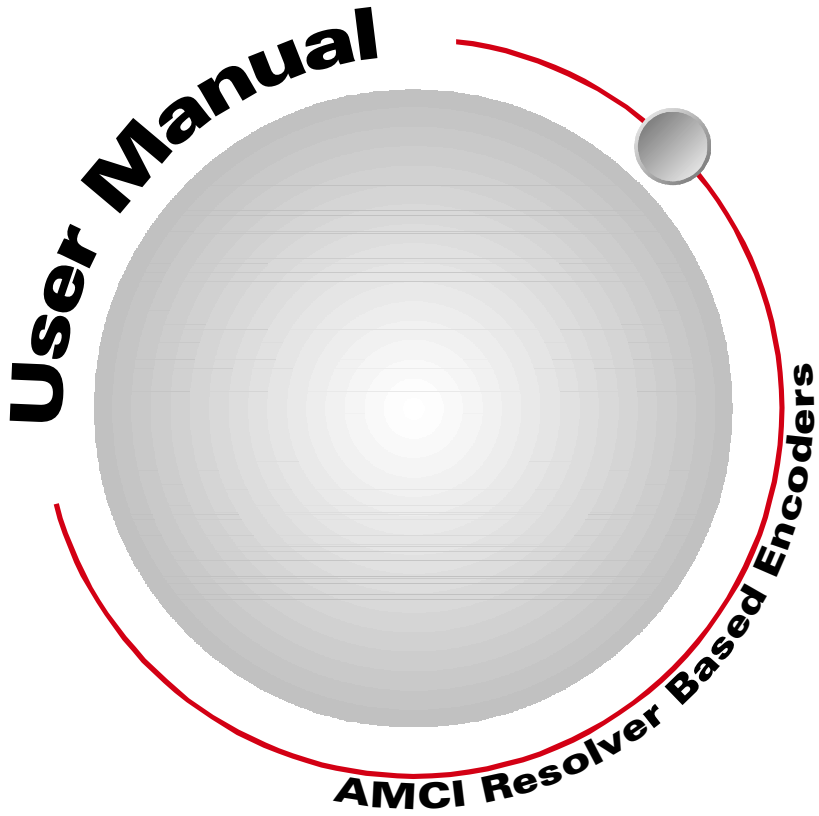
ADVANCED MICRO CONTROLS INC.

Manual #: 940-0D053

DC25
DeviceNet DuraCoder



GENERAL INFORMATION

Important User Information

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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No patent liability is assumed by AMCI, with respect to use of information, circuits, equipment, or software described in this manual.

The information contained within this manual is subject to change without notice.

Standard Warranty

ADVANCED MICRO CONTROLS, INC. warrants that all equipment manufactured by it will be free from defects, under normal use, in materials and workmanship for a period of [18] months. Within this warranty period, AMCI shall, at its option, repair or replace, free of charge, any equipment covered by this warranty which is returned, shipping charges prepaid, within eighteen months from date of invoice, and which upon examination proves to be defective in material or workmanship and not caused by accident, misuse, neglect, alteration, improper installation or improper testing.

The provisions of the "STANDARD WARRANTY" are the sole obligations of AMCI and excludes all other warranties expressed or implied. In no event shall AMCI be liable for incidental or consequential damages or for delay in performance of this warranty.

Returns Policy

All equipment being returned to AMCI for repair or replacement, regardless of warranty status, must have a Return Merchandise Authorization number issued by AMCI. Call (860) 585-1254 with the model number and serial number (if applicable) along with a description of the problem. A "RMA" number will be issued. Equipment must be shipped to AMCI with transportation charges prepaid. Title and risk of loss or damage remains with the customer until shipment is received by AMCI.

24 Hour Technical Support Number

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*

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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 DeviceNet DuraCoders. It is written for the engineer responsible for incorporating the DeviceNet 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.

Trademarks and Other Legal Stuff

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Revision Record

This manual, 940-0D053 is the fourth release of the manual. It changes the format of the manual and specifies new shaft and mounting options. It was first released May 7, 2009.

Revision History

940-0D052: 04/04/2005 Corrected Flange Mount length and added Position Update time

940-0D051: 04/09/2001 Added EDS file download information

940-0D050: 01/28/2000 Initial Release

Where to Go From Here

This manual contains information that is of interest to everyone from engineers to operators. 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 DEVICENET DURACODER*	Intended for anyone new to the DeviceNet DuraCoder, this chapter gives a basic overview of the unit, including an explanation of its programmable features. The chapter also explains the DeviceNet DuraCoder part numbering system and lists complementary equipment available from AMCI
2	*INSTALLATION*	This chapter is intended for the engineer or technician responsible for installing and wiring the DeviceNet DuraCoder. Information in this chapter includes mechanical drawings, installation guidelines and connector pinout.
3	*NETWORKING*	This chapter is intended for anyone responsible for adding the DuraCoder to the DeviceNet network or changing its default parameter values. Information on adding the DuraCoder to a network using RSNetWorx for DeviceNet software is provided.
4	*SAMPLE PROGRAMS*	This chapter provides sample ladder logic programs when using the DeviceNet DuraCoder.

CHAPTER 1
THE DEVICENET DURACODER

DeviceNet 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.

Figure 1.1 A DeviceNet DuraCoder

Originally designed for military applications over 60 years ago, resolvers have gained popularity in many industrial markets from steel mills to presses to packaging machines. If you are interested in learning more about resolvers, check out our web-site 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) position value is available as DeviceNet data.

The DeviceNet DuraCoder is available in a variety of industry standard size 25 optical encoder packages. A flange mount unit with a 3/8" shaft and a side connector is shown in figure 1.1. Servo mount and end connect units are also available. A blind shaft option is available for motor mounting or mounting in small spaces. Finally, a face mount unit with a 5/8 inch shaft is available for applications that may be exposed to high shaft loads. The 5/8 inch shaft option is not an industry standard and is only available from AMCI. Outline drawings of all of the packing options is available in the *Outline Drawings* section of the ***INSTALLATION*** chapter, starting on page 13.

The DeviceNet DuraCoder uses the Resolver Device Profile, (Device type: 09hex), defined in volume II, release 2.0 of the DeviceNet Specification published by the ODVA. In addition to absolute position, the DuraCoder offers the Zero Offset, allowing you to zero the position without rotating the DuraCoder shaft, and one dual-setpoint CAM switch that can easily be configured as an ON/OFF or single ended limit switch.

The AMCI DeviceNet DuraCoder uses the standard DeviceNet "mini" connector for quick and easy connection to your DeviceNet network.

