Rockwell
Automation

Bringing Together Leading Brands in Industrial Automation

DeviceNet™

Book of Knowledge

Version 1/22/2013

Robert D. Law P.E

Sr. Application Engineer

What's New In this BOK Since 9/26/2012!!

1) Changed slide 110 to state V11 of RSNetWorx for DNet software is latest version.
2) Updated 1756-DNB Fun Facts on pages 141 and 143.
3) Updated last two bullets on the 1769-SDN fun facts slide on page 151.
4) Updated Important Publication slide on page 10.
5) Added fun facts to 1784-PCIDS card about no drivers for Windows 7 on page 172.
6) Added PointBlock I/O note about product going to Silver Series on page 302.
7) Changed last bullet on PanelView Plus slide 391.

Book of Knowledge Index

Book of Knowledge Index (cont.)

The Ten Commandments of DeviceNet

- Thou Shalt Read Publication DNET-UM072C-EN-P (DN-6.7.2), First!!

- Thou Shalt Use two Terminator Resistors, Always!!

- Thou Shalt Ground Thy Network

- Thou Shalt Honor Thy Maximum Trunk and Drop Distances

- Thou Shalt Purchase a 193-DNCT Handheld Configurator

- Thou Shalt Avoid Electrical Noise Sources

- Thou Shalt Not Exceed Maximum Cable Current

- Thou Shalt Space Away From Higher Voltages

- Thou Shalt avoid Excessive Common Mode Voltage

- Thou Shalt Purchase a Brad Harrison NetAlert NetMeter

Who ya gonna call?

- *...... DeviceNet Busters!*

- **Rockwell Automation/Technical Support**
  Hotline: 440-646-5800

Intranet DeviceNet Info

Go To:

http://www.cle.ab.com/netlinx/resources/devicenet/index.html

DeviceNet Book of Knowledge is KnowBase record 44883.

http://rockwellautomation.custhelp.com/cgi-bin/rockwellautomation.cfg/php/enduser/std_adp.php?p_faqid=44883

Extranet Homepage DeviceNet Info

Go To:

http://rain.ra.rockwell.com

Then Select:

Channel Extranet

Then Select:

Products and Services

Then Select:

Complete Information

Then Select:

Networks

Then Select:

DeviceNet

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Where should customers go for DeviceNet Information?

- **Internet**

  – **Global Technical Support Records**

  http://www.ab.com/mem/technotes/techmain.html

  or simply select Rockwell Automation Technical Support link from www.ab.com

  – **Networks Information**

  http://www.ab.com/networks/

  – **Rockwell Automation EDS files**

  http://www.ab.com/networks/eds/

Important Publications

- **Netlinx Selection Guide Pub. No. NETS-SG001D-EN-P**

- **On Machine Media Publication M117-CA001A-EN-P**

- **Latest Cable System Planning & Installation Guide Publication No. DNET-UM072C-EN-P (Formerly DN-6.7.2)**
  - **Many topics relating to the installation**
  - **Power Distribution**
  - **Media Components**
  - **Distance specs for trunk & Drops**
  - **Topology**

  <u>Above publications can be ordered on-line at www.theautomationbookstore.com</u>

- **Troubleshooting Guide - Pub ABT-N100-TSJ20, Revision August 2001**
  - **Step by step guide to troubleshooting installed systems.**
  - **Order via Passport**

- **The Common Industrial Protocol (CIP™) and the Family of CIP Networks**
  - **Download from http://www.odva.org/10_2/09_down/09_CIP_Book.htm**

First DeviceNet Network in the World!!
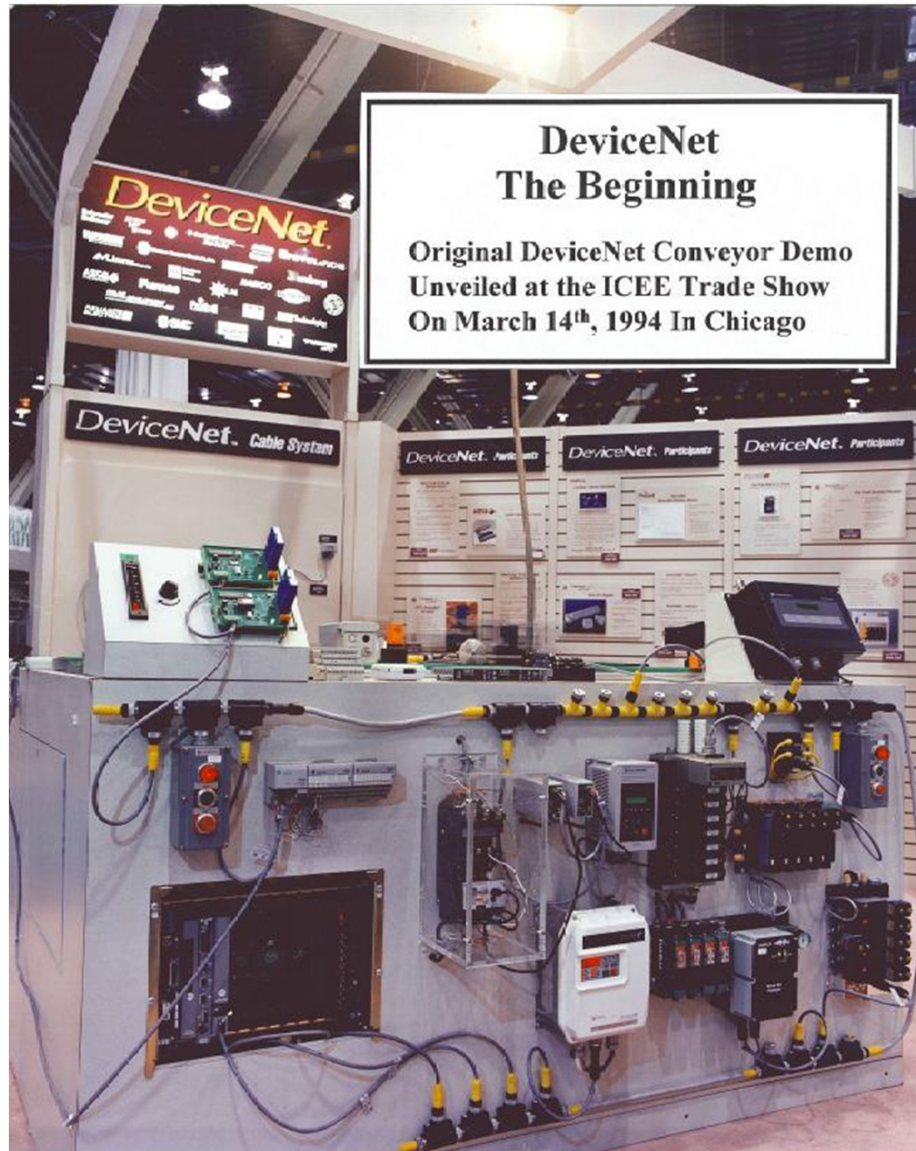
The first operational DeviceNet network ever built in the world, was unveiled at the ICEE show held March 14th thru 16th in 1994.

Selling DeviceNet
&
Common DNet Architectures

What is DeviceNet?

DeviceNet is a simple, *open* networking solution that *reduces the cost and time required* to wire and install industrial automation devices, while *providing interchangeability* of like components from multiple vendors.

Quote from Bob Law (Dr. DeviceNet)

"The only limitation for a DeviceNet device is the imagination of the Design Engineer and how much the customer is willing to pay for the extra functionality. Once you make that four wire communication, connection to a DeviceNet network, it opens up a whole new arena of data, diagnostics and configurability with that device."

ODVA
(Open DeviceNet Vendors Association)

- Owns technology
  - Conformance Testing
  - Specifications
  - Electronic Data Sheets (EDS)
  - Trademark

- More than 265 members worldwide

- European, Chinese, and International standard

- More than 780 companies have requested vendor product IDs
  - **RA leads the way with > 650 ODVA**-tested and certified product catalog numbers
  - More than 100 SI/OEM members

- http://www.odva.org
  - Online product catalog
  - Newsletters/current events
  - Member companies and contact information

Why use it?

- ## Reduces wiring and installation cost
  - Labor and hardware expense

- ## Reduces start-up time
  - Minimizes miswiring
  - Makes it easier to "stage" sub-systems
  - Allocate resources to next job quickly

Conventional Method
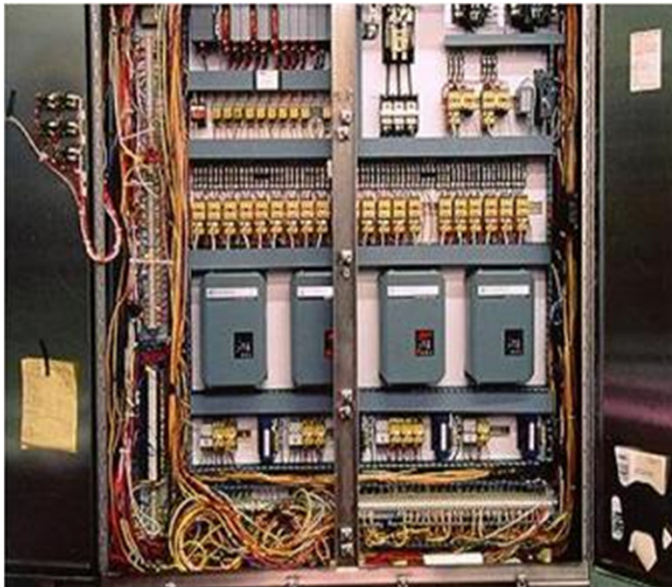
DeviceNet Solution

Why use it? (Cont)

- Significantly reduce downtime and total cost of ownership with the aid of diagnostics, Auto Device Replacement, and other time- and cost-saving features

Conventional Method

DeviceNet Solution

- **Run standard and safety applications on the same wire**

DeviceNet Safety™

What Does a DeviceNet Device Really Bring to the Show

Standard Discrete Photoeye
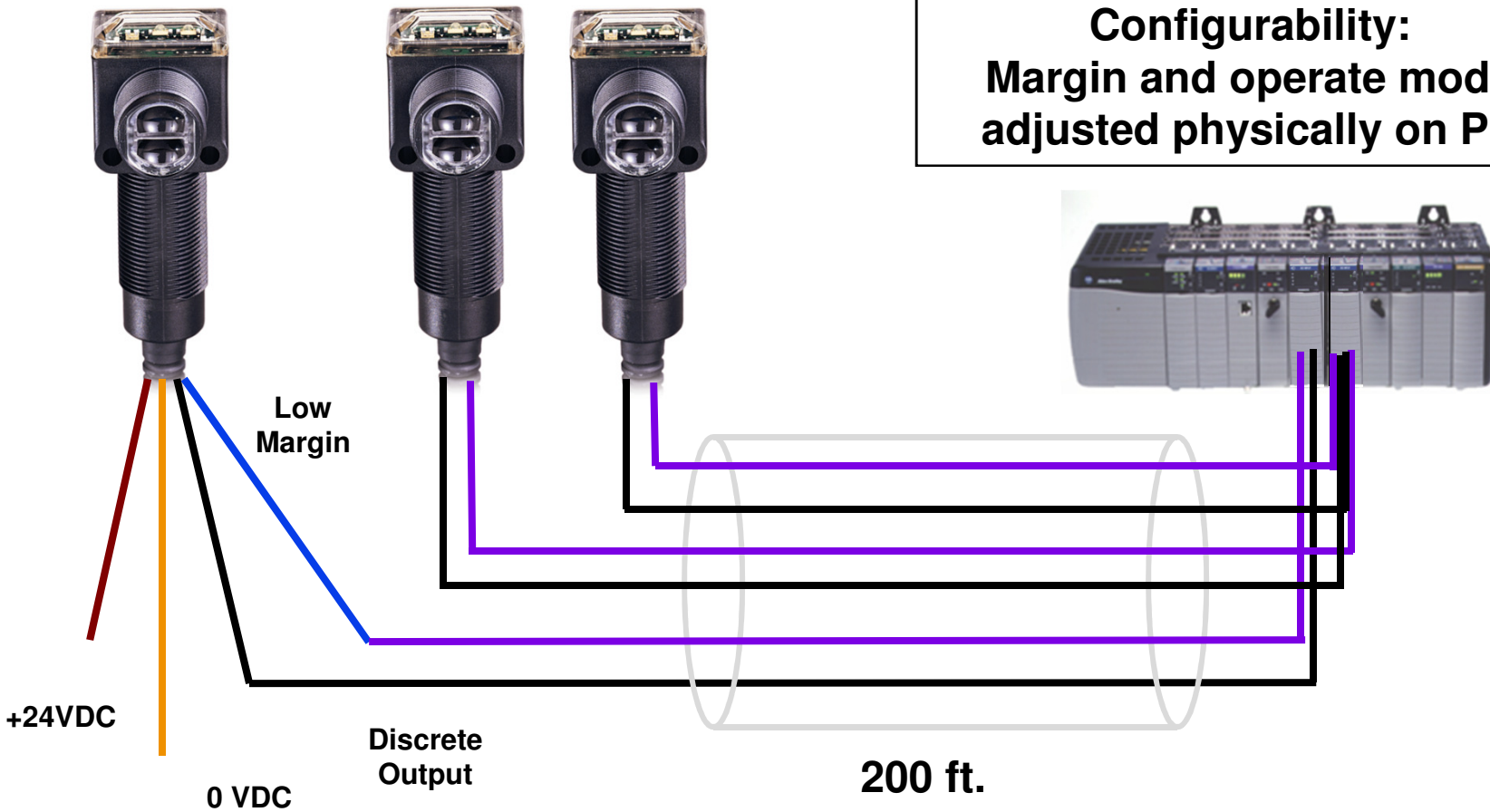
Data Available: On, Off, Low Margin
Configurability: Margin and operate mode adjusted physically on PE

Low Margin

+24VDC

0 VDC

Discrete Output

200 ft.

What Does a DeviceNet Device Really Bring to the Show (Continued)

DeviceNet Photoeye
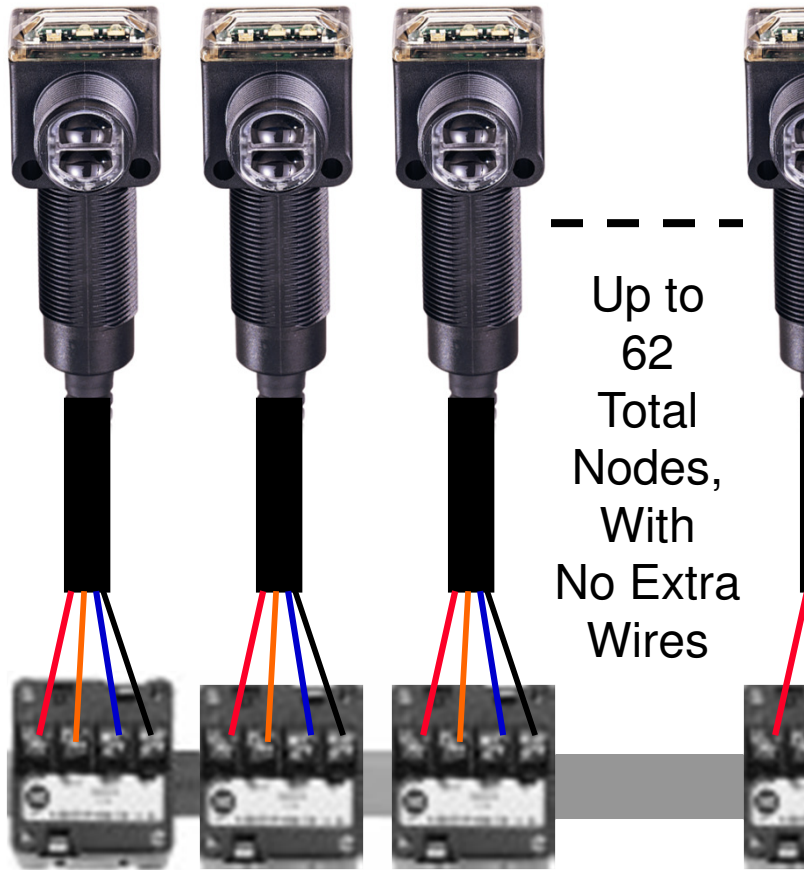
Data Available:
Large amount.

Configurability:
...hout
.

Up to 62 Total Nodes, With No Extra Wires

ID		Parameter	Current Value
1	🔒	Light Source Detected	Not Detected
2		Operate Mode	Light Operat
3	🔒	Sensor Output	Off
4	🔒	Margin LED	Off
5		Diagnostic Operate Mode	Dynamic Dia
6	🔒	Margin Diagnostic 1	Ok
7	🔒	Margin Diagnostic 2	Ok
8	🔒	Diagnostic	Ok
9		On-Delay Timer Enabled	Disabled
10		On-Delay Timer Timebase	1 ms
11		On-Delay Timer Preset	0
12	🔒	On-Delay Timer Elapsed Time	0
13		Off-Delay Timer or One-Shot Enabled	Disabled
14		Off-Delay Timer or One-Shot Timebase	1 ms
15		Off-Delay Timer or One-Shot Preset	0
16	🔒	Off-Delay Timer or One-Shot Elapse…	0
17		Up Counter Enabled	Disabled
18		Counter Preset	0
19	🔒	Counter Value	0
20	🔒	Counter Output	Off
21	🔒	No Motion Detect	Motion Dete
22		No Motion Detect Timer Preset	0 ms
23		Autobaud	Enabled
24	🔒	Configuration Consistency Value	0
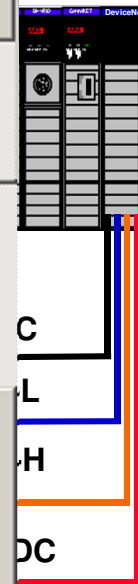
Great applications (1 of 2)

- "RIO Lite" - nodes with a few points per node
- "Drive net"

Change-of-State or Cyclic Data

Peer-to-Peer I/O   Command I/O

- Not a replacement for RIO
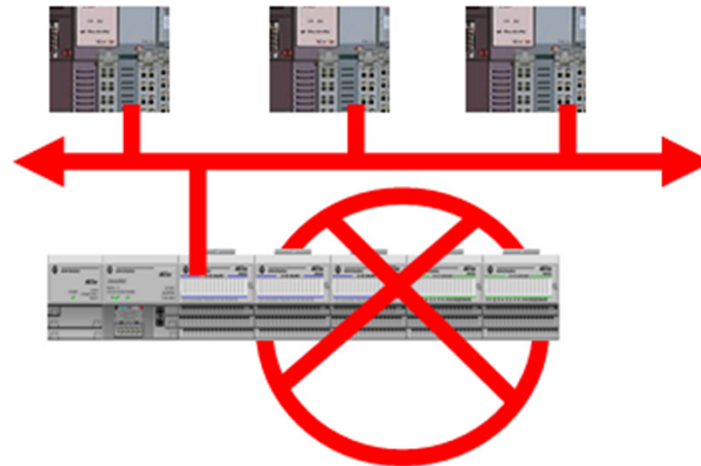
Great applications (2 of 2)

- **"Panel Net"** **The networking of power products inside an MCC or DeviceNet devices in other control enclosures is easily done on DeviceNet. This simplifies the wiring and allows advanced diagnostic and configuration to be done easily to the products over the network. IntelliCenter and DeviceNet Capable MCCs are a perfect use of DeviceNet networking. Using Linking Devices these MCCs can be connected quickly back to a control system.**

- **A true "DeviceNet"** **Limit switches, photo eyes, sensors that would be typically hardwired to I/O modules**
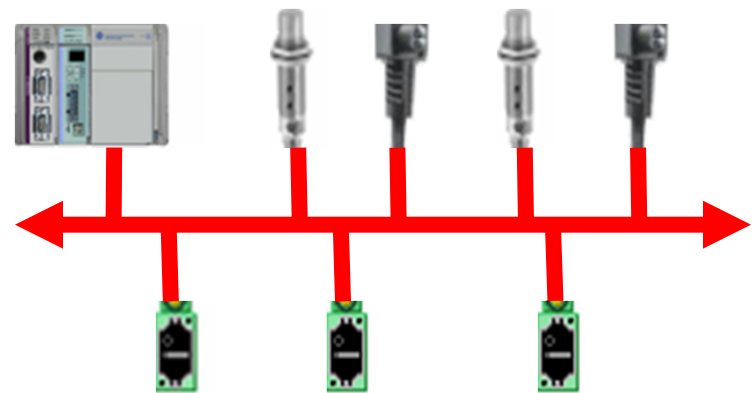
Linking Devices on DNet

- When using either ControlNet or EtherNetIP as a "backbone" network, it is easy to use the Linking Devices offered by Rockwell to bring in "Zones of DeviceNet IO" back to the control system. These zones are actually groups of DeviceNet devices in the same general area. But they may be a longer distance from another group of devices, that can be handled, by a single DeviceNet network. A linking device can be simply placed in this area, to interface to the DeviceNet devices and bring the data back to the control system over the "backbone" network. This will generally eliminate most issues with the node number and distance limits of DeviceNet.

- The Linking Devices 1788-CN2DN for ControlNet and 1788-EN2DN for EtherNetIP, act as a master scanner on the DeviceNet network. When connected onto the backbone, network, the IO data for the DeviceNet network is passed to/from the control system. This takes advantage of the increased distance capabilities of ControlNet and EtherNetIP to easily distribute DeviceNet devices over much larger distances.
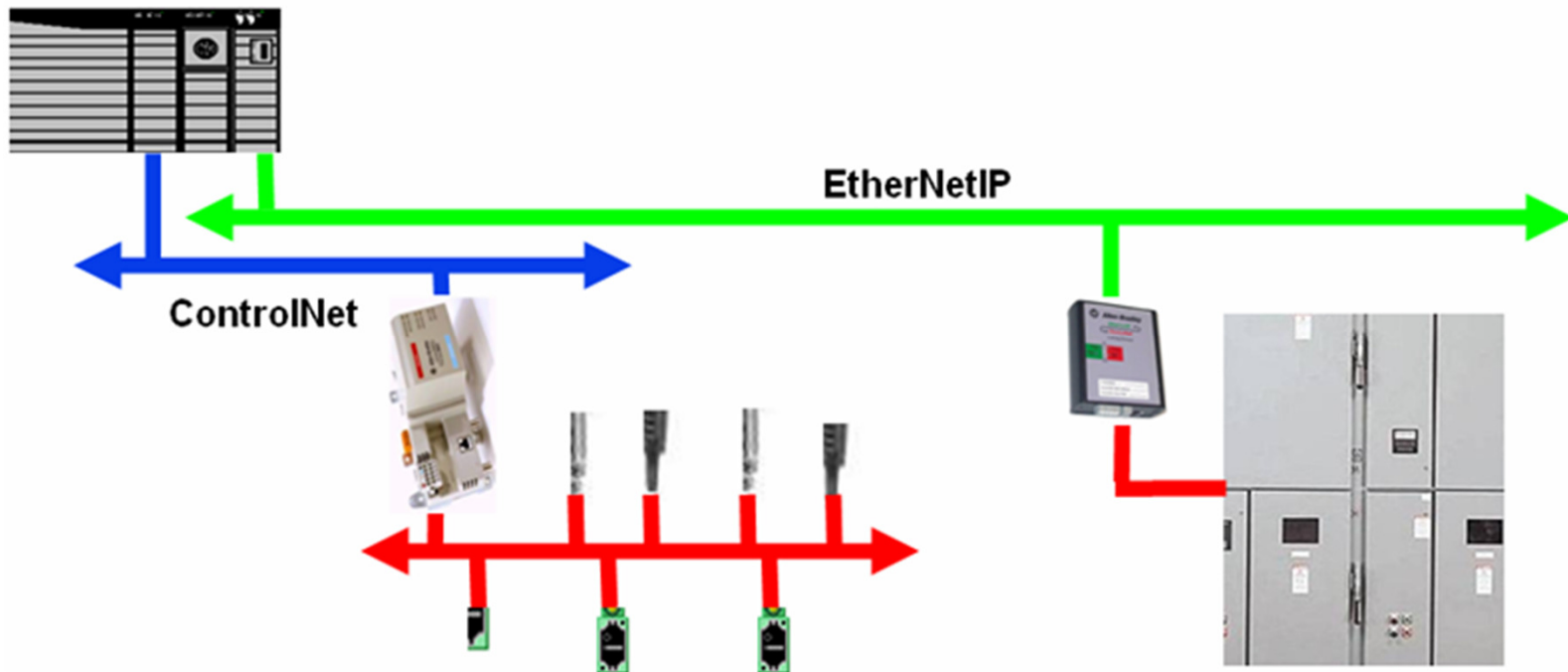
A Network the US Navy Depends On!!!!

11 DeviceNet based cargo handling systems are installed on each United States Navy Nuclear Powered Aircraft Carrier from CVN-70 through CVN-77. Rudder control and steering on CVN-70 and CVN 76 have been retrofitted to a new, standard DNet Interface card

Builders Sea Trials May 5 - 8, 2003

| Thumbnail | Description | Next Page>> |

030505-N-0610T-001
Precommissioning (PCU) Unit Ronald Reagan (CVN 76) May 5, 2003 -- Sailors aboard the soon-to-be USS RONALD REAGAN (CVN 76) took the world's newest aircraft carrier out to sea for the first time during Builder's Sea Trials off the coast of Virginia. Official U.S. Navy photo Petty Officer 2nd Class (PH2 (NAC)) James Thierry

View>>

Download>>
Printable image

PHYSICAL LAYER

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Did you know??

95% OF ALL DeviceNet NETWORK PROBLEMS IN THE FIELD ARE MEDIA or INSTALLATION RELATED!
Moral: <u>USE PUBLICATION DNET-UM072C-EN-P !!</u>
(Formerly DN-6.7.2)

General Information

- **Refer to media selection publications 1485-CG001A-EN-P and 1485-SG001A-EN-P for excellent information on picking media components.**

- **Support for up to 64 nodes**

- **Node removal without severing trunk line and under power.**

- **Protection from wiring errors. Reverse wiring protection circuitry built into devices.**

- **Selectable data rates: 125, 250, 500 K bits/sec**
  - **Not required to support all**
  - **Data rates trade speed for distances**

- **Trunk line-drop line topology**
  - **Branching allowed on drops**

- **Allows zero node separation**

General Information

- **Twisted pair, low loss, low delay cable**

- **Use of sealed or open connectors**

- **Support of both (opto)isolated and non-isolated devices**

- **Separate power bus contained in the cable**
  - **Support of both network-powered and self-powered devices**

- **High current capability (thick and flat cable supports up to 8 amps)**

- **Power taps that allow the connection of several power supplies. NOTE: Power Taps are only needed where power supplies are added to network outside of a sealed enclosure. Most power connections are made inside the main control cabinet using ordinary terminal strips.**

- **PowerTap replacement fuses are Littlefuse model 297 07.5 or similar, 7.5 Amp Fast Blow Automotive Type.**

DeviceNet Cable Highlights

🟥 Red			+24VDC (V+)
⬜ White			CAN-H
⬜ Bare			Shield
🟦 Blue			CAN-L
⬛ Black			+0VDC (V-)
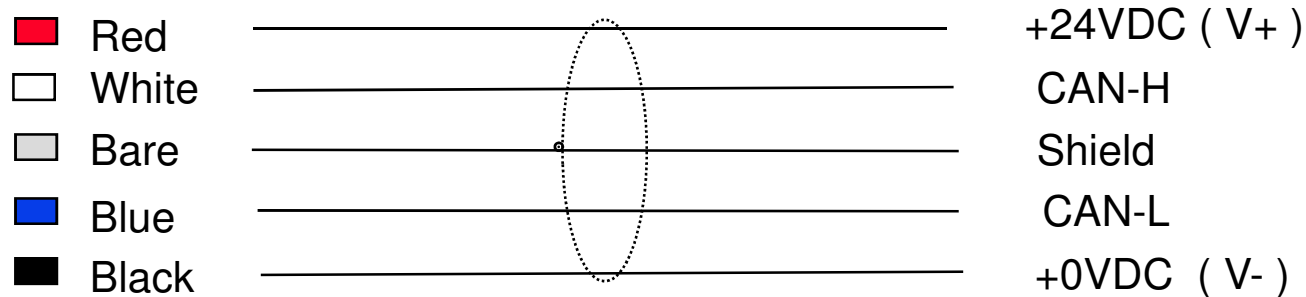
- **5 Conductors, 1 pair for 24 Volts DC power, 1 pair for CAN communication, 1 Shield**

- **Maximum current capability for 24 Volts DC in thick and flat cable is 8 amps. However no more than 4 amps is permitted in Class 2 thick cable per NEC requirements. (North America Only)**

- **Maximum current capability for 24 Volts DC in thin wire is 3 amps.**

Network Topology
(Trunkline - Dropline)

Terminator

Trunk

Tap

Terminator

Total Trunk Distance

Node Node

Drop Length

Node

Node

Node Node

Power Supply

Node

max 20 feet

Node

Node

Node

Branching Drop

Zero Drop

Daisy Chain Drop
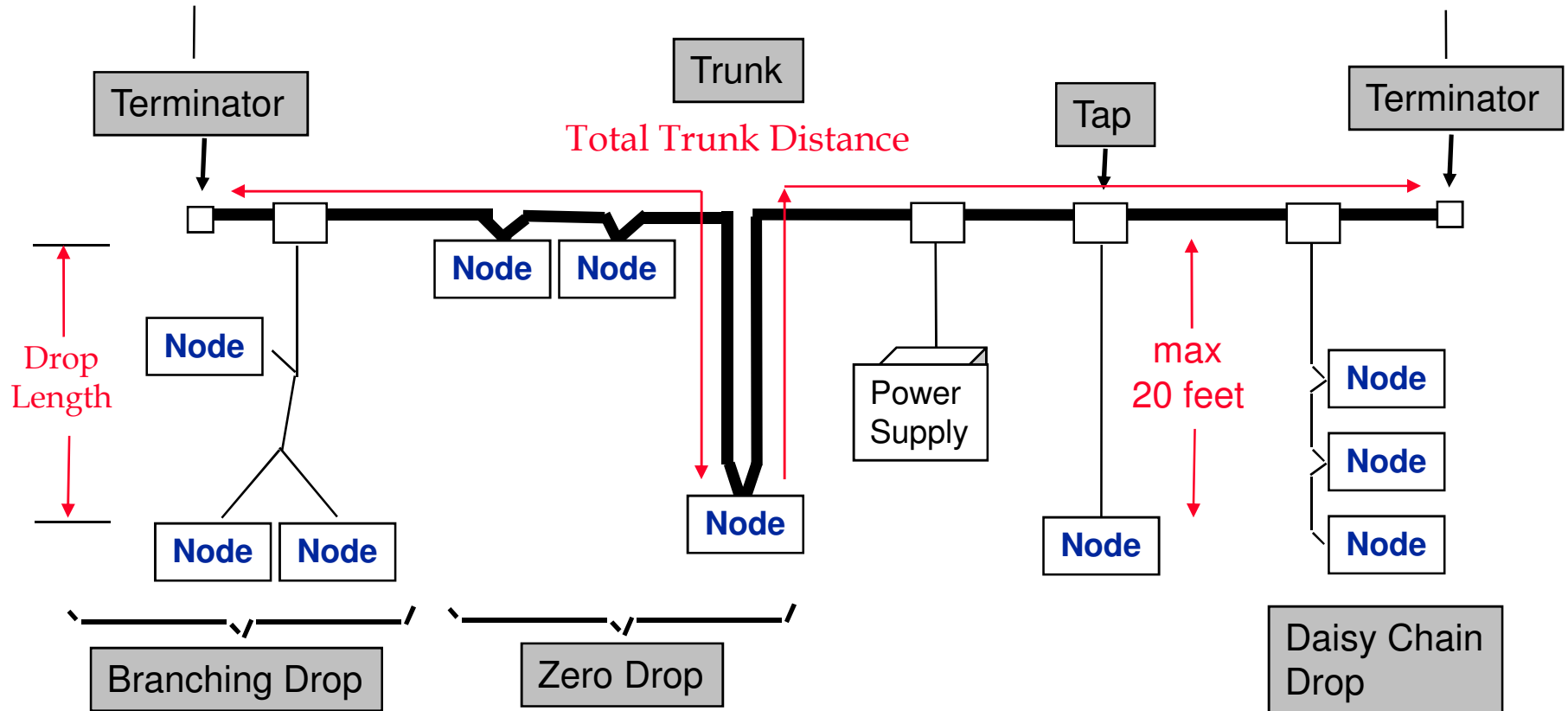
Power (24Vdc, 8A) & Signal to all devices on a single cable!

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Termination Resistors

- **Termination resistors are 120 or 121 Ohms, 1/4 Watt or larger**

- **They <u>MUST</u> be placed at each end of the trunk line between white and blue wires.**

- **There are both open and sealed versions.**

- **Do not use carbon resistors!! Metal film is preferable.**

DeviceNet Physical Media Terms

- **"Trunk" and "Drops" are topology terms.**
  - The trunkline is the "backbone" of your network.
  - Drops serve as physical connection mechanisms to the trunkline. Drop length up to 20 feet.

- **There are 5 types of cables: Thick Round, Flat (KwikLink) , Flat (KwikLink Lite) Thin Round cable and Class 1 Round drop cable.**
  - Thick, Flat (KwikLink) and Class 1 drop cables are rated for 8 amps of current. Class 2 thick cable, only 4 amps in North America.
  - Thin cable is rated for 3 amps of current
  - Thick, Flat and Thin cable can be used for "Trunk"
  - Class 1 drop cable is designed only for drops.

What is Class 1 and Class 2?

Class 1 installations require that all components of a cable be able to resist voltages in their vicinity of up to 600 Volts. This is especially important when DeviceNet is used in Motor Control Centers. All components, both trunk cable and drop cable, must be Class 1 rated for the entire system to be Class 1. Class 1 rated media available from Rockwell is KwikLink original trunk cable, Class 1 drop cable assemblies (See pictures below) and spools of Class 1 round trunk and Class 1 round drop cable. Up to 8 amps of current can be drawn through Class 1 round trunk and drop cables. <u>1485C-P1BSXXX catalog numbers are spools of Class 1 Thick, round cable, but distances are only 80% of regular thick, round cable.</u> In some catalogs the 871A-TS5-XXX Mini style field installable connectors are said to be only rated for 250V which would keep them from being used in a Class 1 system. This information is out of date and they can indeed be used in a Class 1 cabling system.

Specifications

Storage Temperature	-40°C to +85°C (-40°F to +185°F)
Operating Temperature	-25°C to +75°C (-13°F to +167°F)
Enclosure Rating	Unsealed: NEMA 1; IP60 (IEC 529) Sealed: NEMA 6P, 13; IP67 (IEC 529) and 1200psi (8270kPa) washdown
Vibration	1.5mm displacement @ 10 to 500Hz, 10G peak, 3 planes
Housing Material	Valox®
Dimensions	45mm x 49mm x 59mm (1.8in x 1.8in x 2.3in)

Mini Style Pigtail Drop IDC

PowerTap/Cable Drop IDC

Description

KwikLink pigtail drops/power taps are Insulation Displacement Connectors (IDC) with integral Class 1 round cables for interfacing devices or power supplies to flat cable. These components are Class 1 rated (8A at 24V DC) and are available in multiple lengths for application flexibility. Each model includes both the pigtail drop module and the insulation displacement connector. For additional information on the IDC connector, see page 12.

According to NEC regulations (North America Only), Class 2 Installations can only be in the vicinity of up to 300 Volts, but no higher. Class 2 cable systems can carry no more than 100 Watts. So doing a calculation of 100 Watts/24 VDC = 4.16 amps of maximum allowable current in a Class 2 cable. <u>The 1787-DNPS and 1606-XLSDNET4 power supplies are specifically designed to be used on Class 2 cabling systems.</u>

Cable	Catalog Number	Class	Shield	Comment	Belden
Round Thick Trunk	1485C-P1BSX	1	Yes	X=75, 200 or 420 m spool	7896A or 7897A
Round Thin Drop	2100H-DNRC1	1	No	50 m spool	7900A

Cable Budgets - Thick Trunk

Data Rates	125 Kbits/sec	250 Kbits/sec	500 Kbits/sec
Trunk Distance	500m / 1640ft	250m / 820ft	100m / 328ft
Max. Drop Length	6m / 20ft	6m / 20ft	6m / 20ft
Cumulative Drop	156m / 512ft	78m / 256ft	39m / 128ft
Number of nodes	64	64	64

Cable Budgets - Thin Trunk

Data Rates	125 Kbits/sec	250 Kbits/sec	500 Kbits/sec
Trunk Distance	100m / 328ft	100m / 328ft	100m /328ft
Max. Drop Length	6m / 20ft	6m / 20ft	6m / 20ft
Cumulative Drop	156m / 512ft	78m / 256ft	39m / 128ft
Number of nodes	64	64	64

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Cable Budgets – KwikLink Flat Trunk

Data Rates	125 Kbits/sec	250 Kbits/sec	500 Kbits/sec
Trunk Distance	420m / 1378ft	200m / 656ft	75m / 246ft
Max. Drop Length	6m / 20ft	6m / 20ft	6m / 20ft
Cumulative Drop	156m / 512ft	78m / 256ft	39m / 128ft
Number of nodes	64	64	64

Cable Budgets – KwikLink Lite Trunk

Data Rates	125 Kbits/sec	250 Kbits/sec	500 Kbits/sec
Trunk Distance	350m / 1148ft	150m / 492ft	55m /180ft
Max. Drop Length	6m / 20ft	6m / 20ft	6m / 20ft
Cumulative Drop	156m / 512ft	78m / 256ft	39m / 128ft
Number of nodes	64	64	64

Extending the Trunk or Drop distances

Communications - Bridges & Gateways

Bus Extender

WRC's WRC-CANX-DIN and WRC-CANX-NEMA CAN and the new fiber-optic version, WRC-CANR-NEMA Can Bus Extenders extend CAN Bus networks such as DeviceNet where cable length is determined by network data rates. WRC's Bus Extenders allow a user to extend either the trunk lines and drop line without sacrificing network speed.WRC-CANX and WRC-CANR do not consume a MAC ID and it is not necessary for software to consider any set-up of these devices.

