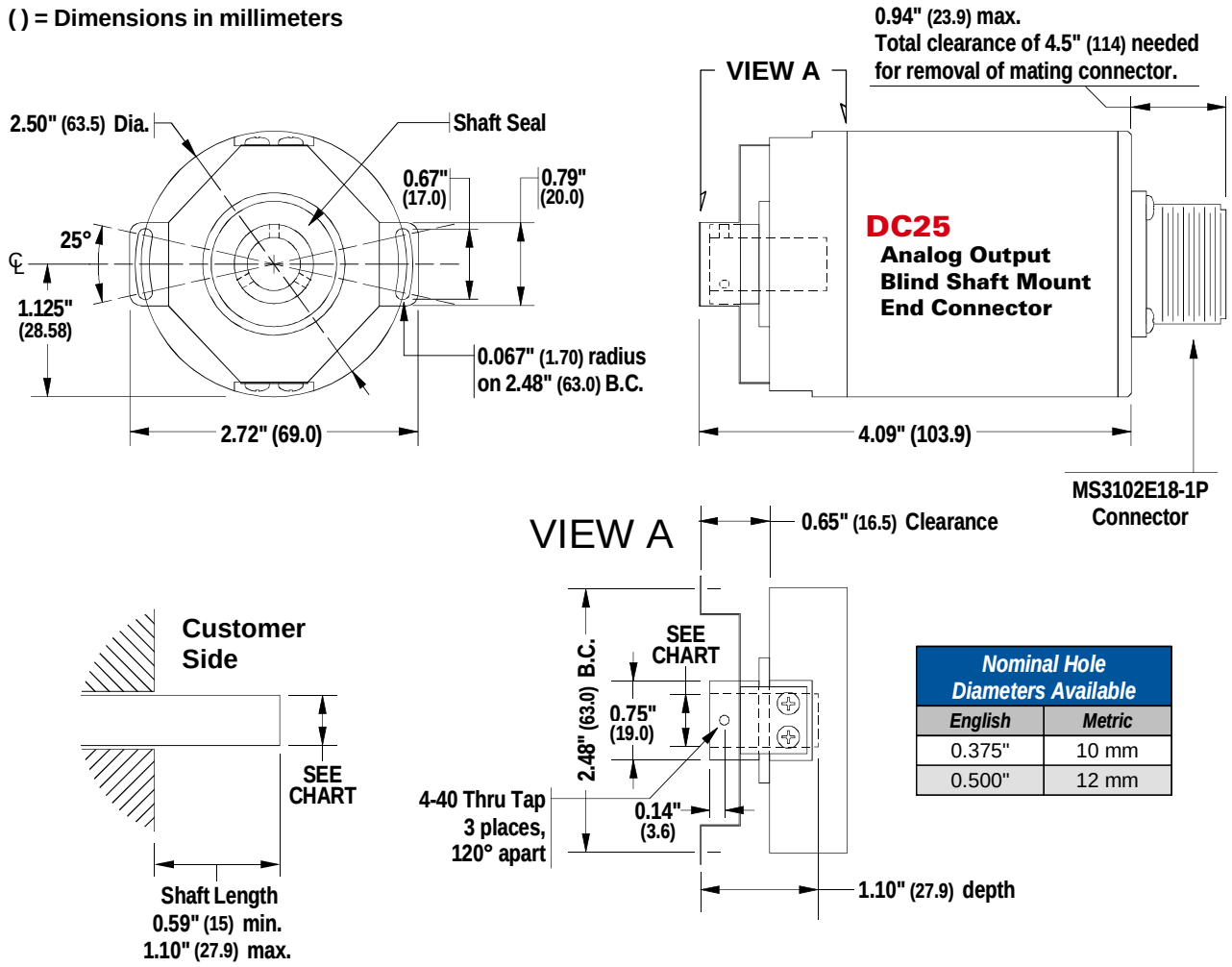


Figure 2.7 Blind Shaft Mount, End Connect Outline Drawing

Blind Shaft Mount Outline Drawings (continued)

