E7N and E5N
DeviceNet Slave DigiSolver
(RSNetWorx™ Version)
Instruction & Operation Manual

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The DeviceNet Slave E7N and E5N DigiSolver

Introduction

The DigiSolver, a Digital Resolver

The DeviceNet DigiSolver is a resolver-based encoder, in which the analog signal produced by a brushless resolver is transformed to a digital format by a built-in ratiometric tracking converter. This new concept and the advanced technology of the DigiSolver, with electronic circuitry, provides higher accuracy, increased reliability, higher operating speeds, more flexible counts per turn and a smaller size than optical encoders.

No Optics, Mil-Grade Resolver
There is no optical coded disc or similar component used in the DigiSolver. A miniature Mil-Grade resolver produces an analog position signal and high-grade electronics molded in epoxy transforms this signal to digital format. The resolver is a passive transducer, well known for its ruggedness and performance in hostile industrial environments. The DigiSolver combines the ruggedness of a resolver with the reliability of solid-state electronics and is designed to operate reliably under severe environmental conditions, such as mechanical shock, vibrations, temperature and humidity changes, oil mist, coolants and solvents. No broken discs! No disc misalignments! No LED aging!

High Resolution in Small Compact Housing
The single-turn DigiSolver provides up to 12 bit Binary, Gray Code or Decimal in a 2.5-inch diameter size (size 25) housing.

Single-Turn Operation
The DigiSolver is an absolute encoder, that is, it keeps track of the exact shaft position even during power outage or switching off the machine. At power-up, the DigiSolver will pick up the exact shaft position even if the machine moved during the power outage. In a single-turn operation, the machine cycle is completed during one complete revolution of the transducer shaft.

Field Selectable CW or CCW Operation
The DigiSolver is factory wired for ascending counts with Counterclockwise shaft rotation. However, the direction of operation can be easily selected in the field by opening up the case and simply reversing the DigiSolver input plug. No wires need to be unsoldered or soldered.

Ratiometric Resolver-to-Digital Converter
The Autotech ratiometric tracking converter is practically immune to electrical noise, voltage, frequency and temperature variations.

DeviceNet Connection
The DeviceNet E7N DigiSolver model is enclosed in a size 25 (2.5-inch diameter), NEMA 13 housing and designed for medium duty applications. It is available as a flange mount or a servo mount model with a DeviceNet connector at the end. The E5N model is enclosed in a size 40 (4-inch diameter), NEMA 13 housing and is designed for heavy duty applications. It is available as a face mount with a DeviceNet connector at the end.

Variety of Outputs
The DigiSolver is available with Binary, Gray Code, or Decimal absolute position output formats.

Power Supply
An existing power supply can be used to power the DigiSolver, that is, if a programmable controller operates at 24 VDC, an 11-30 VDC DigiSolver model can be connected to the same power supply, thus cutting down the system cost.

Flexible Programming of Counts Per Turn
The advanced R to D converter used in the DigiSolver has made it possible to program any number of scaled Binary, Decimal, or Gray Code counts per revolution. The default encoding format is set to 10 bit Binary.

DeviceNet Basics

DeviceNet is an open network standard, This means that users may specify, install, and use various products from a wide number of suppliers without the need to purchase special equipment, software, or licensing rights. Thus, the user can create a system from a variety of vendors, yet specific to the exact application, mainly using off-the-shelf parts.

DeviceNet is a low-cost communication link that connects industrial devices, such as limit switches, photoelectric sensors, proximity sensors, valve manifolds, motor starters, process sensors, bar code readers, variable frequency drives, panel displays, and operator interfaces to a common network.

Networking devices eliminates the necessity for expensive hard wiring, and the attendant testing and maintenance that goes with it. It also reduces the cost and time needed to wire and install automation devices, while providing improved communication between devices, as well as important device-level diagnostics not easily accessible or available through hardwired I/O interfaces.

Functional Description of the DigiSolver LED

The bi-color (green/red) LED provides limited device and communication status. The table below provides a description of the different LED states and their indications. For its location on the resolver, see page 5.

Combined Module/Network Status LED		
For this state:	**LED is:**	**To indicate:**
Not powered/Not online	OFF	Device is not online. — the device has not completed the Dup_MAC_ID test yet. — the device may not be powered.
Device Operational AND Online, Connected	GREEN	The device is operating in a normal condition and the device is online with connections in the established state. — the device has one or more established connections.
Device Operational AND Online, Not Connected or Device Online AND Device needs commissioning	FLASHING GREEN	The Device is operating in a normal condition and the device is online with no connections in the established state. — the device has passed the Dup_MAC_ID test, is online, but has no established connections to other nodes. — the device has no established connections.
Critical Fault or Critical Link Failure	RED	The device has an unrecoverable fault, may need replacing. Failed communication device. The device has detected an error that has rendered it incapable of communicating on the network (Duplicate MAC ID, or Bus-off).