Features Include:
- Isolated network extender
- Automatic speed selection or fixed baud rate
- No address selection required
- Multiple extenders can be used in serial, daisy-chain fashion with fixed baud rates
- Powered from 24 VDC supplied by DeviceNet or by the user (on each side of the repeater)

DeviceNet Features

Device Type:
- Explicit Peer to Peer Messaging
- I/O Peer to Peer Messaging
- Configuration Consistency Value
- Faulted Node Recovery
- Master/Scanner

Baud Rates: 125K,250K,500K

I/O Slave Messaging:

wrcakron.com
WRC

Western Reserve Controls, Inc.
1485 Exeter Road
Akron, OH 44306
USA

Phone: (1) 330-733-6662
Fax: (1) 330 733-6663

Web: www.wrcakron.com
e-mail: sales@wrcakron.com

Various Companies make network extenders for both the trunk and drop lines, but I like these products from WRC best. Each unit allows another maximum length of cable to be added to either the trunk or drop lines of a network. For thick, round media, that would mean another 500 meters per unit. Multiple units can be used to extend the trunk or drop even more. This unit can also convert to fiber optic for outdoor or high noise areas. The units cost around $300 each and have become very popular. Note: These units store and repeat, which means they will ACK packets on the local network and retransmit them on the remote network. This will impart a small network delay of .5ms, along with the amount of time for a retransmit of the packet, when doing performance calculations. This maximum packet time for

8 bytes at 125 kbits/sec is 1 msec, at 250 kbits/sec is .5 msecs and at 500 kbits/sec is .25 msecs .

Mixing Media on the Trunk

Always use the cable limits of the lowest distance media in the mix for the entire network. In other words if you use flat and thin media then use the max trunk line distance for the thin media for the whole network. If you use thick and flat media in a mix, then use the maximum trunk length of the flat media for the whole network. It doesn't matter whether there is much smaller length of the lower distance cable compared to the higher distance cable on the network. To avoid doing some complicated, risky calculations, just use the "weak link theory" and spec out the max distance of the lower distance media.

When combining Flat media and any other shielded media. Connect the shield wire of the shielded media to the V- wire of the Flat media, when making that transition. Remember to only ground the V- wire at only one location in your network.

Wireless Modems on DeviceNet

Communications - Bridges & Gateways

Data Portal

Wireless sensor interfaces for DeviceNet - Matric's Wireless CAN Bridge and Data Portal provide two methods for DeviceNet communication without the limits of wire. These systems are ideal for mobile applications or environments that can damage fragile wiring.

Wireless CAN Bridge - This system extends DeviceNet's flexibility by implementing a wireless CAN bus that is transparent to nodes on either side of the wireless link. All DeviceNet data rates are supported and a full 64 node network can be implemented over a typical range of 500 feet indoors.

Wireless Data Portal - This system allows up to 5 separate DeviceNet networks to share data in a wireless data pool. Each Data Portal appears as a node to its respective scanner. The scanners can access read and write objects on the Data Portal which contain data that is duplicated in all the other Data Portals. All DeviceNet data rates are supported over a range up to 300 feet.

DeviceNet Features

Device Type: Generic
- Explicit Peer to Peer Messaging
- I/O Peer to Peer Messaging
- Configuration Consistency Value
- Faulted Node Recovery
- Master/Scanner

Baud Rates: 125K,250K,500K

Matric

Matric
2099 Hill City Road
Seneca, PA 16346
USA

Phone: (1) 800 462-8742
Fax: (1) 814 678-1301

Web: www.matric.com
e-mail: sales@matric.com

These modems act as invisible wireless connections between the Device Net networks they are attached to. They are very useful for moving machinery, where cable connections are not feasible. Matric has a short distance version capable of going up to 200 feet while the long distance version can go up to1400 feet.

Connector Fun Facts

- 5 pin Phoenix Male pin connector for making extension cables.

5	Dnet plug, 5 position, black, Phoenix Male	22186-084-01	Phoenix Contact Inc

- Open style Phoenix connector selections. (UL rated for two stranded wires per terminal 16 gauge to 24 gauge)

Catalog no. 1799-DNETSCON, PN 942154-05 (with jack screws)
Catalog no. 1799-DNETCON, PN 942153-05 (without jack screws)

Jack Screw   Jack Screw
Red   Black
White   Blue
Shield wire if using Belden 7896A
cable, ground shield at one end only
5 pin linear plug (open)   4170

probe holes   1787-PLUG10R
mechanical key   mechanical key
jack screw   jack screw
Black   Red
Blue   White
          Shield or Bare
10-pin linear plug (open)   41708

Note: Ordering 1787-PLUG10R gets a box of <u>10</u> of these connectors

- Open style Phoenix, female connector with jack screws, to sealed style micro male pin connector. Catalog number 1799-DNC5MMS.

Connector Fun Facts

- IP67 Rated Bulkhead connectors for bringing sealed media into enclosures

Description	Catalog Number
Bulkhead passthru, 5-pin Micro Female to Male	**1485A-CXR5-D5**
Bulkhead passthru, 5-pin Mini Female to Male	**1485A-CXN5-M5**
Bulkhead passthru, 4-pin Mini Female to Male	**889A-CXN4-M4**

- Open style Y adapter

Product Selection

Female Connector (x1)	Male Connector (x2)	Electrical Rating	Catalog Number
Open-Style DeviceNet	Open-Style DeviceNet	24V, 8A	1485P–P1J5–UU5

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Thick Cable Components

Thick Trunk Round Media

Typical Configuration
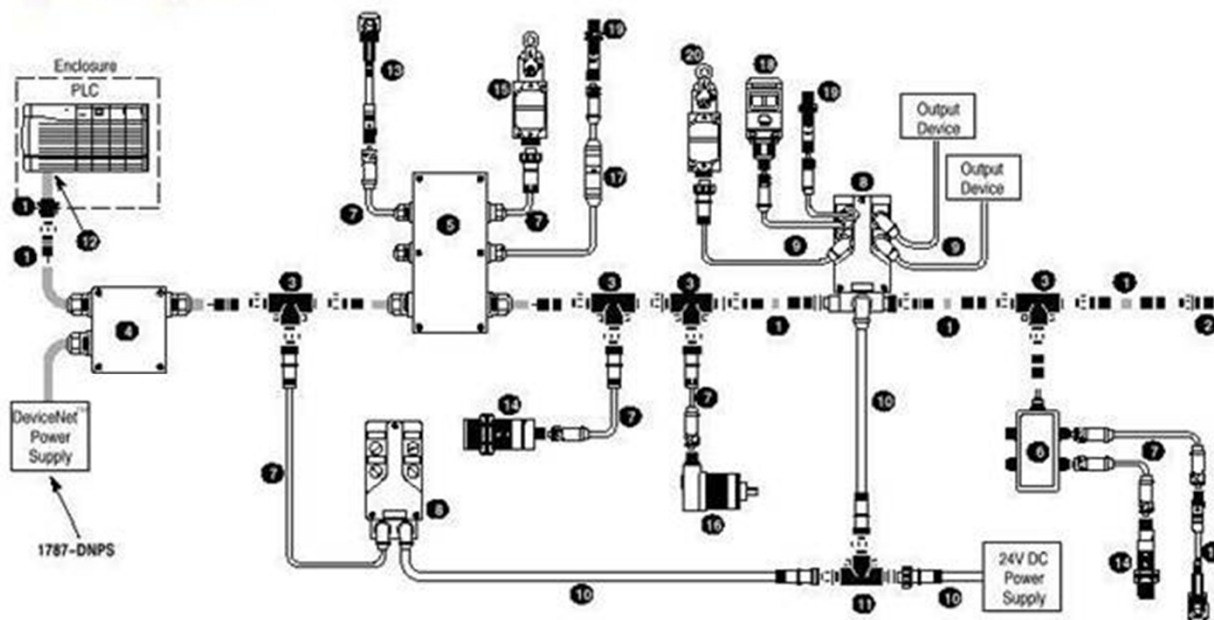
● Thick Trunk Cable . . . . page 22	● ArmorBlock MaXum . . . . . . page 31	● DeviceNet Limit Switch . . . . page 70
● Terminator . . . . page 23	● ArmorBlock Cordsets . . . . . page 32	● DeviceNet Encoder . . . . page 72
● T-Port . . . . page 24	● Aux Power Cable . . . . page 34	● DeviceLink . . . . page 52
● Power Tap . . . . page 25	● Aux Power Tee . . . . page 35	● Standard Photoelectric
● DeviceBox . . . . page 26	● Open Terminator . . . . page 36	● Standard Proximity
● DevicePort . . . . page 27	● DeviceNet Photoelectric . . . page 60	● Standard Limit Switch
● Thin Drop Cable . . . . page 28	● DeviceNet Inductive page68	

See the *Sensors* Catalog.

1485-CG001A-EN-P

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Sealed Thick Components

Thru-Trunk Style DevicePort Tap

Trunk Connection Type	Drop Connection Type	Number of Drop Ports	Part Number
Mini Male / Mini Female	Mini Female	4	1485P-P4N5-MN5
		6	1485P-P6N5-MN5
	Micro Female	4	1485P-P4R5-MN5
		6	1485P-P6R5-MN5

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Sealed T-Taps for Thick Media

- **Tee Tap**
  - Keyed left & right
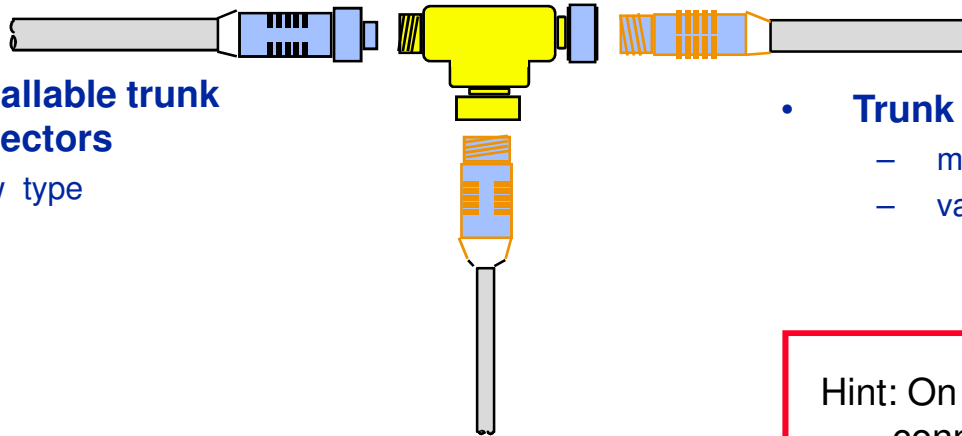
- **Field Installable trunk line connectors**
  - screw type

- **Trunk line segments**
  - molded minior micro connectors
  - various lengths

- **Drop lines**
  - mini or micro molded connectors
  - up to 20ft
  - mini, micro or pigtail at sensor

Hint: On most mini style female connectors, the female sockets are split barrel style. Some manufacturer's female sockets may spread under use and cause intermittent connections and network problems. This can happen on T-Taps or cable connectors.

Thick Cable Description

- Signal pair (#18), blue/white

- Power pair (#15), black/red

- Foil/braid shield with drain wire(#18)

- PVC/nylon insulation on power pair

- Industrial temperature range

  - Storage: -40° C to +85°C

  - Operating: -20° C to +60° C @ 8A

    - derate linearly to 0A at 80° C

- Flame resistant, UL Oil Res. II

- 0.480 inch / 12.2 mm diameter

- .0045 ohms/foot / .015 ohms/m on Power Pair

- Cable bought on spools from Rockwell is rated for Class 2 installations ONLY.

DeviceNet Thick Cable

Beldfoil Aluminum/Polyester Shield

Vinyl Jacket
0.480" O.D.

Polypropylene Fillers

Blue & White Data Pair
Datalene Insulation

18 AWG.
Tinned and Stranded
Copper Conductors

65% Coverage
Tinned Copper Braid Shield

Stranded Drain Wire
Tinned Copper
18 AWG.

15 AWG.
Tinned and Stranded
Copper Conductors

Red & Black DC Power Pair
PVC/Nylon Insulation
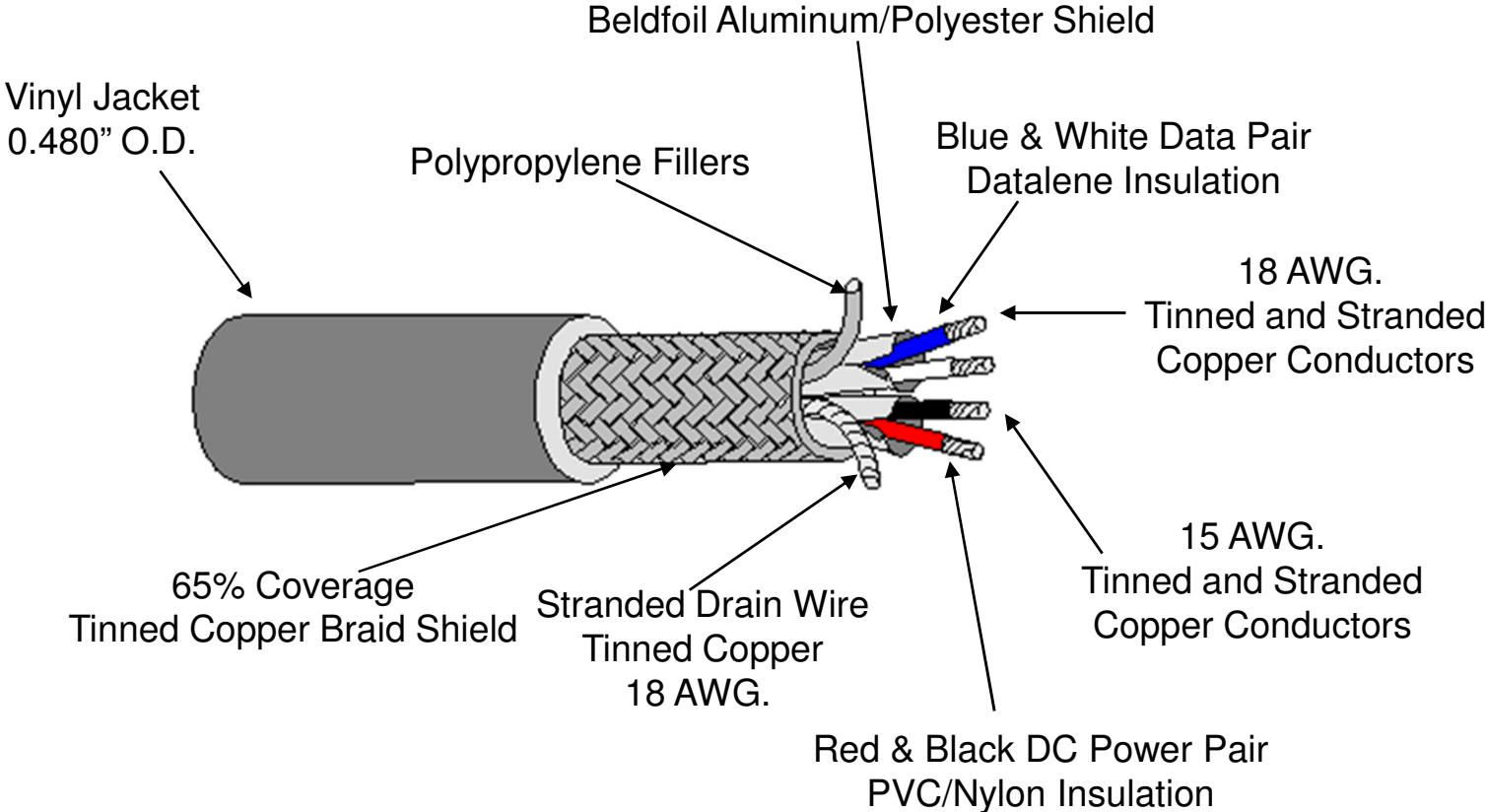
Thick Cable	Belden	Class	Capacity (DC Amps)
Grey PVC	7897A	1	8
Grey PVC	3082A	2	4
Yellow CPE	3083A	2	4

Thin Cable Components
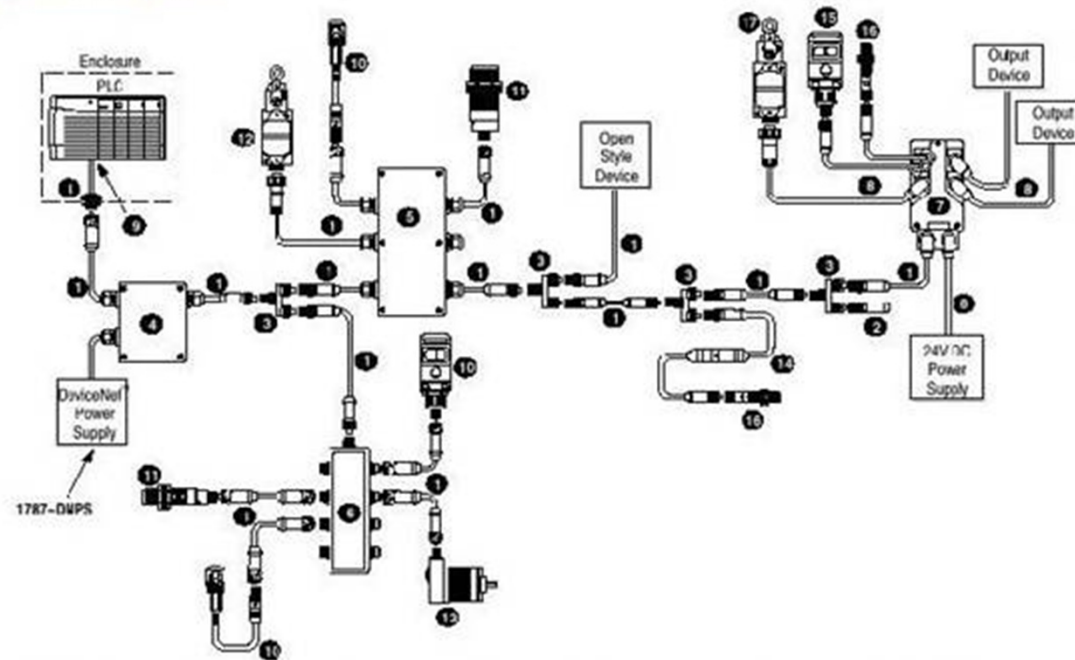
Short thin media, drop cables.

(Micro male straight connector to micro female straight connector.)

1485R-P05FR5-D5

(.5 feet 6 inch drop cable)

1485R-P0X5R5-D5

(.5 meters 1.5 feet drop Cable)

Typical Configuration

① Thin Trunk/Drop Cable .... page 38
② Terminator .... page 41
③ T-Port .... page 42
④ Power Tap .... page 43
⑤ DeviceBox .... page 44
⑥ DevicePort .... page 45
⑦ ArmorBlock MaXum ..... page 46

⑧ ArmorBlock Cordsets ...... page 47
⑨ Open Terminator .... page 49
⑩ DeviceNet Photoelectric ... page 60
⑪ DeviceNet Inductive ...... page 68
⑫ DeviceNet Limit Switch .... page 70
⑬ DeviceNet Encoder .... page 72
⑭ DeviceLink .... page 52

⑱ Standard Photoelectric
⑯ Standard Proximity
⑰ Standard Limit Switch

See the *Sensors* Catalog.

1485-CG001A-EN-P

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Thin Cable Description

- **Signal pair (#24), blue/white**

- **Power pair (#22), black/red**

- **Foil/braid shield with drain wire(#22)**

- **PVC/nylon insulation on power pair**

- **Industrial temperature range**
  - **Storage: -40° C to +85°C**
  - **Operating: -20° C to +70° C @ 3A**
    - **derate linearly to 0A at 80° C**

- **Flame resistant, UL Oil Res. II**

- **0.270 inch / 6.9 mm diameter**

- **0.0222 ohms/ft / 0,073 ohm/m on power pair**

- **Cable bought on spools from Rockwell is rated for Class 2 installations ONLY.**

DeviceNet Thin Cable

Beldfoil Aluminum/Polyester Shield

Vinyl or CPE Jacket
0.270" O.D.

Polypropylene Fillers

Blue & White Data Pair
Datalene Insulation

Overall Mylar Tape

24 AWG.
Tinned and Stranded
Copper Conductors

22 AWG.
Tinned and Stranded
Copper Conductors

65% Coverage
Tinned Copper Braid Shield

Stranded Drain Wire
Tinned Copper
22 AWG.

Red & Black DC Power Pair
PVC/Nylon Insulation

Thin Cable	Belden	AB number
Grey PVC	3084A	YR-29832
Yellow CPE	3085A	YR-39660

DeviceNet Power Supplies
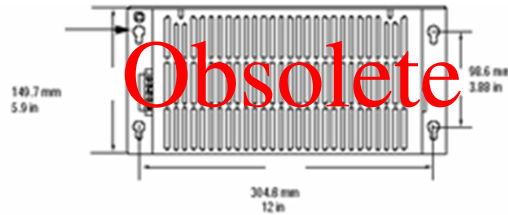
Obsolete

1787-DNPS   1606-XLS

- The 1787-DNPS is a Class 2 rated, ODVA compliant Power Supply capable of 4 amps of current at 24VDC. This power supply is currently obsolete and the 1606-XLSDNET4 described below should be used instead.

- The 1606-XLSDNET4 is also a Class 2, ODVA Compliant power supply with the ODVA compliancy checkmark. Rated for 4 amps at 24VDC

- The 1606-XLSDNET8 is a Class 1, ODVA Compliant Power Supply with the ODVA compliancy checkmark. Rated for 8 amps at 24VDC.

- **Important Note: The 1606-XLDNET4 and 1606-XLDNET8 Power Supplies are NOT ODVA compliant or marked, <u>but will work just fine on DeviceNet networks regardless.</u>**

- **The 2100-DNBPS redundant power supply is used to power devices that get their power from the DNet network, such as the E3 overload. This supply can either get power from the DeviceNet network power or an external AC power source. It is handy if a device can not be powered down with the network power. Publication 2100-TD022A-EN-P describes this power supply in more detail.**

- **1606-XLSRED is a redundant power supply that gets its input from two different 24VDC power supplies. It's output is 24VDC and will still be powered if either of the power input power supplies are operational. It is still recommended to use 1606-XLSDNET4 or 1606-XLSDNET8 DeviceNet compliant power supplies as the input power to this unit.**

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DeviceNet Power Supplies Cont.

Backup Power Supply Connections   2100-DNBPS
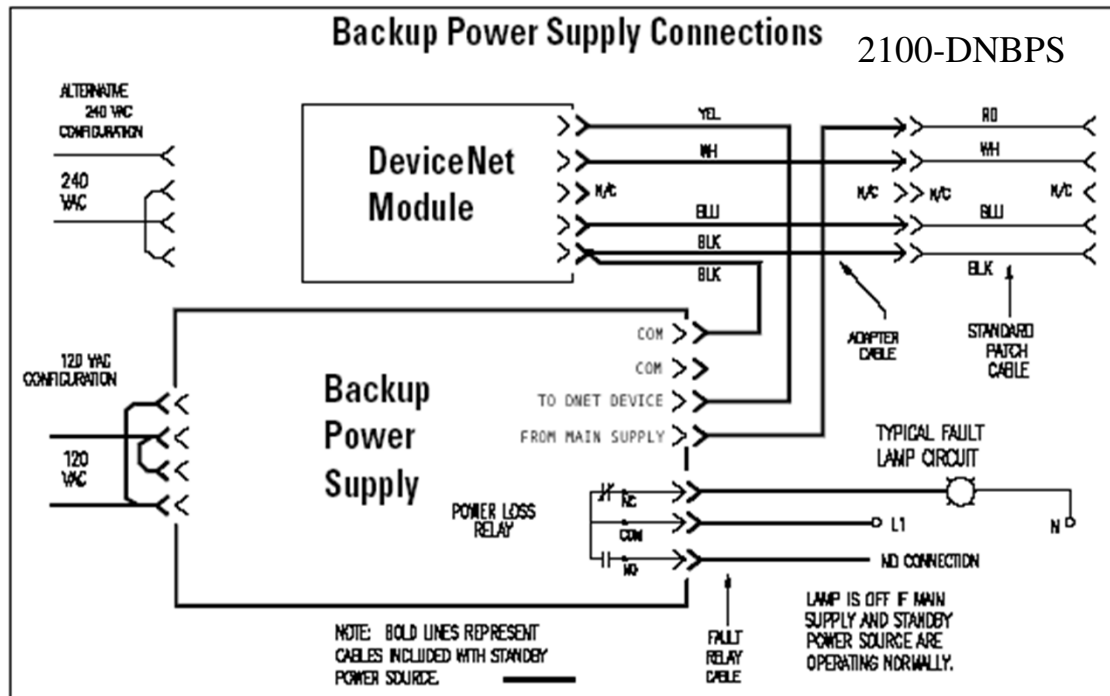
- The 2100-DNBPS is a 24VDC power supply used specifically in MCC enclosures to provide back up power to the E3 overload, Bulletin 100 DSA and other power products that get their entire operating power from the DeviceNet cable. The 2100-DNBPS gets its operating power from either a 110VAC or 220VAC power connection and supplies 24VDC at 250 ma. It is used so if the DeviceNet power is interrupted, this supply will take over and supply power to the device which allows the E3 overload to continue to protect a motor or have it's outputs stay energized even after a DeviceNet power interruption occurs. The 2100-DNBPS is an LV MCC unit insert and is available for sale via CIRCE through the LV MCC Business. Technical Data Sheet 2100-TD022-EN-P gives more details and specifications. Dimensions are 5.5" L X 2.5" W X 1.5" D.

On Machine Sealed Power Supplies

- The 1607 On Machine power supplies are sealed, IP67 rated 24VDC supplies that can be used on DeviceNet networks. They are not ODVA tested yet, but power supplies do NOT need to be ODVA approved to be used on DeviceNet network.

- 1607 Selection Guide Publication 1607-SG001-EN-P

Product Selection

Input Voltage	Output Power [W]	Output Voltage [V DC]	Output Current [A]	Inrush Current	Cat. No.
100...240V AC, 100...353V DC	48.0	24 (+1%)	2.0	<25 A	1607-XT50D1A
	91.2		3.8		1607-XT100D1A

Bulletin 1607 — ArmorPower™ On-Machine™ Power Supplies

- IP67 and NEC Class 2 ratings
- Vacuum encapsulation technology
- Quick connectors
- Smooth surface, suitable for washdown

Standards Compliance
UL 508, UL 60950
CSA C22.2 No. 14
CSA C22.2 No. 60950-1
EN/IEC 60950

Certifications
UL Listed (File Number E56639
Guide No. NMTR)
cURus Recognized(File
Number E168663 Guide
Number QQGQ2/QQGQ8)
CE Marked

Pinouts

Input

Pin	Connection
1	NC
2	L
3	N

Output

Pin	Connection
1	+
2	+
3	-
4	-

KwikLink
4-wire Flat Cable
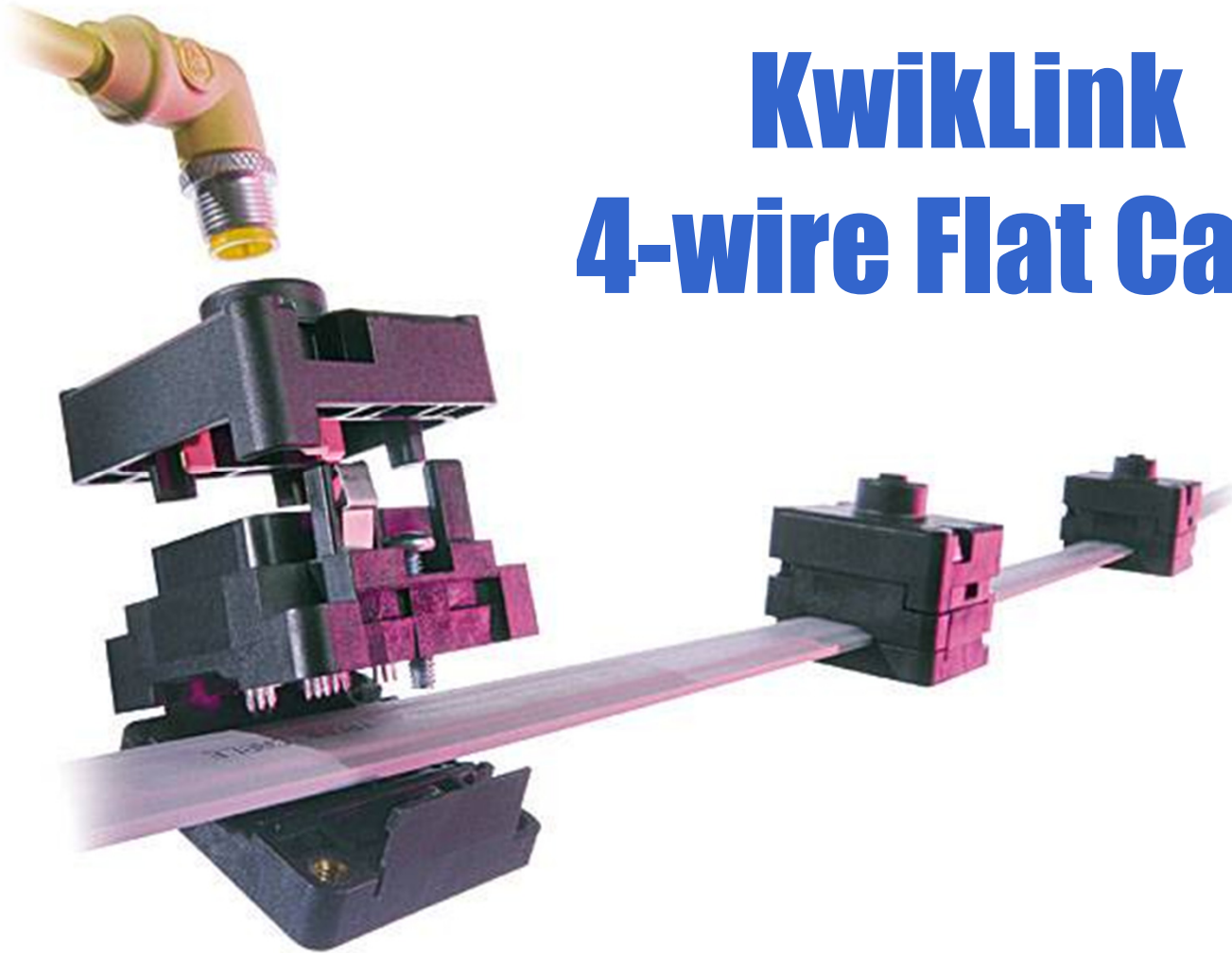
Insulation Displacement Connector (IDC) Used for KwikLink Flat Cable

Flat Wire

Four through-holes for mounting entire assembly

Module Top

"Sealed style"
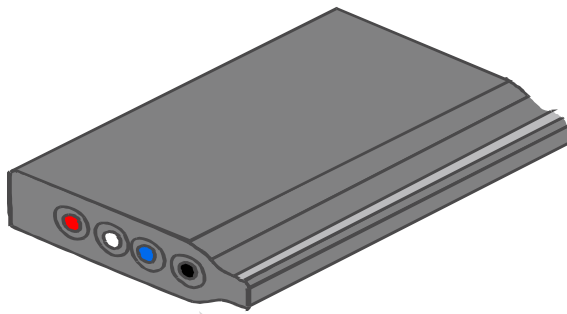
"Open style"
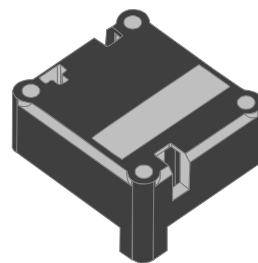
Mechanically-keyed 4-wire flat cable

"Snap-on" connection

Term. Resistor

Two retentive screws for driving blades through cable

DeviceNet Flat Media

DeviceNet Cable

+24Vdc   CAN_H   CAN_L   0 Vdc

.0049 ohms/ft / .016 ohms/m on power pair

DeviceNet Power, 8 Amps Max.

Auxiliary Power Cable

+24Vdc   User defined 1   User defined 2   0 Vdc

Output Power, 8 Amps Max.
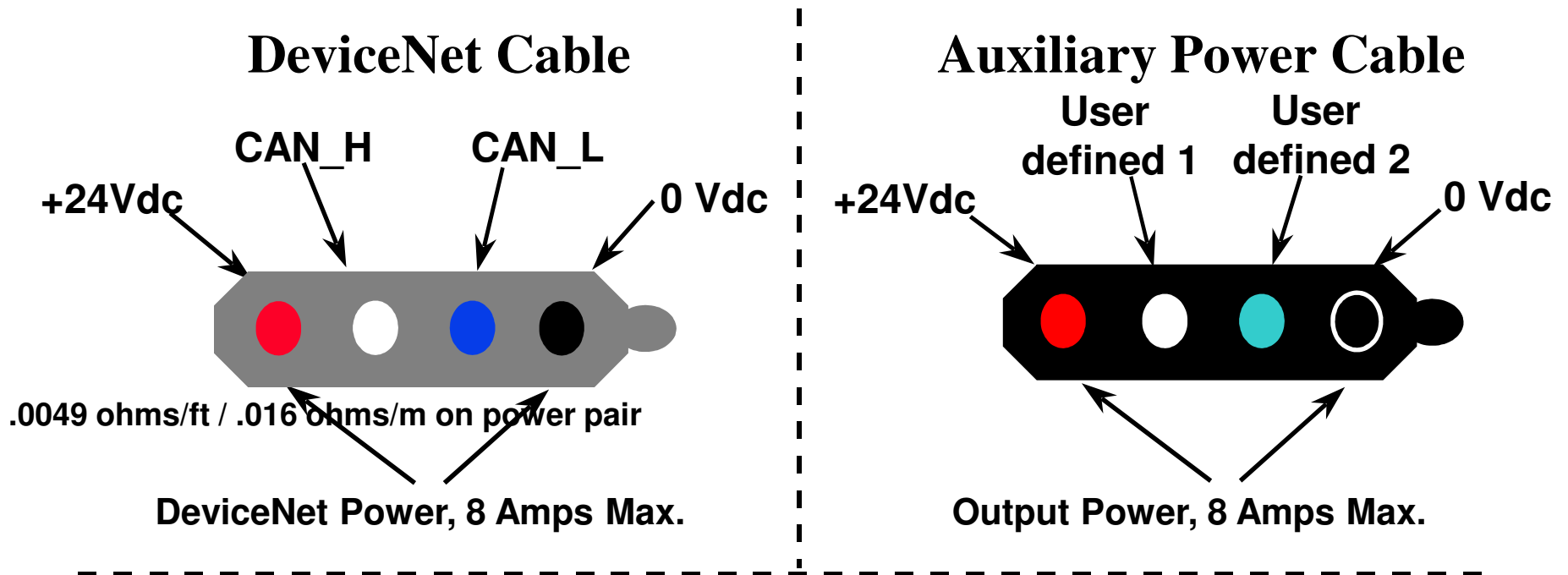
Media Features

- 600V, 8A rating, Class 1
- Physical key
- Fits in 1" conduit
- .0049 ohms/ft / .016 ohms/m on power pair
- Flame Resistance @ UL 1581 Vertical Tray CSA FT4

- Works with existing devices
- TPE / jacket
- Highly flexible

Note: Use ONLY bases with date code 98472 or later. Year = 98, Week = 47

KwikLink Fun Facts

- Standard Class 1 cable in spools 1485C-P1E75 (75m), 1485C-P1E200 (200m), 1485C-P1E420 (420m).

- Standard Class 2 cable in spools 1485C-P1G75 (75m), 1485C-P1G200 (200m), 1485C-P1G420 (420m).

- Highly Flexible Class 2 cable in spools 1485C-P1K75 (75m), 1485C-P1K200 (200m), 1485C-P1K420 (420m). CLASS 2 CABLE <u>SHOULD ONLY BE USED WITH GENERAL PURPOSE CONNECTORS 1485P-K1E4-R5. STANDARD KWIKLINK IDC CONNECTORS WILL NOT WORK ON THIS CABLE!!</u>

- Auxiliary Power cable in spools 1485C-P1L75 (75m), 1485C-P1L200 (200m), 1485C-P1L420 (420m).

- There is a new KwikLink General Purpose connector available catalog number 1485P-K1E4-R5 is a smaller, less expensive connector that comes in a micro style version only. This connector can be used with all three KwikLink trunk line cables. Environmental Rating is IP67 only.

- Original KwikLink connector environmental rating is IP67, NEMA 6P, 1200psi washdown.

- Standard class 2 KwikLink drop cables are only rated for 3 amps at 24VDC.

- Class 1 drop cables rated at 8 amps are also available with a raw cable end or a mini female pin, connector. Class 1 drops are NOT available to a micro style connector since the connector is not rated for 8 amps.

- KwikLink Radiated Immunity Testing Publication Number 1485-WP001A-US-P gives details on how KwikLink cable, without a shield, can still be highly noise immune.

- <u>Some of the Kwiklink interface tops with date codes 04300 to 05200 may have intermittent connections when installed. This problem will only show up at installation and the tops, not the bases should be replaced, if this problem is seen.</u>

- Publication Number 1485-CG001A-EN-P is the media selection guide that includes KwikLink media.