Side Connector

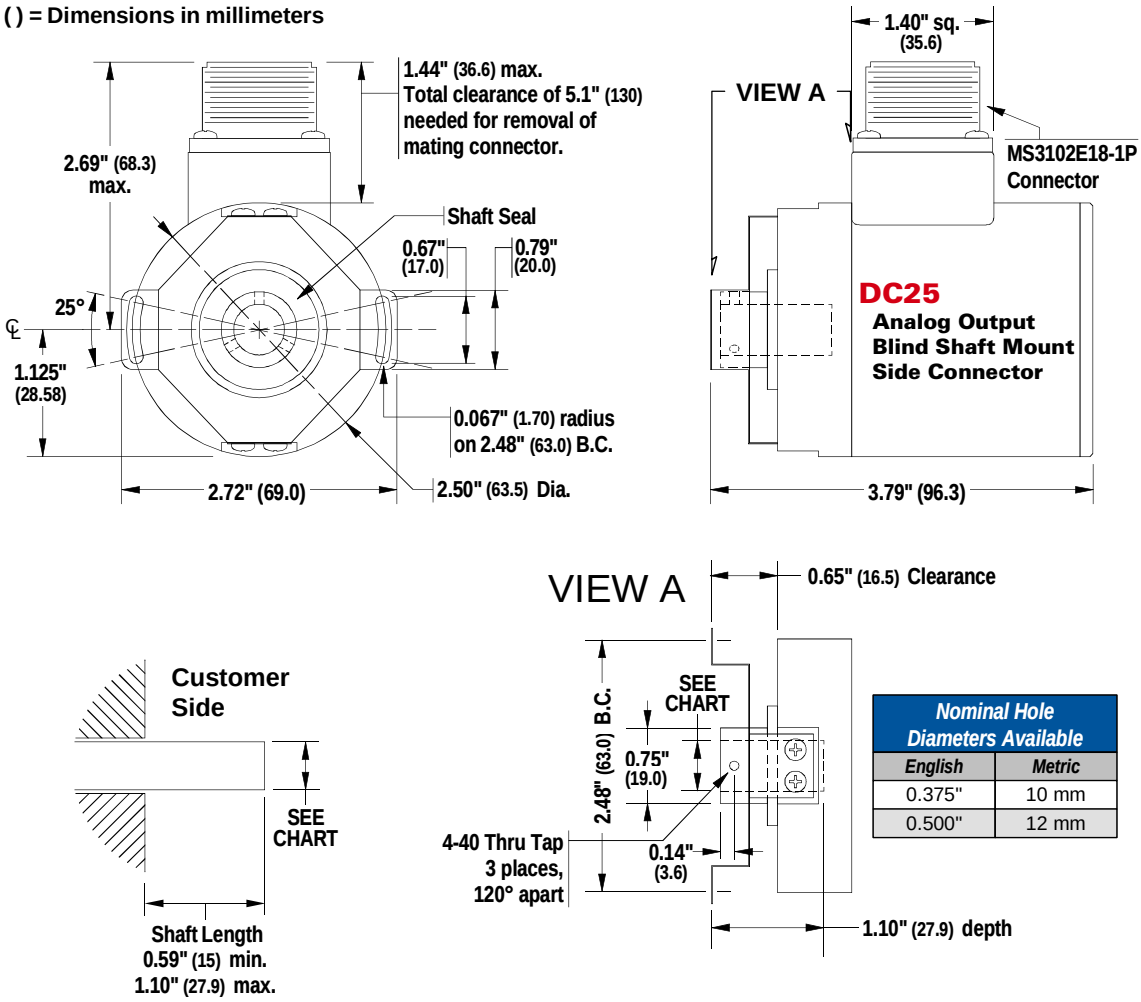


Figure 2.8 Blind Shaft Mount, Side Connect Outline Drawing

Available Shaft Diameters

The diameter of the drive shaft must be specified when ordering a blind shaft DuraCoder. Available options are given in the table below. Other diameter options may have become available after the release of this manual. Please check our website, *www.amci.com*, if you do not see the shaft diameter that fits your application.