Electrical Specifications

Input Power

Input Voltage:
11–30 VDC
Maximum Input Current:
0.15 Amp
Typical Input Current:
0.06 Amp @ 24 V

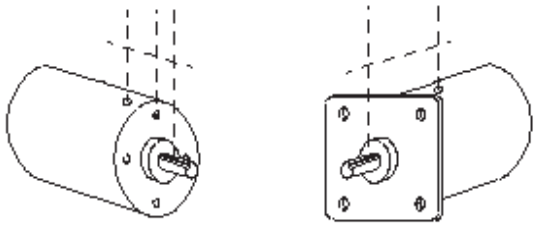
Installation

Mounting

1. Servo-Mount:
The DigiSolver can be either mounted with traditional servo-clamps or through the four 4-40 mounting holes on the face of the resolver.

Zero Reference (±5°) : When flat on shaft lines up with the screw in the case and the two mounting holes on the face plate.

Zero Reference



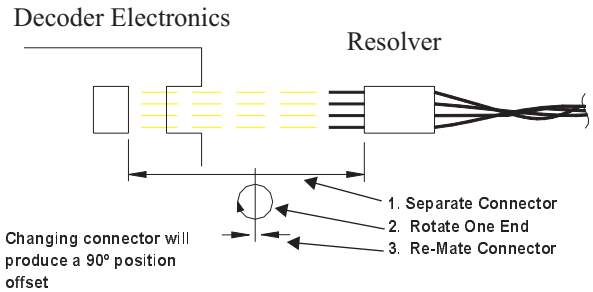
2. Flange-Mount:
The DigiSolver can be mounted using the four .218 diameter mounting holes on the square face plate.

Zero Reference (±5°): When flat of shaft lines up with the case screw that is in the middle of a flat side.

Direction of Rotation

The direction of rotation is normally set at the factory for increasing count with CCW rotation (viewed from the shaft end). This may be changed to increasing count with CW rotation by reversing the internal connector between the resolver and decoder electronics. When reassembled, ensure connector mates securely and wiring is not pinched.

Direction of Rotation Vs Increasing Count Adjustment



CAUTION NOTES:

1. It is recommended that E7 series DigiSolver be coupled to an external shaft using a flexible coupling. Autotech recommends ACR series helical couplings. For further information contact helical products company directly at 805/928-3851.
2. NEMA 13 rating - to maintain the NEMA 13 rating of the DigiSolver, the bearing seals must be checked once every six months and replaced if necessary. Lubricating the bearing seal periodically prolongs its life.
3. If the DigiSolver is to be axially driven, be sure that the shafts are aligned. if misaligned, it can destroy the DigiSolver bearing.
4. The DigiSolvers must be returned to the factory for repair. DO NOT ATTEMPT TO REPAIR the Electronic Module in the field; THIS WILL VOID ALL WARRANTIES.