Flat Cable Components

1485-CG001A-EN-P

KwikLink Lite 4 wire Flat Cable
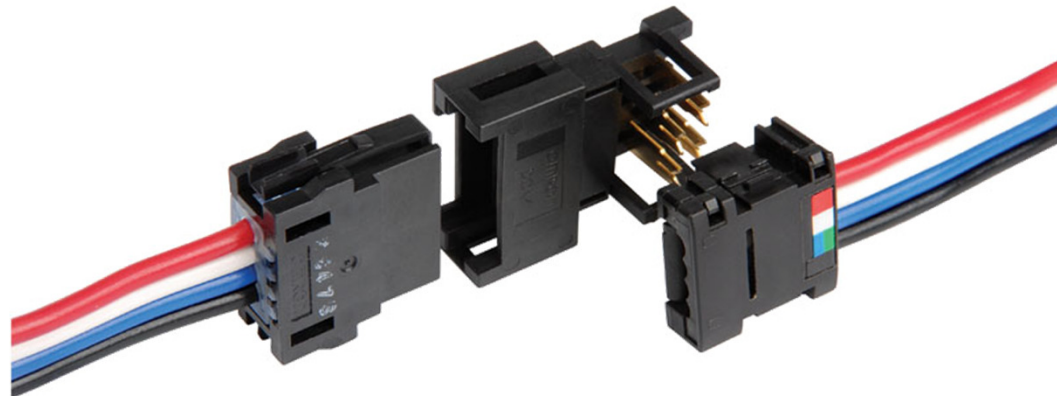
KwikLink Lite Fun Facts

- Similar to standard KwikLink in that it uses Insulation Displacement Connection (IDC) technology to pierce into the flat cable to make network connections.

- KwikLink Lite media is rated IP 20 and is perfect for use inside an enclosure. For those who are IP challenged, IP20 means the media is rated for protection against solids 12 mm (millimeters) or greater and has no liquid protection.

- The Open Style Terminal block 1485P-K1TLR4 is used to apply power to the network. It only has the V+ and V- signals brought out to terminals. It has a termination resistor built inside so it must be installed at one end of the trunk line only.

- When converting over to thin round media, make sure to use the KwikLink thin cable that does not contain a shield wire. The unshielded cable is grey, compared to the yellow shielded thin cable.

- While using a pair of parallel pliers is recommended for crimping on the connectors, I found that a pair of channel lock pliers worked equally well.

- KwikLink Lite media is available for sale NOW!!

KwikLink Lite Cable Components

1 - KwikLink Lite IP20 Flat Media	1485C-P1W200
2 - Trunk Line Connector	1485P-K1TG4
3 - Drop Line Connector	1485P-K1DL4
4 - Terminating Resistor	1485P-K1TR4
5 - 5-pin Open Style Connector	1485P-K1G4-Y5
6 - Terminal Block	1485P-K1TLR4
7 - Flat to Thin Cable Converter	1485P-K1GK4
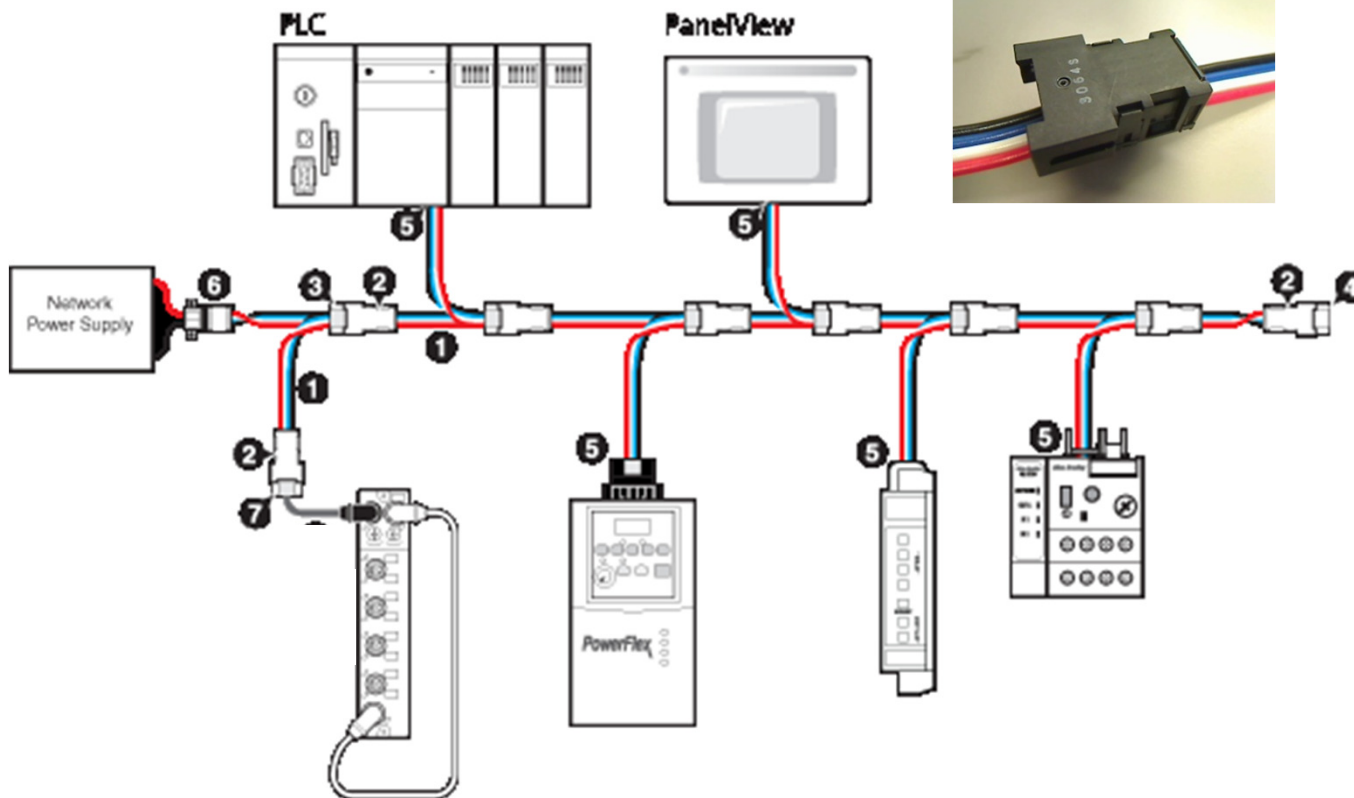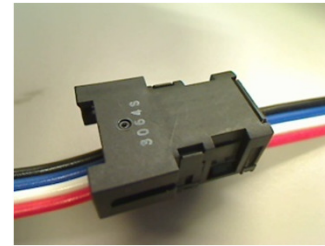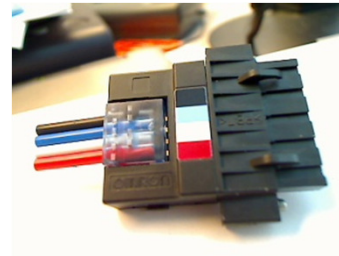
Power Bus Capabilities

- Single & multiple supply configurations

- High current capability by using multiple power supplies.

- Easy to meet supply specifications. 1606-XLSDNET4 and 1606-XLDNET4 power supplies are both rated Class 2 capable for 4 amps of current at 24VDC. Power supply calculation tools available. DeviceNet Assistant or DNETPWR.XLS in 9240-GTSTK toolkit.

- **A change has been made to the policy, so that device output power can now be wired to the DeviceNet network power supply. Consult the Cable Planning and installation guide DNET-UM072C-EN-P, Appendix B for guidelines, before attempting this. Remember that the output current must also be added into the common mode calculations.**

- DeviceNet specifications state that 24VDC power supplies must power up to full voltage in no more than 250ms under full load and 7000uF capacitance. Failure of power supply to follow this specification will cause devices to Bus Off (solid red network LED) when AC is switched on to the power supply. If devices go Bus Off when AC is applied, cycle DC power off then on at the supply and see if devices still Bus Off. If they don't then power supply is out of spec. If they still Bus Off, then you have other issues with your network.

NETWORK GROUNDING

- **V- (Black Wire) and Shield (Bare Wire) MUST be connected to a good earth ground at only <u>one</u> location on a DeviceNet System.**

Signal

Signal

Shield

V-

V+

Power Tap

V-   V+
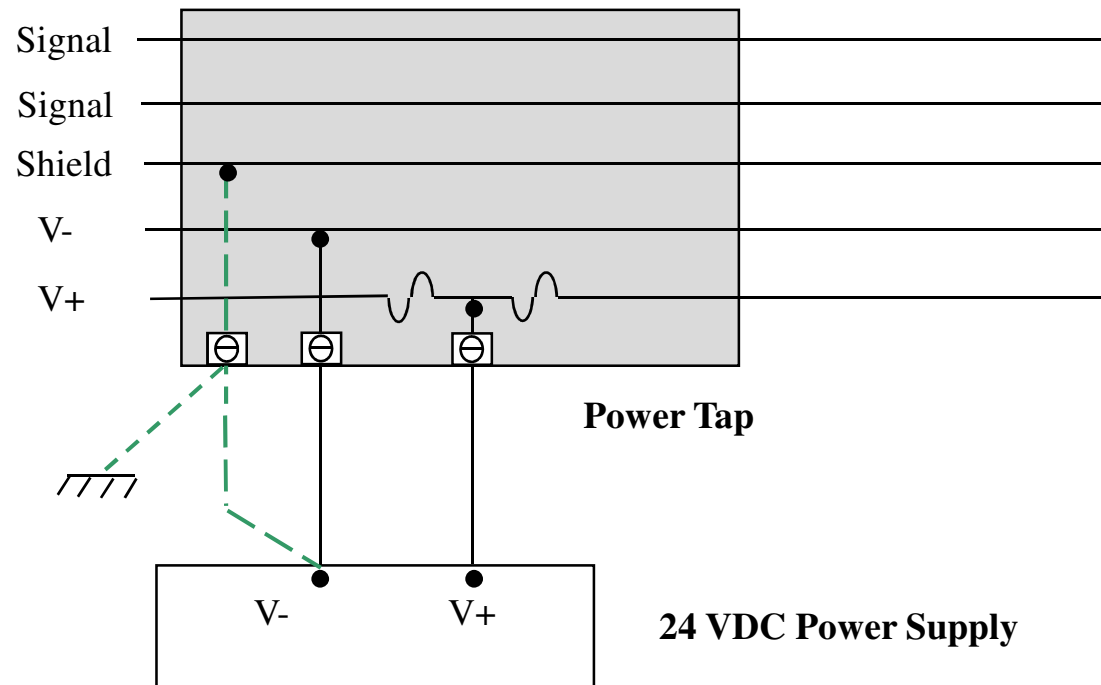
24 VDC Power Supply

Single Supply Configuration
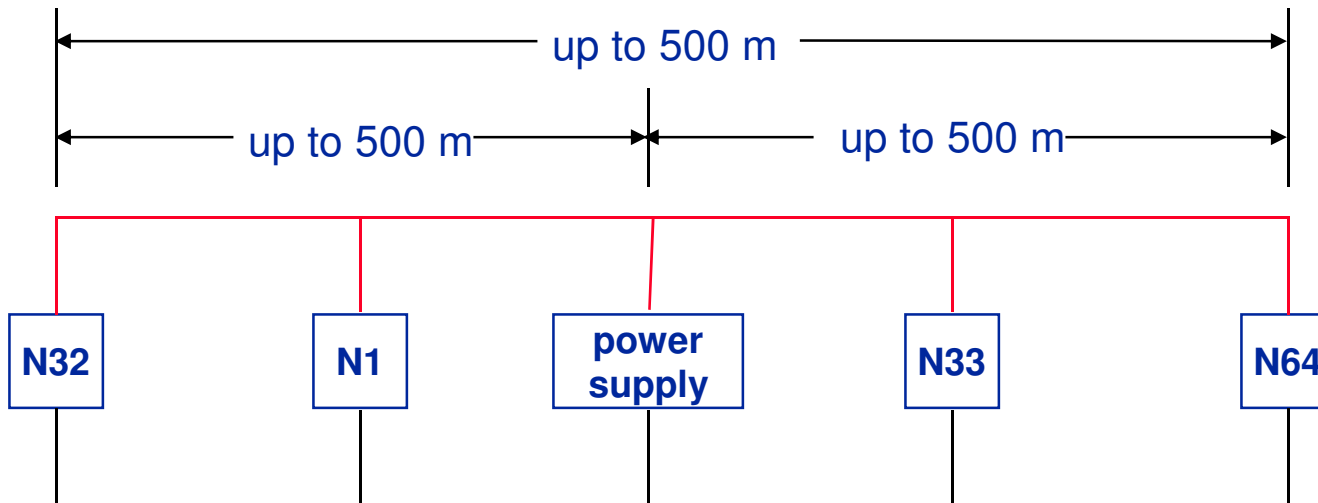
- **Characteristics and Advantages**
  - **Power supplies can be located anywhere on the network**
    - **Must consider IR losses along cable**
  - **Greater current than most comparable networks**
    - **Up to 8 amps (NEC limits to 4 amps for Class 2 thick, round media)**
  - **Power supplies are standard, low cost models**

Two Supply Configuration (Current Boost)

up to 500 m

| N1 | Power Supply | N32 | N33 | Power Supply | N64 |
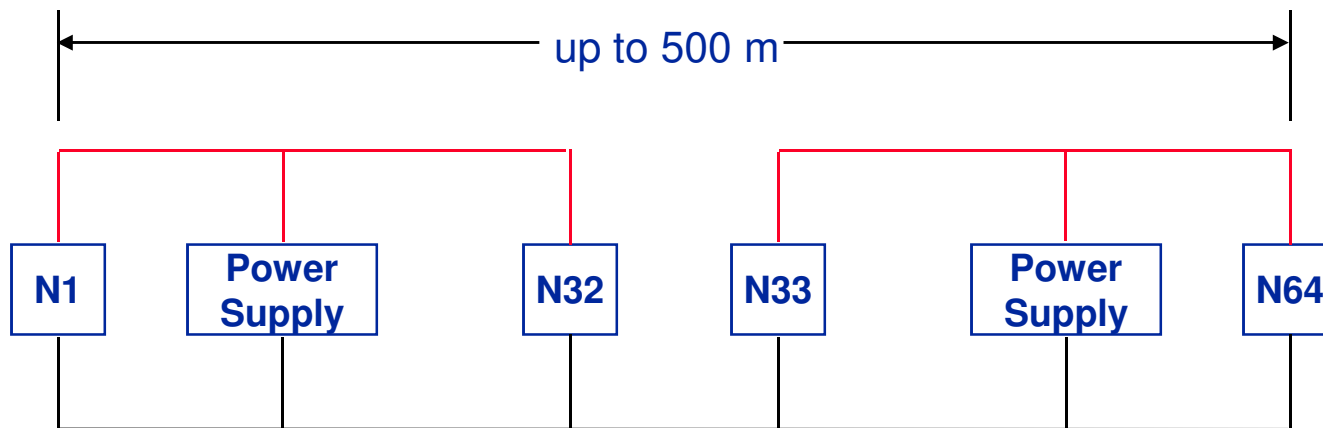
- **Characteristics and Advantages**
  - **Loads shared by supplies so same low cost supplies are used**
  - **Substantially more current**
    - **Still 8 amp limit on any branch of the trunk (NEC limit of 4 Amps for Class 2 thick round cable)**
  - **Supplies can be located anywhere (consider IR losses)**

Topology for Power Along the Bus

Optional Second Supply

24 V Power Supply

24 V Power Supply

Node

Node

Node

Node

——— V+ Power Conductor

——— V- Power Conductor

——— CAN-H, CAN-L, Shield
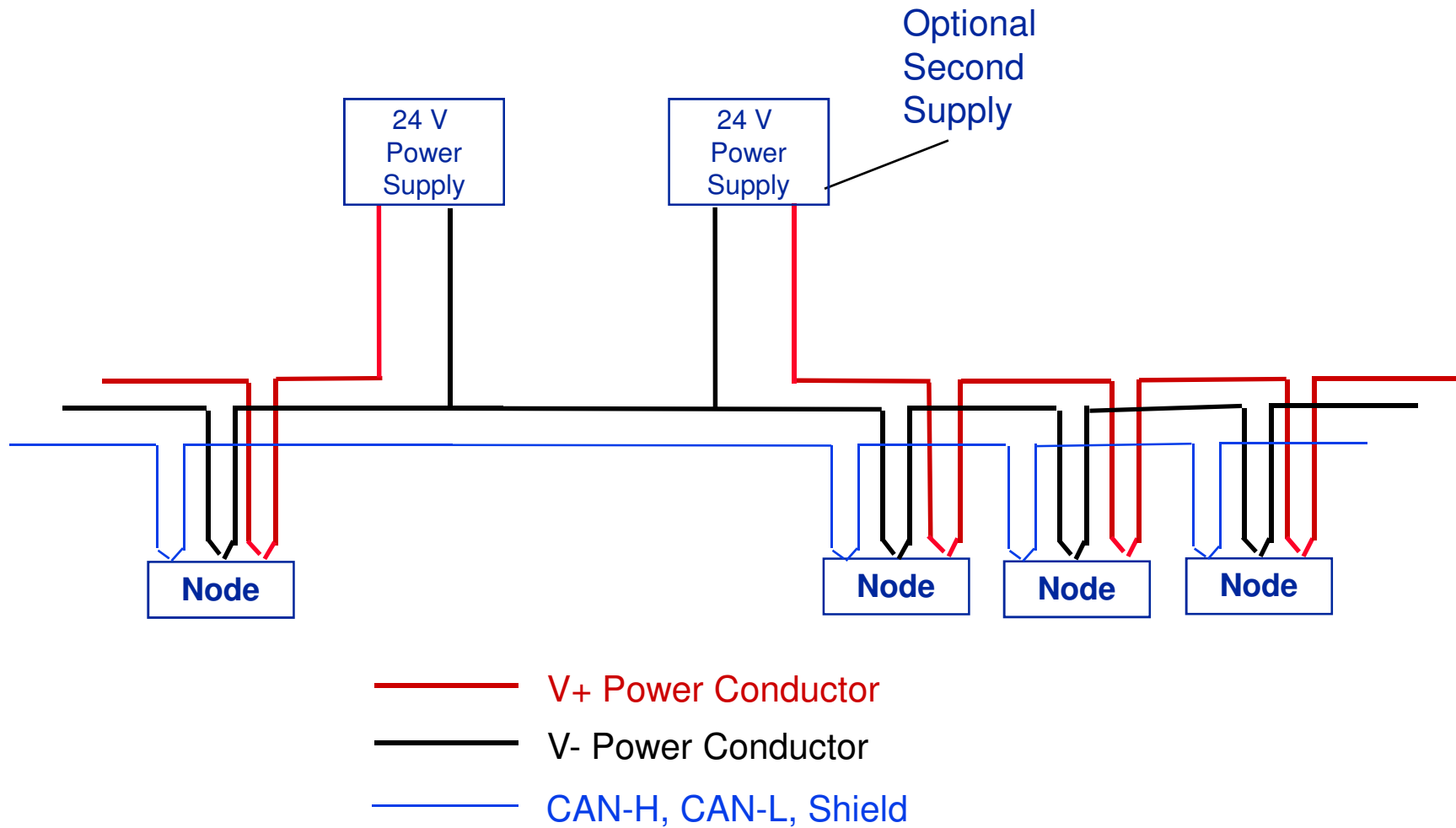
Power Utilization of Devices

- All devices have a source voltage range of 11 VDC to 25VDC. Some devices will draw more current as the source voltage drops.

- All devices on a DeviceNet network will draw at least 60 milliamps of current off of the 24VDC network power. This is because all products, regardless of type, at the minimum will have their transceiver circuitry powered from the network power!!!

- Some devices are designed to draw all of their power off of the network power through the DeviceNet connection entirely. Examples of these type of products include Series 9000 Photoeyes, DeviceLinks and an all input ArmorBlock.

- Some devices will have their power requirements satisfied by another source of current such as external AC voltage or DC voltage through terminal strips. Examples of these type of products include the DTAM Plus, FlexI/O and the Bulletin 160 drive.

- The last category of products are those with outputs driving AC loads or higher current DC loads. These products will have transceivers and electronics powered by the DeviceNet network power, but the output circuitry will be powered from an external connector or terminal strip. A classic example device is an ArmorBlock with 2 or 4 DC outputs. In this case a 3 pin mini connector is provided to connect in a source of 24 VDC to power the output circuitry ONLY.

E-Stops with DNet

On a DeviceNet network containing only standard DeviceNet devices, all E-stop circuits must be hard wired to kill power to all output devices. Normally all output devices will have an additional connector, terminal strip, etc. to connect Aux power to. This power is ultimately used to power the outputs connected to the device through the output circuits of the device. The E-Stop circuit must kill power to all auxiliary power connections of all output devices. This ultimately turns off all outputs in the system. **Obviously, if you are using DeviceNet Safety, it is allowed to network E-Stop and safety devices directly on the DeviceNet network, because the devices are specifically designed for this implementation. See the section on DeviceNet Safety in this document for more details.**

It is not normally necessary to kill the network power to the DeviceNet network during an E-Stop condition. In fact it is handy to take another set of contacts from the E-Stop switches into an input device connected to the network. Once the E-Stop input is added to the network, it is easy to determine which E-Stop switch was actuated from data received by the master scanner.

66
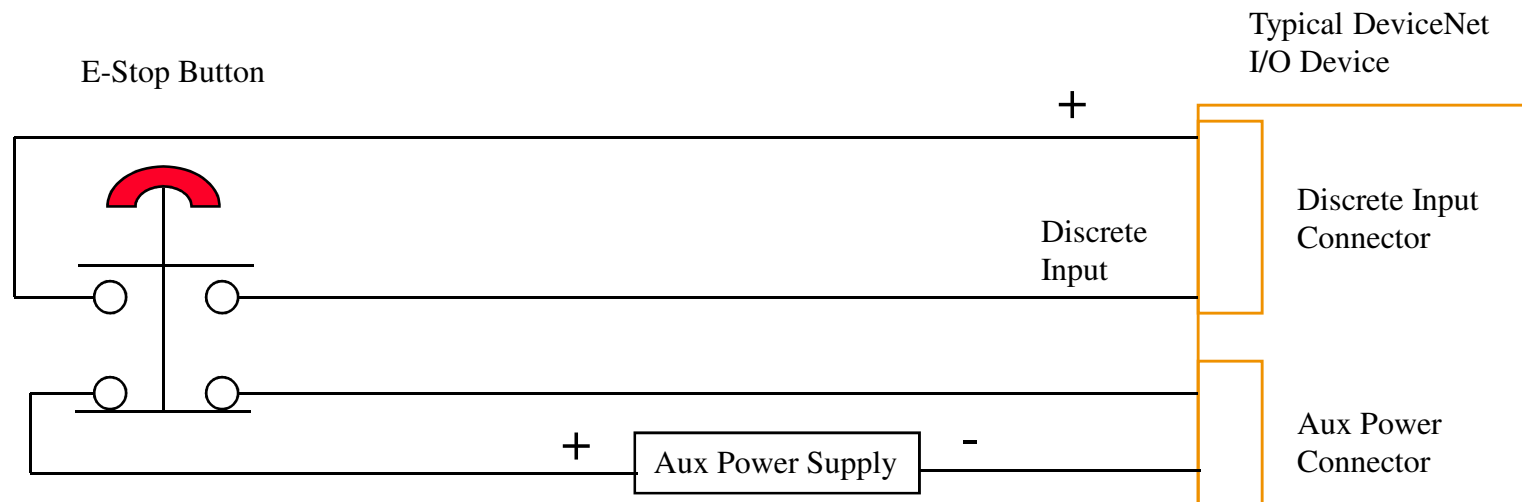
Common Mode Voltage

When current is drawn through the power pair on the DeviceNet trunk line, the length of the cable and current draw becomes important. The thick wire, normally used for trunk line, has a resistance of 0.0045 Ohms/foot. So as the distance from the DeviceNet power supply connection becomes greater, the power pair will act as a resistor whose value will be equal to 0.0045 multiplied by the Distance From The Power Supply (In Feet). At any particular point on the power pair the Common Mode Voltage will equal the Current being drawn on the power pair at that point times the Resistance of the Power Pair. (V = I X 0.0045 X Distance)

The effect of the Common Mode Voltage is that the V+ line will lower gradually from the 24VDC at the power supply as you move farther down the trunk line. More importantly the V- wire will gradually raise from the 0VDC value at the power supply along the length of the trunk line. On most networks the amount of voltage the V+ lowers and V- raises are equal. So even though there may be exactly 24VDC measured at Network Power Supply, further down the cable the voltage on the V+ and V- wires may only be 20VDC. This effect is due to Common Mode Voltage and should the voltage drop become too large the network will fail to operate properly. Since the CAN-H (White Wire) and the CAN-L (Blue Wire) both are referenced to the V- wire, if the V- line varies more than 4.65 VDC at any two points on the network the CAN tranceivers will fail to operate properly.

An easy way to measure for Common Mode Voltage problems is to go the the farthest ends of the network and measure between the Red V+ and Black V- wires. This voltage should NEVER be less than 15 Volts. **The Integrated Architecture Builder software will allow Common Mode Voltages to be easily and accurately calculated for most networks.**

DeviceNet Spacing From AC Voltage

DeviceNet is a Category 2 network and you will need to adhere to the following spacing guidelines from publication 1770-4.1 (Industrial Automation Wiring and Grounding Guidelines)

Route this category of conductor cables:	According to these guidelines:
Category 1	These conductors can be routed in the same cable tray or raceway with machine power conductors of up to 600V ac (feeding up to 100 hp devices).
Category 2	• If it must cross power feed lines, it should do so at right angles. • Route at least 5 ft from high-voltage enclosures, or sources of rf/microwave radiation. • If the conductor is in a metal wireway or conduit, each segment of that wireway or conduit must be bonded to each adjacent segment so that it has electrical continuity along its entire length, and must be bonded to the enclosure at the entry point. • Properly shield (where applicable) and route in a raceway separate from category-1 conductors. • If **in a contiguous metallic wireway or conduit**, route at least 0.08m (3 in) from category-1 conductors of less than 20A; 0.15m (6 in) from ac power lines of 20A or more, but only up to 100 kVA; 0.3m (1 ft) from ac power lines of greater than 100 kVA. • If **not in a contiguous metallic wireway or conduit**, route at least 0.15m (6 in) from category-1 conductors of less than 20A; 0.3m (1 ft) from ac power lines of 20A or more, but only up to 100 kVA; 0.6m (2 ft) from ac power lines of greater than 100 kVA.
Category 3	Route conductors external to all raceways in the enclosure or in a raceway separate from any category-1 conductors with the same spacing listed for category-2 conductors, where possible.

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Hazardous Environments

Article 501 of the National Electric Code gives guidelines on how to install most wiring in a Hazardous Environment, Class 1 Div 1 and Class 1 Div 2. DeviceNet cable should be able to be installed in Hazardous Environments, as long as the NEC guidelines are followed for running of the cable. For example: NEC Article 501 appears to state that most wiring in these Environments require rigid, threaded, conduit to be used, with Explosion Proof fittings and approved seals must be located inside the conduit close to the enclosure.

Some DeviceNet thick, round cable has a PLTC rating which may help in easing the installation effort according to Article 501, by allowing it to be installed in a cable tray. Verify PLTC rating on any cable being used!!

Absolutely read and fully understand the NEC code starting with Article 501, before planning or installing DeviceNet cable in a hazardous environment!!!

Slip Rings

Slip rings can be used on DeviceNet as long as they adhere to the following specifications.

Parameter	Manufacture's Specification	General Requirements ControlNet/DeviceNet
Contact bounce or chatter at rated speeds or Delta R	30 mohms	No chatter should be allowed over the speed of the Slip Ring. Some Slip Rings may be rated in dynamic Resistance
DC contact resistance	Less than 100 mohm	5.8 mohms (measured) change De-rate system length by 30 ft for DeviceNet (mhoms/.0045). ControlNet low impact.
Life expectancy of slip ring	200 million revolutions	As maintenance cycles require
Shielding and ground isolation of shielding	~ 95 % shielded. Will require special mounting for Isolation	Case can be used as a shield, must be isolated from machine grounds.
DC current rating (DeviceNet)	250 ma /ckt.	Tested to # contacts * .250A/contact (DeviceNet)
Slip ring and brush construction (is Mercury used in the contact?)	Precious metals (Gold and Silver)	Watch for heavy metals such as Mercury
Signal to Noise (S/N)	60	30 minimum both networks
Number of circuits.	Consistent with application 4, 6, 8, 10, 32	2 ControlNet, 5 minimum DeviceNet.
Cross Talk	none	25 dB both networks
Isolation from adjacent circuits	500 V ac	500 V ac Minimum both networks
RPM rating	As application requires	Tested to 2000 rpm Should cover most applications

Slip Rings (cont)

To adequately test the device in a DeviceNet and ControlNet system, several different tests had to be performed. DeviceNet being a DC powered network, required both DC and signal quality testing. The slip ring tested was able to supply clean uninterrupted power when loaded to the maximum published current. In a two node network, DeviceNet signaling was clean and error free at the MAC level. The higher data rates of ControlNet, required that the test be performed different. The chance of a data error occurring in ControlNet is greater than DeviceNet due to the Bit width and expected noise. Therefore a special test fixture was designed and built to convert a continuous stream of data from a TTL level to ControlNet signaling and back. A random data generator was used to provide the data and statistics on BER Characteristics in an industrial network.

ControlNet systems do not allow the cable shield to be grounded at any point in the system. DeviceNet requires a single point ground (usually at the power supply) for the cable shields. The slip ring selection process must consider these factors when installed in to either system. Do not mix high voltages in the same slip ring package with DeviceNet and ControlNet systems, doing so could cause hazardous conditions and violate local codes.

The slip rings can be purchased from;

Michigan Scientific
730 Bellevue Ave.
Milford, MI. 48381-2209
Phone : 248-684-0035

        or

Michigan Scientific
Ance Rd. P.O. Box 206
Charlevoix, MI 49720-0206
Phone: 616-547-5511
Fax: 616-547-7070

Typical System Connections

Power Supply

+24V

0V

Normal Control Enclosure

Scanner Drop Cable With Phoenix Connector

V+

CAN-H

SHLD

CAN-L

V-

Trunk Line

Terminal Strip

1770-KFD/1784-U2DN Drop Cable with Phoenix Connector

Earth Ground
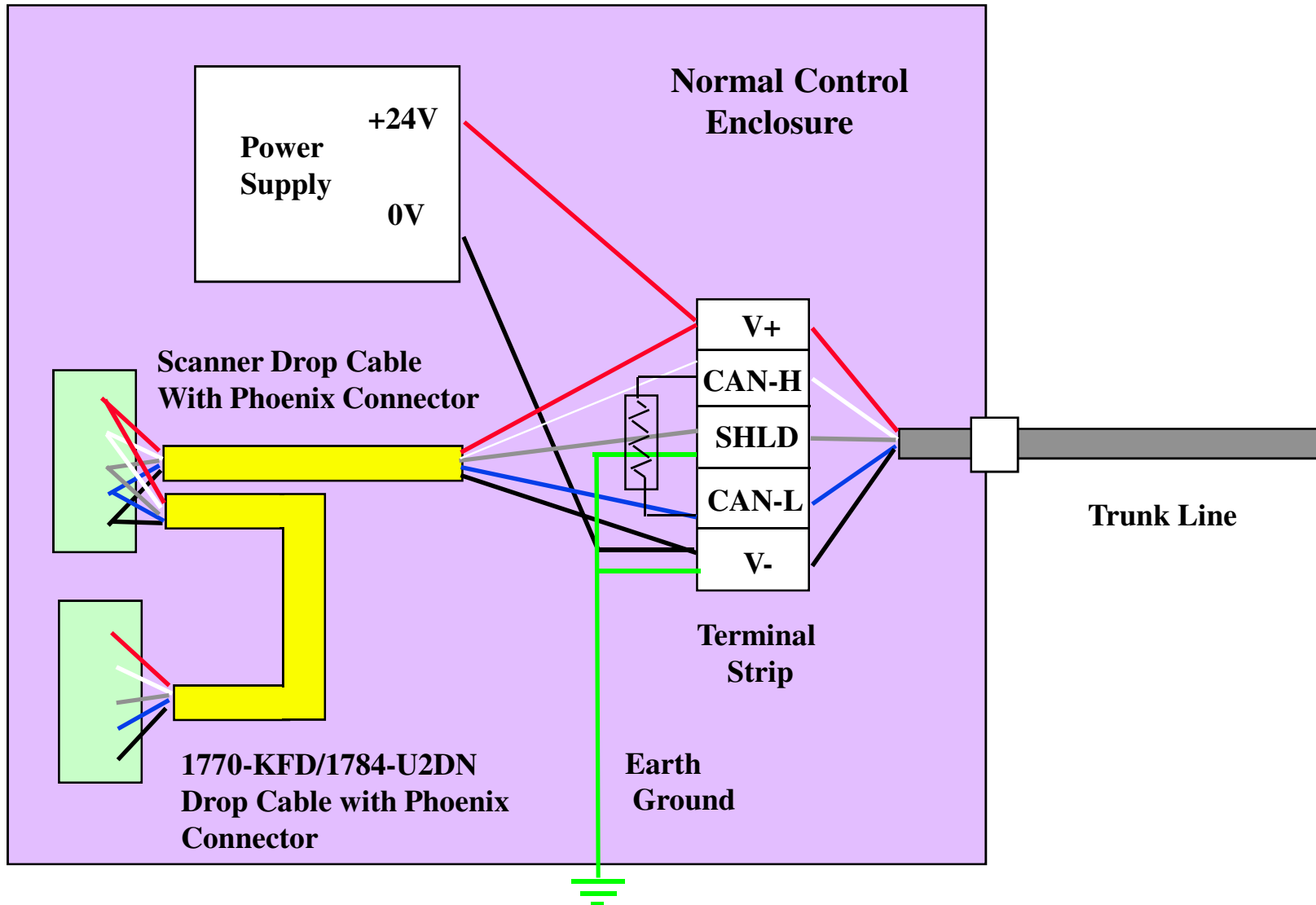
Node Commissioning of Devices

- **Every DeviceNet device needs at a minimum a unique node address (0-63) and appropriate data rate (125kb, 250kb, or 500kb) set prior to gaining access to the network.**

- **NOTE: devices default to address #63, data rate 125 kbps fresh out of the box.**
  - **Hardware (set via dip switches, push wheel)**
    - **e.g., RediSTATION**
  - **Software only (set via PC, HHT)**
    - **e.g., DeviceLink, ArmorBlock I/O**
  - **Both hardware and software**
    - **e.g., Series 9000 photoeye**
  - **"Autobaud"**
    - **e.g., Flex I/O, ArmorBlock I/O, DeviceView**

Configuring Devices on DeviceNet

Setting Up Internal Operating Parameters

- **Hardware**
  - **e.g., RediSTATION**

- **Software**
  - **Custom Applications**
    - **e.g., Drive Tools, GML, Flex I/O, AdaptaScan**
  - **Electronic Data Sheets (EDS)**
    - **RSNetWorx or DeviceNet Manager pre-installed**
    - **3.5" floppy disk w/device**
    - **Internet/BBS**
    - **Factory-stored on product**

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Replacing Devices

- **Connect device to system**

- **Set node address, data rate (or Autobaud)**

- **Configure device parameters**

- **Slave devices must pass electronic "key"**
  - Manufacturer
  - device type
  - part number

- **Auto Device-Replace (ADR)**

Automatic Device Replace
(ADR)

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Auto Device Replace（ADR）

- **RSNetWorx for DeviceNet software must be used to configure ADR feature.**

- **ADR consists of two parts which are Node Recovery and Configuration Recovery. Node Recovery cause the node number of the replacement device to be automatically changed to the node number of the original device. This feature needs the replacement devices node number to writable over the DeviceNet network and it's node number must be 63 to begin with.**

- **Configuration Recovery will cause the replacement devices configuration to be made identical to the original device. The replacement device must be able to have it's configuration written over the DeviceNet network. Configuration Recovery files are stored in the master scanner that is communicating with the original device by RSNetWorx.**

- **Electronic key of replacement device must match the original device exactly as defined in the scan list entry for the device**

All Rockwell Scanner Modules Support ADR

Original Device   Replacement Device

#55   #63
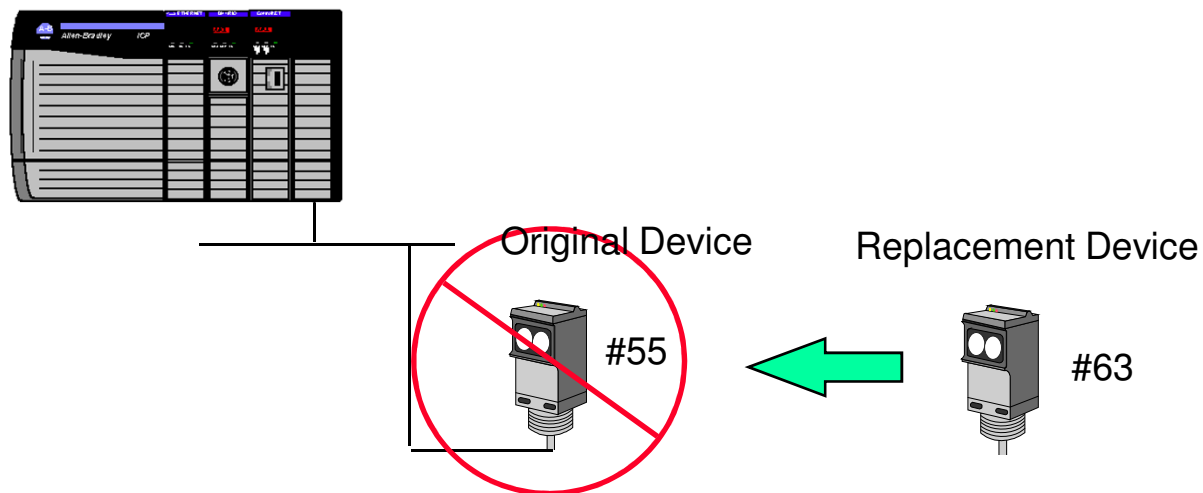
ADR (cont)

- **All Rockwell scanners <u>except the 1769-SDN</u> contain at least 65 kbytes worth of ADR configuration recovery, storage area. The 1769-SDN only contains 48K of ADR configuration recovery, storage area. The 1756-DNB Series C and D contains 1 Meg of ADR configuration recovery, storage area. Be aware that some of the larger AC drives ADR configuration may be up to 10 kbytes large. So be careful that the total configuration data for all slaves assigned to a scanner does NOT exceed the ADR space limit of the scanner you are using. If the ADR space is exceeded on a scanner, then another scanner will need to be added to the network to ADR to a portion of the slaves on the network.**

- **The 1756-DNB Series C and D both have 1 meg of ADR memory on them. Compared to 65K in Series A and B saccners.**

- **The Configuration Recovery feature of ADR will be automatically disabled if the Auto Scan feature is enabled in the scanner.**

- **Make sure that when configuring ADR in RSNetWorx software, that the latest slave device configuration is uploaded to the RSNetWorx project and saved. This is because when the configuration recovery configuration is loaded into the ADR configuration tool, it is NOT uploaded from the network, but is gotten from the project. If the latest device configuration is not already in the project, then factory defaults will be used for the ADR data. You can do an "upload all configuration " function, by clicking on any white space on the browse screen and right mouse clicking on Upload from Network selection. This will cause the latest configuration to be read into RSNetWorx and be used in the configuration recovery function to a slave device.**

- **The Series C and Series D 1756-DNB scanners have been tested and they handle the CCV (Class 1, Instance 1, Attribute 9) value correctly, with slave devices that support it. At least V9 of RSNetWorx for DeviceNet software reads the CCV from a slave device after it has been configured and stores it to the DNB when the ADR data is downloaded to it. The DNB reads the CCV value from the slave device before it attempts to download the devices configuration during an I/O connection restoration. If the CCV matches between the scanner and device, the ADR will not be downloaded to the device, because it's configuration also matches what is in the ADR data in the scanner. Devices who do not support the CCV, will have their ADR downloaded to them during EVERY I/O connection restoration, such as after a network power cycle.**

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MEDIA ACCESS

ISO11898 NOMINAL Signal LEVELS
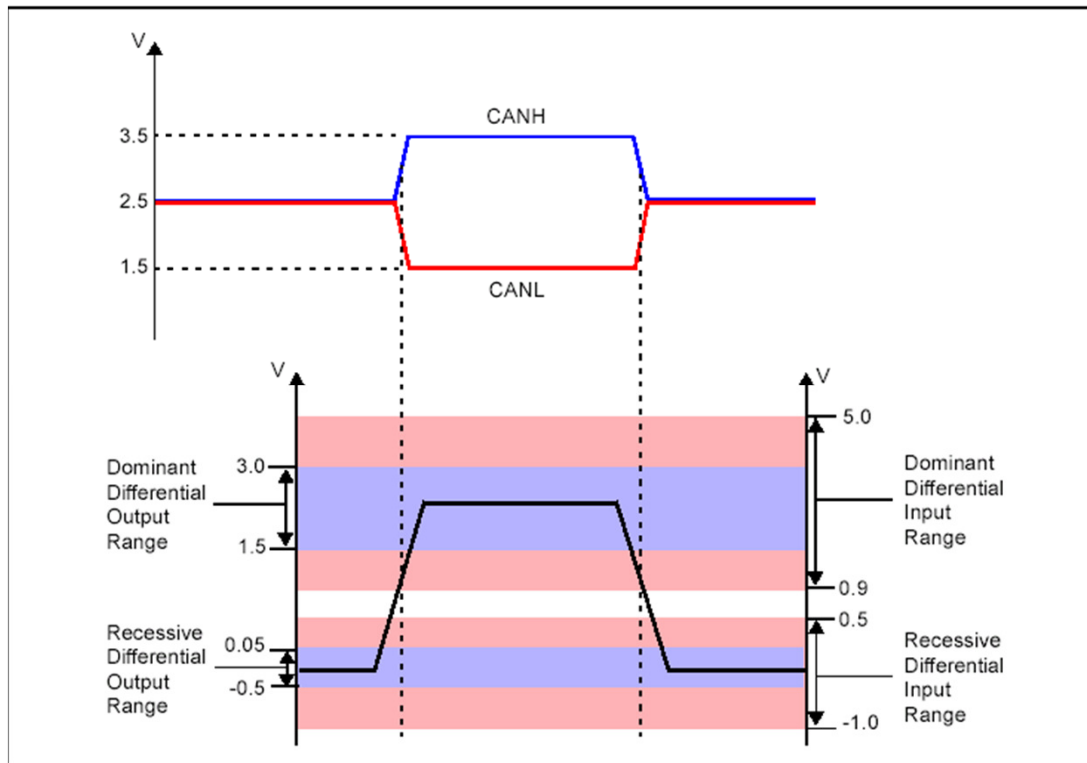
What is "recessive?"