Nominal Hole Diameters	
English	***Metric***
0.375"	10 mm
0.500"	12 mm

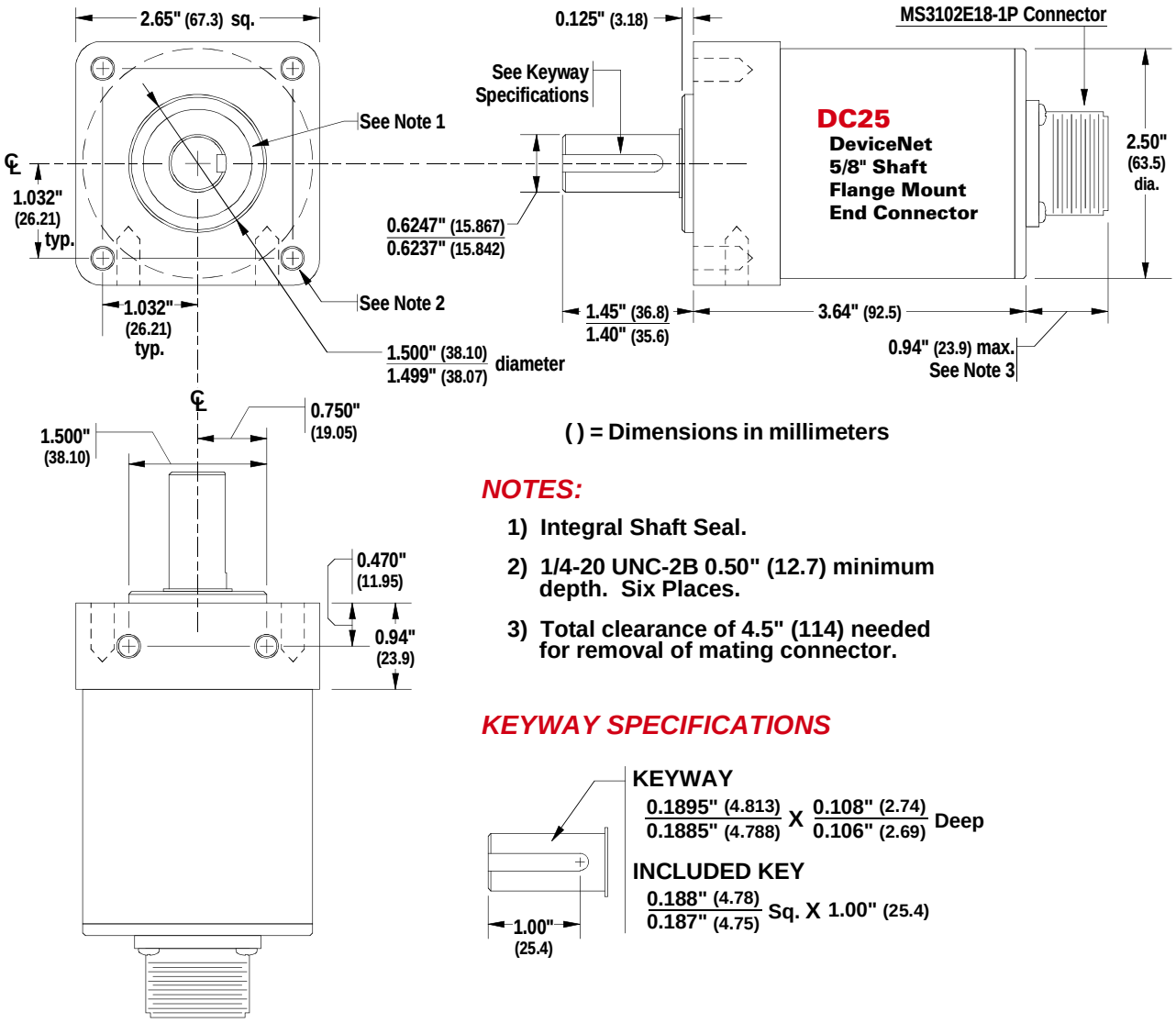
Table 2.3 Available Blind Shaft Diameters

Shaft Loading

The load that the Analog DuraCoder presents *to* your input shaft, which is equal to the load presented to the DuraCoder *by* your input shaft, is difficult to calculate and is dependent on the accuracy of the mounting. The flexible metal mounting bracket will be able to absorb most of the radial loading forces, but accurate mounting of the DuraCoder is important.