Part Numbering System

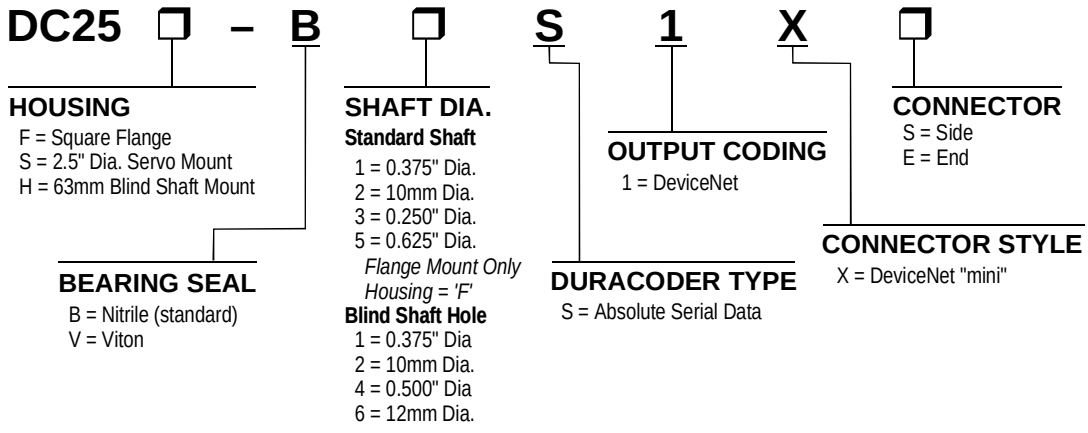


Figure 1.2 Part Numbering System

Programmable Parameters

There are four programmable parameters that allow you to configure the DeviceNet DuraCoder to match your application. When you are configuring you device under RSNetWorx for DeviceNet, these parameters are available under the properties of the device after it has been added to the network.

Bit Resolution

This parameter sets the counts per turn of the DeviceNet DuraCoder and is programmable in powers of two. Table 1.1 shows the available values and their corresponding count range.

Number of Bits	Counts per Turn	Count Range	Number of Bits	Counts per Turn	Count Range
1	2	0 to 1	7	128	0 to 127
2	4	0 to 3	8	256	0 to 255
3	8	0 to 7	9	512	0 to 511
4	16	0 to 15	10	1,024	0 to 1,023
5	32	0 to 31	11	2,048	0 to 2,047
6	64	0 to 63	12	4,096	0 to 4,095

Table 1.1 Position Resolution

Zero Offset

The Zero Offset parameter allows you to adjust the position value output by the DeviceNet DuraCoder without rotating the shaft. The Zero Offset is useful only during setup. If you want to adjust the position value "on-the-fly", you must calculate and apply an offset in your ladder logic program. See the sample ladder logic, ***Sample 2 - Calculating a Position Offset***, on page 26 for one way to calculate and apply this offset.

Use the following formulas to calculate the Zero Offset. These calculations assume that the Zero Offset presently equals zero. If it does not, or you are not sure of its present value, then program the Zero Offset to zero before applying these formulas.

If Desired Position > Current Position:

Zero Offset = Desired Position – Current Position

Example: Counts/Turn = 4,096 (Bit Resolution = 12 bits)
Current Position = 1,234
Desired Position = 2,000
Zero Offset = 2,000 – 1,234 = 766

If Desired Position < Current Position:

Zero Offset = Counts/Turn – (Desired Position – Current Position)

Example: Counts/Turn = 1,024 (Bit Resolution = 10 bits)
Current Position = 987
Desired Position = 123
Zero Offset = 1,024 – (987 – 123) = 1,024 – (864) = 160

Programmable Parameters (continued)

CAM Low and CAM High

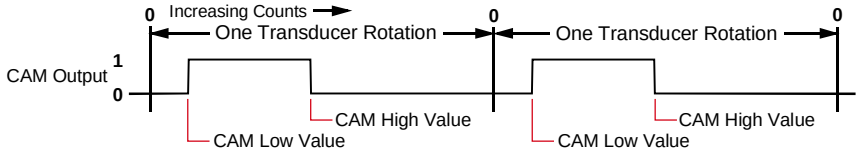
These two parameters program an electronic CAM, or limit switch, in the DuraCoder. The on/off status of the CAM is available as a bit in the data sent by the DuraCoder. The range of the CAM Low and CAM High parameters is 0 to 4,096.

NOTE If your Bit Resolution is less than 12 bits, then you can program a CAM limit to a value greater than the programmed maximum count of the DuraCoder. For example, if you have a Bit Resolution of 10 bits, the maximum count from the DuraCoder will be 1,023. You are still allowed to program a CAM limit up to 4,096. If both CAM limits exceed 1,023, then the CAM will never be on.

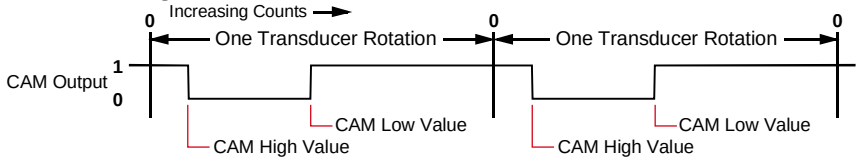
Even though you can program a CAM limit to exceed the maximum programmed count, AMCI strongly suggests against it. You do not gain any functionality by programming either CAM limit above your maximum count and your programming may be harder to understand.

The following figure shows the state of the CAM bit based on the values of the two CAM parameters.

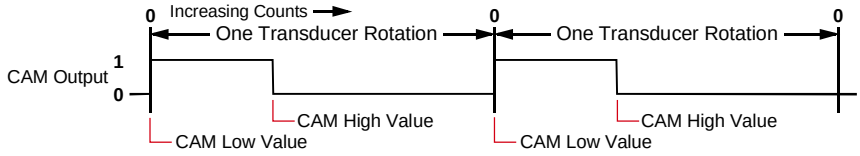
CAM Low < CAM High



CAM Low > CAM High



CAM Low < CAM High, CAM Low = 0



CAM Low > CAM High, CAM High = 0

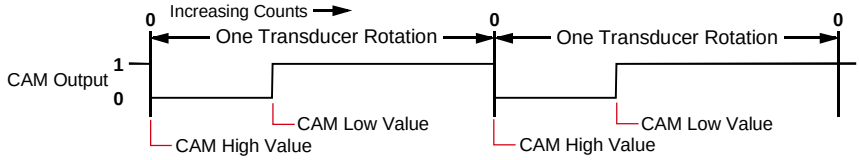


Figure 1.3 CAM Outputs

Data Format

Input Data

The DeviceNet DuraCoder transmits forty data bits over the network. The data format of these bits is shown in figure 1.4. Bit number 32, which is labeled "CAM" in the figure, is the on/off status of the programmed CAM switch.

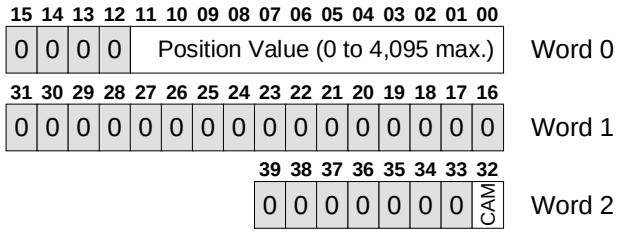


Figure 1.4 Input Data Format

Output Data

The DeviceNet DuraCoder is configured to receive eight bits of data from the network. These eight bits are currently not used. They should be considered reserved and set to zero for compatibility with future products.