DeviceNet messages consist of 1's and 0's. A 1 is "Recessive" meaning that the difference in voltage between CANH and CANL should be as close to 0 volts as possible

What is "dominant?"

"Dominant" meaning that the difference in voltage between CANH and CANL must be within certain limits when a 0 (dominant bit) is sent.

Logic scope view of CAN transmission

0 0 0 0 1 0 1 0 1 0 1 0	0 0 0 0 1 0 1 0	1 0 1 0 1 0 1 0	0 0 0 0 1 0 1 0 0	0 0 0 1 0 1 0 1 1 1 0 0 0 0 0 1 0 1 0 1	
11 bit Identifier	Control Field	Data byte 1	Data byte 2	CRC Field	

SOF   RTR

CRC Delimiter
Ack Slot
Ack Delimiter

$\underline{1}$ = Stuff bit

A
B
C
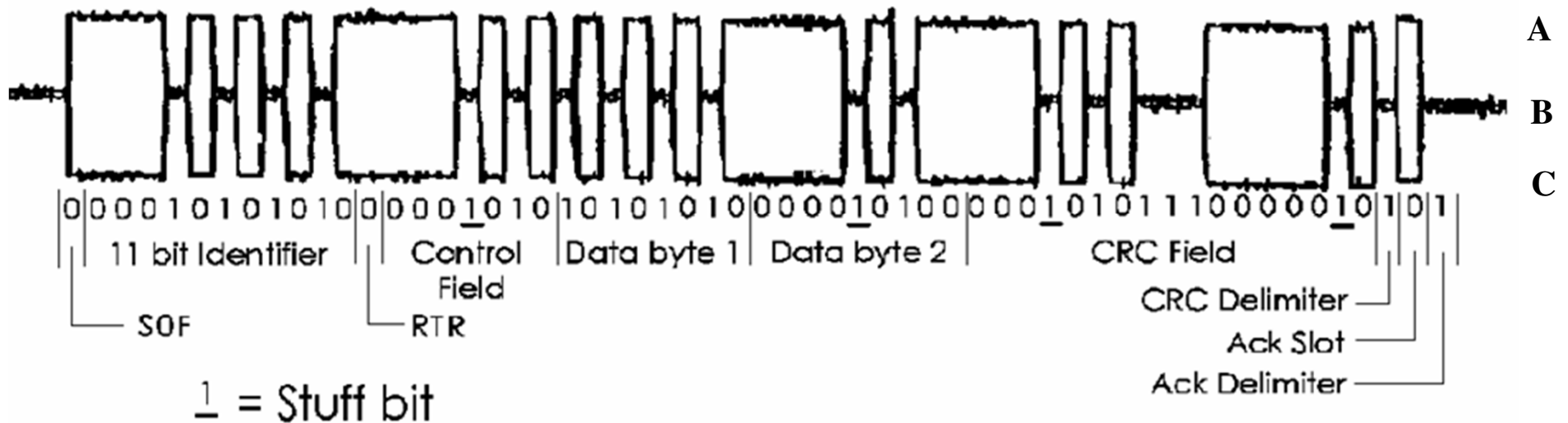
0 VDC
V-

A = + 3.5 VDC to +4.0 VDC (Dominant State)
B = +2.5 VDC to +3.0 VDC (Recessive State)
C = +1.5 VDC to +2.0 VDC (Dominant State)

Physical Signaling

- **Bus level 0 = *dominant***

- **Bus level 1 = *recessive***

- **Bus idle   = *recessive***

- **The *dominant* level overrides the *recessive* level**

- **Bit coding is w/bit stuffing**

- **Example:**

#1	#2	#3	resulting bus level
0	0	0	0
0	0	1	0
0	1	0	0
	...		
1	1	1	1

DeviceNet Frame Format

1 bit	11 bits	1 bit	6 bits	0 - 8 bytes	15 bits	1 bit	1 bit	1 bit	7 bits	>=3 bits

Interframe Space (top right)

Interframe Space (left)

- Start of Frame
- Identifier
- RTR Bit
- Control (2 bits reserved for future, DLC0-3 is the data length code)
- Data Field
- CRC Sequence
- CRC Delimiter
- ACK Slot
- ACK Delimiter
- End of Frame
- ACK

RTR = Remote Transmission Frame
CRC = Cyclic Redundancy Check
ACK = Acknowledge
DLC = Data Length Code

Note: Whenever there are five consecutive 0 or five consecutive 1 bits, an additional bit called a "stuff" bit will be inserted into the packet. This mechanism could add a considerable number of bits to the packet, which will cause the packet to take longer to be transmitted.

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DeviceNet Identifiers

DeviceNet CAN Identifier Usage

IDENTIFIER BITS											HEX RANGE	IDENTITY USAGE
10	9	8	7	6	5	4	3	2	1	0		
0	Group 1 Msg ID				Source MAC ID						000-3ff	Message Group 1
1	0	MAC ID					Group 2 Message ID				400-5ff	Message Group 2
1	1	Group 3 Message ID			Source MAC ID						600-7bf	Message Group 3
1	1	1	1	1	Group 4 Message ID (0-2f)						7c0-7ef	Message Group 4
1	1	1	1	1	1	1	X	X	X	X	7f0-7ff	Invalid CAN Identifiers

Allocate & Release Messages

Byte Offset	7	6	5	4	3	2	1	0
0	Frag [0]	XID	MAC ID (opposite of identifier's MAC ID)					
1	R/R [0]	Service Code: [4B] allocate [4C] release						
2	Class ID [3]							
3	Instance ID [01]							
4	Resvd	Ack Suppress	Cyclic	C.O.S.	Resvd	Bit Strobe	Polled	Expl Msg
5	0	0	Allocator's MAC ID (byte not present in Release reqst)					

Allocation/Release Choice byte (#4): set bits to allocate/release specific connections

IDENTIFIER BITS											DESCRIPTION
1	9	8	7	6	5	4	3	2	1	0	
0 0	Group 1 Message ID			Source MAC ID							Group 1 Messages
0	1	1	0	0	Source MAC ID						Slave's I/O Multicast Poll Response
0	1	1	0	1	Source MAC ID						Slave's I/O Change of State or Cyclic Message
0	1	1	1	0	Source MAC ID						Slave's I/O Bit-Strobe Response Message
0	1	1	1	1	Source MAC ID						Slave's I/O Poll Response or COS/Cyclic Ack Message
1	0	MAC ID					Group 2 Message ID				Group 2 Messages
1	0	Source MAC ID					0	0	0		Master's I/O Bit-Strobe Command Message
1	0	Source MAC ID					0	0	1		Master's I/O Multicast Poll Group ID
1	0	Destination MAC ID					0	1	0		Master's COS/Cyclic Acknowledge msg
1	0	Source MAC ID					0	1	1		Slave's Explicit/Unconnected Explicit Response Msgs
1	0	Destination MAC ID					1	0	0		Master's Connected Explicit Request Messages
1	0	Destination MAC ID					1	0	1		Master's I/O Poll Cmd/COS/Cyclic Msgs
1	0	Destination MAC ID					1	1	0		Group 2 Only Unconnected Explicit Req. Msgs
1	0	Destination MAC ID					1	1	1		Duplicate MAC ID Check Messages
1	1	Group 3 Message ID			Source MAC ID						Group 3 Messages
1	1	1	0	1	Source MAC ID						Unconnected Explicit Response (UCMM) Messages
1	1	1	1	0	Source MAC ID						Unconnected Explicit Request (UCMM) Messages
1	1	1	1	1	Group 4 Message ID						Group 4 Messages
1	1	1	1	1	0-2B						Reserved Group 4 Identifiers
1	1	1	1	1	2C						Communication Faulted Response Message
1	1	1	1	1	2D						Communication Faulted Request Message
1	1	1	1	1	2E						Offline ownership Response Message
1	1	1	1	1	2F						Offline ownership Request Message

Note: Arbitration only comes into play when two or more devices need to transmit at exactly the same time. Arbitration is done starting at bit 10 of identifier, proceeding through bit 0 and the lowest binary number in complete identifier field will win arbitration. Group 1 messages are highest priority, next highest are Group 2 messages, next highest are Group 3 messages and lowest priority are Group 4 messages.

Media Access Logic

If a transmission is occurring, a node must wait until it is complete before attempting to transmit.

Node "Y"

Node Y wants to transmit
It listens to the network and hears traffic
Must wait until transmission is complete
for at least 3 bit times (Interframe Space)

Network Latency Time

Node X's Transmission

Interframe
Space

Node Y's Transmission

> 3 bit times

Time

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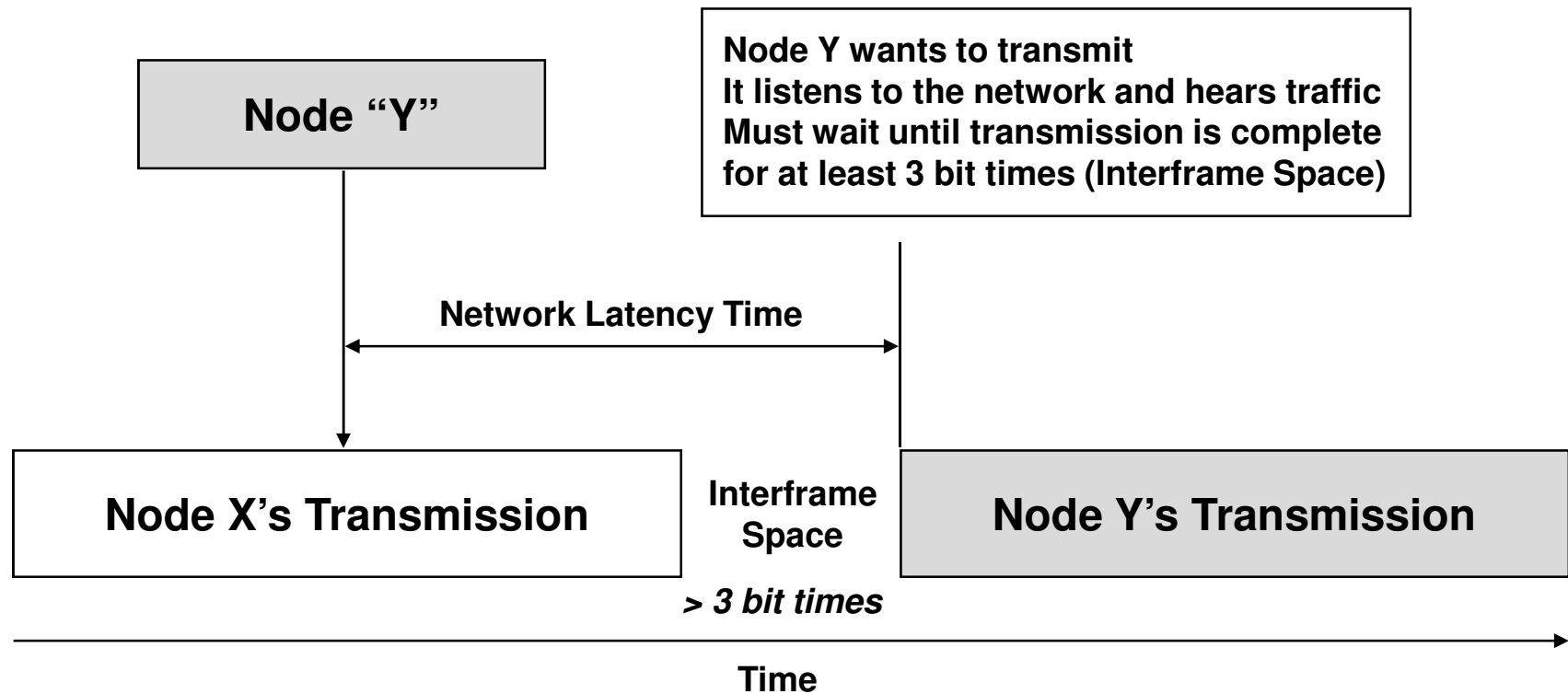
Arbitration Example

Node 1 Transmits:

0	10110110100	0	0	0	1	00000001	xxxx	11	E O F

Ack field

Node 2 Transmits:

0	10110111
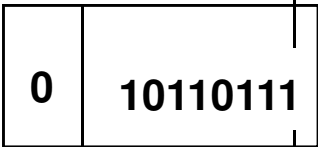
Node 2 losing arbitration and stops transmitting!

Node 2 still ACKs message.

01

As seen on the wire:

0	10110110100	0	0	0	1	00000001	xxxx	01	E O F

Arbitration Field

Acknowledgments

- <u>**ALL**</u> **nodes check all messages for validity**
  - Each node will ack valid messages in the *ACK Slot*
    - Indicates to the sending node that <u>*at least one node*</u> has received its message correctly
  - Each node will flag invalid messages with an error frame
    - Indicates to all nodes that <u>*at least one node*</u> did not receive the message correctly

- **There is no separate acknowledge frame in CAN**

Data Fragmentation

- **Any device that needs more than 8 bytes of data sent either direction will cause fragmentation to occur in that direction.**

- **Fragmented packets can only send a maximum of 7 bytes of data in each packet, because the first byte of the data is used as flag bits to help reassemble the fragments. A value of 00 hex in the flag byte tells you that this is the first fragment. A value of 40 to 7F hex says that the packet is an intermediate fragment. The lower 6 bits of the byte is the fragment number. The fragment numbering always starts at 0 for the first fragment. A value of 80 to FF hex says that this packet is the last packet and again the lower 6 bits is the fragment number.**

	Data Packet	Description
Example:	00 01 02 03 04 05 06 07	First Fragment Number 0
	41 08 09 11 22 33 44 55	Intermediate Fragment Number 1
	42 08 09 11 22 33 44 55	Intermediate Fragment Number 2
	83 66 77 88 99	Last Fragment Number 3

Bus Off Condition
Separates Men from Boys

- The most challenging Device Net system anomaly to be debugged is what is called the Bus Off condition. This condition will result in a solid red network LED on a slave device or a 91 or Bus Off message on a master scanner's front display. What causes a Bus Off is that each device has an error counter which increments on CAN based network errors. The counter will also count down as good frames are received. If this counter gets too high over too short of time the device assumes the network is not stable and shuts itself down. A device could also go Bus Off because it is bad or even worse causes a good device to go Bus Off, by transmitting trash to it.

- The problem is that there are so many things that can cause a Bus Off condition on the network, such as: A Device at the wrong baud rate, intermittent connection on CAN lines causing short or open circuits, Electrical noise on network, trash packets sent from defective devices, CAN lines being held dominate, bad devices causing CAN errors on power up or power down , too few termination resistors, too many termination resistors, power supply rise time too slow, network cables too close to high voltages, drop lengths beyond 20 feet (6m) , trunk line too long for media, etc.

- To debug a Bus Off requires knowledge, patience, luck and a diagnostic device that can identify CAN based network errors. I carry the SST NetAlert, Dearborn Group Monitor or DeviceNet Detective for this purpose. The DeviceNet Monitor or Traffic Analyzer software can NOT detect CAN based errors!!!!

- On a slave device, cycling power to that device is the only way to recover from a solid red light Bus Off condition. Cycling the network power of a master scanner will clear the error on the scanner. Also, toggling the reset bit in the command register of a master scanner, will cause a reboot to occur on the scanner and will indirectly clear the Buss Off error.

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Network Voltage/OHM Readings

It needs to be understood that DeviceNet is actually a three wire Differential Voltage network. Communication is accomplished by switching the CAN-H (White wire) and CAN-L (Blue wire) signals relative to the V- line (Black Wire). **IMPORTANT NOTE: The CAN to V- voltages given in the rest of this slide assume NO common mode voltage effect is occurring anywhere on the V- wire of the network. On a network with Common Mode Voltage influence, the voltages will be higher depending on where you take the measurement. Nodes closest to the power supply will exhibit voltages lower due to the Common Mode Voltage, while nodes at the farthest end of the network away from the power supply will exhibit higher voltages.** The CAN-H swings between 2.5 VDC (Recessive State) and 4.0 VDC (Dominant State) while the CAN-L swings between 1.5 VDC (Dominant State) and 2.5 VDC (Recessive State)

Without a network master connected to the DeviceNet, the CAN-H and CAN-L lines should read between 2.5 VDC and 3.0 VDC relative to V- and the voltages should be identical. (Recessive State) I normally measure these voltages right at the SDN scanner connection which is normally also where the power supply is connected to the network. I normally use a voltmeter in DC mode.

With a network master connected to the DeviceNet **and communicating on the network,** the CAN-H to V- voltage will be around +3.2 VDC. The CAN-L to V- voltage will be around 2.4 VDC. The reason these values appear a little different than the ranges shown on the scope trace, is that the signals are switching, which slightly affects the DC value being read by the VOM.

With the 24VDC power supply not energized you can measure the resistance between the CAN-H and CAN-L signals. The ohm reading between the CAN-H and CAN-L lines should be 60 ohms (two 120 ohm resisters in parallel), however with a large amount of devices connected to the network the resistance could be as low as 50 Ohms. Without termination resistors and with one or more nodes on the network, a resistance of approximately 8000 ohms will be read between the white and blue wires.

DeviceNet Network Installation Checklist

Termination resistors. (1 at each end of trunk)

Grounding of Network. (One location only)

Cumulative drop line budget in spec. for selected baud rate.

Trunk as linear topology. No Star off of trunk > 20 feet (6 m).

Spacing guidelines from AC cables.

No Drops > 20 feet (6 m).

Trunkline budget in spec. for baud rate.

Total Network Current Check (DeviceNet Assistant)

Common Mode Voltage Check at network ends, <u>with full load</u>.

Voltage and Ohm readings of CAN wires within spec.

PROTOCOL DETAILS
(Application Layer)

Miscellaneous Protocol Notes

Duplicate Mac Check

Whenever a device is attached to the network, it will generate a Duplicate Mac Check message to the node number it is configured to be. If the message is receives an Ack from any node on the network it will generate this message twice and if no response is received from an existing node on the network, the device will assume it is that node number. If there is no Ack to the Dup Mac Check message (no one else is on the network) the device will continue to transmit the message repeatedly until an Ack is finally received. If an existing node is already on the network and answers the message, the slave device will declare a Dup Mac Fault error, by turning it's Network Led solid red.

Important: The serial number of the device is transmitted as data in the Dup Mac Check message and it is essential that every device on the network has a unique serial number. In fact every DeviceNet device in the world MUST have a unique combination of Vendor ID and serial number according to the specification. There have been reports of companies producing devices with the same serial numbers and if they are on the same network, communication problems will occur and they will periodically fall off of the DeviceNet network. To read the serial number use the CIA editor in RSNetWorx to read Class 1, Instance 1, Attribute 6 of a device.

DeviceNet Interface Notes

- DeviceNet Protocol supports Master/Slave, Multiple Master and Peer to Peer Communications.

- 1771-SDN Scanner for 1771 platform, 1747-SDN for SLC-500 platform, 1756-DNB for the ControlLogix platform, 1769-SDN for the MicroLogix 1500 and CompactLogix platform, 1788-DNBO for FlexLogix platform, 1784-PCIDS or 1784-PCID for the PC platforms and the 1788-CN2DN, 1788-EN2DN and 193-DNENCATR bridges are currently available Network Masters.

- Network Masters send outputs from the platform to each slave device and receive inputs from each slave device to be put to the platform.

- User program in PLC or PC utilizes data in platform to do actual control of devices over DeviceNet.

Master Scanner Data Flow Overview

Input Image

B	A
D	C
	E

Data Table

A   X

— | | — — ( )

4   5

Output Image

Z	Y
	X

Data Table

Ladder Processor

Discrete I/O Xfer

A
B
C
D
E

Internal Input Data Storage

Y
Z
X

Internal Output Data Storage

Discrete I/O Xfer

Master Scanner

A
B
C
D
E

Input Data From DeviceNet Device

Y
Z
X

Output Data To DeviceNet Device
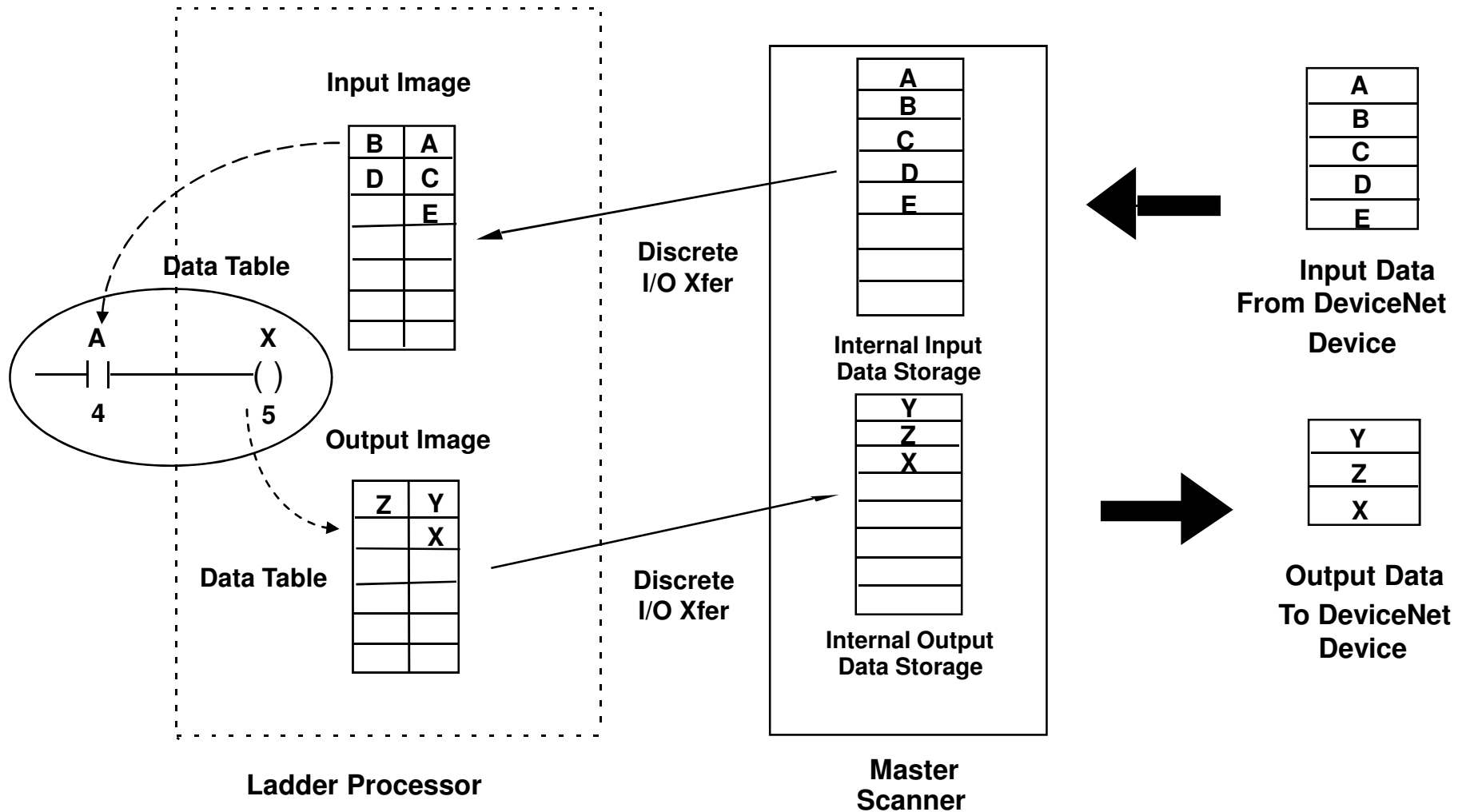
Producer/Consumer

- **Data is identified as to its content**
  - **No more Source/Destination requirements**
  - **No sense of mastership**

- **Allows the functionality of the Source/Destination models: Master/Slave and Peer-to-Peer**

- **Additional models allowed because relationships can be built dynamically:**
  - **Multicast - one to many**
  - **Change of State, event based; Cyclic, time based**

- **Superior performance because bandwidth is not wasted**

- **Examples - DeviceNet, ControlNet, EtherNet/IP, FIP, Fieldbus**

Network Models - Master/Slave

- **The simplest and most understood; "polling"**

- **The PLC or scanner is the master and I/O devices are the slaves**
  - **The slaves speak only when spoken to**
  - **Only one master per slave ("single master")**
  - **Deterministic but not repeatable**

- **Network examples - Remote I/O, Profibus DP, Interbus-S, Seriplex, LON**

PLC

3,6,..

1,4,...

I/O 1

2,5,..

I/O 2

I/O 3
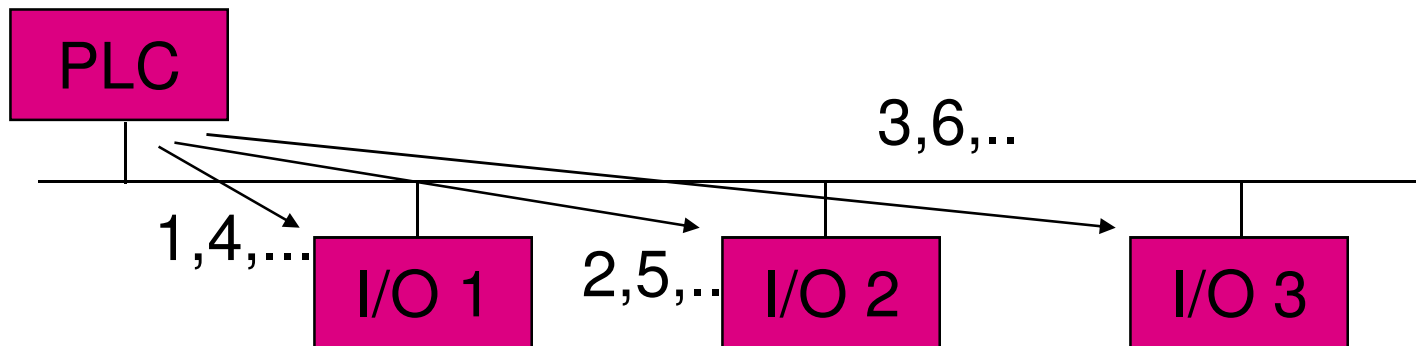
Protocol Notes

- DeviceNet protocol supports both Polled and Strobed commands and responses.

- Strobe Command/Response

  -- Strobe Command - An 8 byte I/O message broadcast to all Slaves on network at same time. 1 bit of output data for each possible node number. 8 byte message looks like 64 bit bitmask with node number of device acting as index into bitmask to extract devices 1 bit of data.

Strobe Transmission format

Node/Bit #	63	56	55	48	47	40	39	32	31	24	23	16	15	8	7	0
	Byte 7		Byte 6		Byte 5		Byte 4		Byte 3		Byte 2		Byte 1		Byte 0	

  -- Strobe Response - All Strobe Slave devices will send back their input data, if a slave is also an input device.

Protocol Notes (Cont)

- **Poll Command/Response**

  - **-- Poll Command - An I/O message is directed towards a single, specific Slave (point-to-point). The Master must transmit a separate Poll Command for each one of its Slaves that is to be polled.**

  - **-- Poll Response - Polled Slave device will send back its input data, if slave is also an input device.**

- **<u>Gross network timeout for a Polled or Strobed device is the EPR timeout. The EPR timeout is set in the scanner modules configuration screen using RSNetworx or DeviceNet manager.</u>**

Scan Cycle

Once the scanner starts sending out its strobe and polls, the I/O devices will start responding. Therefore, what actually takes place on the network is replies from slave devices are interspersed with the commands from the scanner as it goes through its scan cycle. An example of what the network traffic may look like is shown below:

New Cycle

Strobe/responses   Polls/Responses

| S | | | P1 | R1 | P2 | P3 | R2 | R3 | ..... | P | R | ...packet processing ... time | ISD | S |

... (up to 63)   ...... (up to 63) .....
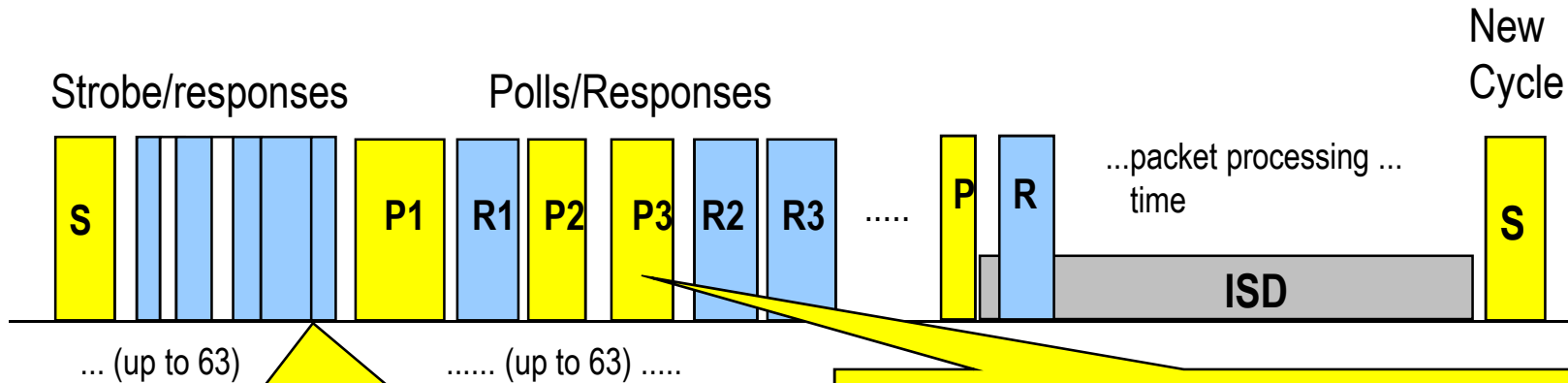
Note that the scanner sends the next poll without waiting for the previous response

Note that after the strobe there may be multiple strobe responses before the polls start. This is because strobe responses are a higher priority than scanner polls. Therefore, if a slave device attempts to send a strobe response the same time the scanner attempts to send the next poll, the slave device will win the arbitration.

Scan Cycle

<u>INTER SCAN DELAY:</u> User selectable minimum quiet time to allow other devices access to the network and to allow slower poll responses to be processed. Begins after last poll message sent by scanner. Scanner will not start another scan cycle (even if packet processing is complete). <u>Bumping this value up will cause a longer network scan, which will adversely affect overall input to output performance. However, it will allow lower priority messages to get more network access without preempting higher priority I/O messages. These lower priority messages include those used to do network browsing and configuration upload/download functions. So if these functions are sluggish on your system bump the ISD up to improve their performance.</u>

Strobe/responses   Polls/Responses   New Cycle

| S | | | | | | | | P1 | R1 | P2 | P3 | R2 | R3 | ..... | P | R | ...packet processing ... time | | S |

ISD

... (up to 63)   ...... (up to 63) .....
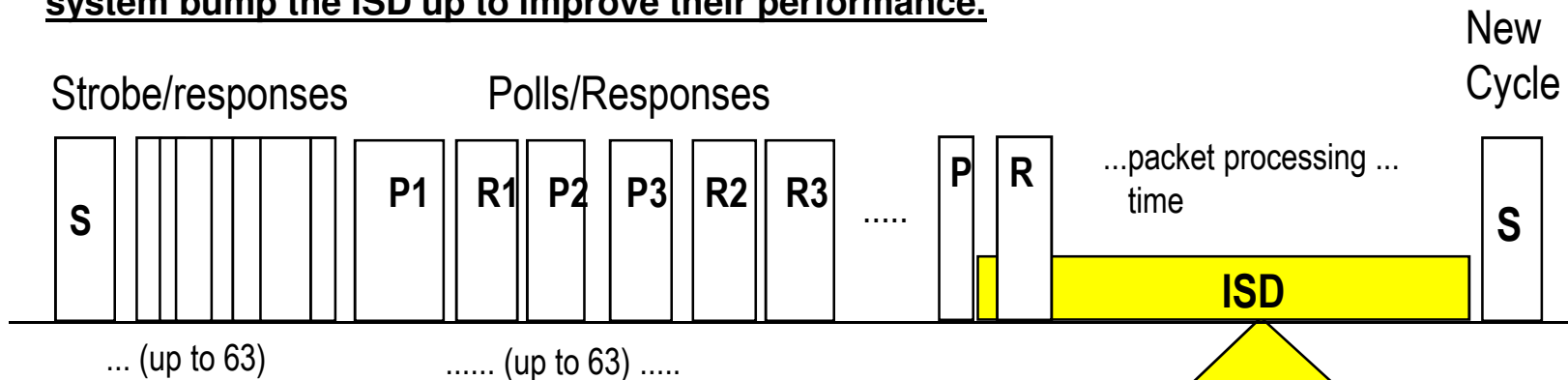
The ISD allows lower priority messages that are not part of the normal scan cycle to get access to the network. These may be messages from programming terminals or explicit messages between devices. RA scanners default to a 10 ms ISD.