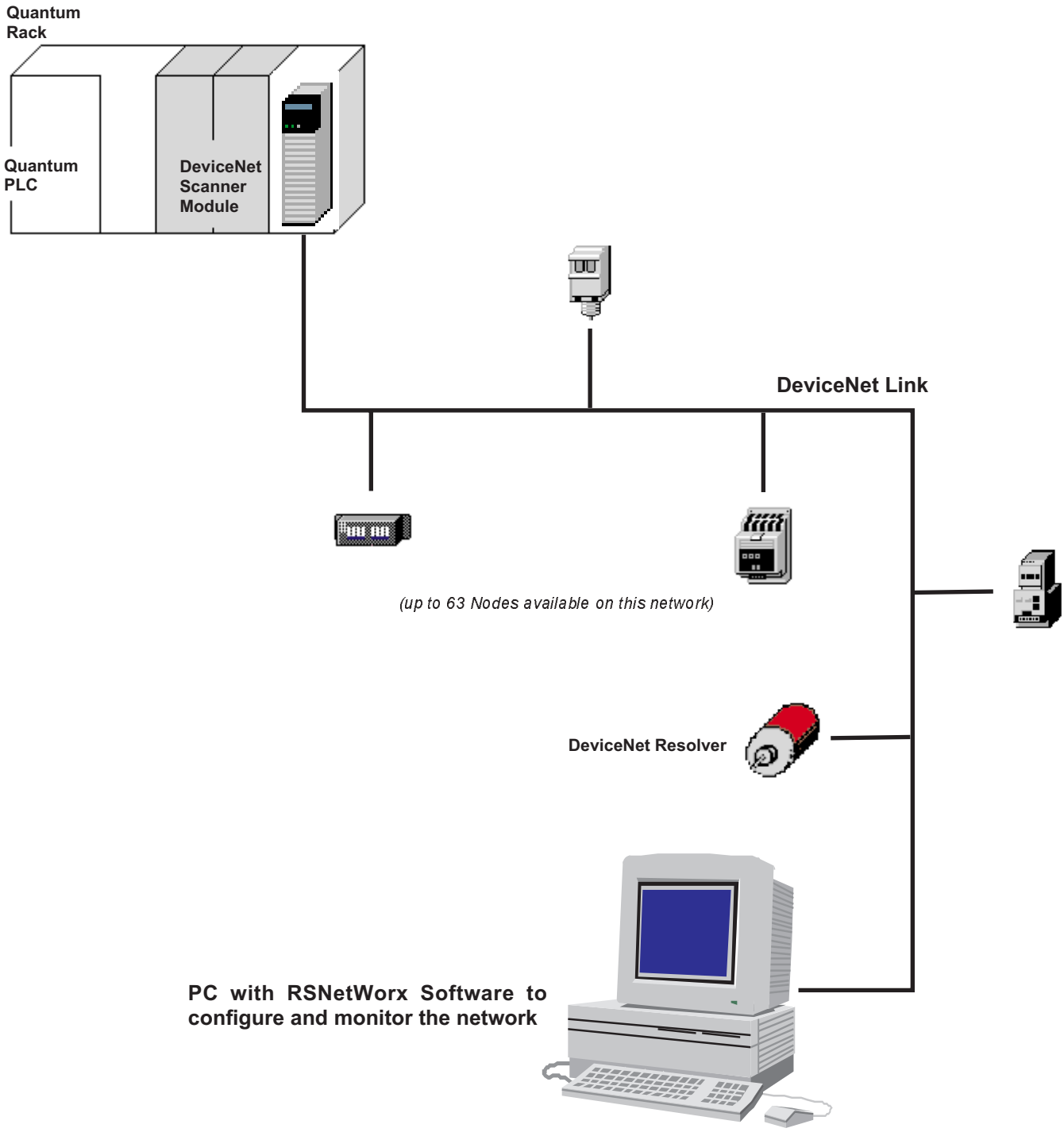
Wiring

1. The shielded interconnecting cable should be routed in its own conduit and kept separate from other high voltages/high inductance wiring. The shield drain wire should be connected to earth ground at both ends of cable.

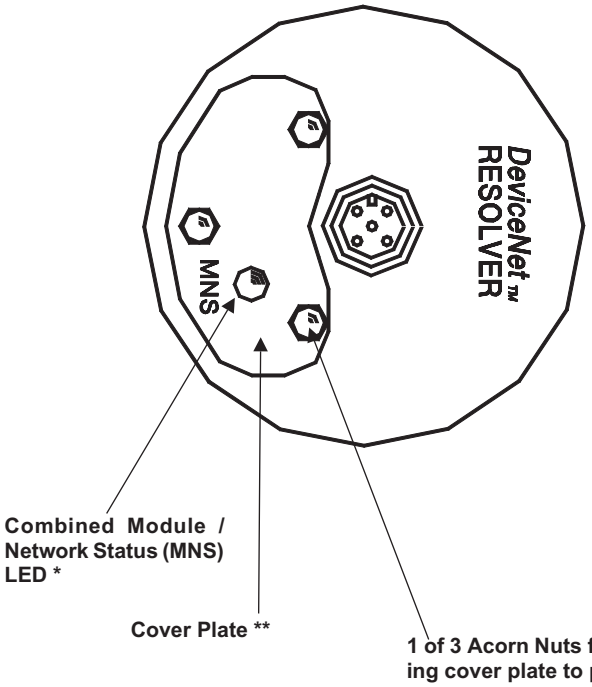
2. This equipment uses isolated Sig Ref (Com). Failure to assure at least 100 K Ohm resistance between sig ref and earth ground may cause erratic output data.