Obtaining the EDS and Icon Files

If this is the first time you have used a DeviceNet DuraCoder in a Rockwell Automation system, then you will probably need the Electronic Data Sheet (EDS) and icon files when configuring the DuraCoder in the RSNetWorx software. These files are available on our website, *www.amci.com*. You'll find them as a single ZIP file in our Tech Library section. Once you have downloaded them, unzip the file to your hard drive to access the EDS and icon files.

DeviceNet Feature Specifications

Device Type: ..... Resolver
Node Address: ..... Programmable 0 to 63.
Default of 63.
Explicit Peer to Peer Messaging: ..... N
I/O Peer to Peer Messaging: ..... N
Configuration Consistency Value: ..... N
Faulted Node Recovery: ..... N
Baud Rate: 125K, 250K, 500K
Default of 125K
Master/Scanner: ..... N
I/O Slave Messaging:
Bit Strobe: ..... N
Polling: ..... Y
Cyclic: ..... Y
Change of State: .. Y

Electrical Specifications

Operating Voltage
4.5Vdc to 30Vdc

Power Requirements
1.0 W max.
35mA @ 24Vdc optimal

Position Resolution
12 bit maximum
Programmable Bit Resolution from 2 to 12 bits.
Default value of 12 bits

Position Update Time
1 millisecond

Direction of Increasing Counts
CCW looking at shaft

Zero Offset:
Programmable: 0 to 4,096

CAM Low Limit
Programmable 0 to 4,096

CAM High Limit:
Programmable: 0 to 4,096

Mechanical Specifications

Package Style
2.5 inch aluminum housing with flange or servo 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.

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

Notes

Flange Mount Outline Drawings

End Connector

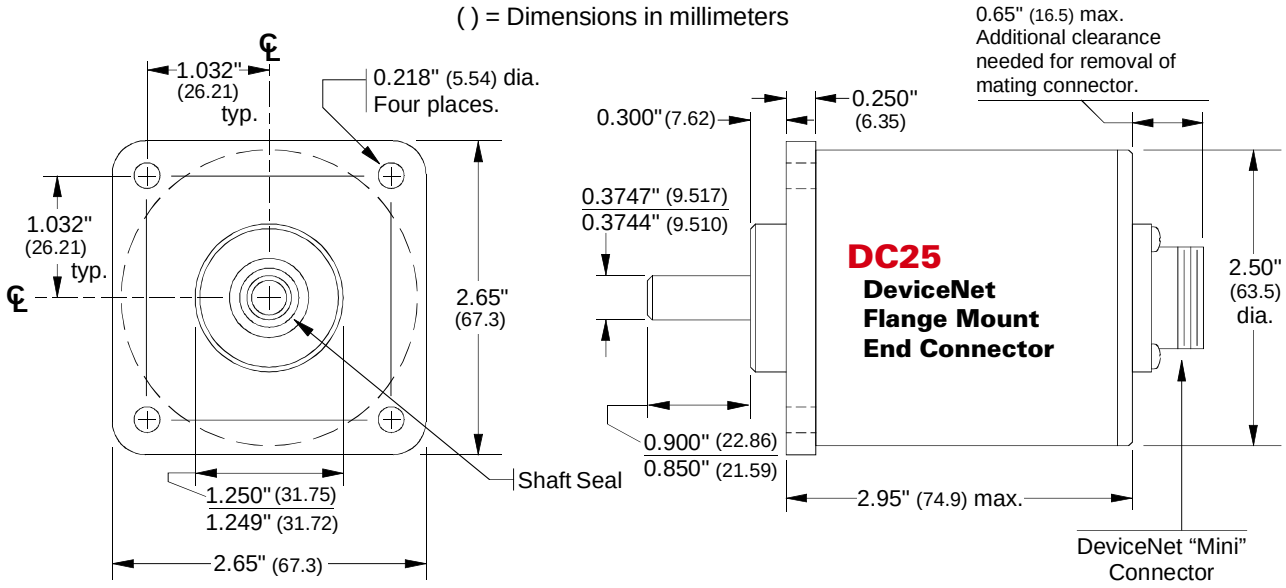


Figure 2.1 Flange Mount, End Connect Outline Drawing

Side Connector

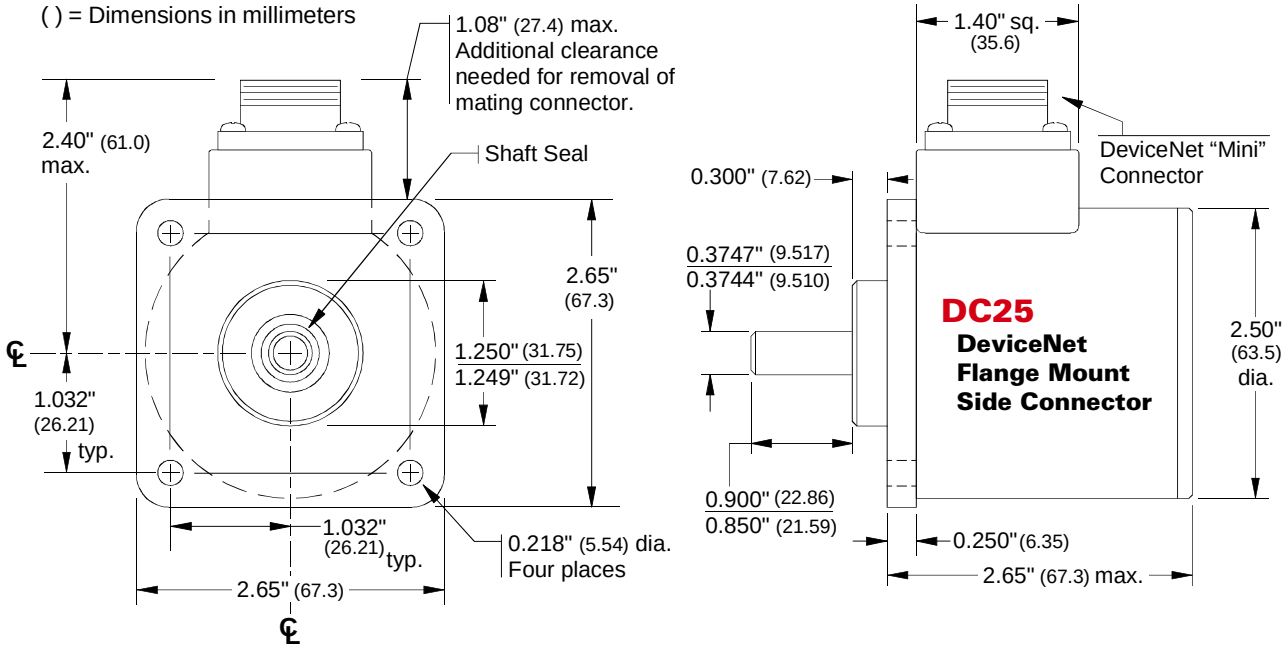
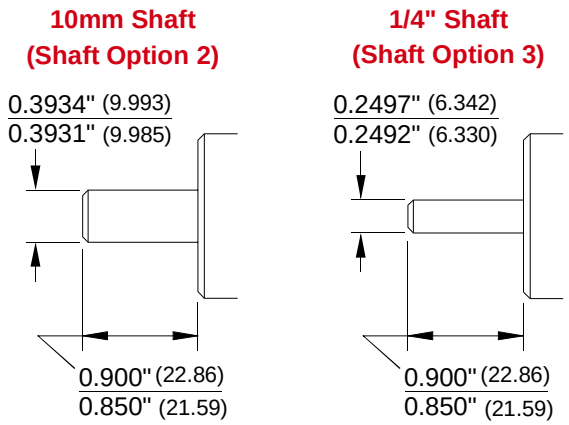