Network Models - Change of State

- **Devices report data (input or output) on a change-of-state basis as the events happen**
  - **Rather than a master going through a polling list (scanning),**
- **Change of State is more efficient for discrete applications**
  - **Network traffic is significantly reduced**
  - **Performance is greatly improved**
- **Background heartbeat for device health. <u>Gross network timeout for a COS device is 4 times the heartbeat. So keep heartbeat as small as possible so failed devices can be quickly detected.</u>**
- **Can be used in Master/Slave, Peer-to-Peer, or Multimaster environments**
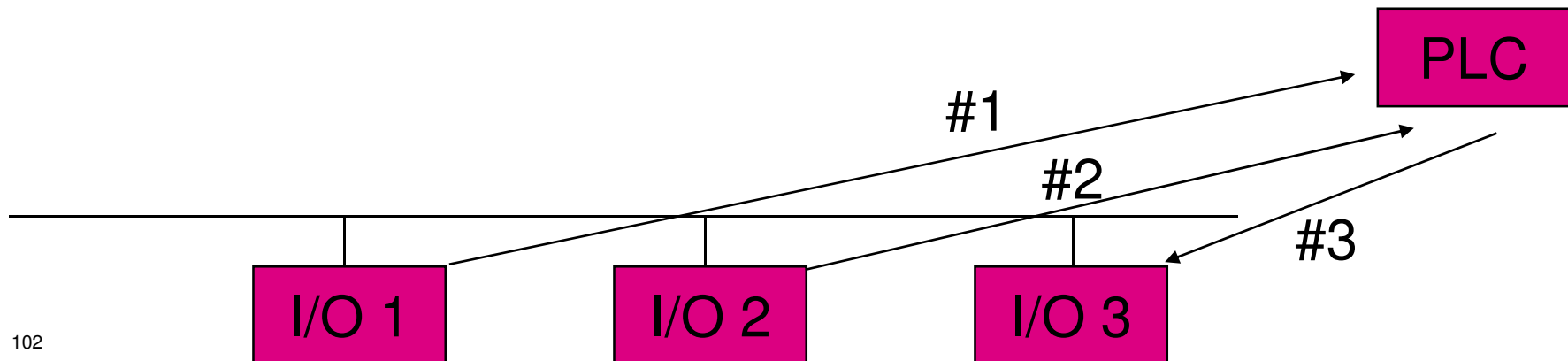
Network Models - Cyclic Data Production

- **Devices report data on a user-configured time increment basis (input or output)**

- **Cyclic Data Production is more efficient for applications with slowly changing I/O (analog)**
  - **Network traffic is reduced**
  - **Performance is repeatable**

- **Can be used in Master/Slave, Peer-to-Peer, or Multimaster environments.**

- **<u>Gross network timeout for a Cyclic device is 4 times the send rate. So keep send rate as small as possible so failed devices can be quickly detected.</u>**

PLC

every 500 ms

every 25 ms

I/O 1   I/O 2   I/O 3

every 2000 ms
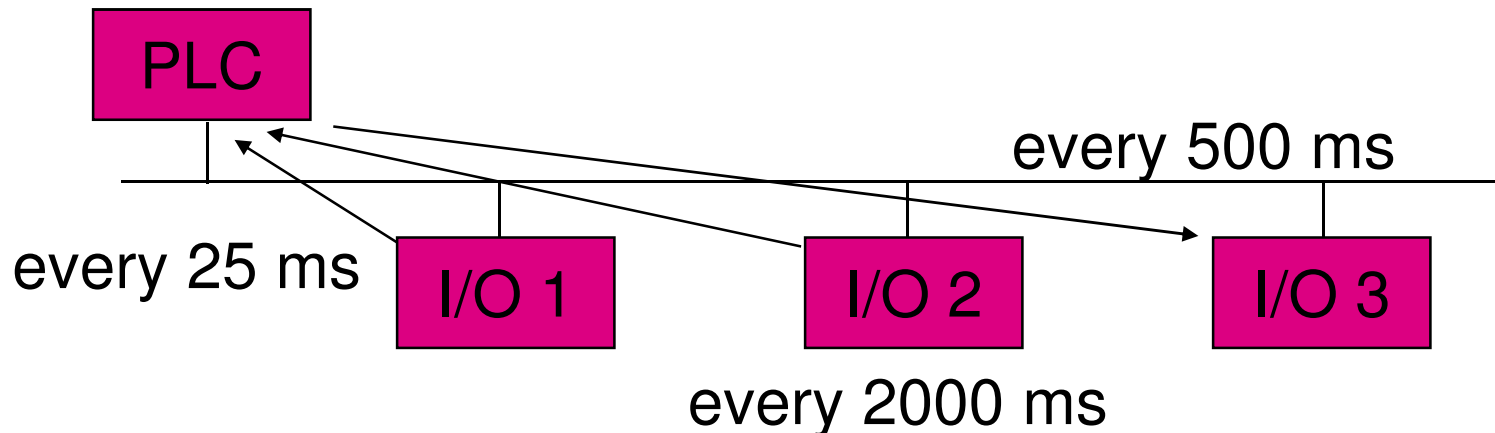
DeviceNet COS/Cyclic

- **COS / Cyclic Scan Model**
  - **Network bandwidth and CPU load both reduced dramatically from Poll/Strobe scheme**
  - **Note: Hybrid systems are allowed (any mix of COS, Cyclic, Poll/Strobe)**

COS / Cyclic Model

Poll / Strobe Model
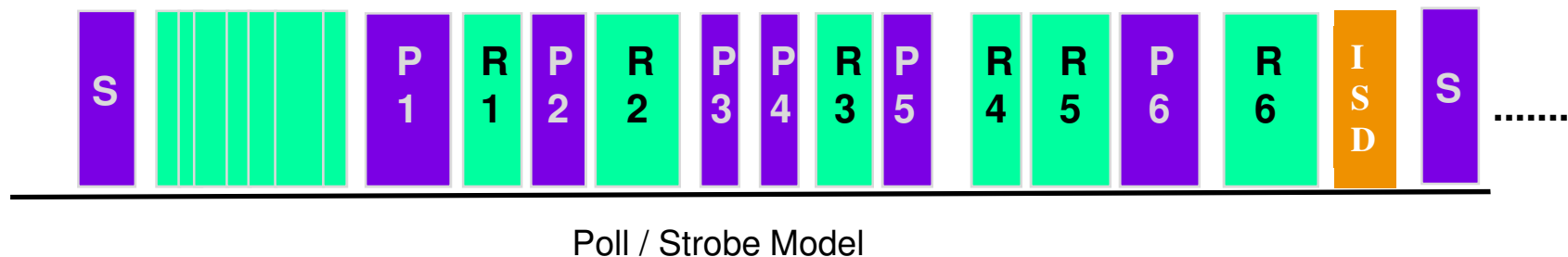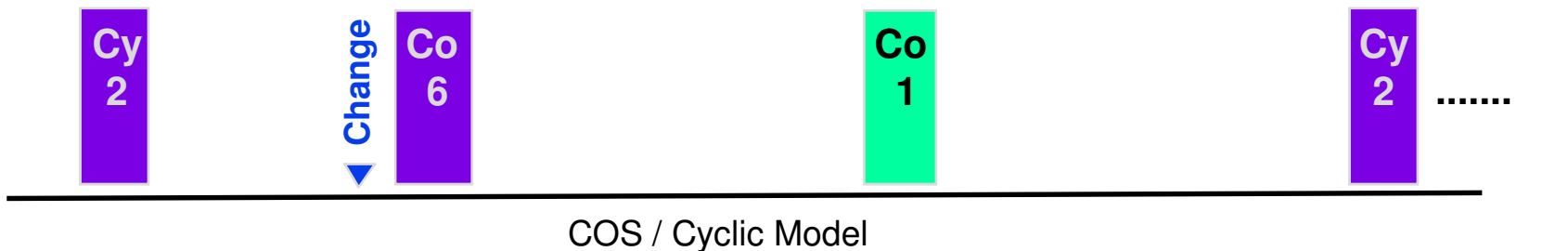
Important Concepts

Proxy by Master Scanner

When a master scanner has an active I/O communication to a Group 2 Only slave device, the scanner will proxy for the slave device, in response to explicit messages on the network. This means that the scanner becomes an integral part of the communication, for a slave, for such operations as the network browse and configuration display/modification from RSNetWorx for DeviceNet. If there is ANY error showing on the scanner, for the I/O connection to a Group 2 Only slave, then the scanner will no longer proxy for it and the slave will not show up on a network browse. The only way around this issue, is to resolve the communication error, remove the slave's scan list entry from the scanner or remove the scanner from the network. Depending on the scanner and firmware revision the slave device will then answer the network browse. All 1771-SDN Series A or B scanners and 1747-SDN scanners prior to firmware revision V4.001 will also require you to cycle power to the network to get the slave to answer the browse. This is because the slave's I/O connection timeout, is set by these scanners to infinity and will never timeout, even if the scanner is not communicating to it. All other scanners set the timeout to 10 seconds, after which the slave will answer its own browse. If in doubt cycle network power, with no scanner on the network, to see what devices are actually on the network.

EPR (Expected Packet Rate)

When the scanner opens an I/O connection it sets a gross timeout into the device. If the device does not receive a packet from the scanner in this time period, then the device drops the connection. If the scanner does not receive a packet from the slave in this time period, it will drop the connection and attempt to open a new connection periodically. This timeout value is called the Expected Packet Rate (EPR) and is located in the scanner's, module config, advanced screen. For POLLED and STROBED Messaging EPR defaults to 75, which is a unitless number and needs to be multiplied by 4 to get the gross timeout in milliseconds. The default is 75 X 4ms = 300ms. Bumping this number should be done carefully as this is how long it takes for a missing device to be detected by the scanner. Gross network timeout for a COS device is 4 times the heartbeat. Gross network timeout for a CYCLIC device is 4 times the send rate.

Important Concepts (Cont)

ISD (Interscan Delay)

When the scanner is done polling the network, it goes into an idle mode, where it stops sending for a certain amount of time. This time is called the ISD (Interscan Delay) and this is configured in the scanner using RSNetWorx for DeviceNet software. It is configured under the Module tab of the scanner configuration and is entered in milliseconds, with 2 ms being the minimum value allowed. The Interscan Delay starts after the scanner sends the last, outgoing, polled packet to the last slave device on it's scan list. During the ISD period the network is basically idle except for slave response packets and explicit message packets. The important thing to realize is that these packets use up some of the ISD time and if enough activity occurs, there may be little or NO actual idle time on the network. This can especially happen if slave devices at the end of the scan list send multi packet responses. The moral of the story is that if the ISD is too short, the network will become starved for bandwidth and erratic operation could occur, with devices dropping off the network sporadically. Using the DeviceNet Traffic Analyzer will allow you to measure the actual ISD time for a polled, network scan and if necessary bump up the ISD to allow at least 10ms of true idle time on the network.

DeviceNet Products

Allen-Bradley

Founder and *Still* the Leader in DeviceNet™ Products

Host Network

150 Dialog Plus

160 AC Drive

Host Computer

Or ControlLogix

Or SLC/PLC

DeviceNet to Ethernet / Control Net Bridge

DSA I/O

Starter w/MCS-E1 Overload Relay

871TM DeviceNet Proximity Sensor

Standard Sensor

PanelView Family

DeviceNet Control Tower

Right Sight DeviceNet Photoelectric Sensor

1305/1336 AC Drives

1394 Servo

Standard Sensors

DC Power Supply

Device Link I/O

Standard Sensor

DeviceNet Redi STATION Panel

Series 9000 DeviceNet Photoelectric Sensor

802T DeviceNet Limit Switch

9/PC

CNC Servo Drive

Servos

Compact Block I/O

Standard Sensors

DeviceNet Interface

Starter w/SMP-3 Overload Relay

Dodge EZ Link Smart Bearing

Armor Block MaXum

Flex I/O

Standard Sensors

DeviceNet Network using KwikLink Media

Rockwell Automation

RSNetWorx for DeviceNet

RSNetWorx for DeviceNet Fun Facts

- RSNetWorx for DeviceNet software is used with RSLinx to configure, monitor and diagnose all Rockwell Automation DeviceNet devices, along with most third party devices.

- Revision V11 is latest released revision of RSNetWorx software.

- Revision of software V10.00 uses RSLinx V2.54. Patches are available to correct some anamolies in V10 and these patches are contained in Knowbase records 69236, 69237 and 70173.

- RSNetWorx for DeviceNet software uses Electronic Data Sheets (EDS) as a template to determine how to configure any DeviceNet device. RSNetWorx comes with all of the most current EDS files at the release date for the software. If a new product or product revision, requiring a new EDS file, is released after RSNetWorx, the EDS file will need to be registered into RSNetWorx, before the product can be configured. EDS registration is done right inside the RSNetWorx software.

- Always have an active RSLinx browse running to the DeviceNet network when using RSNetWorx software online. Knowbase document 41211 gives more Best Practices guidelines on how to successfully use RSLinx and RSNetWorx software on a DeviceNet network.

- **IMPORTANT!! Doing only a network browse does NOT read the current configuration from ANY of the devices on the network. The configuration in the project will be set to factory defaults, which means a blank scanlist in all scanners. In order to create an "archive" file with the latest configuration, an upload all function must be done at least once and saved to a file. You can do an "upload all network" function, by clicking on any white space on the browse screen and right mouse clicking on the Upload from Network selection. Then save this archive to a .dnt project file.**

- Without an activation installed, RSNetWorx can be still run in demo mode which will allow support for nodes 0 thru 5 only.

- V9.0 of RSNetWorx has some issues that are corrected with some released patches. See Knowbase records 56881, 60587 and 61099 for more details about the issues and patches.

- V9.0 of RSNetWorx has a change where some device parameters in the EDS editor will no longer appear. Knowbase record 56251 contains information and a software patch to correct this.

- RSNetWorx for DeviceNet project files can be opened with an RSNetWorx software version equal to or greater than the file was originally developed on. Project files can NOT be opened with any software revisions earlier than what the file was originally created with.

Electronic Data Sheets (EDS)

- DeviceNet projects, created by RSNetWorx software will have a .dnt extension and be stored in the Program Files\Rockwell Software\RSNetWorx II\networks folder

- Makes supporting the Parameter Object optional. Parameter Object allows uploading EDS files from devices. A-B products that allow EDS uploads are typically all power products such as networked Drives and Smart Motor Protectors.

- Contains the same information as the Parameter Object Class, but in ASCII format. Can be vied in a text editor.

- Manufacturer of product will provide on disk or via BBS or ftp site

- The RSNetWorx software contains EDS files for most A-B products. However any EDS files not already included in the software, or from other vendors, can be installed using the RSNetWorx EDS Wizard.

- EDS files are available for download at the Rockwell website http://www.ab.com/networks/eds.html

- Make sure when installing EDS files into RSNetworx for DeviceNet software, that you are logged in with Administrative Privileges. This is because the registry is modified when doing the EDS install.

- When installing EDS files the following hints will be helpful. Shutdown RSLinx and all of its services. Shutdown RSNetWorx for DeviceNet software. Use the EDS Hardware Installation Tool under the RSLinx Tools folder under Rockwell Software folder to register the EDS file. Once the EDS file is registered, it has been suggested from various people that a good thing to do is to reboot the computer to have a good chance of the installation being successful. Doing the reboot can't hurt and will just take a little extra time waiting for the computer to initialize.

- Sometimes after an EDS registration, the device does not show up on the RSLinx Browse view anymore, even though you know it was on the network, before you tried to register its EDS file. This happens when an EDS file is not completely registered into the computer, by the software. By removing the EDS file, using the *EDS Hardware Installation Tool*, the device should show up again as an unidentified device on the browse. The only recourse you have is to try the registration process again. The second EDS registration is normally the charm and will be successful.

  If all else fails when unsuccessfully registering EDS files, it has been discovered that removing the RSLinx Harmony files can help that stubborn EDS installation. Knowbase document 40021 details very well how to delete these harmony files from the RSLinx directory.

- Some windows versions have a weird filename sort order that makes it difficult to work with files with hex numbers in their file names. http://support.microsoft.com/kb/319827 describes how to restore the Windows 2000 sort order.

Electronic Keying and EDS File Storage

Knowbase document 19896 has an excellent discussion on Electronic keying and DeviceNet.

Every DeviceNet device has a set of attributes that collectively form its electronic identity. The electronic identity can be used to differentiate one device from another based on manufacturer, type of product, or revision level. Allen Bradley's DeviceNet scanners employ this electronic identity to form an "Electronic Key" that is used to verify that the devices connected to the network, and being communicated to by the scanner, are the devices that were expected. Electronic Keying defined in the scanlist editor for a device, is also used in the ADR configuration to determine if a replacement for that device should be recovered, depending on the electronic keying level. Let's discuss the components of the electronic identity that can be used in keying. In RSNetWorx for DeviceNet the devices identity can be viewed inside the properties screen for the device.

Vendor – The vendor attribute defines the manufacturer of the product.

Device Type – The Device Type attribute distinguishes one type of product from another (e.g. motor protector vs. limit switch).

Product Code – The Product Code is a number assigned by the manufacturer to distinguish one product of type "A" from another type "A" product. For example a 4 point DC discrete output module must have a different product code than a 4 point AC discrete output module.

Major Revision – The major revision of the product.

Minor Revision – The minor revision of the product.

All EDS files are stored in the Program Files\Rockwell Software\RSCommon\EDS folder. They are stored with a file name that utilizes the electronic keying information and with a .eds extension. The file name is composed of 4 digits of vendor, 4 digits of Product Type, 4 digits of Product code, 2 digits of Major revision and 2 digits of Minor revision. Important: The different parts of the file name are stored as a hex representation of field. So if the Product Code is a 10 decimal, the 4 digit field will have an 000A in it. Also, generally the two digit minor revision field will have a 00 in it which is a wildcard that tells RSNetWorx to use this EDS file with ALL minor revisions, for a particular major rev.

Example: 0001000B00040200.eds = Vender 1 (0001), Product Type 11 (000B), Product Code 4 (0004), Major Rev 2 (02), Minor Rev 0 (00 = Wildcard)

Faulted Address Recovery

This feature is implemented beginning in V3.000 of RSNetworx for DeviceNet. The Faulted   Address Recovery Wizard is used to recover a device onto the network after it fails a duplicate node check. The serial number of the faulted device is read, by the software and is used to identify the device. The node number can then be changed to an unused node number using the wizard.

In order to use this feature the faulted device must support the special network messaging being sent from the software. The support of Faulted Address Recovery should be listed in the device documentation. Also, until further notice this feature can only be used with a direct connect interface to the network such as a 1770-KFD, 1784-PCD card, 1784-PCID card and 1784-U2DN. NO SCANNER BRIDGING OR PASS THROUGH WILL SUPPORT IT YET!!!

The network LED on the device can be flashed, from the tool, to easily identify which device is actually having it's node number being changed. The LED will flash quickly between red and green when this feature is being used.

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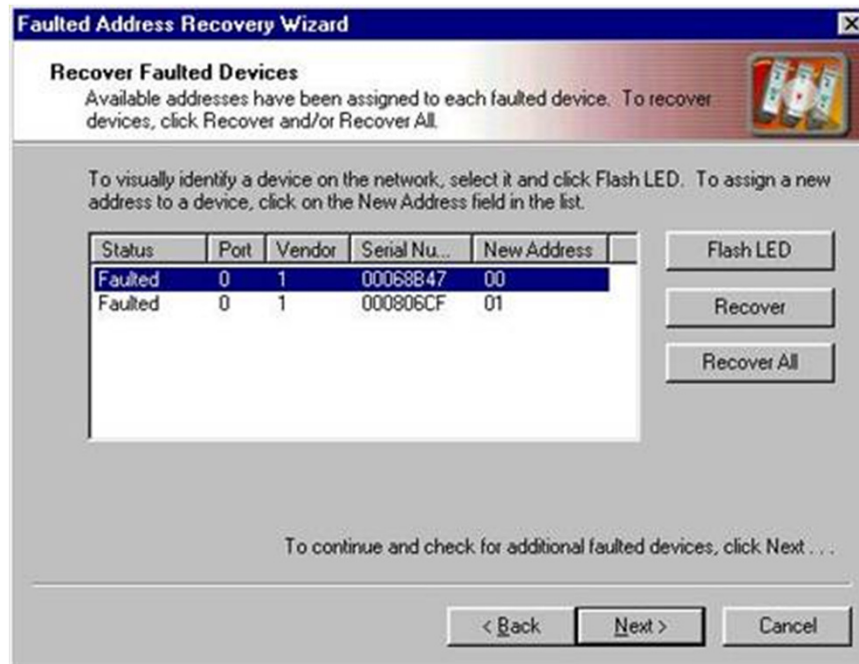
FAR Capable Devices

Most Rockwell Automation devices support the FAR capability.

Device Name	Comment
All 1734 Point I/O Products	Excludes 1734-ADN
Bulletin 100-DNY Auxiliary Starters	
Bulletin 160-DN2	Set switches 7 and 8 on
193 E3 and E3 Plus Motor Overloads	
1203-GK5 and 1203-GM5 Scanport Adapters	Set switches 7 and 8 on
1203-GU6 and 1203-GM6 Scanport Adapters	
Modular DSA 198-DN and 198-DNG	
Bulletin 1329I Integrated Motor/Drive	
20-COMM-D DPI/DeviceNet Comm Adapter	
800E Pushbutton Station	
Ultra 100 Digital Servo Drive.	Network LED may Flash erratically.

1770-KFD DETAILS
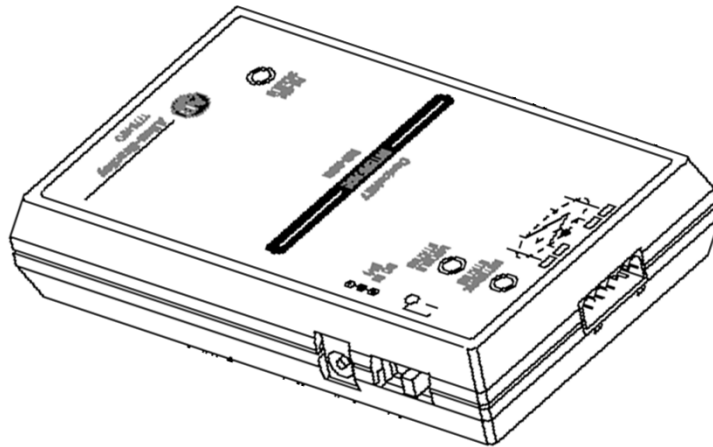
1770-KFD Fun Facts

- The 1770-KFD is not a true RS232 to DeviceNet converter. The KFD is actually a buffering interface between the two networks. The RS232 device connected to the KFD is actually running a DeviceNet driver to communicate through the KFD.

- 1770-KFD can NOT be put on-line unless at least one other node is also on the network. At least one other node must Ack the 1770-KFD Dup Mac Check.

- The RS232 LED on the KFD must blink when there is correct RS232 communication to the KFD. If not, then there is some configuration conflict in the computer that keeps the COM port on the computer from being used for the KFD.

- 1770-KFD firmware revision now at V1.4, current as of 3/25/97

- 1770-KFD firmware is NVS Flash Tool upgradable.

- If the KFD is connected to a network that has a 24VDC power supply attached, the use of an AC adapter connected to the jack on the KFD is NOT necessary.

- An AC adapter, connected to the KFD, can source 60 ma of DC current for point-to-point connections to devices.

- 1770-KFD contains a built in termination resistor for point to point use. This resistor should only be connected to the DeviceNet network when the KFD is powered from the power jack on the side of the KFD. However in some rare instances, this resistor may connect to the network even when the KFD is powered from the network. This acts as a third terminating resistor which will load the CAN-H and CAN-L transceivers beyond their specifications and could cause communication problems.

- In RSLinx software, the 1770-KFD driver may not appear after configuring it new. This is due to RSLinx running as a service in the PC. Go to the Administrative Tools window and then go to the services window and change RSLinx Classic from automatic to manual Startup Type.

1770-KFD LED Details

Module Status Led	Network Status Led	Mode
Off	Off	KFD is not powered up
Blinking Green	Off	KFD is off-line
Solid Green	Blinking Green	KFD is on-line but not currently communicating on the network.
Solid Green	Solid Green	KFD is on-line and currently communicating on the network.
	Solid Red	KFD is Bus Off, probably from a duplicate node on network.

1784-U2DN DETAILS

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1784-U2DN Fun Facts

- The 1784-U2DN is a USB to DeviceNet adapter. It is used to easily connect a PC to a DeviceNet network if a DB-9 serial connector is not available on the PC.

- RSLinx V2.54 or later has driver already installed for the 1784-U2DN. Knowbase document ID 53280 contains details on how to load the drivers for earlier RSLinx revisions.

- The 1784-U2DN gets its operating power solely off of the USB connector.

- Rotary switches on the unit are used to set the node number of the unit.

- A slider switch on the side of the unit is used to set the baud rate of the U2DN to either the default baud rate of 125 Kbits/sec or Autobaud. Autobaud is recommended if there is always a master scanner on the network communicating, so a baud rate will be easily detected by the U2DN. When in Autobaud mode, if the U2DN does not detect any network traffic in 12 seconds, it will default to a fallback data rate. This will be 125Kbits/sec, right out of the box. If a different fallback baud rate is desired other than the default, the rotary switches are used to set it. If the rotary node number switches are set to 91 (125K), 92 (250K) or 93 (500K) before the USB cable is plugged into the PC, it will manually set the fallback baud rate to the value in the () when plugged in. Then the USB cable is removed and the node number switches are set to the desired node number. Reconnect the USB cable and the U2DN is ready to use. The fallback baud rate can also be changed via RSNetWorx software, by using the node commissioning feature, but again only when the slider switch is in autobaud position.

- The U2DN uses a standard 5 pin Phoenix connector to make a connection to the DeviceNet network. A 1787-Plug10R connector can be easily used for this connection.

- The 1784-U2DN can NOT be used with the 9220-WinTA Traffic Analyzer software, but it can be used with the FrontLine NetDecoder software.

- The 1784-U2DN will not operate with the MD functionality in RSNetWorx software. You can not get beyond the Device ID level for any DeviceNet device on MD.

- There is an issue in all firmware revisions prior to V1.09, where monitoring device parameters with RSNetWorx, will cause the monitoring to abort and stop.

- Installation manual is 1784-IN046B-EN-P

1784-PCD PCMCIA DeviceNet Interface Card

DeviceNet PCMCIA Interface
(1784-PCD)

- PCMCIA card for PC connectivity to DeviceNet

- Use PC to configure devices, monitor data, or perform simple maintenance functions

- Type II compatible

- Autobaud capable

- Cabling scheme makes use of 1770-KFD cable options. The 1784-PCD comes with a short cable that connects from the card itself into a standard, female socket Phoenix connector.

- Operating system drivers for Windows 3.x, Windows 95, 98 or 2000 and NT

- Works with DeviceNet Manager and RSNetWorx for DeviceNet software. To use with DeviceNet Manager you must load the 16 bit driver in PC. To use with RSNetWorx for DeviceNet you must load the 32 bit driver in PC.

- DeviceNet Monitor software uses the 1784-PCD card, but is only compatible with the 16 bit driver. Traffic Analyzer software uses the 32 bit driver. Since only one driver can be installed on the PC at a time, it is best to have both 16 and 32 bit drivers on the PC and selectively install/uninstall the driver that is compatible with the software you want to run.

- The 1784-PCD card is now obsolete and the 1784-U2DN should be considered its replacement.

1747-SDN DETAILS

1747-SDN Fun Facts

- Node Number and Baud rate are all set via node commissioning in the RSNetWorx or DeviceNet Manager software.

- Series A and Series B hardware is identical except for the removal of an unused DH485 connector on the Series B card. Both cards are completely compatible with all firmware.

- Firmware revision V4.001 or higher contains Explicit Messaging and Change of State/Cyclic modes of operation. This version also supports the Flush bit and CRC display features in the Module Command word.

- Firmware revision V4.015 contains support for the Pass Through and Automatic Device Replace (ADR) feature. IMPORTANT NOTE: When using firmware 4.015 the M0 and M1 file sizes increase from 256 to 361 words and will need to be modified in the SLC-500 processor configuration using the APS or RSLogix 500 programming software.

- Firmware flashing SDN scanners prior to V5 requires the NVS Update function in the GTS Toolkit. V5 firmware updates or later uses ControlFlash software, which only works with a V4.015 firmware or later 1747-SDN. Special care should be exercised when flash upgrading an older 1747-SDN scanner to V4.015. The init, boot and main code segments must be flash upgraded as separate operations in the GTS Toolkit.

- 1747-SDN scanner supports Slave Mode.

- 1747-SDN up to V4.026 do not allow scan list downloads unless Program keyswitch on processor is in program mode, even with Run bit off in command register.

- Auto Address Recovery of ADR will not work more than once to group 2 only devices in firmware up to V4.026. To get it to work a second time, cycle power to 1747-SDN scanner.

- IMPORTANT!! Whenever an M file access is done in the ladder logic to a 1747-SDN, an interrupt is generated to the SDN. This interrupt will take 1 msec to execute and will stop the DeviceNet network scan, along with the ladder execution, for this 1 msec period. It is highly recommended than when using the M files, do a copy from the M1 file into an integer file at the top of the ladder logic and a copy to the M0 file from an integer file at the end of the ladder logic. Then use the Integer files in the ladder logic for control. This will keep any system delays to an absolute minimum. This is all well described in the 1747-SDN installation instructions.

1747-SDN Fun Facts (cont.)

- V5.01 allows a scan list download to the scanner to be accepted even if the processor is in RUN mode as long as the scanner is in idle mode.

- **IMPORTANT NOTE: With V6.02 or above, you should increase M1 and M0 sizes in the SLC-500 program to 395 bytes.** This fixes a bug where PanelView uploads and downloads using Pass through would fail.

- V6.02 added a nice Device Active table in words 206 to 209.

- V6.02 supports CCV value of ADR feature.

- V6.02 supports Quick Connect feature.

- **Until further notice DO NOT use firmware revision V7.006 in any 1747-SDN modules!!! V6.02 is the latest recommended firmware for this module, Series A or B.**

- It has been reported from the field, but not verified that V6.002 firmware may put garbage data into the M1 data table in areas that do NOT have actual devices mapped to them.

- Putting the 1747-SDN scanner in the remote chassis with an ASB module is possible, but not recommended. Only 2 words of Discrete IO data is accessible in the SDN through RIO and no M transfers. Unfortunately, the first word of IO in each image is reserved, which only leaves one word of mappable Discrete data for the DeviceNet devices into the IO, in each direction.

- Most SLC-500 processors support 4096 bits of Discrete IO data both directions. Divide this by 16 to get 256 words of IO data. Divide by 32 words/scanner and you can run up to eight 1747-SDN scanners in a single chassis. As long as no other modules using discrete IO data are in the chassis and the SLC-500 power supply can manage the current requirements.

- Firmware is flash upgradable over the DeviceNet network using the Control Flash update tool on a PC after V4.015

- Installation Manual is Publication 1747-5.8 and Configuration Manual is Publication 1747-6.5.2.

1747-SDN Series C & D Fun Facts

- 1747-SDN Series C and D modules are each a completely new hardware designs, each with a more powerful CPU.

- Firmware V8.005 is latest and greatest but is ONLY FOR THE SERIES C hardware and is NOT compatible with ANY other Series of the 1747-SDN scanner.

- Firmware V9 is latest and greatest firmware revision for the Series D hardware ONLY and is NOT compatible with ANY other Series of the 1747-SDN scanner.

- Updated Installation Instructions is Pub # 1747-IN058E-EN-P

- Updated User Manual is Pub # 1747-UM655B-EN-P.

- Firmware V8.002 includes Auto-Scan and an embedded EDS file as new features.

- A problem was introduced after V8.002 where when using the configuration recovery function of ADR and devices with large amounts of configuration data, there exist situations where the scan list and configuration data may be lost upon a power cycle. This only occurs if the module is not placed into program/idle mode before power down under certain circumstances. V8.006 corrects this issue and is available for use.

- New DEM instruction in SLC 5/03, 5/04 and 5/05 FRN 10 simplifies DeviceNet explicit messaging through the 1747-SDN (any series)

- When downloading a scan list to a Series D, firmware revision 9 1747-SDN scanner, an error may occur at the end of the download. DON'T PANIC!! The download did actually complete successfully, but the SDN did not return the correct response to the software. This is a nuisance error only and will be fixed in next firmware release.

- The 1747-SDN EDS file can be uploaded into RSNetWorx directly from a Series C or D module using RSLinx.

1747-SDN Input and Output Data Table Formats

SLC M1 FILE

Word 395	V6.02 or Higher
Word 360	Pass Through
Word 256	V4.015 or Higher
Word 255	Explicit MSG
Word 224	Table
Word 223	Auto Verify
Word 220	Table
Word 219	Device Failure
Word 216	Table
Word 215	Reserved
Word 212	
Word 211	Scan Counter
Word 210	CRC/LEDS
Word 209	Device Active
Word 206	V6.02 or Higher
Word 205	Reserved
Word 150	
Word 149	Input Data
Word 0	

SLC M0 FILE

	V6.02 or Higher
	Pass Through V4.015 or Higher
	Explicit MSG Table
	Reserved
	Output Data

SLC INPUT IMAGE

Word 31	Input Data
Word 1	
Word 0	Module Status

SLC OUTPUT IMAGE

Word 31	Output Data
Word 1	
Word 0	Module Command

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1747-SDN Module Command Word

Bit Number	Meaning
0,1	0 = Channel in IDLE mode; 1 = Channel in RUN mode 2 = Channel in FAULT mode; 3 = reserved
2	1 = Flush Scanner Database (Only in Idle Mode)
3	Reserved
4	0 = Enable Channel; 1 = disable Channel
5	0 = Reserved
6	0 = Scanner run; 1 = scanner halt (requires reset)
7	0 = Scanner run; 1 = reboots scanner firmware
8-10	M1 Word 210 Select (0 = Error LEDS, 1-7 = CRC's)
11-15	Reserved for future use

1747-SDN Module Status Word

Bit Number	Meaning
0,1	Echoes bits 0,1 in Module Command Register
2	Reserved
3	Reserved
4	Echoes bit 4 in Module Command Register
5	Reserved
6	1 = Channel device failure detected
7	Reserved
8	1 = Channel autoverify failure detected
9	Reserved
10	1 = Channel communications failure detected
11	Reserved
12	1 = Channel failed DUP MAC ID test
13	Reserved
14	Reserved
15	1 = Explicit Message Response Pending

Sample PLC Program to Use the 1747-SDN Inputs and Outputs

Do a 128 word File Copy to get the data into the Scanner from SLC-500 file N22:0 and a second 128 word File Copy to get data out of the Scanner into SLC-500 file N23:0. Note: 1747-SDN is in slot 1 of SLC-500 Chassis.

```
                              FILE COPY
                              Source          #M1:1.0
                              Dest            #N23:0
                              Length              128

                              FILE COPY
                              Source          #N22:0
                              Dest            #M0:1.0
                              Length              128

   N23:5/00    I:1.1/04                      N22:0/06
   ──┤/├──────────┤ ├──────────────────────────( )──

                                              O:1.1/09

                                              ──( )──
```

1747-SDN Scanner Data Flow Overview

Discrete Input Image

B	A

Data Table

D	C
	E

A   X

0   1

Discrete Output Image

	X

Data Table

Z	Y

SLC-500 Processor

Discrete I/O Xfer

IO Map

M1 File Copy

Discrete I/O Xfer

IO Map

M0 File Copy

A
B
C
D
E

Internal Input Data Storage

Y
Z
X

Internal Output Data Storage

1747-SDN Scanner

A
B
C
D
E

Input Data From DeviceNet Device

Y
Z
X

Output Data To DeviceNet Device

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1771-SDN DETAILS

1771-SDN Fun Facts

- Node Number and Baud rate are all set via dip switches on the SDN module.

- Series A and Series B hardware operate identically and with 100% compatibility. The only differences are cosmetic. Series B have dip switch banks that are right side up, Phoenix connectors that are centered on module front and Phoenix connectors with jack screws.

- Firmware is flash upgraded over the DeviceNet network using the NVS update tool on a PC. However, there are two different firmware revisions. V4.006 for Series A or B hardware and V6.006 for Series C hardware. These firmware revisions are NOT interchangeable between the Series A or B and Series C hardware!!!

- All scanners have 356 words of Input and 356 words Output data broken into six Block Transferable pieces. This data is shared between two different channels.

- ALL 1771-SDN SCANNERS SERIES A and B SHOULD BE AT LEAST V3.006 REVISION FIRMWARE FOR BEST RELIABILITY!!

- Current shipping firmware revision is V4.006 for Series A and B hardware. Firmware revision V4.001 or higher contains Pass Through functionality, however use V4.006 for best reliability.

- I/O Chassis Address Switches on the SDN module MUST be set to the same density as the Chassis Density switches on the I/O chassis. These switches determine how many bits of discrete data are available to the 1771-SDN on the backplane. 2 slot = 0 bits of Discrete I/O, 1 slot = 8 bits of Discrete I/O and 1/2 slot = 24 bits Discrete of I/O space available for 1771-SDN use.

- 1771-SDN Series A and B do NOT support slave mode or ADR.

- 1771-SDN Series C scanner is released and is DML based and does ADR. This scanner is a complete new hardware design so is not compatible with Series A or B firmware. Current shipping firmware is V6.005.

- 1771-SDN Series C MUST be at firmware V6.005 for best reliability. Prior to V6.005, the input data brought in via Block Transfers can be erratic, mixing new and old data.

- 1771-SDN Series C V6.004 or higher support the Quick Connect feature

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1771-SDN Fun Facts (Cont)

- Series C Scanners appear to Poll a DeviceNet network considerably faster than a Series A or B scanner. This will reduce the poll cycle time and cause more packets per second to be transmitted on the network. It has been reported that some third party devices choke if they are sent packets too often. If a Series A or B scanner works on a network, but a Series C doesn't, then this is an indication of this happening. Bumping up the InterScan Delay (ISD) in the Series C scanner will stretch back out the Poll cycle and will mask the end devices problem.

- Series C 1771-SDN modules have a sensitivity to how far away from the network power supply they are located. If you see an error 91, 79 or other communication errors on a network you trust, move the power supply closer to the scanner. Or break the V+ wire between the scanner and the network then apply another source of 24VDC to the SDN's network connector. Lastly, a Series B scanner can be substituted in place of the Series C scanner. This issue was verified on KwikLink flat media and occurred when the power supply was placed over 290' from the scanner.