CAUTION: Check the cable wiring before applying power to the DigiSolver

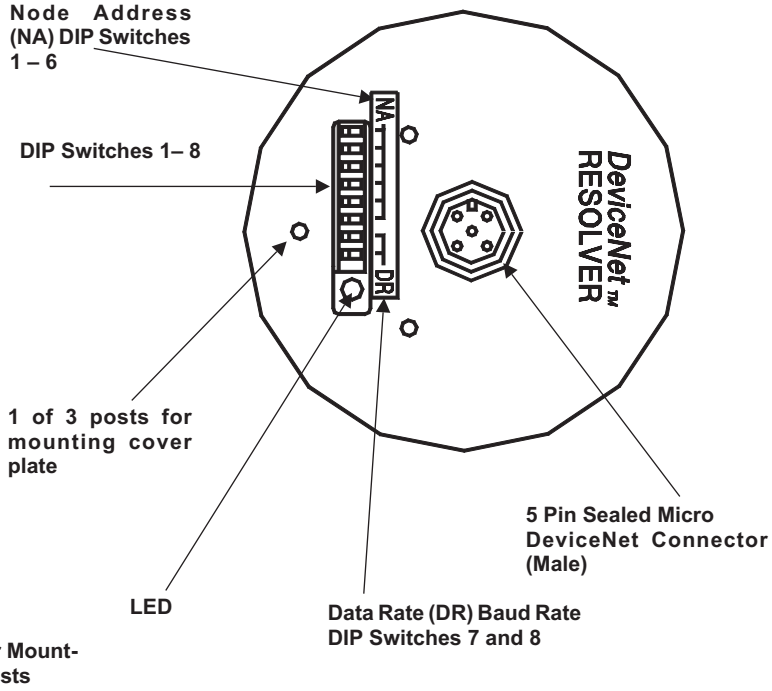
Diagram of DeviceNet Resolver in a Typical System



DeviceNet Resolver Connector End with Cover Plate



DeviceNet Resolver Connector End without Cover Plate



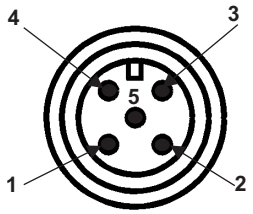
* LED

For a functional description of the DigiSolver LED, see page 2.

** Cover Plate Removal

1. Remove Cover Plate to access Dip Switches.
2. Using appropriate tool, loosen the 3 acorn nuts, and set aside.
3. Pull plate off posts.