Figure 2.2 Flange Mount, Side Connect Outline Drawing

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 19.

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

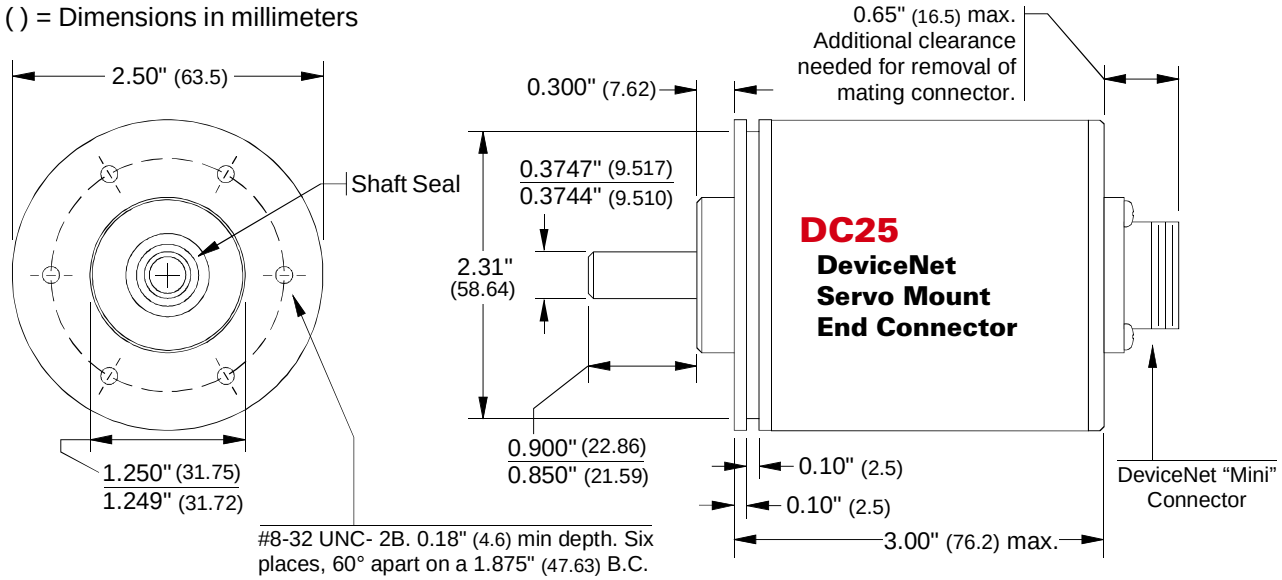


Figure 2.4 Servo Mount, End Connect Outline Drawing

Side Connector

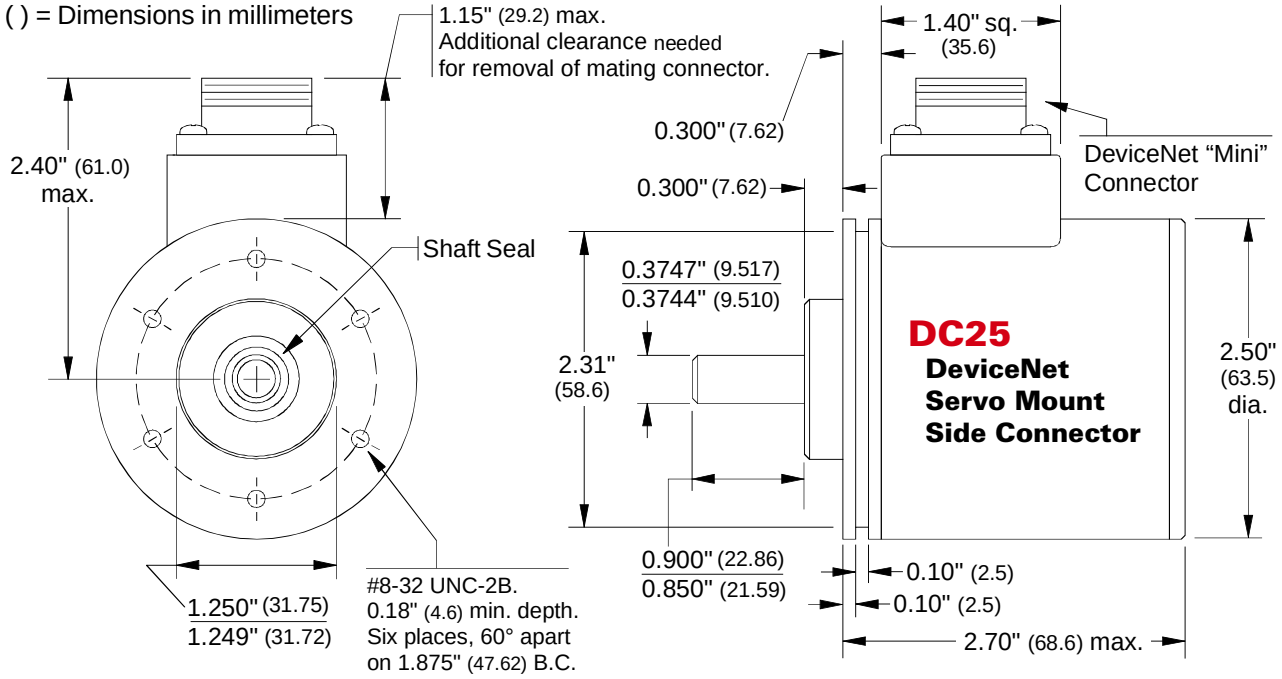
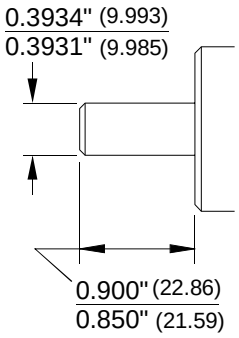


Figure 2.5 Servo Mount, Side Connect Outline Drawing

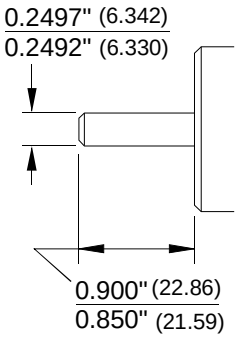
Servo Mount Outline Drawings (continued)

Alternate Shafts

10mm Shaft (Shaft Option 2)



1/4" Shaft (Shaft Option 3)



() = 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 19.