- Any 1771-SDN Series C scanner prior to revision V6.006, can only utilize 32kbytes of ADR space per channel, instead of the normal 64kbytes.

- Installation Manual is Publication 1771-5.14 and Configuration Manual is Publication 1771-6.5.118.

- Switch 3 (Series A hardware) or Switch 6 (Series B hardware) on Configuration switch bank is the flush switch to clear SDN database with scan list. Flip switch down (Series A) or up (Series B) and cycle power on SDN to flush scanner. Module Status LED will flash red when flush is complete. Flip switch back up (Series A) or down (Series B) and cycle power again and scanner will power up with default configuration and no scan list.

- Switch 4 (Series A hardware) or Switch 5 (Series B hardware) on Configuration switch bank puts the SDN in a special firmware download mode. Flip switch down (Series A) or up (Series B) and cycle power on SDN. Module Status LED will flash green. Flash update the firmware on the SDN. Flip switch back up (Series A) or down (Series B) and cycle power again and scanner will power up normally, Useful if a Flash upgrade fails and the module will no longer boot up under normal circumstances.

- The 1771-SDN Series C EDS file can be uploaded into RSNetWorx directly from the module using RSLinx.

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Typical Block Transfer Data Flow From 1771-SDN to PLC-5

Input Data Table

Block Transfer

read $\longrightarrow$ **N23:0**

62 words

Module Status Word	N23:0
Channel A Input Data	N23:1
Channel A Input Data	N23:61
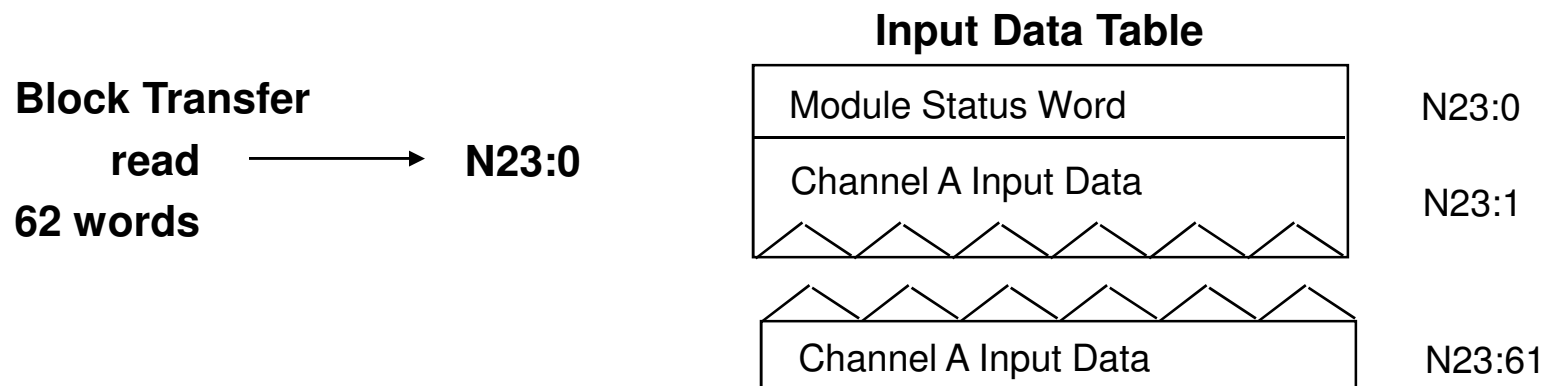
Module Status Word:

Bit Number	Meaning
0,1	Echoes bits 0,1 in Module Command Register
2,3	Echoes bits 2,3 in Module Command Register
4	Echoes bit 4 in Module Command Register
5	Echoes bit 5 in Module Command Register
6	1 = Channel A device failure detected
7	1 = Channel B device failure detected
8	1 = Channel A autoverify failure detected
9	1 = Channel B autoverify failure detected
10	1 = Channel A communications failure detected
11	1 = Channel B communications failure detected
12	1 = Channel A failed DUP MAC ID test
13	1 = Channel B failed DUP MAC ID test
14	1 = Scanner Configuration missing/corrupted
15	1 = Explicit Message Response Received

Typical Block TransferData Flow From PLC-5 to 1771-SDN

Block Transfer

    write ←   **N22:0**

62 words

Output Data Table

Module Command Word	N22:0
Channel A Output Data	N22:1
Channel A Output Data	N22:2
Channel A Output Data	N22:61
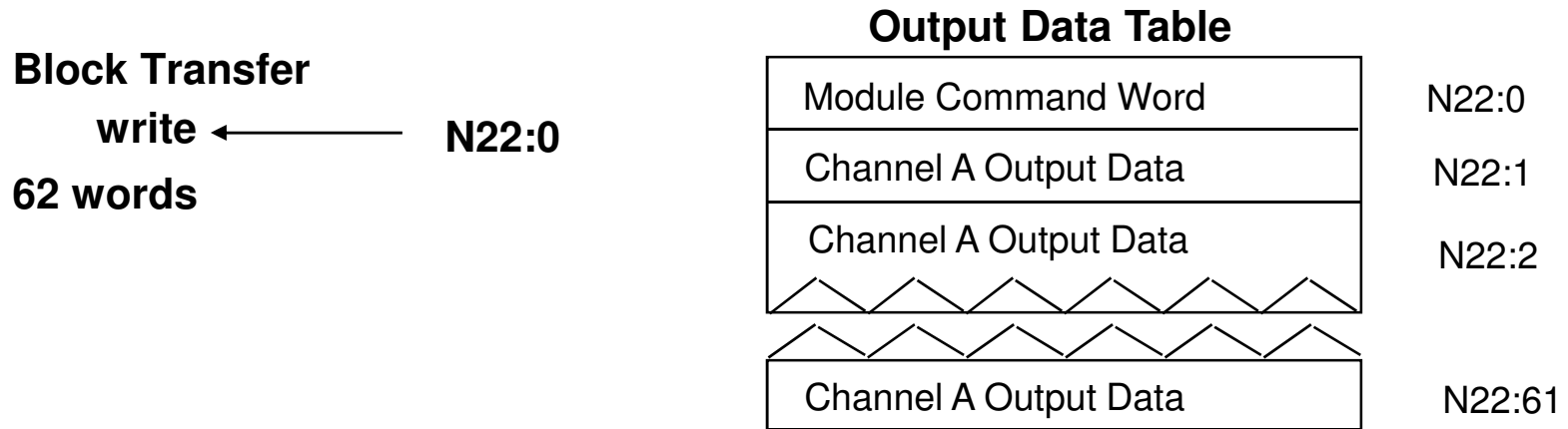
Module Command Word:

Bit Number	Meaning
0,1	0 = Channel A in IDLE mode; 1 = Channel A in RUN mode
	2 = Channel A in FAULT mode; 3 = reserved
2,3	0 = Channel B in IDLE mode; 1 = Channel B in RUN mode
	2 = Channel B in FAULT mode; 3 = reserved
4	0 = Enable Channel A; 1 = disable Channel A
5	0 = Enable Channel B; 1 = disable Channel B
6	0 = Scanner run; 1 = scanner halt (requires reset)
7	0 = Scanner run; 1 = reboots scanner firmware
8-15	Reserved for future use

Sample PLC Program to Use the 1771-SDN Inputs and Outputs

Do a 62 word Block Transfer Read and 62 word Block Transfer Write to get the data into the Scanner from PLC file N22:0 and out of the Scanner into PLC-5 file N23:0

| BTR /EN | BTW /EN | BTR
Dest: N23:0
Size: 62 words | (EN)
(DN)
(ERR) |

| BTR /EN | BTW /EN | BTW
Dest: N22:0
Size: 62 words | (EN)
(DN)
(ERR) |

N23:5/00 I:000/04   N22:1/06
  ─| / |──────| |────────────────────────────( )

                                                O:0/10
                                              ──( )

1771-SDN Scanner Data Flow Overview

Discrete Input Image

B	A

Block Xfer Data Table

D	C
	E

B — **Y**

9 — **1**

Discrete Output Image

	X

Block Xfer Data Table

Z	Y

PLC-5 Processor

Discrete I/O Xfer

IO Map

Block Xfer Read

Discrete I/O Xfer

IO Map

Block Xfer Write

A
B
C
D
E

Internal Input Data Storage

Y
Z
X

Internal Output Data Storage

1771-SDN Scanner

A
B
C
D
E

Input Data From DeviceNet Device

Y
Z
X

Output Data To DeviceNet Device

1771-SDN Block Transfer Info

Block Transfer Details Between PLC-5
and 1771-SDN scanner

SIZE (In Words)	Description	
64	**Explicit Message Response**	**(read)**
64	**Explicit Message Request**	**(write)**
57, 58 59, 60, 61 or 62	**Input I/O Table**	**(read)**
57, 58, 59, 60, 61 or 62	**Output I/O Table**	**(write)**
52 words	**Device Failure Table**	**(read)**
51 words	**Device Active Table (Series C Only)**	**(read)**
2-50 words	**Partial access to first 50 words of 62 word input I/O Table**	**(read)**
2-50 words	**Partial access to first 50 words of 62 word output I/O Table**	**(write)**
1 word	**Module status register**	**(read)**
1 word	**Module command register**	**(write)**

1771-SDN Device Failure Data to PLC-5

Block Transfer

   read $\longrightarrow$ **N24:0**

52 words

Device Failure Table

The scanner shall maintain one of these tables only.
The table shall consist of the following:

• The Communications Failure bitmap. This consists of the first
  128 bits (8 words) in the table. It is used to track IDN device
  communication failures.

• The Channel Scan Counter. This is a one word counter that
  is incremented by the scanner whenever a scan of the
  Channel's devices has been completed. This counter simply
  rolls-over when it reaches its maximum value.

For the two 64 bit bitmaps, one bit of the 128 shall be assigned
to each possible IDN device that may reside on the two IDN
networks (64 MAC ID's per network, two networks supported by
the scanner.)

**Word 26 of this table contains the Error Display LED Status
and will mimic the Error Display on front of the SDN.**

Communication Failure Bitmask 0-15 Channel A	N24:0
Communication Failure Bitmask 16-31 Channel A	N24:1
Communication Failure Bitmask 32-47 Channel A	N24:2
Communication Failure Bitmask 48-63 Channel A	N24:3
Communication Failure Bitmask 0-15 Channel B	N24:4
Communication Failure Bitmask 16-31 Channel B	N24:5
Communication Failure Bitmask 32-47 Channel B	N24:6
Communication Failure Bitmask 48-63 Channel B	N24:7

Channel A Scan Count	N24:16
Channel B Scan Count	N24:17

1756-DNB DETAILS

1756-DNB Series A & B Fun Facts

- Firmware is flash upgradable over the DeviceNet network using the NVS update tool on a PC. The firmware is also upgradeable over the ControlLogix backplane using the ControlFlash utility.

- Latest current released revision of firmware is V7.002 Q5.

- Version V3.004 or earlier can not be directly flashed to any revision beyond V3.004 without a two step process. Refer to Knowbase record 64809 for all details.

- Firmware V6.002 or higher is the most stable firmware and allows a true 2ms backplane RPI. AutoConfigure feature is also supported which is described elsewhere in this BOK. **Revision V6.002 and higher also <u>handles a Polled network twice as fast as previous revisions, but only at 250 Kbits/sec and 500 Kbits/sec.</u>**

- <u>1756-DNB can NOT be used to bridge from a DeviceNet network back to the backplane of the ControlLogix chassis, such as to do ladder programming back to the L1 processor.</u>

- Even though the Input and Output I/O tables are 124 Double Words big, only 62 Double Words worth of data is available through explicit messaging to the 1756-DNB. This includes explicit message activity through the backplane or over the network.

- Only 5 Explicit Messaging backplane connections can be handled by a 1756-DNB at one time. These connections are also used for browsing the network from the backplane and will limit how many explicit messages can be handled in parallel by the DNB.

- On all versions of the DNB, the explicit message connections may be used up and not freed inside the DNB. The symptom of this is that no browsing/bridging can be done from the backplane to the DeviceNet network. However, the IO data still works fine. Cycling power or doing a RIUP to the DNB recovers the module. V6.02 firmware in the 1756-DNB finally cures this issue.

1756-DNB Series A & B Fun Facts

- Firmware revision V3.010 or later supports the CCV feature of ADR.

- An ERC error on the DNB display can occur on ALL versions of the 1756-DNB when using a large amount of ADR memory. Updating to V5.002 of the 1756-DNB firmware will keep this from happening

- Series B scanners use a new Mid Range ASIC chip in the hardware and will ONLY work with firmware revisions V6.02 or later. ControlFlash will not allow you to backflash the Series B module to an earlier firmware revision. So don't try it or you will brick the 1756-DNB.

- Each 1756-DNB uses two connections over the backplane back to the logic processor. One connection is used for the Input/Output data and the second connection is used for the 1756-DNB Status data.

- 1756-DNB hardware boards have been susceptible to ERC errors in a few installations. The ERC error 4:2 S_UCMMBUFFS=0 BCBs=0 PCBs=0 D=0 E=22 F=2 G=0 H=0 is shown on the front display of the 1756-DNB and is due to a watchdog timeout error in the firmware. The problem stems from a circuit in the hardware that handles the DC-Fail signal on the backplane. When noise gets on the DC-Fail line, the board ERC errors. The hardware has been updated and new boards are currently being produced that fixes this anomaly. The CATALOG REV. of the new boards are E01 and the PART NO. is 96486273A01.

- Firmware revision V7.001 supports Online Scanlist Changes At Run (OSCAR) feature. This also requires version 7 of RSNetWorx software to download a scanlist in Run mode.

- V7.002 firmware has been reported to cause the 1756-DNB to go through random resets in a small amount of systems. It appears to be related to how much bridging is being done through the scanner at a particular time, like via DDE/OPC. This appears to be fixed in the unreleased V7.003 firmware.

- Firmware V5.002 and higher supports the Embedded EDS file, which means the EDS file can be uploaded from the module into RSNetWorx for DeviceNet software.

- User Manual is Publication 1756-6.5.15.

1756-DNB Series C and D Fun Facts

- Node number and baud rate set via rotary switches on module. All three rotary switches set to 888 will take module back to factory defaults.

- USB port on front of module allows easy/fast connection to ControlLogix backplane and the DeviceNet network. This connection performance is as fast as EthernetI/P connected through a 1756-ENBT.

- ADR space increased to 1 meg bytes.

- An Active Node Table in the DNB allows very fast browsing when using bridging from the backplane. A full network browse takes about 10 – 15 seconds. Doing a Get Attribute Single of Class 3, Instance 1, Attribute 13 decimal reads the Active Node Table.

- Network diagnostics include a network healthy bit 8 in the Status Register. A 1 indicates an unhealthy network. Doing a Get Attribute Single of Class 3, Instance 1 Attribute 12 decimal reads the CAN based error counters.

- Knowbase document 50064 gives details of accessing and using new data and features.

- Series C hardware and Series D hardware work identically and are interchangeable.

- Series D Scanners require a minimum of version V11.001 or later firmware which will also work with all Series C 1756-DNB modules. V11.003 or higher is currently recommended as the best firmware for both the Series C and D module and fixes an issue where during DNB bridging the attribute is not sent out on the network if it is a value of zero.

- IMPORTANT!!: See the 1756-DNB Series E slide for a full description of an issue affecting Series C, D and E 1756-DNB scanners concerning a Comm's Fault error 71 being displayed on PowerFlex drives.

- An issue was introduced in V11.003 firmware where when bridging through the DNB and while monitoring parameters on certain devices such as E3 overloads using RSNetWorx software, the connection(s) timeout and an error message is displayed. This issue is fixed in V11.005.

- Since V16 of RSLogix5000 does not have a V11 profile for the 1756-DNB Series C or D scanner, don't panic. Just select the V10 version and Compatible Keying for the 1756-DNB configuration. V10 and V11 are 100% compatible on the backplane interface and this will work perfectly.

- The 1756-DNB EDS file can be uploaded into RSNetWorx software directly from the module using RSLinx.

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1756-DNB Series E Fun Facts

- Due to parts obsolescence on the Series D 1756-DNB scanner module, a brand new hardware platform was created and released in January 2012. This scanner card is called the Series E 1756-DNB and the operation/features of this scanner is identical to the Series C and D scanners.

- Released firmware for the first Series E 1756-DNB scanners was V12.003. But an anomaly was found that if you were to interrupt the committing of a flash update to non-volatile memory, you could brick the DNB module. Since it takes almost two minutes to commit the flash update to memory, this created a large window of opportunity to brick the module. V12.005 of the firmware corrects this issue, <u>but be careful flashing to V12.005 and don't interrupt the commit operation.</u>

- V20 of RSLogix5000 is the first RSLogix5000 software to have a V12 profile for the 1756-DNB Series E scanner configuration, but don't panic. To use an earlier revision Logix controller just select the largest 1756-DNB Major Revision number in the I/O Configuration pull down menu, in the software. Then select Compatible Keying as the Electronic Keying for the 1756-DNB configuration. Series E 1756-DNB scanners are compatible with all commonly used Logix controller revisions and will work perfectly, using this technique.

- Series C, D and E 1756-DNB scanners use the same DeviceNet Master Library (DML) and all have an issue that was introduced when the Active Node table was implemented in the DML. While the DeviceNet network is still powered, if the HVAC is killed to PowerFlex Drives on the network and re-applied, the scanner occasionally has a problem re-initializing the I/O connection to one or more drives on the network. It has been found that the scanner seems to abort the I/O connection to a drive after the first attempt and then does the initialization successfully a second time. This situation does NOT generally cause a device problem UNLESS you have configured the PowerFlex drive to fault on a communications loss. Then a F071 will be displayed on the PowerFlex drive display. The only way to recover from this is to clear the fault either at the drive or remotely. Series A and B scanners do NOT have this problem. If you see a confirmed case of this issue happening in the field please send Bob Law a quick e-mail.

- IMPORTANT!! V12.001 and later firmware is ONLY compatible with the Series E 1756-DNB Scanner!!

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1756-DNB Firmware/Hardware Compatibility Matrix

Series B scanners use a new Mid Range ASIC chip in the hardware and will ONLY work with firmware revisions V6.02 to V7.XXX . ControlFlash will not allow you to backflash the Series B module to an earlier firmware revision. So don't try it or you will brick the 1756-DNB.

Series C Scanners have brand new hardware and require firmware V10.001 to V11.XXX to operate correctly.

Series D Scanners also have an ASIC upgrade and require a version V11.001 to V11.XXX firmware which will also work with all Series C 1756-DNB modules. V11.003 is currently recommended as the best firmware for both the Series C and D module and fixes an issue where during DNB bridging the attribute is not sent out on the network if it is a value of zero.

Series E Scanners require a minimum of firmware V12.003 to operate.

Firmware	Prior to V6.002	V6.002	V7.002	V10.001	V11.001 to V11.XXX	V12.003
Series A	▬	▬	▬			
Series B		▬	▬			
Series C				▬	▬	
Series D					▬	
Series E						▬

1756-DNB: Data Details

- **I/O Output size is 123,   32 bit double words**

    Local:# :O.Data[%].&   # = Slot, % = Index, & = Bit

- **I/O Input size is 124,   32 bit double words**

    Local:# :I.Data[%].&   # = Slot, % = Index, & = Bit

- **Scanner Status size is 128 bytes** **(Status format in CN2DN Section)**

⊞-Local:3:I	{...}
⊞-Local:3:O	{...}
⊟-Local:3:S	{...}
⊞-Local:3:S.ScanCounter	2#0000_0000_0000...
⊞-Local:3:S.DeviceFailureRegister	{...}
⊞-Local:3:S.AutoverifyFailureRegister	{...}
⊞-Local:3:S.DeviceIdleRegister	{...}
⊞-Local:3:S.ActiveNodeRegister	{...}
⊞-Local:3:S.StatusDisplay	{...}
⊞-Local:3:S.ScannerAddress	16#00
⊞-Local:3:S.ScannerStatus	16#5c
⊞-Local:3:S.ScrollingDeviceAddress	16#00
⊞-Local:3:S.ScrollingDeviceStatus	16#5c
⊞-Local:3:S.DeviceStatus	{...}

Normal DeviceNet Data Flow to/from 1756-DNB

DeviceNet

Configure, Monitor and Diagnose

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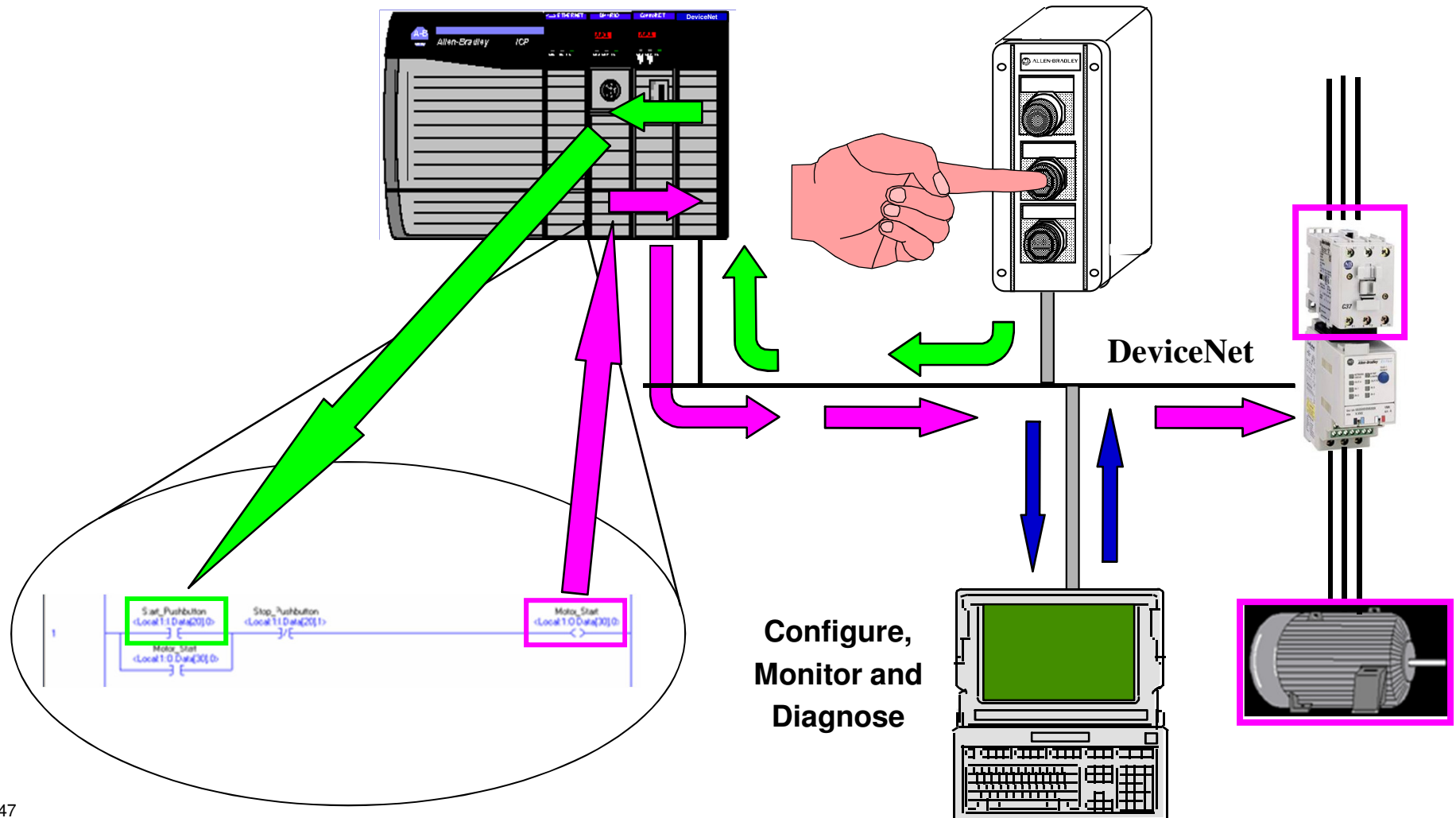
1756-DNB Bridging
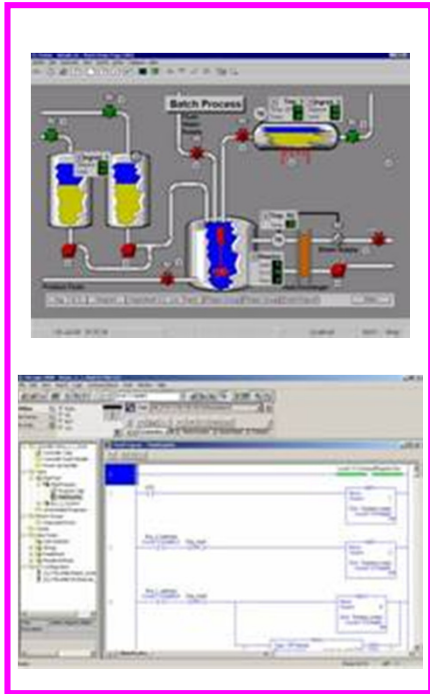
- DeviceNet configuration software utilizes the same supervisory network as RSLogix 5000.

- No need to directly connect to DeviceNet network to do configuration.

ControlNet or Ethernet

DeviceNet Network

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1769-SDN DETAILS

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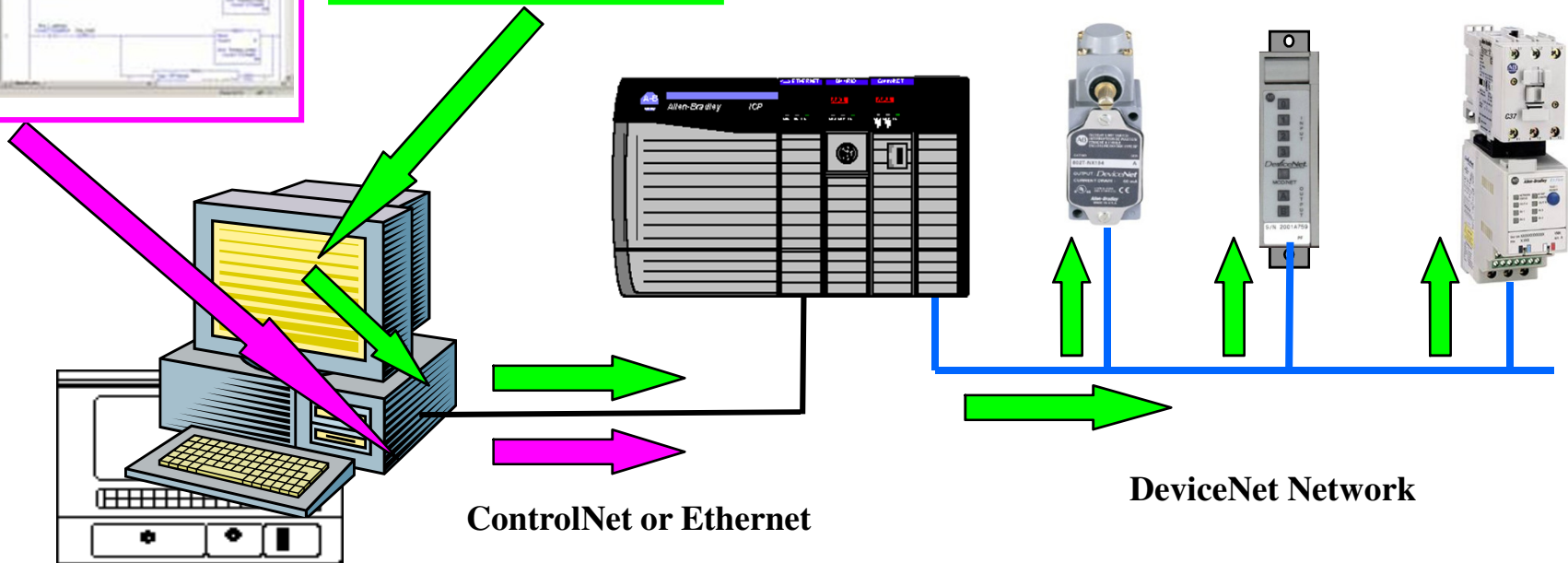
1769-SDN Fun Facts

- **Installation Manual is Publication 1769-IN060-EN-P and user Manual is Publication 1769-UM009A-EN-P.**

- **Ground lug on front of module MUST be grounded to good earth ground.**

- **1769-SDN can be used both in the MicroLogix 1500 and CompactLogix platforms.**

- **1769-SDN can be a master, slave and can originate explicit messages.**

- **RSLogix 500 software 5.0 supports 1769-SDN.**

- **Series A and Series B modules have identical hardware and can both use any firmware revision. Until using V3.001 or greater firmware, only flash upgrade the 1769-SDN over the network, not the CMPLX backplane.**

- **Powered by 1769 backplane and Device Net power. <u>MUST</u> be within 4 slot positions of a power supply (MicroLogix base or 1769 power supply)**

- **1769-SDN Series A does NOT support ADR.**

- **1769-SDN Series B does support ADR, but only has 48Kbytes of ADR configuration recovery memory.**

- **1769-SDN Series A supports up to 32 words of Transmit data and 32 words of Receive data to/from a slave device.**

- **1769-SDN V4.001 or higher supports AutoScan feature.**

- **When browsing a network with RSNetWorx software through a 1769-L35E backplane, the 1769-SDN will not show up in browse screen. Update 1769-SDN firmware to V2.002 to correct the problem.**

- **Latest released firmware as of 11/26/2012 is V4.004**

1769-SDN Fun Facts (Cont)

- 1769-SDN Series B supports up to 64 words of Transmit data and 64 words of Receive data to/from a slave device. The download will error with a 409 error, but the scanlist entry is still downloaded and will execute correctly. Since the scanlist download aborts on an error, the scanlist may or may not have been committed to non-volatile memory and may not survive a power cycle.

- When running 500Kbits/sec, while Strobing devices, while in RUN mode and communicating to Group 2 Only slave devices, an error 84 may occur during network initialization that will not go away. Also, at least one of the Group 2 Only slaves will no longer be communicated to. To get around this, do not Strobe any devices on the network or you can delay going into RUN mode until after the 1769-SDN has begun communicating with all of its slaves on the network.

- V4.001 firmware using the Easy Backup feature will cause the listen only input data in the secondary data table to twiddle randomly by itself. It only seems to happen if a slave device sends 3 or more fragments in the poll response back to the primary scanner. Originally duplicated with a FlexI/O chassis with enough modules installed to create a large receive size over 14 bytes.

- The backplane communication mechanism, which includes explicit messaging and network browsing involving a 1769-SDN may not work reliably. This was introduced with V18 firmware of L2x and L3x CompactLogix controllers. See Knowbase document 462381 for details about controller firmware updates that fix this issue.

- A situation with CompactLogix controllers starting at V18 can cause corrupted packets to be sent to the 1769-SDN over the backplane that will cause the module to fault with an error code 64 20 E0 to be displayed. V21 of the firmware for the CompactLogix controllers will fix this issue and V4.004 of the 1769-SDN will keep the corrupted packets from faulting the SDN module. When the module faults, the configuration/scanlist will be lost and the node number and baud rate will return to factory defaults of 63 and 125Kbits/sec respectively.

MicroLogix 1500 and 1769-SDN

All MicroLogix 1500 series C FRN 6 controllers are compatible with the SDN

SDN Input Configuration

> 66 Status words
>
> 180 Input data words (configurable)
>
> > Input data starts at word 65

SDN Output Configuration

> 2 Control words
>
> 180 Output data words (configurable)
>
> > Output data starts at word 1

No imposed limit concerning the number of modules attached to a ML1500 controller

> OS enhanced to support 250 input words and 250 output words per SLOT.
>
> I/O data consumes 3 memory words for each real world word, so practical limits do exist. (246 input words + 182 output words = 428 words per module max. 3 x 428 = 1284 words of consumed memory. 4000 / 1452 = 3.11 modules.
>
> So you could have more than 2 SDN's in a system. But you would probably be data space limited.

LRP Processor will allow backplane messaging.

> Ladder Logic is directly accessible via Device Net.
>
> Peer to Peer messages (PCCC format) supported.
>
> Explicit Messages (CIP) to 1769-SDN scanner or through it to other nodes on the DNet network.

CompactLogix and 1769-SDN

All CompactLogix controllers can use the 1769 SDN for I/O master functionality.

Explicit Messaging functions are NOT supported in the L20 and L30 processors, but is supported in all other series B processors. 1769-SDN should be Series B V2.001 of firmware.

L20 and L30 controllers are significantly limited in the amount of I/O data that's supported.

Only 256 words of I/O memory is available for all modules in the CompactLogix chassis. 34 words of overhead is used for the CompactLogix processor and 76 words of overhead is used for the1769-SDN. That leaves a maximum of 146 words of I/O area for both input and output data to/from the 1769-SDN assuming no other modules in the chassis.

All other Series B controllers allow up to 180 words of I/O data each direction per slot. 1769-SDN should be V2.001 of firmware.

I/O data size limitation of 64 words each direction per node.

1768-L4X processors can bridge from the EtherNet port directly over to the DeviceNet network for browsing and configuration.

1768-L43 processor V15.7 has an anomaly where some explicit messages sent from the ladder logic to the 1769-SDN, on the backplane, error. The work around is to add a ,2,1769-SDN_Node_Number to the end of the path in the message instruction. If the 1769-SDN is node 0 on the DeviceNet network, then the message path extension would be ,2,0.

Each 1769-SDN uses two connections over the backplane back to the logic processor. One connection is used for the Input/Output data and the second connection is used for the 1769-SDN Status data.

1788-DNBO
FlexLogix Interface

1788-DNBO Fun Facts

- The 1788-DNBO board interfaces the FlexLogix control platform to DeviceNet.

- The latest firmware revision is 2.002.

- The baud rate and node number are set via hardware pushwheels on the board.

- This module is DML based and supports the fancier features, such as Automatic Device Replace (ADR), AutoScan and Easy Backup.

- Quick Connect Feature also supported.

- The 1788-DNBO does not respond to FlexLogix backplane browse when the DeviceNet baud rate is set for anything other than 0 = 125k, 1 = 250k, 2 = 500k. The real issue is that the label indicates that 3 = PGM which would indicate that the baud rate is software configurable; however, this is not the case. When the baud rate thumbwheel is configured for anything other than 0, 1, or 2 the 1788-DNBO fails to respond to the backplane when using RSLinx, the web interface, or even to the processor as indicated in RSLogix5000 screen capture with error 16#0204 Connection Request error: Connection timed out.

- Input Data area is 124 Double Integers (DINT) and Output Data area is 123 DINTs, the same as the 1756-DNB.

1788-CN2DN
ControlNet to DeviceNet
Linking Device

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1788-CN2DN Fun Facts

- This device bridges from ControlNet to DeviceNet and also acts as a master scanner on the DeviceNet network.

- DeviceNet Node Number and Baud Rate are configured using rotary switches.

- Input Power consumption is 500 milliamps at 24VDC.

- DNet Power consumption is 90 milliamps at 24VDC.

- Firmware is flash upgradeable over the DeviceNet network using the NVS update tool on a PC.

- A scan list must be entered into the 1788-CN2DN module that contains communication parameters and data mapping configuration for all slave devices being communicated to by the card. These parameters are defined as Message Type, Transmit Size, Receive Size and the Input/Output Mapping locations for each slave device. This scan list entry is normally done using RSNetWorx for DeviceNet software.

- As of 4/18/2000, explicit messages originating from the user program in a ControlNet PLC-5 processor, can only be sent to the CN2DN Bridge, not through it to devices on the DeviceNet network. This is a limitation of the PLC-5 MSG instruction and programming software, not a CN2DN issue.

- The CN2DN bridge has an Output data table of up to 123 Double (32 bit) Words and an Input data table of up to 124 Double (32 bit) Words. It also has a Status Table of 128 bytes in length. (See next slide for Status Table Format)

- When using a ControlNet PLC-5, the first double word of the output data table is used for the Module Command Word and the first double word of the Input table is used for the Module Status Word. These words will offset the Input and Output Data, as mapped by RSNetWorx for DeviceNet, down one double word. For example, if a node's I/O data is mapped starting at double word [0] using the software, it will actually be located starting at single word [2] of the data table. Also, remember to turn on bit 0 of the Module Command Word to put the CN2DN in Run mode.

- Explicit Message path, for ControlLogix message instruction, once onto the 1788-CN2DN bridge is ,2,NODE. The 2 means remote port of the CN2DN bridge and NODE means the desired Device Net node number.

- 1788-CN2DN unit can NOT be used in a PLC-5, redundant ControlNet system due to a 1788-CN2DN implementation limitation. A 1771-ACNR remote adapter with a 1771-SDN in a remote chassis can be used as a substitute for a 1788-CN2DN in this application.

- Each 1788-CN2DN uses two connections over the ControlNet network back to the logic processor. One connection is used for the Input/Output data and the second connection is used for the 1788-CN2DN Status data.

- Active Node Table problems persist in the V1.024 firmware. A scanlist download to the CN2DN causes the Active Node table to stop working in the CN2DN (All bits go to 0). Cycling the CN2DN main power or DeviceNet power to the CN2DN causes the Active Node bits to start working again.