Connector Pins

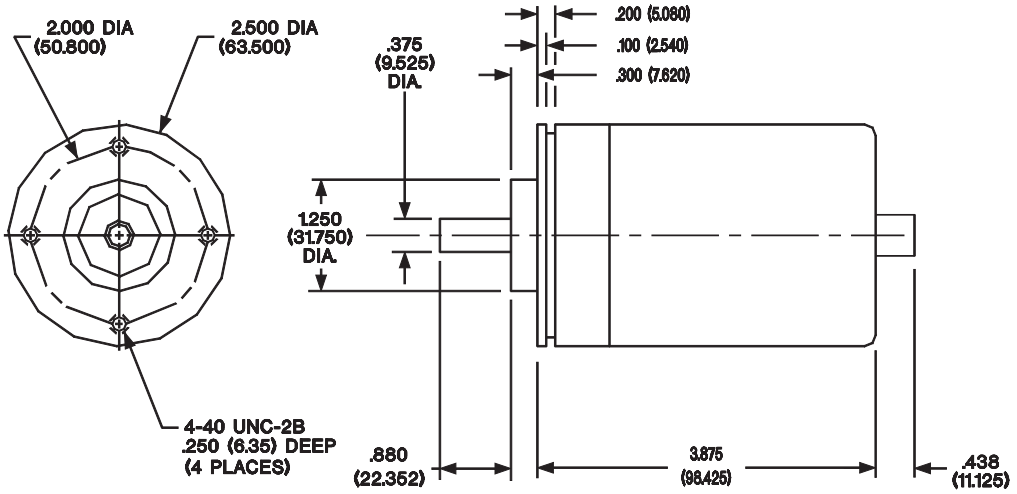


Connector Pin Out		
1	Drain	Bare
2	V+	Red
3	V-	Black
4	CAN_H	White
5	CAN_L	Blue

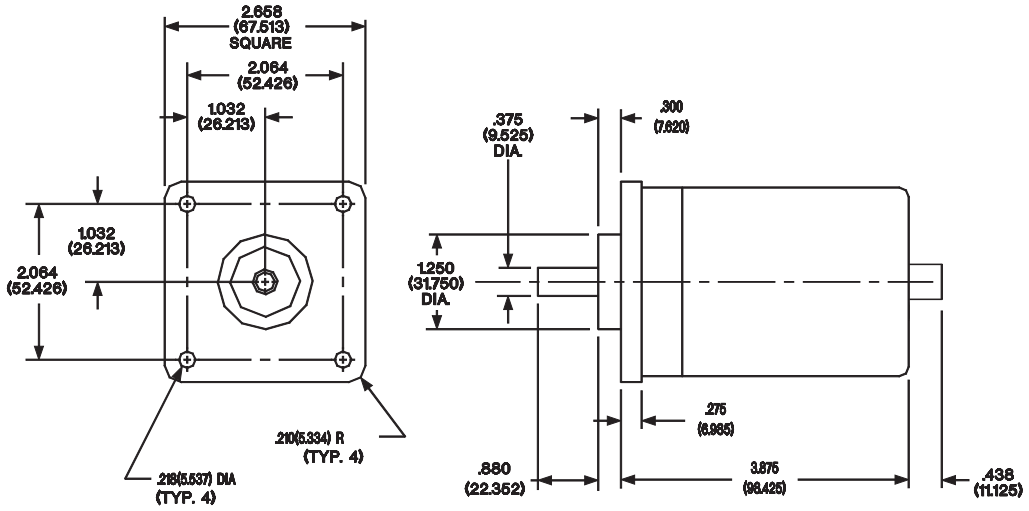
Outline Dimensions

The outline dimensions of the DigiSolvers are shown in the following diagrams.

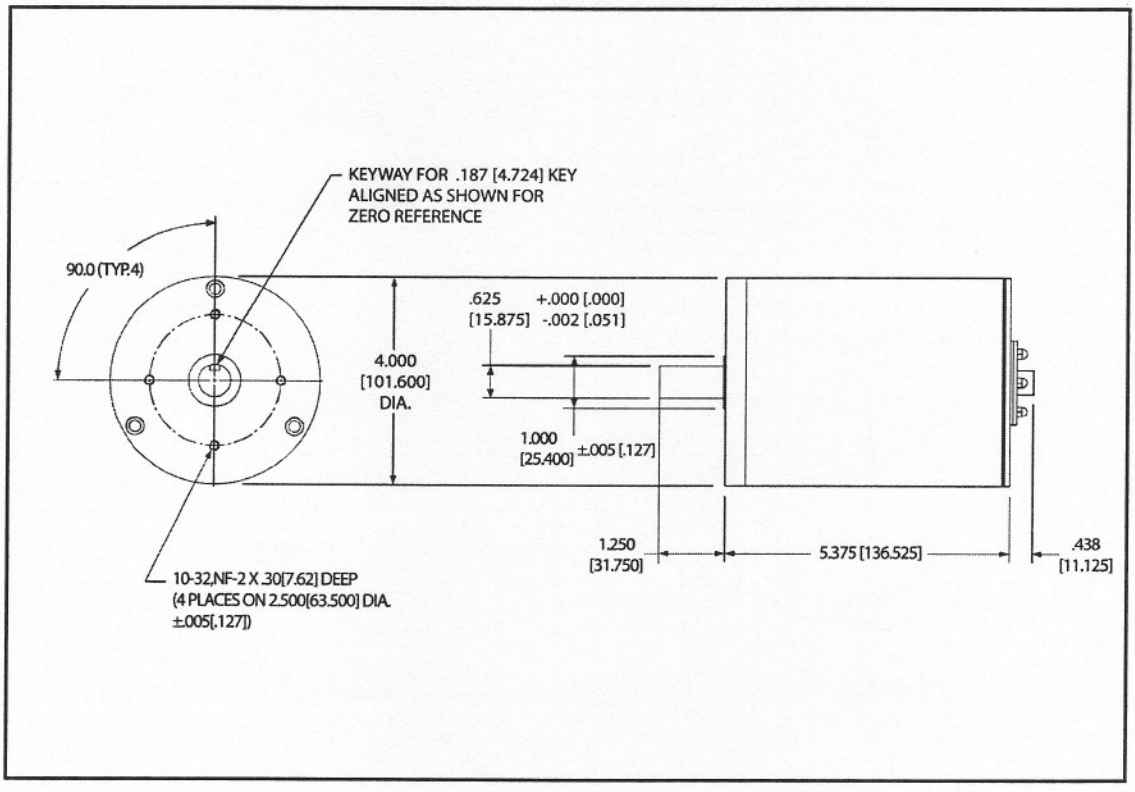
Servo Mount



Flange Mount



E5 Face Mount



Programming

The DeviceNet Resolver provides basic resolver functionality for control systems equipped with a DeviceNet interface.

Features:

- User definable resolution (12 bit maximum)
- Eight user-definable dwells. Each dwell has 1 ON/OFF setpoint
- Continuously computed RPM

DeviceNet Interface

Supports Polled, Strobed, COS/Cyclic. Produces 4, 5, 6, or 8 bytes depending on features utilized. Consumes 0 or 1 byte.

Response Time for Resolver:

COS/Cyclic — Value (4 bytes) 2 ms
Value + Cams + RPM (8 bytes) 2.5 ms
Polled — Value (4 bytes) 2 ms
Value + Cams + RPM (8 bytes) 4 ms

Produced Bytes:

Value — This is the current position value after bit resolution and offset have been added. Value uses 4 bytes. Throughout the manual, Value and Position Value are equivalent.