5/8" Shaft Outline Drawings

End Connector



NOTES:

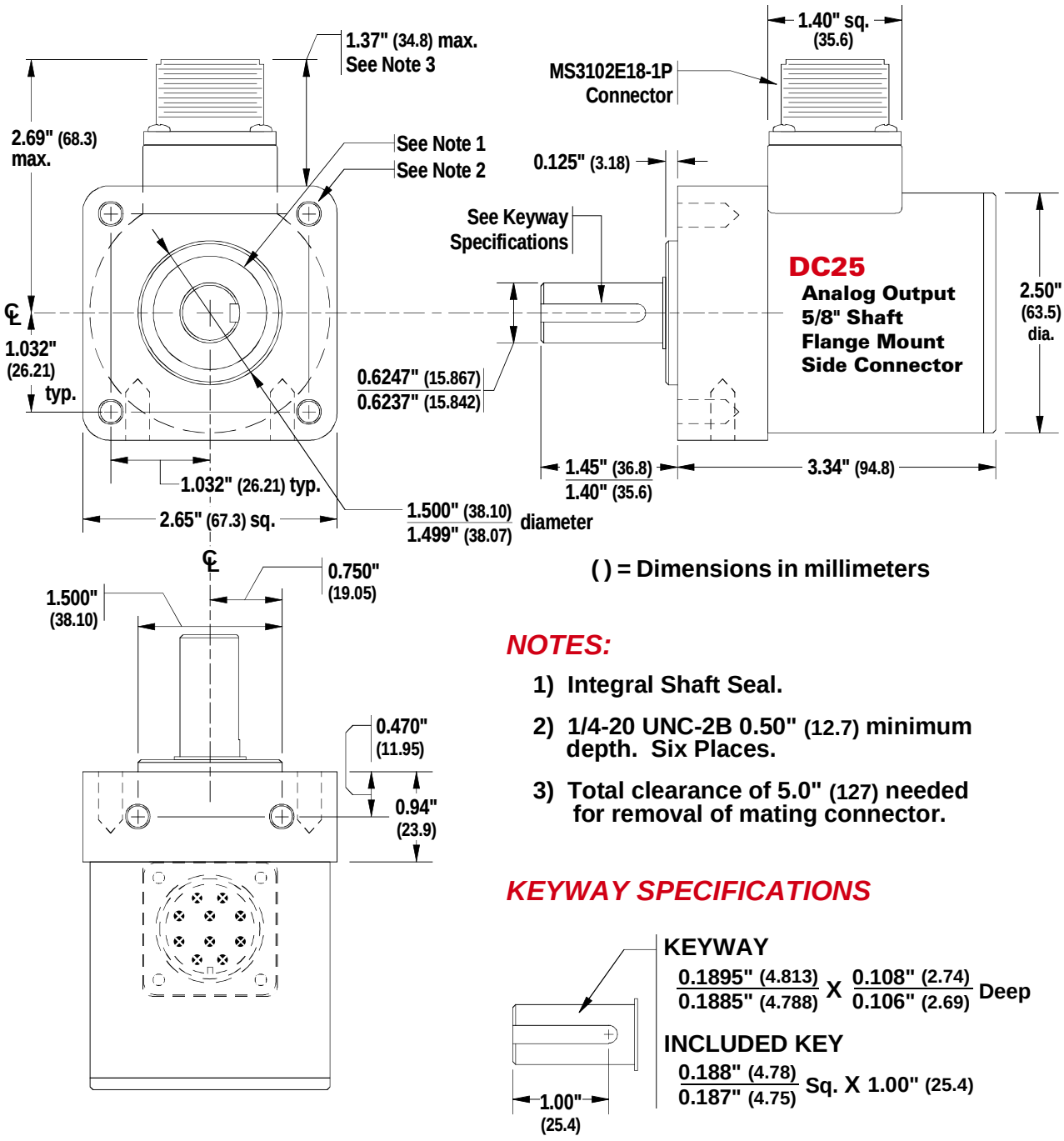
1) Integral Shaft Seal.
2) 1/4-20 UNC-2B 0.50" (12.7) minimum depth. Six Places.
3) Total clearance of 4.5" (114) needed for removal of mating connector.

KEYWAY SPECIFICATIONS

Figure 2.9 5/8" Shaft, Face Mount, End Connect Outline Drawing

5/8" Shaft Outline Drawings (continued)

Side Connector



( ) = Dimensions in millimeters

NOTES:

1) Integral Shaft Seal.
2) 1/4-20 UNC-2B 0.50" (12.7) minimum depth. Six Places.
3) Total clearance of 5.0" (127) needed for removal of mating connector.