1788-CN2DN and 1756-DNB Status Format

Scan_counter	Counter incremented each I/O scan	32-bit
Device_failure_register	Device failed bit table, (One bit per node number)	64-bit
Autoverify_failure_register	Device I/O size does not match table	64-bit
Device_idle_register	Device Idle bit table	64-bit
Active_node_register	Node is active in Scan List	64-bit
Status_display	Ascii display data for DNB, unused for CN2DN	4-byte
Scanner_device_status	BCD display(See format below)	4-byte-BCD
Scanner_address	DeviceNet node address of DNB or CN2DN	8-bit-BCD
Scanner_status	Status of DNB or CN2DN (ex: 80 = Idle mode)	8-bit-BCD
Device_address	Scrolls through faulted DeviceNet devices	8-bit-BCD
Device_status	Scrolls through error code for each faulted device	8-bit-BCD
reserved_array	20 bytes for future expansion	20-byte
device_status_array	64 byte array with status code of each node number	64-byte
		------------
	Total Size	128-byte

1788-EN2DN
EtherNet/IP to DeviceNet
Linking Device
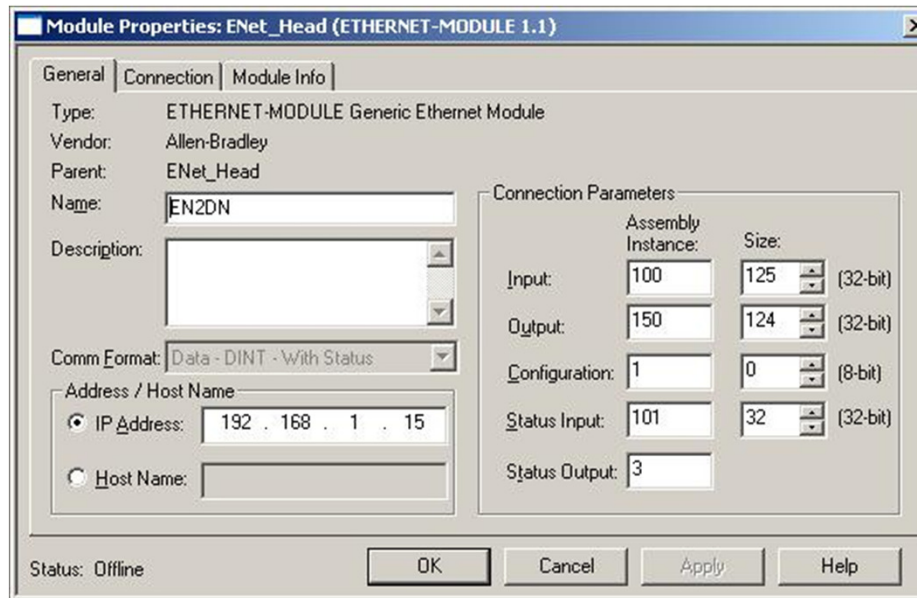
1788-EN2DN Fun Facts

- This device bridges from Ethernet/IP to DeviceNet and also acts as a master scanner on the DeviceNet network.

- DeviceNet Node Number and Baud Rate are configured using Node Commissioning over the DeviceNet Network. However, this module defaults to autobaud enabled right out of the box which is a problem if it is the master scanner for the network. To disable the autobaud feature, do a Set Attribute Single, to Class 3, Instance 1, Attribute 64 hex of one byte length. A 0 enables the autobaud feature and a 1 disables it. Look on page 20 of publication 1788-IN055A-EN-P for more details.

- The 1788-EN2DN has a bank of 8 dip switches on it that help to set the IP address. These dip switches form the last octet of the IP address which would be 192.168.1.dip switches. If the dip switches are set to 0 (All Off) or to a 255 (All On), then the DHCP capability is enabled and the IP address can be set via a BOOTP server or the module web page. Note: Switch 8 corresponds to bit 1 of this octet and when a switch is turned On, it means the appropriate bit is on. So the largest number that can be used for this octet is 254.

- Firmware is flash upgradable over the EtherNet network using the NVS update tool on a PC.

- A scan list must be entered into the 1788-EN2DN module that contains communication parameters and data mapping configuration for all slave devices being communicated to by the card. These parameters are defined as Message Type, Transmit Size, Receive Size and the Input/Output Mapping locations for each slave device. This scan list entry is normally done using RSNetWorx for DeviceNet software.

- In firmware V1.05.3 through V2.02.1, every 16th Double Word of the Input data table may not update as expected in the device. Double Words 15, 31, 47 etc. Firmware V2.03 will fix this problem. PSA ACIG-03-002 describes this more thoroughly.

- Each 1788-EN2DN uses two connections over the backplane back to the logic processor. One connection is used for the Input/Output data and the second connection is used for the EN2DN Status Data. Important!! The 32 Double Words of Status Data coming from the EN2DN is only updated no more often than every 1 second, no matter what the IO connection RPI is set at.

- In all firmware through V2.03, the IO data going to and from the DeviceNet side of the module will freeze, holding the IO in last state. No outward indication appears as the DeviceNet side and EtherNet side are still fat and happy. The only way to recover from this is to cycle power to the EN2DN bridge. PSA ASIG 2006-06-001 describes this more thoroughly and firmware revision V2.005 cures the anomaly.

1788-EN2DN Fun Facts

- **At least V2.05 of the EN2DN will drop the EtherNetIP connection after continuous operation of exactly 50 days. Rebooting the EN2DN will recover the connection for another 50 days. Any firmware revision after V2.05 will correct this issue.**

- **1788-EN2DN modules with hardware revision B are NOT compatible with firmware versions earlier than v2.010. If an attempt is made to update a revision B module with older firmware the ControlFlash update will fail during the download. All firmware (including v2.010 and later) may be used in modules with hardware revision A.**

- Series B hardware exists that must have at least V2.010 firmware or later to operate. Series A hardware can use any revision firmware.

- **It has been reported that 1788-EN2DN modules are being shipped with bogus V2.010 firmware. If connection errors occur back to an EtherNet/IP module in a controller, then flash the module to V2.010 again to cure this.**

- Until V13 of RSLogix5000 is released, a Generic Ethernet Module profile will need to be used to add it to a 1756-ENBT modules configuration. See the next slide for the recommended data sizes of this configuration. <u>Important Note: Until V13 is released, an extra 4 bytes of data will be added to the beginning of both the Input and Output data tables. This will push the I/O data down by 4 bytes compared to the data maps shown in the RSNetWorx for DeviceNet software for the 1788-EN2DN. These extra 4 bytes in the Input data table are Status bits and in the Output data table are the command bits. See following slides for the format of these bits.</u>

- An error code 60 on power up denotes a the module is "stuck" during its Duplicate MAC check, due to the message not being acked by any other device on the network. This could be because of an autobaud issue or the scanner is alone on the network.

- An error 61 during power up means the EN2DN is still trying to autobaud on the network to determine the baud rate. When used as a scanner the EN2DN should have autobaud disabled.

- Default User Name for web site access is Administrator, with no password

- Each 1788-EN2DN uses two connections over the EtherNet network back to the logic processor. One connection is used for the Input/Output data and the second connection is used for the 1788-EN2DN Status data.

- Installation manual is Publication 1788-IN055A-EN-P

1788-EN2DN Generic Data Sizes and CIA Info

Module Properties: ENet_Head (ETHERNET-MODULE 1.1)

General | Connection | Module Info |

Type: ETHERNET-MODULE Generic Ethernet Module
Vendor: Allen-Bradley
Parent: ENet_Head
Name: EN2DN
Description:

Comm Format: Data - DINT - With Status

Address / Host Name
⦿ IP Address: 192 . 168 . 1 . 15
○ Host Name:

Connection Parameters

	Assembly Instance:	Size:	
Input:	100	125	(32-bit)
Output:	150	124	(32-bit)
Configuration:	1	0	(8-bit)
Status Input:	101	32	(32-bit)
Status Output:	3		

Status: Offline   [OK] [Cancel] [Apply] [Help]

All CIA data below is accessed using Get Attribute Single (0x0E) and Set Attribute Single (0x10) Services to the DeviceNet side of the 1788-EN2DN module.

Class 1, Instance 1, Attribute 67 (hex) sets/resets Run/Idle bit. (Read/Write) 0=Idle, 1=Run.

Class 4, Instance 64 (hex), Attribute 3 is the Input Image. (Read)

Class 4, Instance 65 (hex), Attribute 3 is the Status Image. (Read)

Class 4, Instance 96 (hex), Attribute 3 is the Output Image. (Read/Write)

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1788-EN2DN Command Word

Bit Number	Description
0,1	0 = Channel in IDLE mode; 1 = Channel in RUN mode 2 = Channel in FAULT mode; 3 = reserved
2	0 = Enable Channel; 1 = disable Channel
3	Not Used
4	0 = Scanner run; 1 = reboots 1788-EN2DN firmware
5-31	Not Used

492 Bytes of Output Data (123 DINTS)

1788-EN2DN Status Word

Bit Number	Description
0,1	Echoes bits 0,1 in Module Command Register
2	1 = DeviceNet Network is disabled
3	1 = Channel device failure detected
4	1 = Channel autoverify failure detected
5	1 = Channel communications failure detected
6	1 = Channel failed DUP MAC ID test
7	1 = No Dnet Power Detected
8-31	Not Used

496 Bytes of Input Data (124 DINTS)

193-DNENCATR
EtherNet/IP to DeviceNet
Linking Device

193-DNENCATR Fun Facts

- This device was designed to bridge from Ethernet/IP to E3 Overloads on DeviceNet and control them. However, since it acts as a master scanner on the DeviceNet network it can also be used to interface devices other than the E3 on DNet. **The 193-DNENCATR is designed to only control six devices over DeviceNet.**

- The module comes in two flavors. The 193-DNETCAT that has a single EtherNet/IP port on it and the 193-DNENCATR has two EtherNet/IP connectors forming a DLR.

- The 193-DNENCATR has an Add On Profile developed and in RSLogix5000 for interfacing to Logix controllers. You can also use a Generic Ethernet Module Connection with Input Assembly Instance of 101 of size 81 16-bit integers, Output Assembly Instance of 100 of size 24 16-bit integers, and Configuration Assembly Instance of 102 of size 0 8-bit bytes in its I/O Configuration folder.

- The 193-DNENCATR does NOT use RSNetWorx for DeviceNet software for configuration. It uses a web interface and Explorer to do all module configuration including the scanlist and network parameters. However, it will still appear on an RSNetWorx DNet network browse screen.

- The DeviceNet and Baud Rate are configured via the web interface or can be node commissioned.

- A User name/Password must be entered into the module before a scanlist can be configured via Explorer. The defaults right out of the box, are user = Administrator with no password.

- The 193-DNENCATR has a bank of 3 rotary switches on it's front that allow you to set the IP address. These rotary switches form the last octet of the IP address which would be 192.168.1.dip switches. However, if the rotary switches are set to a value greater than 255, then the DHCP capability is enabled and the IP address can be set via a BOOTP server or a static IP address is used. The 193-DNENCATR does NOT require RSNetWorx over EtherNet/IP for configuration.

- A scan list must be entered into the 193-DNENCATR module that contains communication parameters and data mapping configuration for all slave devices being communicated to by the unit. This scan list entry is done using the web interface.

193-DNENCATR Fun Facts Cont.

- **The 193-DNENCATR will not successfully communicate to a CompactBlockIO (1791D) rack that has no TX (Output) data required. This only happens with the 1791D-16V0 module alone or with a 1791D-16V0 and 1791D-16V0X expansion module together. The problem occurs because since no output assembly data exists for this module combination, the CompactBlockIO base returns back an "object not supported" response to the 193-DNENCATR output size read request , during the open I/O connection sequence. All other scanners interpret this response as a 0 Tx size, but the 193-DNENCATR interprets this response as an error and does not open up an I/O connection to the module. There is NO work around for this issue until a firmware patch is rolled out for the 193-DNENCATR.**

- **Devices supporting the CIP Parameter Object, such as most power products, can also be configured through the 193-DNENCATR using the web interface.**

- **Supports CIP IO Messaging and CIP Explicit Messaging.**

- **Firmware is flash upgradeable over the EtherNet network using the NVS update tool on a PC.**

- **User manual for the 193-DNENCATR is publication 193-UM14-EN-P.**

193-DNENCATR Assemblies With Generic Profile

Connection Parameters

	Assembly Instance:	Size:	
Input:	101	81	(16-bit)
Output:	100	24	(16-bit)
Configuration:	102	0	(8-bit)
Status Input:			
Status Output:			

Table 7 - Input Assembly — Instance 101

Byte Size	Contents
4 bytes	Logix Status Word
2 bytes	DeviceNet Scanner Status (Parameter 1) See Table 9 on page 73
2 bytes	Scan List Entry 1 Status Word (Parameter 2) See Table 10 on page 74
2 bytes	Scan List Entry 2 Status Word (Parameter 3) See Table 11 on page 74
2 bytes	Scan List Entry 3 Status Word (Parameter 4) See Table 12 on page 74
2 bytes	Scan List Entry 4 Status Word (Parameter 5) See Table 13 on page 75
2 bytes	Scan List Entry 5 Status Word (Parameter 6) See Table 14 on page 75
2 bytes	Scan List Entry 6 Status Word (Parameter 7) See Table 15 on page 75
[9] Scan List I/O Size	Produced I/O data from the first scan list entry.
[13] Scan List I/O Size	Produced I/O data from the second scan list entry.
[17] Scan List I/O Size	Produced I/O data from the third scan list entry.
[21] Scan List I/O Size	Produced I/O data from the fourth scan list entry.
[25] Scan List I/O Size	Produced I/O data from the fifth scan list entry.
[29] Scan List I/O Size	Produced I/O data from the sixth scan list entry.
2 bytes	Data Link 1 Data
2 bytes	Data Link 2 Data
2 bytes ::	Data Link 3 Data ::
2 bytes	Data Link 48 Data

Table 6 - Output Assembly — Instance 100

Byte Size	Contents
[0] Scan List I/O Size	Data to be delivered to the first scan list entry.
[4] Scan List I/O Size	Data to be delivered to the second scan list entry.
[8] Scan List I/O Size	Data to be delivered to the third scan list entry.
[12] Scan List I/O Size	Data to be delivered to the fourth scan list entry.
[16] Scan List I/O Size	Data to be delivered to the fifthscan list entry.
[20] Scan List I/O Size	Data to be delivered to the sixth scan list entry.

The numbers in the [ ] are offsets of a devices input and output data table in the INT based data table assemblies. These I/O sections default to 8 bytes/4 INTs in size for each device in the 193-DNENCATR scan list. This data size can be easily changed through the web interface under the Advanced Configuration menu.

Web Interface Look

- **Setup the DeviceNet scanner**
- **Create additional datalinks for EtherNet/IP I/O messaging**

1784-PCID and 1784-PCIDS DeviceNet Interface Card

1784-PCID(S) Fun Facts

- The 1784-PCIDS card acts as a master scanner on a DeviceNet network while the 1784-PCID card purely acts as a network interface card. DeviceNet Node Number and Baud Rate are user configurable and initialized when the SoftLogix software is started up.

- Firmware is flash upgradable over the DeviceNet network using the NVS update tool on a PC.

- The 1784-PCIDS card has an Output Image size of 1024 words and also an Input Image size of 1024 words. The 1784-PCIDS card also has a Status area of size 128 words.

- Inside the SoftLogix processor, the Output Image data, Input Image data and Status data is all mapped into separate Integer Files. Inside the SoftLogix programming software, the file numbers for each area MUST be defined before the data can be accessed by the SoftLogix. When using RSLogix 5 as the programming software, this file definition is done inside the "Processor Status" configuration screen with the DNet tab. These integer files will have a file type of N and will automatically be created and sized large enough.

- A scan list must be entered into the 1784-PCIDS card that contains communication parameters and data mapping configuration for all slave devices being communicated to by the card. These parameters are defined as Message Type, Transmit Size, Receive Size and the Input/Output Mapping locations for each slave device. This scan list entry is normally done using RSNetWorx for DeviceNet software running inside the same PC with the SoftLogix software and the 1784-PCIDS card. The scan list entry can also be done from another PC connected to the DeviceNet network through another network interface with the RSNetWork software. Note: Since the PCIDS card will normally also act as your network interface, it is easiest to use the SoftLogix PC to do all network configuration along with the scan list entry.

1784-PCIDS Fun Facts Continued

- There is a test utility with IOLinx that will allow a network to be debugged without having to fire up the SoftLogix software. Once a scan list is entered for an operating DeviceNet network, this utility allows input information to be monitored from all slave devices. It also allows you to manipulate output data being sent to the slave devices.

- DeviceNet power must be applied to PCIDS card when first being configured in RSLinx.

- DeviceNet Traffic Analyzer can NOT be run using a 1784-PCIDS PC card, but only with a 1784-PCID card.

- The 1784-PCID card does not have a driver available that is compatible with Windows XP Professional. A 1784-PCIDS card should be substituted on a Windows XP Professional box.

- The 1784-PCID and 1784-PCIDS cards are NOT supported in any Windows 7 & or Vista operating systems. No drivers are available!!

- Publication 1789-6.5.1 is the user manual for SoftLogix and Chapter 3 gives valuable information about Communicating with DeviceNet I/O.

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1784-PCIDS Scanner Data Flow Overview

Input Image as an Integer File

N10:0	B A
N10:1	D C
N10:2	E

Input I/O Xfer

N10:1 (D)   N11:0 (Y)
      | | ( )
      10   5

Output Image as an Integer File

N11:0	Z Y
N11:1	X

Output I/O Xfer

SoftLogix Processor

0	A
	B
1	C
	D
2	E

Internal Input Data Storage

0	Y
	Z
1	X

Internal Output Data Storage

1784-PCIDS Scanner

A
B
C
D
E

Input Data From DeviceNet Device

Y
Z
X

Output Data To DeviceNet Device
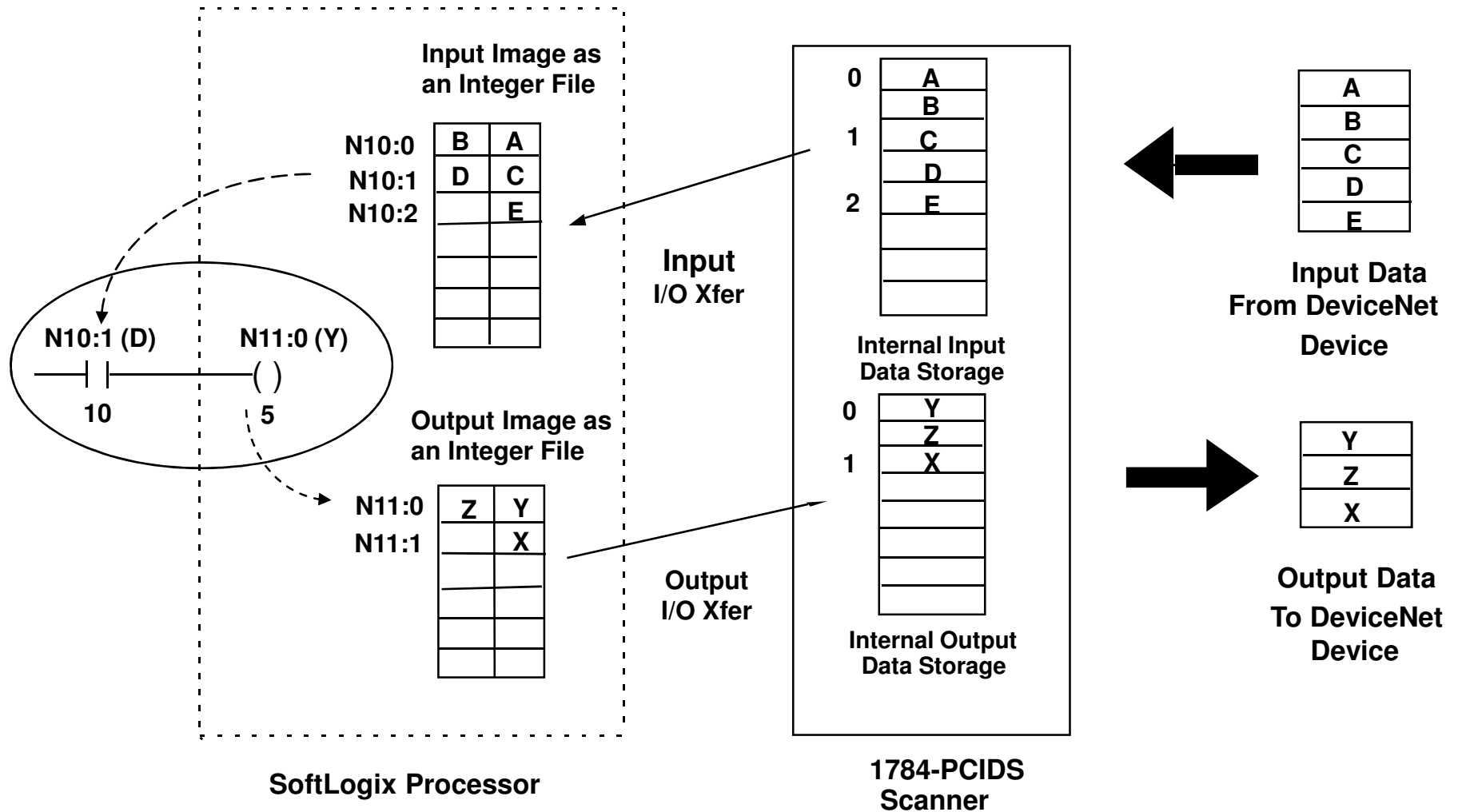
1784-PCIDS Diagnostics

- **Inside the 1784-PCIDS is a 128 word status area for diagnostics of each node being communicated to. This area is broken into 64 groups of two 16 bit words apiece, with one group of words existing for each of the 64 possible node numbers. The low word of each word group contains bits that tell the status of a particular node such as Reset, Idle, Run, Online and Faulted. The high word of each word group will contain the latest error code reported by the 1784-PCIDS for that node. The error code for a node should only be read in the high word when bit 3 of the low word is a 1 indicating the node is currently faulted.**

- **Since the PCIDS card also uses a node number, its node word group will contain general status of the card in general, such as Run or Idle mode.**

- **Since there are 2 words per node, to get a word group for a particular node number, take the node number and multiply it by 2. Use this number as the word number of the integer file you defined for the status file and it will address the low status word for the node. Add 1 to the number to point to the high status word.**

  Example: For Node 21 and assuming the Status file is defined as integer file N23.

          21 X 2 = 42   **Low word = N23:42**

          (21 X 2) + 1 = 43   **High word = N23:43**

Format of 1784-PCIDS Status File

Low Word	Reserved	Fault State	Reserved	Device State	Device State
	Bits 4 thru 15	Bit 3	Bit 2	Bit 1	Bit 0

Bit	**Description**		
0-1	**Device State**		
	Bit 01	**Bit 00**	
	0	**0**	**Reset**
	0	**1**	**Idle**
	1	**0**	**Run**
	1	**1**	**Reserved**
2	**Reserved**		
3	**Fault state**		
	0	**Online**	
	1	**Faulted**	

High Word	Reserved	DeviceNet Error Code
	Bits 8 thru 15	Bits 0 thru 7

1760-DNET
Pico Controller Interface

1760-DNET Fun Facts

- **1760-DNET interface connects to side of Pico Series B or Pico GFX-70 controllers to put them directly on DeviceNet. The 1760-DNET module acts as a slave on DeviceNet and supports all three baud rates, connecting to the network via autobaud.**

- **This module is a UCMM Capable device and the DeviceNet node number is set through the front interface of the Pico Controller or node commissioning via RSNetWorx software.**

- **Interestingly, the 1760-DNET is designed to be communicated to via Polled and Change of State together at the same time. When polled, the 1760-DNET Transmit Size is 3 bytes and the Receive Size is 3 bytes, which contains the actual IO data. The format of the data is shown on the next slide. With COS, the Receive Size is 2 bytes and the Transmit Size is 0. The two bytes of COS data contains only diagnostic information. The data format is shown below.**

- **1760-DNET user manual is 1760-UM003A-EN-P.**

Table 4.9 Diagnostics Data: 2 Byte

Bytes	Meaning	Value	Meaning
0	Pico status (attribute ID 1)	00_{hex}	Static value.
1	Coupling module status (attribute ID 2)	00_{hex}	The basic unit is connected to the 1760-DNET gateway via Pico-LINK.
		04_{hex}	The basic unit is either switched off or disconnected from the 1760-DNET gateway via Pico-LINK.

1760-DNET Fun Facts

Input data from 1760-DNET to master.

Table 5.10 Byte 0 to 2: Input Data, Mode

Byte	Meaning	Value
0	Operating mode scan	
1	Scan status of the Pico outputs S1 to S8	
2	Not used	00hex

The master reads the following data from bytes 0, 1 and 2:

Table 5.11 Byte 0: Operating Mode

Pico Identification	Bit							
	7	6	5	4	3	2	1	0 Stop/Run
Without Input Delay	0	0	0	1	0	0	0	0/1
With Input Delay	0	0	1	0	0	0	0	0/1
Index for transferring valid data	0	0	0	1	0	1	0	0

Output data from master to 1760-DNET .

Table 5.13 Byte 0 to 2: Output Data, Mode

Byte	Meaning	Value
0	Determine mode	
1	Setting/resetting of the Pico/GFX inputs R9 to R16	
2	Setting/resetting of the Pico/GFX inputs R1 to R8	

The master writes the following data to the bytes 0, 1 and 2:

Table 5.14 Byte 0: Operating mode

Pico Operating Mode	Bit							
	7	6	5	4	3	2	1	0
Index for setting the basic unit to safety state	0	0	0	0	0	0	0	0
Index for transferring valid data	0	0	0	1	0	1	0	0
RUN command	0	0	1	1	0	1	0	0
STOP command	0	1	0	0	0	1	0	0

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SCANNER ERROR CODES

Code	Description	Take this action
00 - 63	Normal operation.	Do nothing. (The display shows the scanner's node address.)
70	Scanner failed Duplicate Node Address check. The node address is already in use.	Change the scanner channel address, or change the conflicting device's address.
71	Illegal data in scan list.	Reconfigure scan list and remove any illegal data.
72	Device stopped communicating. (Changes to 78 if device does not recover when scanner retries.)	Inspect the device and verify connections.
73	Device does not match electronic key (vendor, product code, product type, revision) in scanlist.	Verify that the correct device is at this node number. Make sure that the device matches the electronic key as configured in scanlist.
74	Data overrun on port detected.	Check configuration for invalid data. Check network traffic.
75	No network traffic at all has been detected. (Normal if no scanlist.)	Create and download scanlist.
76	No network traffic for scanner detected. (Normal if no scanlist and scanner hears other traffic.)	Create and download scanlist.
77	Device's data sizes do not match scan list.	Reconfigure device or scanlist for the correct transmit and receive data sizes.
78	Device is in scan list but does not exist, or has failed to respond to scanner's retry after code 72.	Add the device to the network, or delete or inhibit its scan list entry. See also code 72.
79	Scanner failed to transmit a message, usually duplicate node check (at power-up).	Make sure that the scanner is connected to a valid network with at least one other node. Check for disconnected cables. Verify baud rate.
80	User has put scanner in IDLE mode.	Set RUN bit in scanner command register. Put PLC in RUN mode.
81	User has put scanner in FAULT mode.	Check PLC program and scanner command register.
82	Error in sequence of fragmented I/O messages from device.	Check device configuration.
83	Device is returning error response when scanner attempts to initialize communications.	Check scanlist entry – it may specify a connection (strobe, poll, etc) not supported by device. Device may be in another scanner's scanlist. Check device configuration. Reboot device. **See DDE/OPC Fun Facts Slide.**
84	Initializing communication with devices in scanlist.	None. This code clears when initialization is complete.

Green shows normal conditions, or abnormal conditions caused by user action.
Blue   shows abnormal or error conditions.
Red   shows severe errors, possibly requiring a replacement scanner.
Bold codes show the most common conditions.

Knowbase document #24919 contains many details about Error code 77

Code	Description	Take this action
85	Data size larger than 255 bytes.	Configure device for smaller data size.
85	Device's input data size changed after initialization.	Configure device for fixed size. Replace faulty device.
86	Device is producing zero length data (IDLE state) while channel is in RUN mode.	Check device configuration and status. This is normal if device is another scanner in slave mode, and is IDLE (code 80).
87	Shared inputs: Device not allocated by primary scanner.	Check primary scanner connection and configuration.
88	Shared inputs: Primary scanner has not allocated connection required by this scanner.	Check that sharing scanner's connections are the same as or a subset of primary scanner's.
88	Display test at power-up or reset.	No action.
89	ADR error. The Device does not support Auto-Device Recovery or is not configured properly.	Check configuration or disable ADR for this device.
90	User has disabled communication port.	Check PLC program and scanner command register.
91	Bus-off condition detected on DeviceNet port. Scanner is detecting communication errors.	Check DeviceNet connections and physical media integrity. Check system for failed devices or other possible sources of network interference. Check for conflicting baud rates.
92	No network power detected on DeviceNet port.	Provide network power. Make sure that drop cable is providing network power to scanner DeviceNet port.
95	FLASH update in progress.	None. Do not disconnect scanner while FLASH update is in progress.
97	User has halted scanner.	Check ladder program and scanner command register.
98	Unrecoverable firmware failure.	Service or replace your module.
99	Unrecoverable hardware failure.	Service or replace your module.
E2	RAM Test Failure.	Return/Replace module.
E4	Lost Power During FLASH Upgrade.	Return/Replace module.
E5	No Boot or Main Code.	Return/Replace module.
E9	User has flushed 1747-SDN scanner.	Check command register and cycle power on SDN to recover.

Green shows normal conditions, or abnormal conditions caused by user action.
Blue shows abnormal or error conditions.
Red shows severe errors, possibly requiring a replacement scanner.
Bold codes show the most common conditions.

Network LED Definitions

Device Network LED Definitions

Color	State	What it Means	What to Do:
None		The device has no power from the network or it is an autobaud device and can't see transmissions.	Check Power connections to Device. To auto baud at least one other device on Network must be transmitting.
Red	Solid	Diagnostics failed on power up or Reset. Device went Bus Off.	Cycle power to the device and network. If fault still exists check for valid DeviceNet network or bad device.
Red	Solid	Duplicate Mac Check failed on power up or Invalid Baud Rate.	Check for other device on network with same Node Address. Check device's baud rate. Cycle power to clear fault.
Red Alternate Green Quickly	Flashing	LED is being flashed via the Faulted Address Recovery feature in RSNetWorx for DeviceNet software.	Stop the FAR flash LED feature in the software.
Red	Flashing	Master I/O connection missing or timed out.	Check if DeviceNet network master is still connected to network and is master still operating correctly.
Green	Flashing	Device is connected to valid network, but not scanned by a master.	Check DeviceNet master for correct scan list information for device. (node address, Tx/Rx sizes etc.)
Green	Solid	Normal operating state and device is allocated to a master.	No action required.

Uploading Scanner EDS Files
From a Scanner

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Uploading a Scanners EDS File

In order to configure any Rockwell Automation scanner in RSNetWorx for DeviceNet software, an EDS file must be registered in the software. Inside these Series of the 1756-DNB (Series C and D), 1747-SDN (Series C and D) and 1771-SDN (Series C) scanners, there are contained the scanners EDS file embedded in it that can be uploaded into RSNetWorx for DeviceNet software. This allows the EDS file to be uploaded and registered into RSNetWorx software, so that the scanner can be configured using the software.

When a EDS file is not found in the software for a specific firmware revision of a Device on the network a large yellow question mark and Unrecognized Device name, will appear in the RSLinx browse screen. When this happens, right click on the device and if it supports the EDS upload feature, the Upload EDS file from Device selection will appear and then click on it. The Rockwell EDS Wizard will appear and follow the steps to continue the EDS upload and registration procedure.
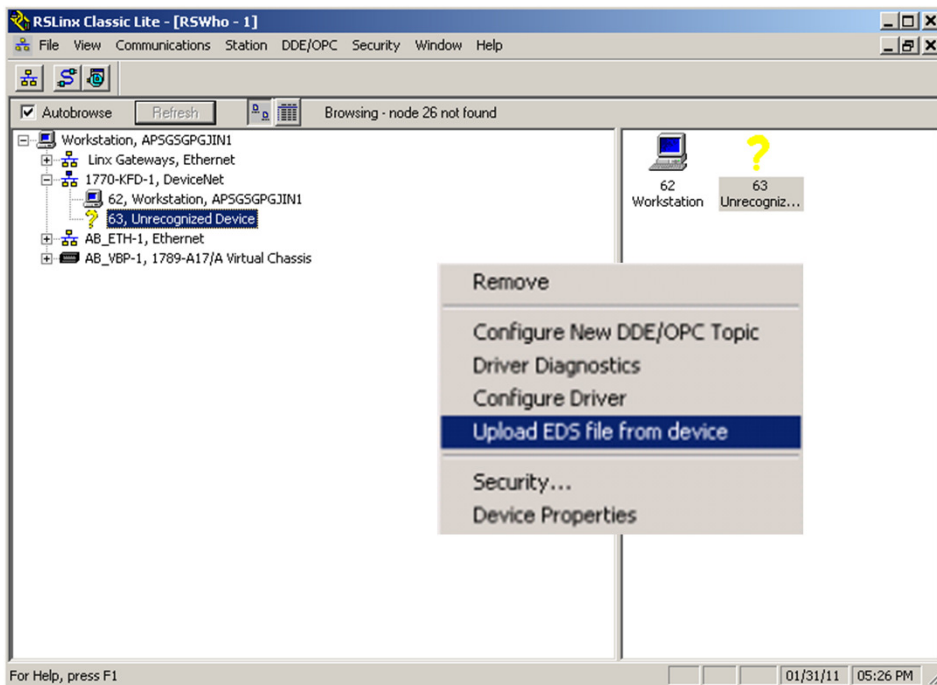
DeviceNet Scanner Archive Ladder Logic

DeviceNet Scanner Archive Application

- Product Family/Part Number
  - **ControlLogix/1756-DNB, CompactLogix/1769-SDN, FlexLogix/1788-DNBO, DeviceNet**

- Description of Problem
  - **A DeviceNet network and scanner are configured originally using RSNetWorx for DeviceNet software. The scanner configuration is only stored in the scanner itself and not in the logic controller. If the scanner must be replaced later, the user must use RSNetWorx software to configure the scanner as a direct replacement. This requires the end user to have the RSNetWorx software handy and be trained on its use. Machine manufacturers particularly require a way to easily "clone" a DeviceNet scanner during machine production and also at the end user, should the scanner need to be replaced, without using a PC**

- Description of Application
  - **This application, written in Ladder Logic, takes the entire configuration of a DeviceNet scanner on demand and uploads/stores it into a Logix based, controller memory. This DeviceNet scanner configuration can then be easily downloaded back to a DeviceNet scanner on demand. The configuration includes all scanlist configuration, all ADR configuration, Node Number, Baud Rate, EPR, ISD and Background/Foreground Poll ratio.**
  - **The ladder logic file for this application can be used as a stand alone building block for a new user program or the modular components in the logic can be easily merged into existing user programs.**

DeviceNet Scanner Archive Application

- Application Details and Features
  - **Requires a Logix Platform to run due to use of UDT functionality.**
  - **Requires approximately 300 Kbytes of controller memory to run.**
  - **DeviceNet scanner can be in local chassis or networked over ControlNet or EtherNetIP. The 1788-EN2DN and 1788-CN2DN linking devices are also supported since they act as DeviceNet scanners. Easily converted for other Logix based Controllers and DeviceNet Scanners.**
  - **The stored Archive in controller memory has a Name and Description field for user entered information.**
  - **Any scanner archive upload or download operation has a time/date stamp automatically applied to help keep a history of these operations.**
  - **Only way in existence to download ALL configuration at once to a DeviceNet Scanner, including Quick Connect configuration. Even RSNetWorx for DeviceNet software does not allow this.**

- Availability Date and Location
  - **Application should be available for use NOW!!**
  - **Application and documentation will be located at the following web site http://samplecode.rockwellautomation.com The application title will be DeviceNet Scanner Configuration Archive Logic for Multiple Scanners and is record number MMS-044847**
  - **Knowbase document 48243**

Node Commissioning
Ladder Logic

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Node Commissioning Application

- Product Family/Part Number
  - **ControlLogix/1756-DNB, CompactLogix/1769-SDN, FlexLogix/1788-DNBO, 1788-EN2DN, 1788-CN2DN**

- Description of Problem and Application
  - **On a DeviceNet network there are many types of devices that are connected to it. But ultimately they all fall under two groups as far as the methods that are used to set the node address of the device. One method is a hardware means of setting the node number such as dip switches or rotary switches. The second method is using the node commissioning utility inside RSNetWorx for DeviceNet software or by using the 193-DNCT hand held configurator. Sometimes it becomes imperative, to quickly node commission a node on the network, such as a replacement device. If a handheld configurator or computer containing RSNetWorx software is not handy, it could delay how soon a replacement node can be added to the network at the correct node number.**
  - **This ladder logic routine is designed so that under program control, a node on one or more DeviceNet networks in a system can be changed from one node number to another. Having this capability directly inside the controller allows faster and easier replacement of devices when needed. The application also allows for multiple networks in a system, with multiple DeviceNet scanners. So node commissioning can easily be done on one of many networks. A FactoryTalk View ME faceplate is also included to allow easy HMI interface to the logic if desired.**
  - **The ladder logic file for this application can be used as a stand alone building block for a new user program or the logic can be easily merged into existing user programs.**

- Location
  - **Application and documentation is located at the following web site http://samplecode.rockwellautomation.com The application title will be DeviceNet Node Commissioning Application for Logix and is record number MMS-051276**

SLAVE MODE FOR SCANNERS

Slave Mode

- **All DML based scanners be a slave to another network master (PLC, SLC, PC) while being a master itself**

- **Slave I/O devices must be segregated between masters**

#01

#02

1771-SDN #01 is Master to #02 and #33
1756-DNB #02 is Master to #55; Slave to #01
Drive #33 is slave to #01 ONLY
photoeye #55 is slave to #02 ONLY

#33

#55
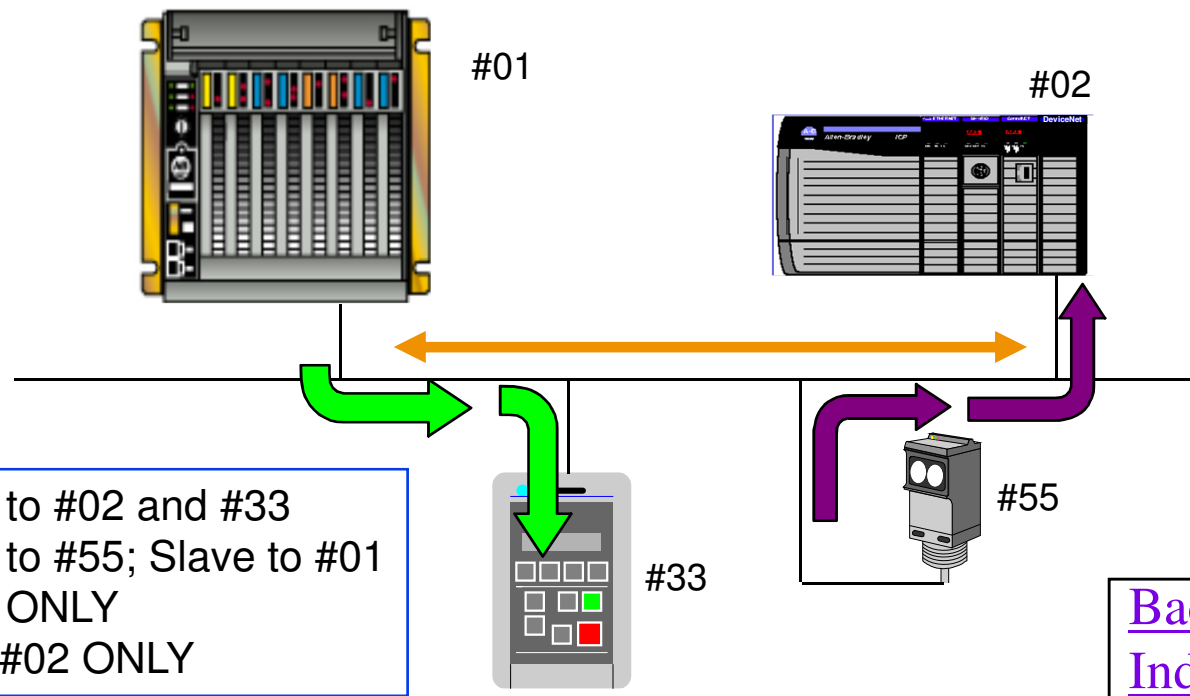
Multiple Masters

- Multiple masters can exist on the same wire, communicating to their own group of slaves.