Cam — This is a 1 byte value with 1 bit representing the status of each of the 8 "dwells". If the bit is "1", the current position is between the Cam Low and Cam High setting.

Example: Cam = 0 x 02 or binary 00000010. This means that the current position is greater than Cam 2 Low and less than Cam 2 High.

Cams — This is the same as Cam above, but 2 bytes are produced instead of 1. The most significant byte (MSB) is reserved and the least significant byte (LSB) functions as Cam above.

RPM — This is the computed revolutions per minute of the resolver. RPM uses 2 bytes.

Consumed Bytes:

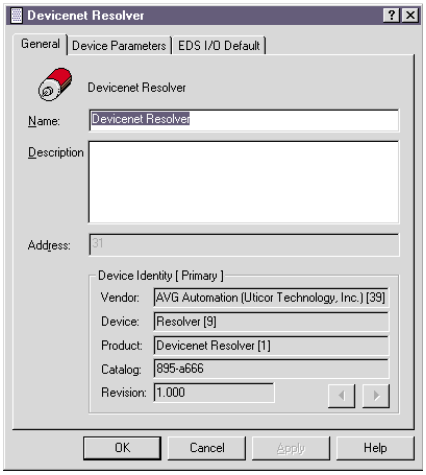
Auto Zero — This attribute controls the auto-zero feature of the resolver. Only the least significant bit of the byte is used. If this bit transitions from 0 to 1, **Zero Offset** is set to a value that results in **Position Value** being zero. The only way to restore the user-defined **Zero Offset** value is to cycle power to the resolver, or to re program **Zero Offset** from a configuration tool. The AutoZero feature may be disabled by setting parameter 21 of the Device parameters. If AutoZero is disabled, the resolver consumes 0 bytes.

Configuration

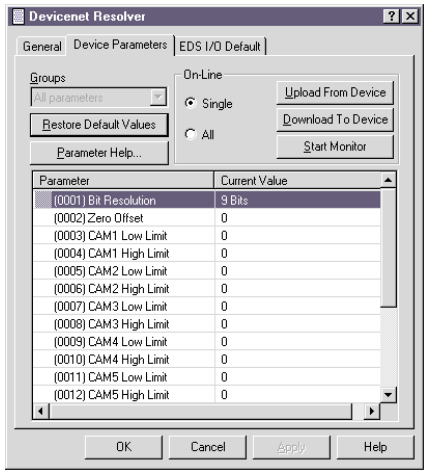
The DeviceNet Resolver is configures like any other slave device on RSNetWorx. After double clicking on the icon for the resolver, several menu tabs are available.

DeviceNet Resolver Dialog Box

General (Tab): Under this tab, basic identification information about the DeviceNet Resolver is provided. You may enter a description of the device in the Description field. It is only saved offline in the program (not in the device itself). The rest of the information is read only (i.e., Vendor, Device, Product, Catalog, Revision).



DeviceNet Parameters (Tab): These parameters allow the resolver to be configured for specific applications. The following parameters are configurable by the user.



Bit Resolution: The Bit Resolution attribute specifies the number of significant bits used for Position Value**.**

IMPORTANT: **In most cases this needs to be set to match the Value Code parameter**.

These are the bit resolutions for each Value Code.

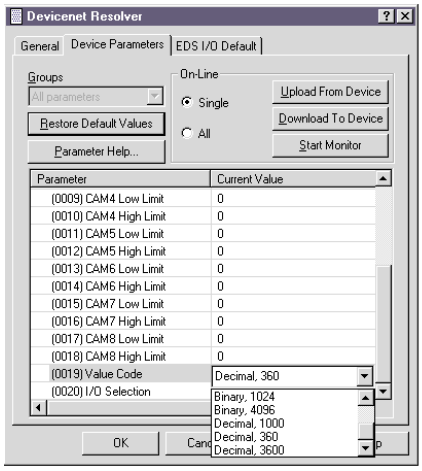
Gray Code 1024 = 10 bits
Gray Code 256 = 8 bits
Gray Code 360 = 9 bits
Gray Code 512 = 9 bits
Gray Code 4096 = 12 bits
Binary 1024 = 10 bits
Binary 4096 = 12 bits
Decimal 360 = 9 bits
Decimal 1000 = 10 bits
Decimal 3600 = 12 bits

Zero Offset: The zero offset attribute adjusts the zero point of Position Value. Zero offset is added to position value to adjust the zero point. This attribute is added after the Resolution attribute. If the result of the addition exceeds the maximum specified by the resolution the overflow bits are discarded. Example: Assuming 8 bit resolution, "physical position" of 0 and zero offset of 10 yields a "logical position" of 10. However, a physical position of 250 and a zero offset of 20 yields 15 (270 with high bits discarded).