KEYWAY SPECIFICATIONS

KEYWAY

0.1895" (4.813) / 0.1885" (4.788) X 0.108" (2.74) / 0.106" (2.69) Deep

INCLUDED KEY

0.188" (4.78) / 0.187" (4.75) Sq. X 1.00" (25.4)

Figure 2.10 Flange Mount, Side Connect Outline Drawing

5/8" Shaft Outline Drawings (continued)

Shaft Loading

Limit shaft loading to the following values. These values statistically yield an L10 life of $2X10^9$ revolutions. (Statistically, only 10% of the bearings will have failed after $2X10^9$ revolutions.) Shaft loading has an exponential effect on bearing life. The bearings will statistically last longer if you can limit shaft loading below the given values.

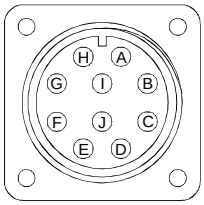
Radial Load	Axial Load
100 lbs. (445 N)	50 lbs. (222 N)

Table 2.4 Flange Mount Shaft Loading

Connector Pinout

The Analog DuraCoder uses a military spec. MS3102E18-1P connector. The pinout of this connector is shown below.

Analog DuraCoder MS3102E18-1P Connector



Pin:	Function
A	No Connection
B	No Connection
C	+DC Input Power
D	Direction Control
E	DC Return

Pin:	Function
F	Analog Output
G	No Connection
H	Case Ground
I	DC Return
J	Preset Input

Figure 2.11 Connector Pinout

Pins A, B, & G: No Connection.

Pin C: +DC Input Power: Input pin to power the DuraCoder. Requires a 5 to 30Vdc power supply at 1.5W.

Pin D: Direction Control: This pin controls which direction the shaft must rotate in to increase the analog output. With this pin open circuit, the output will increase with CCW rotation of the shaft. (While looking at the shaft.) Connecting this pin to Pin I forces the output to increase with CW rotation.

CAUTION

This pin must never be connected to Pin C (+DC Input Power)

The connection between Pin D and Pin I (DC Return), must be done at the DC25 Connector. Do not connect a pair of wires into a custom cable and connect these pins at the other end of this cable.

Pins E and I: DC Return: These two pins are internally tied together. Pin E is the used as the return for the analog signal and pin I is used as the return for the DC power supply.

Pin F: Analog Output: This pin is the analog output and it is referenced to Pin E, DC Return.

Pin H: Case Ground: The DuraCoder body is usually connected to earth ground through it mounting. If the DuraCoder is mounted on a non-conductive surface, or not properly bonded to a painted metal surface, consider running a stranded wire from this pin and attach it to a solid ground point near the DuraCoder. Do not connect the cable shields to this pin as doing so may cause a ground loop between the DuraCoder and the power supply or the signal input device.

Connector Pinout (continued)

Pin J: Zero Preset: This pin is internally tied high, but *not* directly to the +DC Input Power, (Pin C). When this pin is pulled low by connecting it to the DC Return, (Pin I), the analog output will change to its minimum value. (In the case of a 4 - 20mA output, the output becomes 4mA. In the case of a ±10Vdc Output, the output becomes –10Vdc.) This pin must be released from Pin I before normal operation can resume.

CAUTION This pin must never be connected to Pin C (+DC Input Power)

Output Load Calculations

Voltage Output DuraCoder

A voltage output DuraCoder can drive an output load of 2 KΩ or greater. If the output load is greater that 10KΩ, consider installing a 10KW resistor in parallel with the input terminals for greater noise immunity.

Current Output DuraCoder

The maximum load that can be driven by a current output DuraCoder depends on the power supply voltage applied to the +DC Power Input (Pin C). For input voltages up to 15Vdc, the maximum load is 420Ω. For input voltages greater than or equal to 15Vdc, the formula for determining the maximum load is given below along with a simple graph of the curve.

$$R_{LOAD_{MAX}} = \frac{\text{(+DC Input Voltage)} - 5\text{Vdc}}{0.020\text{A}}$$

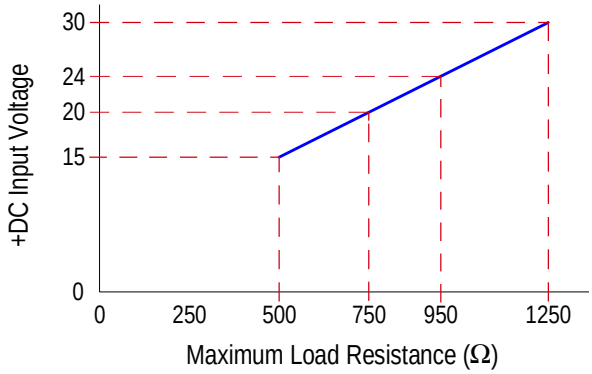


Figure 2.12 Maximum Load Resistance - Current Output

CDCAV Cable

A pre-assembled and tested cable is available from AMCI for use with all Analog DuraCoders. The part number is CDCAV-x, where "x" is the length of the cable in feet.