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

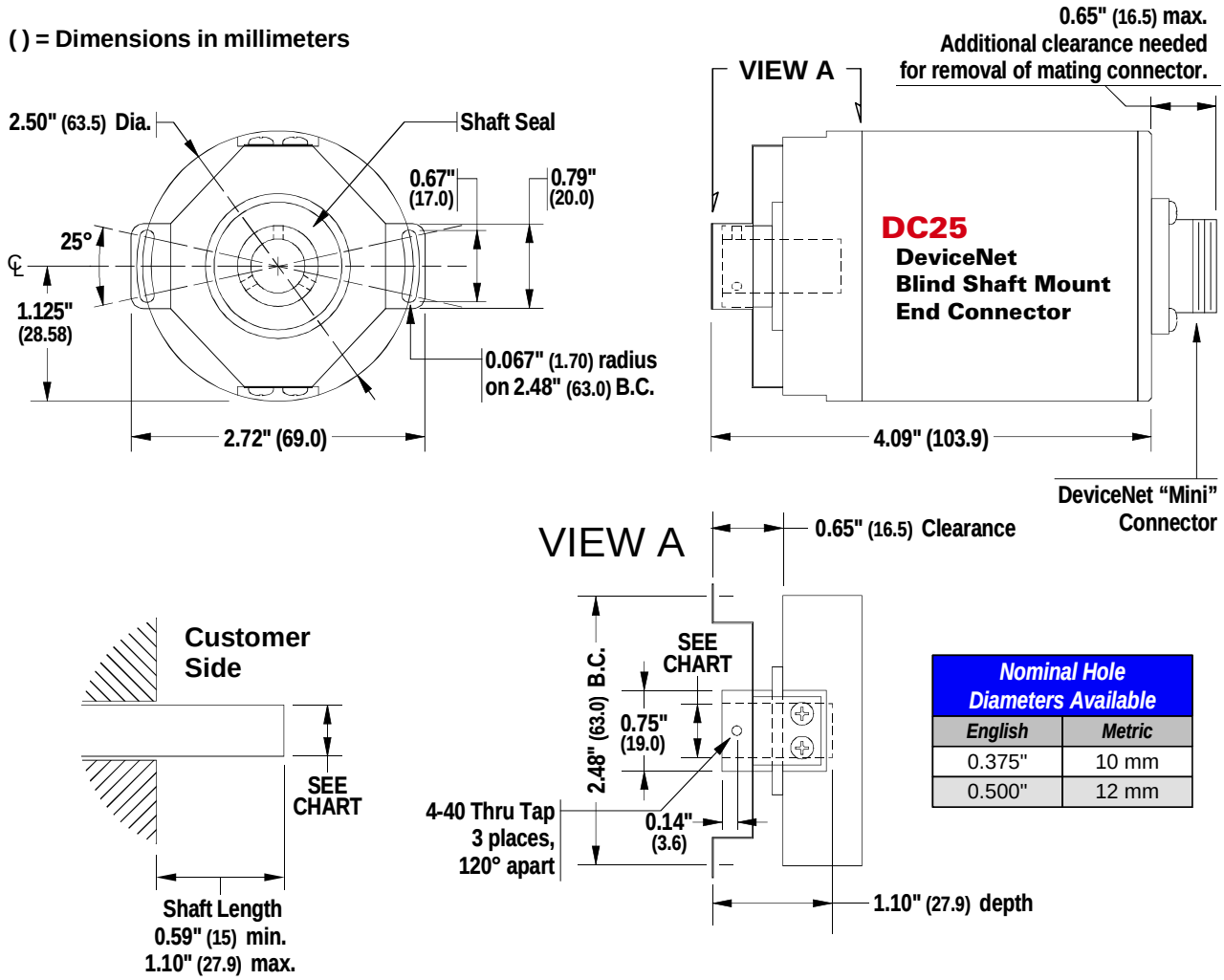
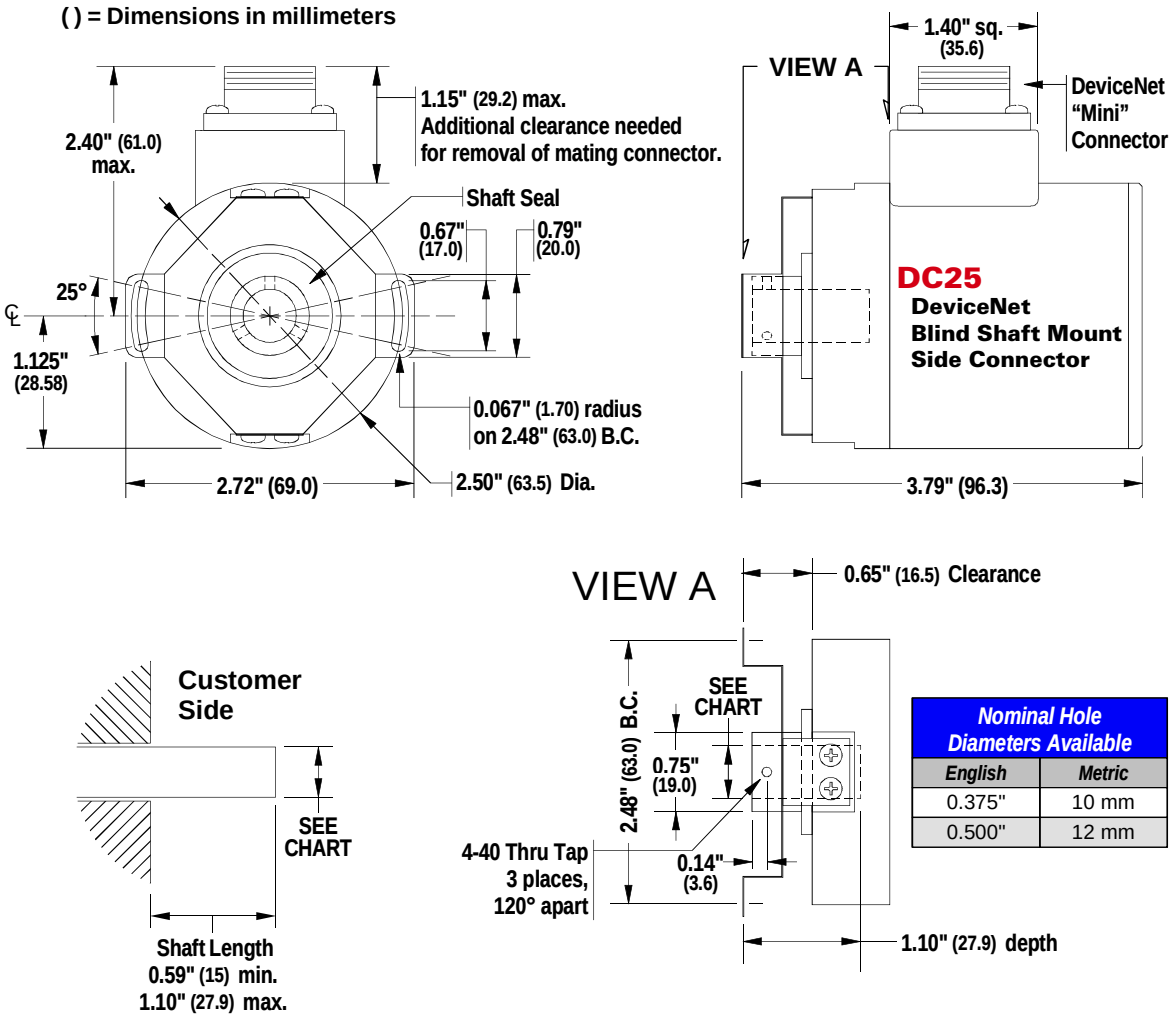