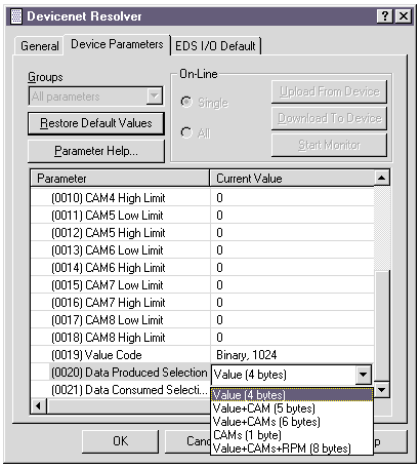
CAMs: There are 8 user-definable cams or "dwells". Each cam is a low and high pair. If the position low and position high value a bit will be set in the Cams byte produced by the resolver to be sent out on the network.

Note: Cams are only valid for binary and decimal value codes. Cams cannot be used with gray codes.

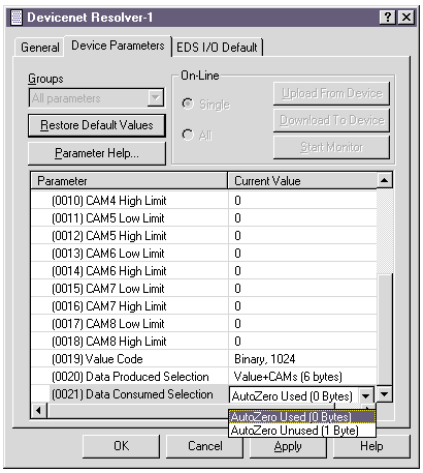
Value Code: This determines the format of the position value. The format can be either gray code, decimal, or binary. RPM and Cams are only available for binary and decimal formats. The bit resolution of each format is discussed under the Bit Resolution Parameter description.



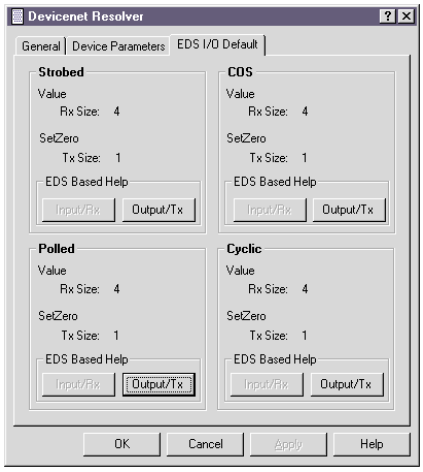
Data Produced Selection: The Data Produced selection is used to control the number of bytes produced by the resolver. The available choices are Value = 4 bytes, Value and Cam = 5 bytes, Value and Cams = 6 bytes, and Value and Cams and RPM = 8 bytes. The master scanner must be configured to match the number of bytes produced by the resolver.



Data Consumed Selection: The Data Consumed Selection controls the number of bytes consumed by the resolver. The available choices are AutoZero Used = 1 Byte or AutoZero unused = 0 Bytes.



EDS I/O Default (Tab): The default I/O settings are the same for Strobed, Polled, COS, and Cyclic. 4 bytes are produced and 1 is consumed. The master scanner will default to scanning this number of bytes and therefore must be changed if the I/O Selection parameter is changed.



DIP Switches:

The 8 DIP Switches are used to configure the resolver's MAC ID and Baud Rate. Reference the tables to the right for DIP Switch settings.