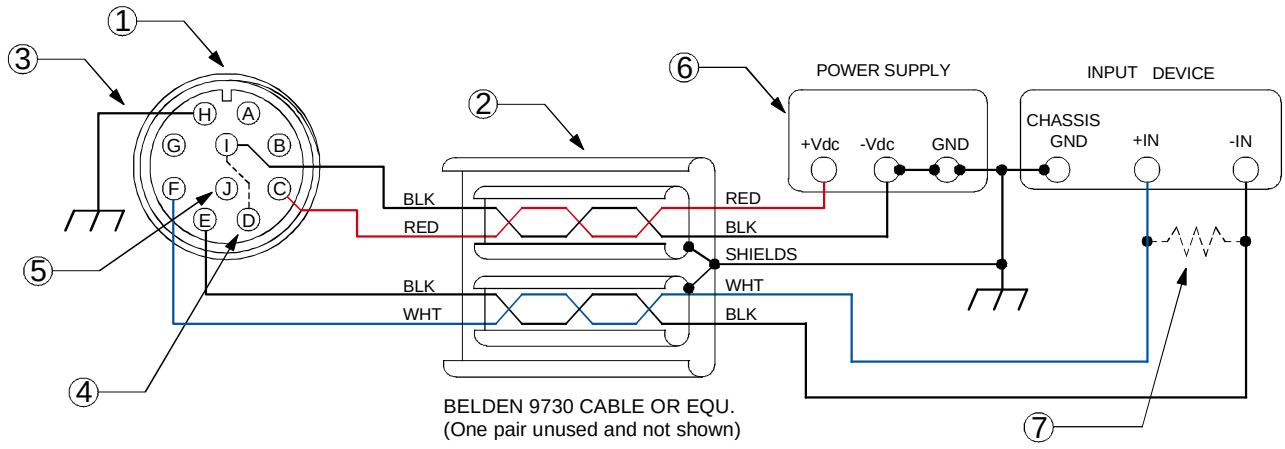


Figure 2.13 CDCAV-x Cable

1) Connector Type: MS3106A18-1S AMCI Part Number: MSD-10
2) CDCAV-x cable is made by AMCI with Belden 9730 cable or an exact equivalent. The 9730 is a three pair cable and the additional pair is cut off inside the jacket and left electrically isolated from the other pairs. If you are making your own cable, Belden 9729, which is a two pair cable, can be used in place of the 9730.
3) The case of the DuraCoder must be connected to Earth Ground. This is usually accomplished through its mounting. If not properly grounded through its mounting, a wire from Pin H must be connected to an Earth Ground point as close as possible to the DuraCoder. Do Not connect Pin H to the cable shields. This can form a ground loop that may affect the operation of the DuraCoder.
4) Units are shipped with CCW increasing output when looking at the shaft. For CW increasing output, jumper Pin D to Pin I at the connector.
5) Each time Pin J detects a transition from open circuit to DC Return (Pin I), the DuraCoder's output will be changed to its minimum value. To be changed, Pin J must be connected to Pin I for a minimum of 100 milliseconds.

NOTE

A) You cannot permanently tie Pin J it Pin I. If you do, the DuraCoder will reset the output to its minimum value on every power up.

B) Presetting the Analog DuraCoder's output causes a preset value to be stored in the DuraCoder's EEPROM memory. This memory has a maximum life of 100,000 write cycles. Therefore, presetting the output value every machine cycle should be avoided.

6) Use a regulated power supply with a voltage output in the range of 7 to 30Vdc. If the cable length is less than 30 feet, a power supply of 5 to 30Vdc can be used.
7) For voltage output DuraCoders, (DC25x-xxVxxx), the input device impedance must be greater than 2KΩ. If the input impedance exceeds 10KΩ, consider installing a 10KΩ resistor in parallel with the input terminals to improve the output's noise immunity.

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