Figure 2.7 Blind Shaft Mount, End Connect Outline Drawing

Blind Shaft Mount Outline Drawings (continued)

Side Connector



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

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

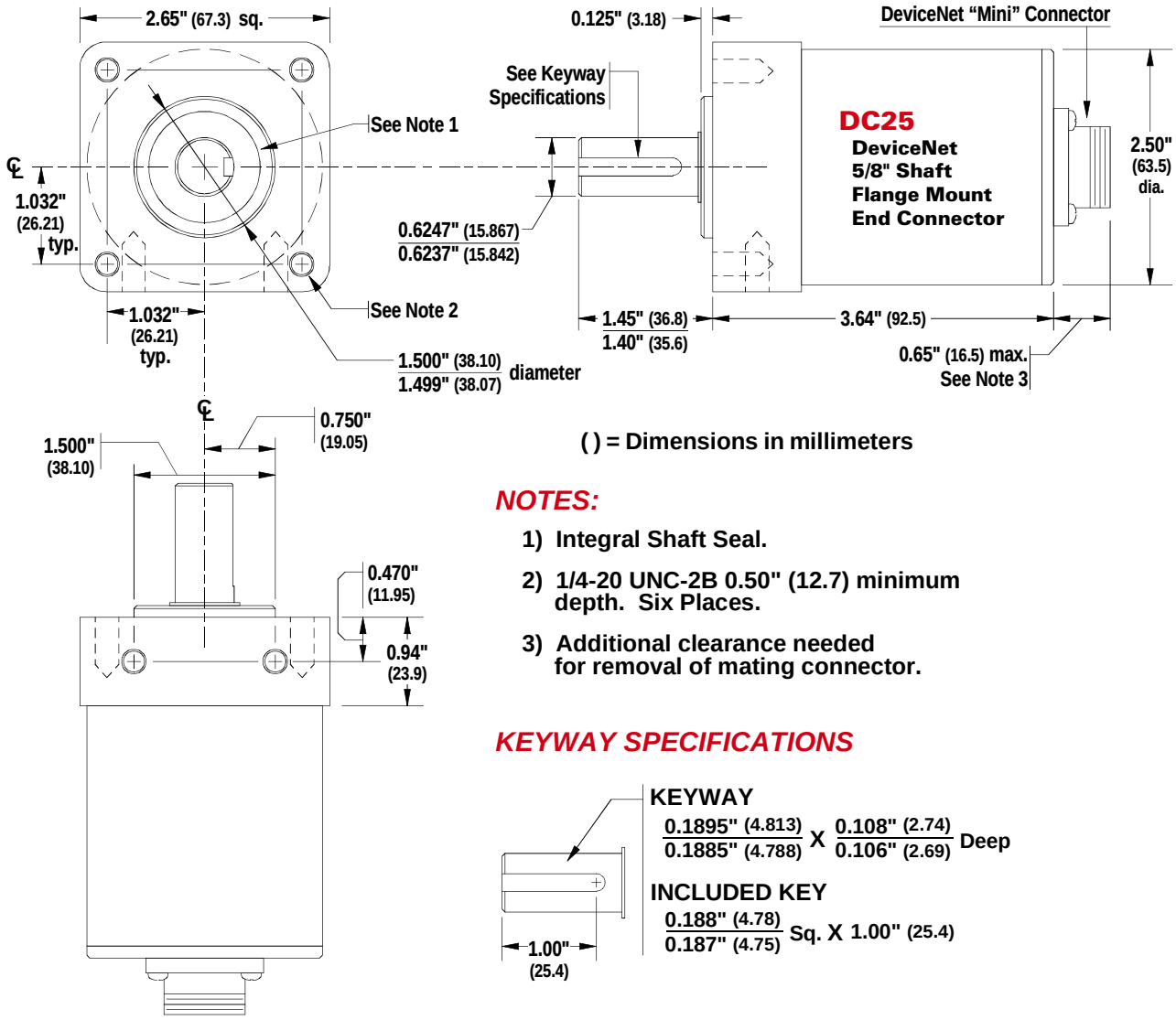
Table 2.3 Available Blind Shaft Diameters

Shaft Loading

The load that the DeviceNet 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



( ) = Dimensions in millimeters

NOTES:

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

KEYWAY SPECIFICATIONS

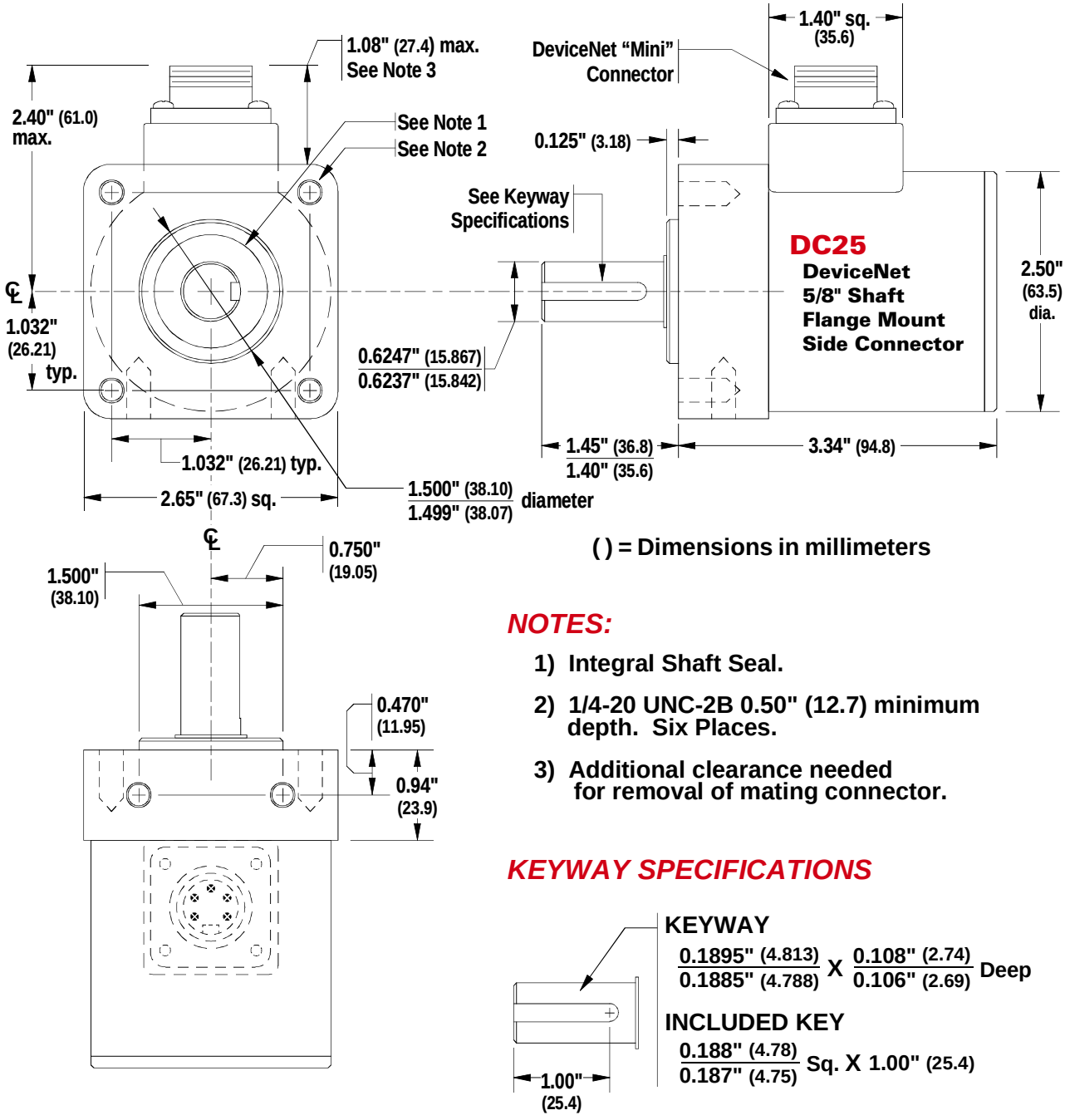
KEYWAY
0.1895" (4.813) / 0.1885" (4.788) X 0.108" (2.74) / 0.106" (2.69) Deep

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

Figure 2.9 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) Additional clearance needed for removal of mating connector.

KEYWAY SPECIFICATIONS

KEYWAY
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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

DeviceNet DuraCoders use the sealed mini-style connector defined in volume I, release 2.0 of the DeviceNet Specification published by the ODVA. The pinout is given in the figure to the right.

NOTE Mating connectors and cables are not available from AMCI. Contact your local DeviceNet distributor or representative for available cabling options.

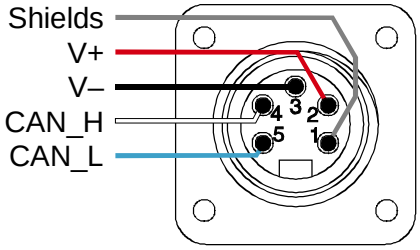

Figure 2.11 Connector Pinout

Notes

CHAPTER 3
NETWORKING

This chapter explains how to configure the RSNetWorx for DeviceNet software so that you can add a DeviceNet DuraCoder to your network.

Obtaining the EDS and Icon Files

If this is the first time you are using a DeviceNet DuraCoder in a Rockwell Automation system, then you will probably need the Electronic Data Sheet (EDS) and icon files when configuring the DuraCoder in the RSNetWorx software. These files are available on our website, *www.amci.com*. You'll find them as a single ZIP file in our Tech Library section. Once you have downloaded them, unzip the file to your hard drive to access the EDS and icon files.

Adding the DuraCoder to Your Network

The AMCI DeviceNet DuraCoder must be added to the list of available devices in RSNetWorx for DeviceNet software before the DuraCoder can be attached to your network. After you have obtained and unzipped the EDS file as outlined in the section above, follow the procedure below to add the EDS to the RSNetWorx database.

1) Start RSNetWorx for DeviceNet
2) In the RSNetWorx program, click on **Tools** in the menu bar.
3) Click on **EDS Wizard...** from the pull down menu that appears.
4) Click on **Next>** in the window that appears.
5) Select **Register an EDS file(s)** and click on **Next>**.
6) Select **Register an EDS file**.
7) Click on **Choose File...** and navigate to the folder where you placed the un-zipped EDS and icon files.
8) Double click on the **amcidnet.eds** file.
9) Click on **Next>**
10) Click on the **amcidnet.eds** file so that it is highlighted.
11) Click on **Next>** to assign an icon to the device.
12) Click on the **AMCI DeviceNet DuraCoder Resolver** item and then click on **Change icon...** to select the icon for the DuraCoder. You can choose one of the built-in icons from A-B or click on the **Browse...** button and select the **dnetdura.ico** icon file.
13) Click on **Next>** and then on **Finish** to complete the installation of the AMCI DeviceNet DuraCoder Resolver EDS file to the RSNetWorx system.

Once the EDS is added to your system, you can add the DuraCoder to your network as you would any other device. In addition to adding the DuraCoder to your network, you must also add the DuraCoder to your scanner module's scanlist. You define the PLC register location of the DuraCoder's 40 input bits and 8 output bits in the scanlist field.

Notes

CHAPTER 4
SAMPLE PROGRAMS

Sample 1 - Reversing Count Direction

The counts of the DeviceNet DuraCoder increase with CCW motion when looking at the shaft. The following program reverses the count direction in the PLC if your application requires CW increasing counts. In the following example, the DuraCoder position in located in register I:1.1, and the counts per turn in set to 4,096. (Bit Resolution is set to 12 bits.)