DIP Switches 1 through 6 MAC ID						
SW1	SW2	SW3	SW4	SW5	SW6	NODE
UP	UP	UP	UP	UP	UP	0
DOWN	UP	UP	UP	UP	UP	1
UP	DOWN	UP	UP	UP	UP	2
DOWN	DOWN	UP	UP	UP	UP	3
UP	UP	DOWN	UP	UP	UP	4
DOWN	UP	DOWN	UP	UP	UP	5
UP	DOWN	DOWN	UP	UP	UP	6
DOWN	DOWN	DOWN	UP	UP	UP	7
UP	UP	UP	DOWN	UP	UP	8
DOWN	UP	UP	DOWN	UP	UP	9
UP	DOWN	UP	DOWN	UP	UP	10
DOWN	DOWN	UP	DOWN	UP	UP	11
UP	UP	DOWN	DOWN	UP	UP	12
DOWN	UP	DOWN	DOWN	UP	UP	13
UP	DOWN	DOWN	DOWN	UP	UP	14
DOWN	DOWN	DOWN	DOWN	UP	UP	15
UP	UP	UP	UP	DOWN	UP	16
DOWN	UP	UP	UP	DOWN	UP	17
UP	DOWN	UP	UP	DOWN	UP	18
DOWN	DOWN	UP	UP	DOWN	UP	19
UP	UP	DOWN	UP	DOWN	UP	20
DOWN	UP	DOWN	UP	DOWN	UP	21
UP	DOWN	DOWN	UP	DOWN	UP	22
DOWN	DOWN	DOWN	UP	DOWN	UP	23
UP	UP	UP	DOWN	DOWN	UP	24
DOWN	UP	UP	DOWN	DOWN	UP	25
UP	DOWN	UP	DOWN	DOWN	UP	26
DOWN	DOWN	UP	DOWN	DOWN	UP	27
UP	UP	DOWN	DOWN	DOWN	UP	28
DOWN	UP	DOWN	DOWN	DOWN	UP	29
UP	DOWN	DOWN	DOWN	DOWN	UP	30
DOWN	DOWN	DOWN	DOWN	DOWN	UP	31
UP	UP	UP	UP	UP	DOWN	32
DOWN	UP	UP	UP	UP	DOWN	33
UP	DOWN	UP	UP	UP	DOWN	34
DOWN	DOWN	UP	UP	UP	DOWN	35
UP	UP	DOWN	UP	UP	DOWN	36
DOWN	UP	DOWN	UP	UP	DOWN	37
UP	DOWN	DOWN	UP	UP	DOWN	38
DOWN	DOWN	DOWN	UP	UP	DOWN	39
UP	UP	UP	DOWN	UP	DOWN	40
DOWN	UP	UP	DOWN	UP	DOWN	41
UP	DOWN	UP	DOWN	UP	DOWN	42
DOWN	DOWN	UP	DOWN	UP	DOWN	43
UP	UP	DOWN	DOWN	UP	DOWN	44
DOWN	UP	DOWN	DOWN	UP	DOWN	45
UP	DOWN	DOWN	DOWN	UP	DOWN	46
DOWN	DOWN	DOWN	DOWN	UP	DOWN	47
UP	UP	UP	UP	DOWN	DOWN	48
DOWN	UP	UP	UP	DOWN	DOWN	49
UP	DOWN	UP	UP	DOWN	DOWN	50
DOWN	DOWN	UP	UP	DOWN	DOWN	51
UP	UP	DOWN	UP	DOWN	DOWN	52
DOWN	UP	DOWN	UP	DOWN	DOWN	53
UP	DOWN	DOWN	UP	DOWN	DOWN	54
DOWN	DOWN	DOWN	UP	DOWN	DOWN	55
UP	UP	UP	DOWN	DOWN	DOWN	56
DOWN	UP	UP	DOWN	DOWN	DOWN	57
UP	DOWN	UP	DOWN	DOWN	DOWN	58
DOWN	DOWN	UP	DOWN	DOWN	DOWN	59
UP	UP	DOWN	DOWN	DOWN	DOWN	60
DOWN	UP	DOWN	DOWN	DOWN	DOWN	61
UP	DOWN	DOWN	DOWN	DOWN	DOWN	62
DOWN	DOWN	DOWN	DOWN	DOWN	DOWN	63

DIP Switches 7 and 8 — Baud Rate		
SW7	SW8	Baud Rate
UP	UP	125K
DOWN	UP	250K
UP	DOWN	500K
DOWN	DOWN	Default (500K)

How to Order

DeviceNet DigiSolvers: Single-Turn

E X N – X XXXX – 9F X X
1 2 3 4 5

Field selectable output format and resolution. Input Power Supply: 11 to 30 VDC

1. Housing Type:

7: NEMA 13, size 25 (2.5" dia.), medium duty bearings
5: NEMA 13, size 40 (4" dia) heavy duty bearing *(Consult factory)*

2. Option:

S: Output format and counts per turn field selectable, Factory default set for 1024

3. Output Format and Counts Per Turn: Field selectable
(Note: Custom counts available, consult factory)

Field Selectable: **0000**

4. Type of Field Bus:

D: DeviceNet

5. Mounting Style:

F: Flange (E7)
S: Servo (E7)
M: Facemount (E5)

WARRANTY

Autotech Controls warrant their products to be free from defects in materials or workmanship for a period of one year from the date of shipment, provided the products have been installed and used under proper conditions. The defective products must be returned to the factory freight prepaid and must be accompanied by a Return Material Authorization (RMA) number. The Company's liability under this limited warranty shall extend only to the repair or replacement of a defective product, at The Company's option. The Company disclaims all liability for any affirmation, promise or representation with respect to the products.

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