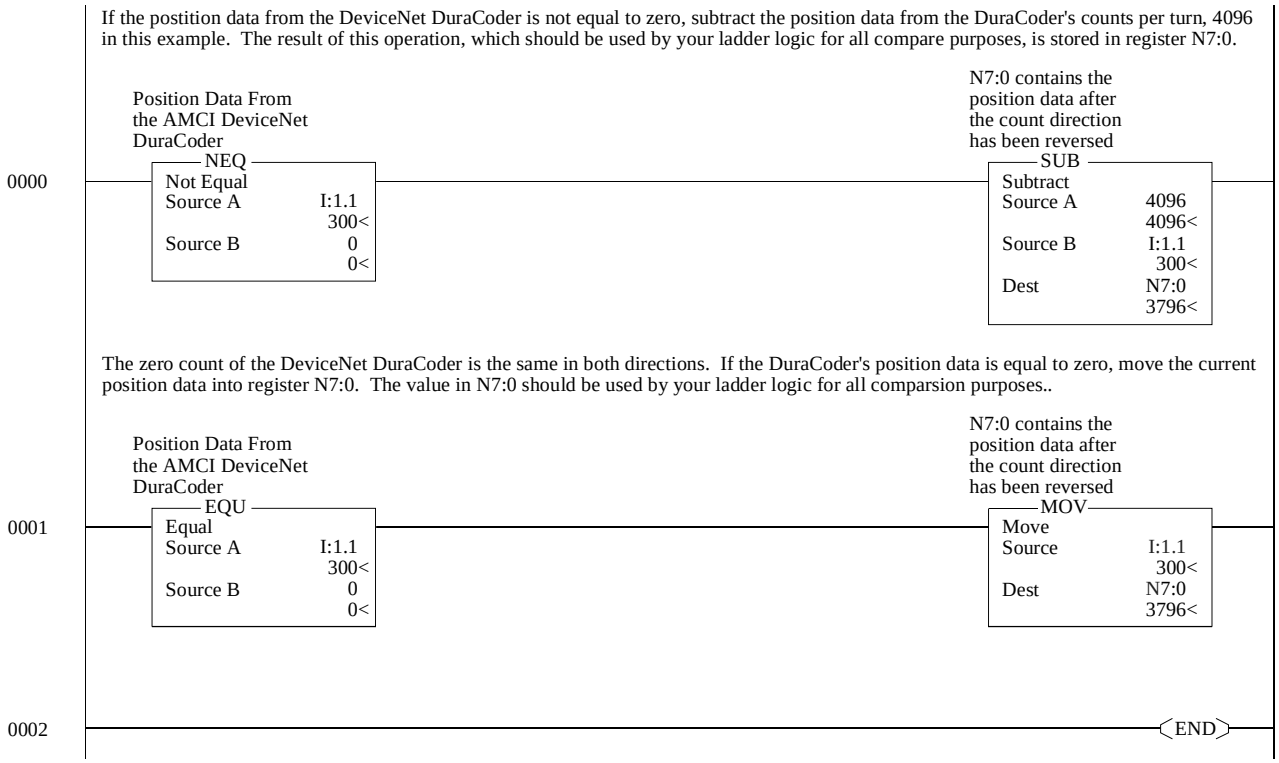

Figure 4.1 Reversing Count Direction Sample Program

Sample 2 - Calculating a Position Offset

The Zero Offset parameter of the DeviceNet DuraCoder is useful for adjusting the position value during initial machine set-up, but some applications require offsetting the DuraCoder position value every machine cycle. The easiest way of accomplishing this is through ladder logic that adjusts an “Internal Offset” whenever a trigger bit is set. This Internal Offset is subtracted from the position value from the DuraCoder to generate an “Offset Position” that is used by the rest of the program. The following ladder logic segment calculates the Internal Offset and Offset Position.

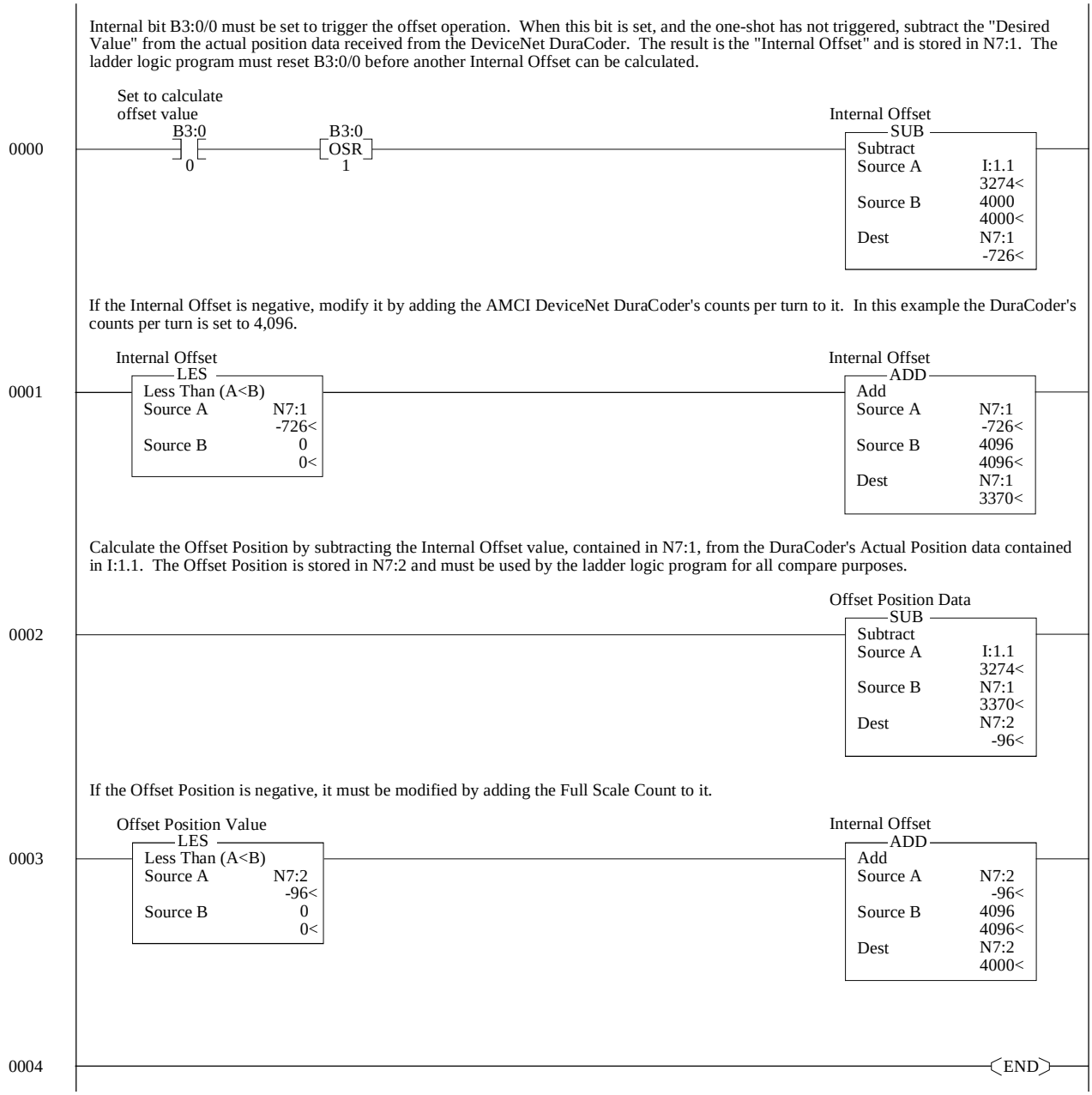

Figure 4.2 Position Offset Sample Program

Notes

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