- A slave can only be owned by one master.

- Important!! Multiple masters on the same network have no mechanism to gracefully share the network bandwidth. So if some tuning is not done to the scanners configuration, the network bandwidth will be maxed out and slave devices could intermittently drop off the network communications and then come back. If the multiple masters are Polling the slaves in their scan lists, then increase each scanners ISD (Interscan Delay) to no more than 50 msecs. This will give each scanner time to communicate, while the others are not communicating during their ISD period. This should cure any slave node drop offs from the DeviceNet network.

#01   #02

1756-DNB #01 is Master to #33
1756-DNB #02 is Master to #55;
drive #33 is slave to #01 ONLY,
photoeye #55 is slave to #02 ONLY

#33   #55
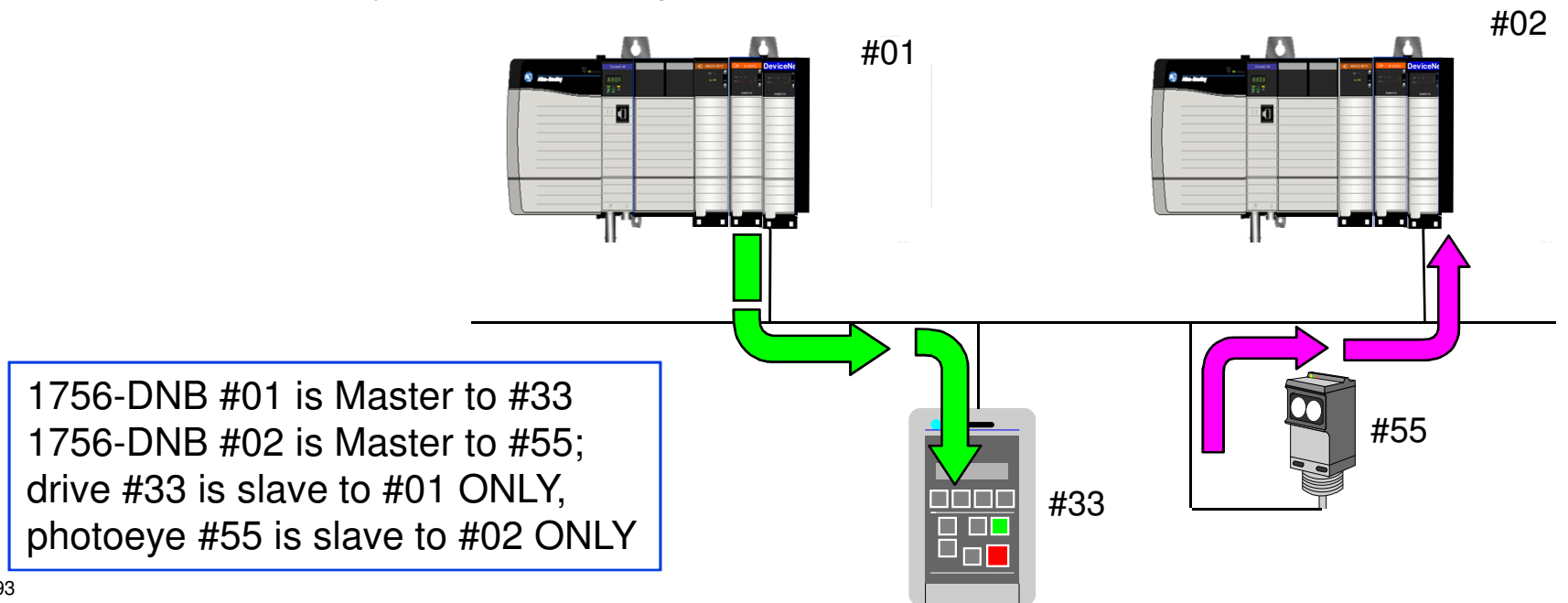
Pass Through

- RSNetWorx running on a PC talks to a communication port on the Processor. The commands/data are then passed through the processor to the SDN scanner who then passes them onto the DeviceNet network. This allows the DeviceNet network to be completely configured, monitored, etc. without the RSNetWorx PC being physically connected to the DeviceNet network.

- RSlinx must contain the appropriate driver for the 1747-SDN and 1771-SDN for the feature to work. Also the SDN scanners must have a firmware revision that supports Pass Through. RSNetWorx, revision V2.22.18 (service 1) and RSLinx V2.1.176 (Service Pack 1) are the minimum revisions of software that work reliably.

- 1756-DNB supports ControlLogix Bridging, which is a feature comparable to Pass Through where RSNetWorx can be connected to the processor or other communication module and the DeviceNet network can be accessed.

PC running RSNetWorx
with RSLinx V2.0

ControlNet or Ethernet
or DH+ or DF1

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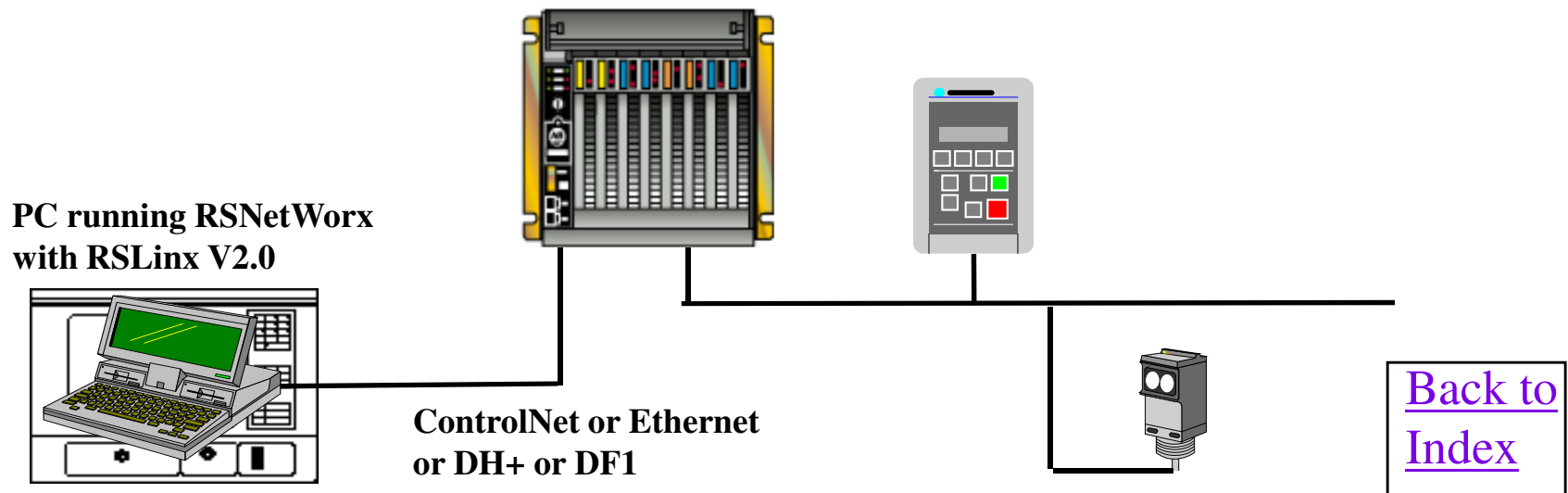
Shared Inputs

- **All DML based scanners can have a device put in its scan list that is already owned by another master. The device's input data can then be consumed as Shared Inputs by the 1756-DNB and be stored in the DNB's input area. RSNetWorx for DeviceNet V 2.11 or higher is necessary to configure the scanners to use this feature.**

- **As of firmware revision V4, the 1769-SDN does NOT support Shared Inputs.**

#01

#02
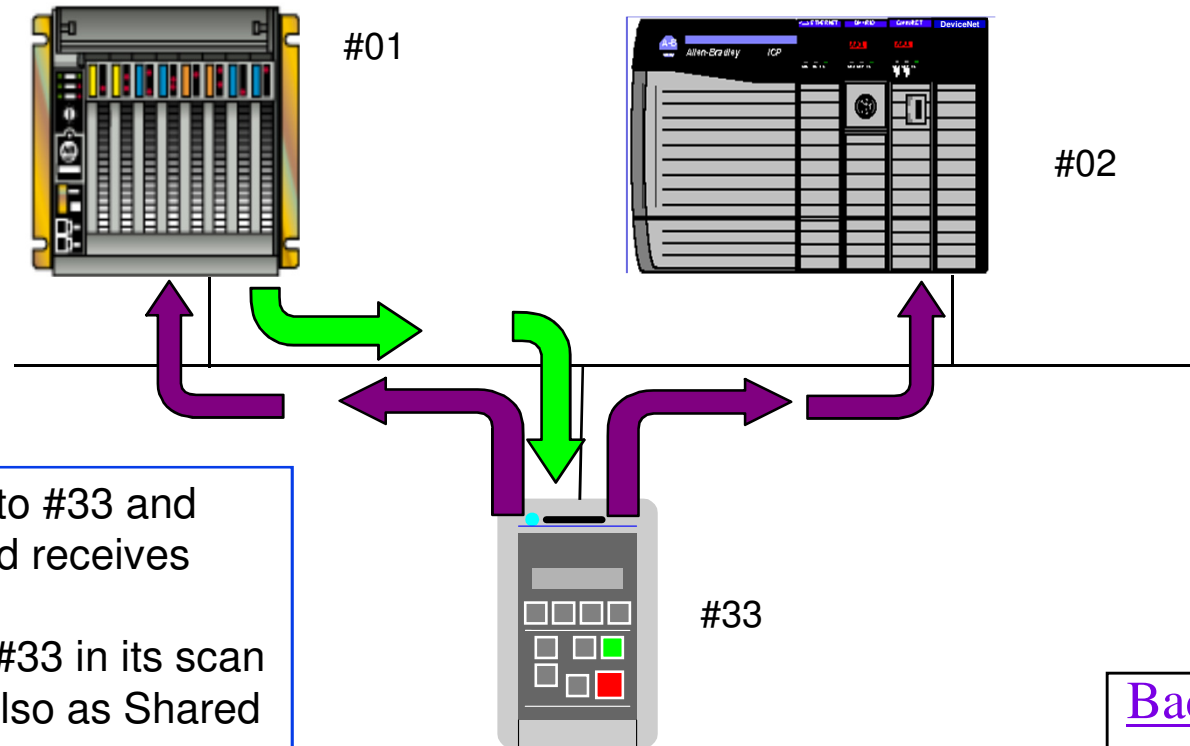
1771-SDN #01 is Master to #33 and sends output data to it and receives input data from it.
1756-DNB #02 also has #33 in its scan list to receive input data also as Shared Inputs

#33

Back to Index

Shared Inputs Cont.

- **Configuring the Shared Inputs feature is done using RSNetWorx for DeviceNet software. With nodes on the network and two masters on the network. Right mouse click in the Available Devices part of the scanlist of the scanner that needs to consume the inputs from a device owned by another master. Click on View All Inputs and the middle view below will appear showing all devices owned by other masters whose inputs are available to be consumed. Notice how they show up in the list with a special red icon showing they are shared inputs. Add a device to the scanlist and it will appear in the scanlist and its input data will be mapped into the Input data table.**

196
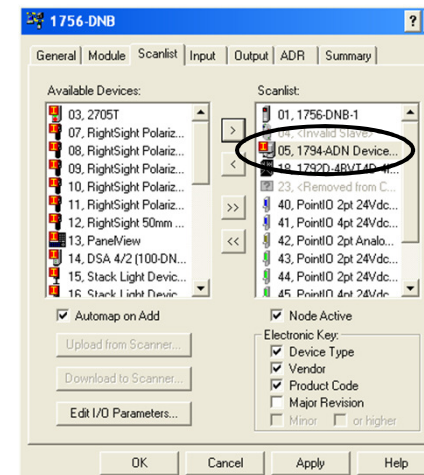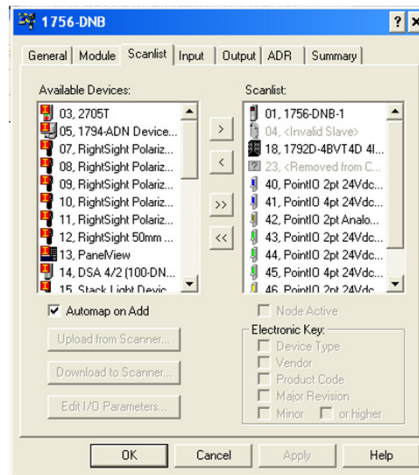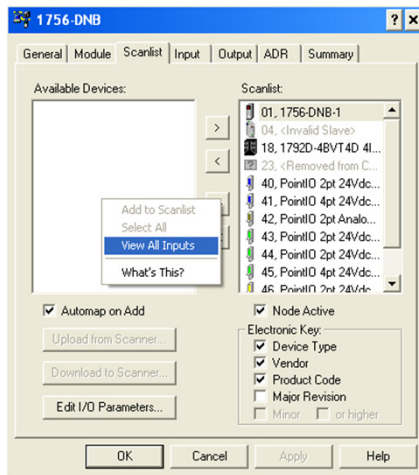
Ladder Programming Over DeviceNet

- **IMPORTANT: Generally, ladder logic programming over DeviceNet back to a Control Processor is NOT supported except for a few product exceptions.**

- **Using the 1761-NETDNI interface, RSLogix 500 or RSLogix 5 software, running on a PC, uses the DeviceNet Driver in RSLinx to communicate to the node number of the 1761-NET-DNI. The DNI passes the programming commands over the DF1 channel to the MicroLogix, SLC-500 or PLC-5 processor. On-line edits, uploads, downloads, etc. can be done the same as if the PC running the RSLogix software were directly connected to the DF1 channel of the processor.**
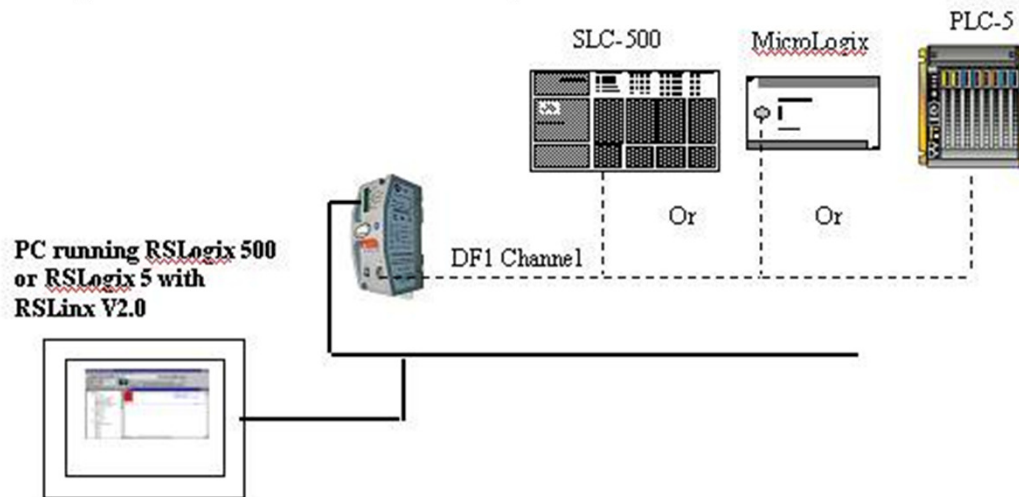
- **Using the 1769-SDN interface, the MicroLogix 1500 can be programmed directly from DeviceNet. The CompactLogix currently can NOT be programmed via the 1769-SDN.**

QuickConnect Feature
for Scanners

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QuickConnect Fun Facts

- The DeviceNet Quick Connect feature allows a reconnected slave device on a DeviceNet network to quickly go into operation by shortening the time required to make the logical connection between it and the scanner. Basically, the feature streamlines the device's startup overhead by allowing a "quick" establishment of connection between a scanner and its slave(s). Approximately, 500msec IO connection times are possible if both the scanner and end devices support Quick Connect. This is compared to a 5 to 10 sec IO connection time otherwise.

  Specifically, Quick Connect enables a DeviceNet scanner to interrupt its operation to initiate a connection request <u>as soon as</u> a "dup mac" request is received from a newly connected slave device. At the slave device, it will accept the connection request from the scanner without waiting for the 2-second delay in its typical power-up sequence.

- Quick connect support is enabled when the RSNetWorx for DeviceNet software is installed in the Custom Setup window. V4.21 of RSNetWorx software or later is required to configure the feature.

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QuickConnect Fun Facts

- **VERY IMPORTANT!! The configuration for Quick Connect is NOT stored in the .dnt project file of the RSNetWorx for DeviceNet software. This is because the configuration is done in a stand alone applet that is started from RSNetWorx software, but does not store the data to the RSNetWorx project. So the feature will need to be reconfigured from scratch whenever a scanner configuration is downloaded to a "fresh" scanner or nodes are added or removed on the network.**

- **The 1756-DNB V4.001 or higher, 1771-SDN/C V6.004 or higher, 1747-SDN V6.002 or higher and the 1788-DNBO V2.002 or higher support this feature.**

- **The following graph compares a network with and without Quick Connect to give a comparison of the connection times.**

- **The feature is enabled by writing a 1 to Class 3, Instance 1, Attribute 102 decimal (66 hex) of each device on the network. Some devices may use Class 3, Instance 1, Attribute 10 decimal to enable/disable this feature. Writing a 1 to Class 91hex, Instance Node Number + 1, Attribute 24 decimal will enable the feature in the scanner on a node by node basis.**

200
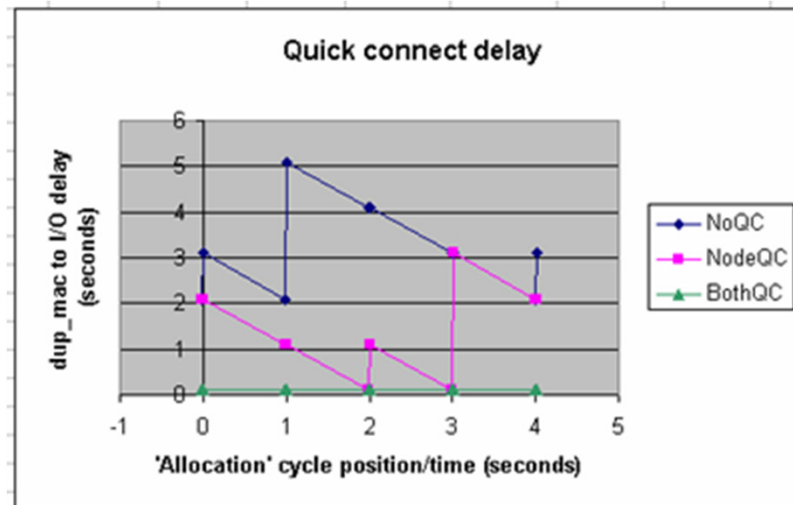
AutoScan Feature
for Scanners

AutoScan Description

The DeviceNet AutoScan feature enables a scanner to automatically map a network of slave devices into its scan list without the use of RSNetWorx for DeviceNet. This greatly improves the ease of setting up a DeviceNet network, especially networks comprised of "simple" devices, with small amounts of IO data.

Basically, when the feature is enabled, via explicit messaging, a DeviceNet scanner will continuously search for devices on the network. Once a qualifying slave device is found, it will be added to the scanner's scan list and its I/O data will be mapped into a predefined location in the scanner's I/O memory table based on the device's node address and map size.

The default AutoScan setting allocates a 4-byte entry in both the input and output memory maps, in the scanner for each slave device detected on the network. Any slaves not found on the network will still have space in the input and output area saved for them. For applications where the user would like to customize the I/O allocation size, the 4-byte allocation could be adjusted through an Explicit Message to the scanner. The entry allocation could be configured for 1 to 32 bytes per node. The input and output data will be mapped into the scanner's I/O data table based on the device's node address and the configured fixed mapping size. The formula for calculating the Input or Output data location is:

Input (Output) Offset = ((Node Address) x (Fixed Mapping Size))/Bytes per Native Datatable Unit

For example, when using the default fixed mapping size of 4 bytes, the input data for the devices shown in the example system below would be allocated in the 1756-DNB's input table as shown below. Notice node 1 is located in the data map at byte location 4 (DINT location 1), node 2 at byte location 8 (DINT location 2), and so on.
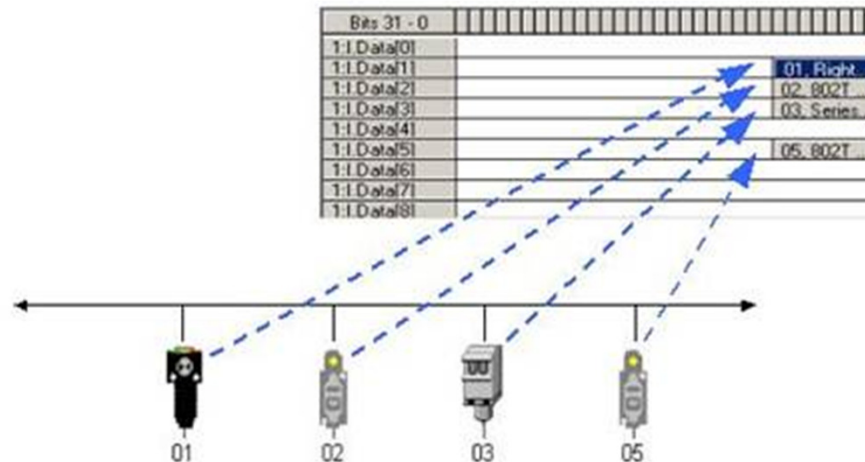
AutoScan Fun Facts

- **The1756-DNB with firmware V4.001or higher can do AutoScan.**

- **The 1769-SDN with firmware V4.001 or higher supports Autoscan.**

- **1747-SDN Series C V8.002 or higher also supports Autoscan**

- **Auto configure will only scan up to node 61. Node 63 is not included due to a possible conflict with ADR. Note: All nodes that support COS messaging will be automatically added to the scanlist configured as COS nodes.**

- **Once enabled, the AutoScan feature will only operate while the scanner is in idle mode. If left enabled, the feature will constantly find and add nodes to the scan list, but again only when in idle mode.**

- **On the transition from disabled to enabled, the feature will delete any existing scan list.**

- **If a scan list download is done from RSNetworx for DeviceNet software the AutoScan feature will automatically be disabled.**

- **Important Note: Depending on the I/O Allocation size the total 63 node range may not be added to the scan list. For Example: In a 1756-DNB, since it has 123 DINTs of Output IO table, if an 16 byte (4 DINT) I/O Allocation Size is entered, only up to node 29 will be added to the scan list. The rest will be skipped, because we are short of space in the Output table.**

- **To configure the I/O allocation size, attach a configurator device on the network and send an explicit message to the scanner using the parameters below. Send the desire allocation size (1 – 32 bytes) to the attribute below to configure the per-node I/O allocation.**

  Service Code 10 Hex, Class 90 Hex, Instance 1, Attribute 11 Hex

- **To enable AutoScan using a DeviceNet configurator, attach the device on the network and send an explicit message to the scanner using the parameters below. Send a 1 to that attribute to enable the feature, and 0 to disable.**

  Service Code 10 Hex, Class 90 Hex, Instance 1, Attribute 10 Hex

- **Important: The configuration Recovery feature of ADR is automatically disabled in a scanner when Auto Configure is enabled in that scanner.**

Tag Generator Tool

RSLogix 5000 (v12 & >)	←→ Tags + Logic	Tag Generator Tool	←→ Device details	RSNetWorx (v7.00)

New or updated

EDS Files
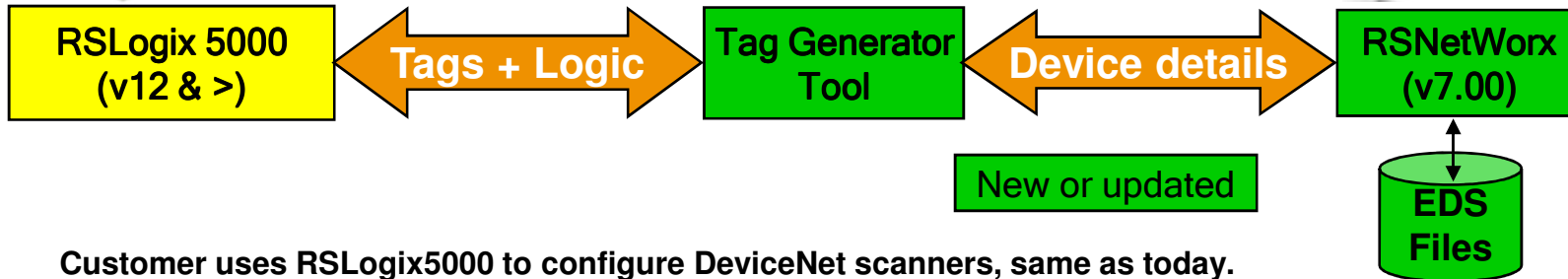
- Customer uses RSLogix5000 to configure DeviceNet scanners, same as today.

- Customer uses RSNetWorx to configure scanlist and download to DeviceNet scanner, same as today

- Customer launches Tag Generator Tool to retrieve and select DeviceNet scanners configured in RSLogix 5000 *.ACD project and in the RSNetWorx *.dnt file

- Tag Generator Tool retrieves device details from RSNetWorx (details included in completed EDS files)

- Tool defines structures, tags, UDT and logic and creates them in the RSLogix 5000 ACD project using the built-in automation interface

- Knowbase document 60257 describes operation details and hints of Tag Generator.

- Free-of-charge standalone tool automates steps that many users do manually today

- Solves the blob problem by creating structured tags and logic
  – Logic copies data from blob to tags and from tags to blob

- Manual synchronization required between RSNetWorx file and RSLogix 5000

- Independent of RSLogix 5000 release

- Independent of controller/scanner type and firmware revision
  – Works with all Logix family processors, including applications with multiple scanners
  – EN2DN, CN2DN and remote DNB supported

Online Scanlist Changes Allowed in Run (OSCAR)

- New feature with 1756-DNB Series B firmware 7.001 or higher and RSNetworx V7.00 software. 1756-DNB Series C V10.005 or higher also supports this feature.

- Allows changes to be made to the scanlist while the DNB stays running! Changes scan be made to a system running 7/24.

- All existing, unmodified I/O connections remain intact to all slave devices.

- Allows users to add devices such as PowerFlex drives and IntelliCenter MCC's into a scanlist while running.
  - Add device, remove device, modify parameters without taking the scanner offline.

- Sometimes even with the correct 1756-DNB firmware and RSNetWorx software, OSCAR refuses to operate correctly. The RSNetWorx software will still say the scanner is in Run mode. This is a Harmony file problem in RSLinx and the harmony files in the RSLinx directory should be deleted to correct it. Knowbase document 40021 describes how to do this.

- Important: When adding devices to a scanlist, make sure the output data in the blob, for the devices, is in a safe state. Because as soon as the download is done to the scanner, the outputs will be sent to the new devices and Outputs energizing unexpectedly, could cause a safety issue.

Easy Backup Feature
for Scanners

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Easy Backup Details

FlexLogix Backup on DeviceNet

Primary

Secondary

All BackedUp I/O must be on DeviceNet
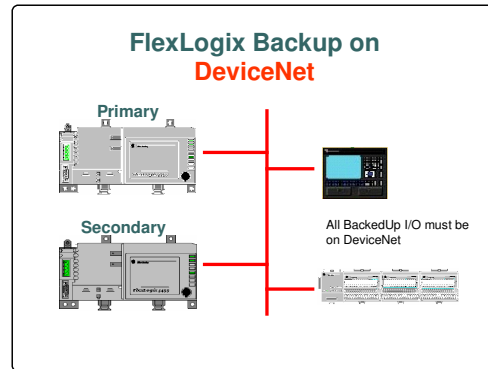
FlexLogix Backup on DeviceNet is a simple, low-cost, backup system targeted towards smaller applications which require fast switchovers from Primary to Secondary processor. No additional HW or special SW is required. FlexLogix Backup is faster than a Software implemented switchover (i.e. inhibit/uninhibit). The 1788-DNBO modules ,connected to the same network, determine who is Primary or Secondary by special messaging that is sent between the modules. The Easy Backup feature needs to be enabled in each 1788-DNBO and they must both have the same node number/scan list configuration.

- Both processors/scanners simultaneously receive all inputs
- Both processors execute in parallel but are NOT synchronized.
- Only Primary sends Outputs to I/O devices. (A virtual switch in the 1788-DNBOs is used to switch outputs between Primary and Secondary.)
- After failure or forced switchover, Outputs are automatically switched by 1788-DNBO from Primary to Secondary. This occurs quickly without the I/O connections being lost and rebuilt.
- Valuable status information, readable from both scanners, give you information about both Primary and Secondary systems

Easy Backup Fun Facts

- The 1788-DNBO with firmware V2.002 or higher can do Easy Backup. Knowbase document 24180 gives all of the gory details.

- The 1769-SDN for CompactLogix with firmware V3.9 or higher supports Easy Backup. Knowbase document 50690 gives all of the gory details. **MicroLogix 1500 is NOT Supported with the 1769-SDN!!**

- Even though each of the scanners have the same node address, the Secondary scanner will actually use that node address + 1, so that node address must be left unused on the network.

- To enable Easy Backup, send an explicit message to the scanner using the parameters below. This parameter is a heartbeat value and if set to 0 the feature will be disabled. The heartbeat determines how often the messaging occurs between the two scanner modules to determine their states and status. The heartbeat is in multiples of 8ms (i.e. 8, 16, 24, etc.) with a recommended value of 16-48ms for most applications. This results in a switchover of 32-96ms (but doesn't include processor scan delays). If multiples of 8 are not used for the requested heartbeat, then the scanner will use the next higher supported heartbeat value, which can be read from the scanner.

- Service Code 10 Hex, Class 90 Hex, Instance 1, Attribute 12 Hex

- To read the Backup State in the scanners, use the following parameters for explicit messaging.

- Service Code 0E Hex, Class 90 Hex, Instance 1, Attribute 13 Hex

- To read the Backup Status, in the scanners, use the following parameters for explicit messaging.

- Service Code 0E Hex, Class 90 Hex, Instance 1, Attribute 14 Hex

- Important!! Using the Class Instance Attribute editor in RSNetWorx for DNet software, reset the scanner back to factory defaults before downloading the scanner configuration. This reset, is a service code 05 sent to Class 1, Instance 1 and Attribute 1.

- A "Forced" switchover is accomplished by turning on the Disable bit in the Command register to the primary scanner.

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DeviceLogix Technology

Smart Components Enable New Control Solutions

What is DeviceLogix?

- DeviceLogix is a set of firmware objects added to products that enable on-board control over some product operations through internal function blocks.

- DeviceLogix can provide simple distributed control functions within a single device.

- DeviceLogix products will:
  - **Reduce overall network traffic.**
    - **Fewer messages will be produced.**
    - **Even better performance when combined with Change of State**
  - **Improve control system performance.**
    - **Smaller programs in controller (PLC or PC-based), saves memory, reduces scan times.**
    - **Faster local input sense to output actuation, avoids network turnaround and I/O scans.** 1 - 4 msec.

210
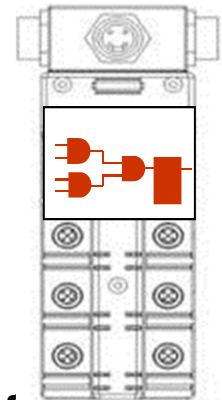
DeviceLogix Fun Facts

- DeviceLogix is implemented in firmware of the I/O device as simple AND, OR, XOR, etc. functions that can be *virtually* linked together into function block programs.

- DeviceLogix technology enables products to perform basic logic on inputs and trigger local outputs. Input to output times using only local inputs/outputs and up to 50 function blocks, are in the 4 millisecond time range.

- Logic program in I/O device is stored in non-volatile memory in the device and can be downloaded to the device using the scanner ADR feature.

- DeviceLogix Function Block Editor is currently configured through a software applet launched from within RSNetWorx for DeviceNet V3.0 or greater.

- Devices can be configured to receive/transmit various data formats and sizes of data sent to/from the master scanner. This configuration is done, via the EDS editor in RSNetWorx, to change the Produced and Consumed I/O Assemblies in the device. To get network inputs from a device, the Produced I/O Assembly in the EDS file must be set to Local Logic Assembly. This assembly will return the status of the local I/O on the device plus the network inputs to the master scanner. The exact format of this assembly varies from product to product. To keep the network data sent to the device from being fed to the device's local outputs, the Consumed I/O Assembly can be changed from Default Consumed Assembly, to a data size of from 0 to 4 bytes. This will detach ALL input data from the local outputs. If left at Default Consumed Assembly, the input to output connection is individually broken when a local output is used in the logic. The input can also then be used as a network input.

DeviceLogix Fun Facts (Cont.)

- **To run the I/O device stand alone, without a network master, the Network Status Override and Comms Status Override should be set to Override Enabled.**

- **Most I/O devices that support DeviceLogix will be Series B or C of existing I/O devices. These higher series devices will have unique EDS files that allow DeviceLogix logic to be configured for the Device. With V3.000 RSNetworx the EDS files that are registered in the software do not support DeviceLogix. The EDS files for DeviceLogix functionality are located on the installable CD for RSNetworx and will need to be registered into RSNetworx before the DeviceLogix functionality can be accessed.**

- **VERY IMPORTANT NOTE: NO retentive logic in the user program is retained over a power cycle. This includes Latches, timer/counter accumulators, and status bits. This is different behavior that you would expect from a standard PLC type controller.**

- **Some DIO products that really do support DeviceLogix may not come up with the DeviceLogix tab in the EDS editor, This is due to the EDS file with DeviceLogix support is not actually registered in RSNetWorx. The current EDS file for the device will need to be unregistered and the correct EDS file be registered. EDS files can be found at http://www.ab.com/networks/eds.html**

DeviceLogix Capable Devices

Catalog Number	Comment
1799-D10U10BL, 1799-D10U10VL	**Standard Embedded IO cards**
1799-D16U16BL, 1799-D16U16VL	**Standard Embedded IO cards**
1799-ZCIOB, 1799-ZCIOV	**ZIP CapableEmbedded IO cards**
Bulletin 100-DNY	**DeviceNet Starter Auxiliary Major Rev 5 or higher**
1792D	**ArmorBlock MaXum I/O**
1792	**High Current Block I/O**
1791D	**CompactBlock I/O Major Rev 3 (Expansion I/O modules not supported)**
Bulletin 280/281 and 284	**ArmorStart with or without VFD**
Bulletin 800E	**Pushbutton Stations**
Bulletin 198-DN, 198-DNG	**DeviceNet Modular Starter Auxiliary Major Rev 4 or higher**
Bulletin 825-PP	**Smart Motor Manager**
Bulletin 193	**E3 Plus Only Overload Relay Major Rev 3 or higher**

14 Function Blocks

- **Boolean - AND,OR, XOR, NAND, NOR, XNOR**
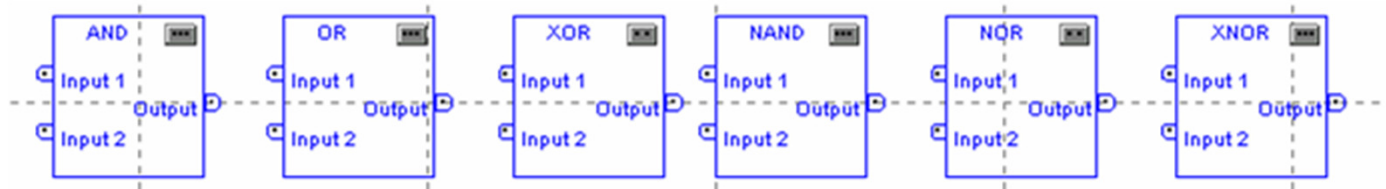
    – **Bi-stable - RS Latch, SR Latch**

    – **Counters / Timers**

214
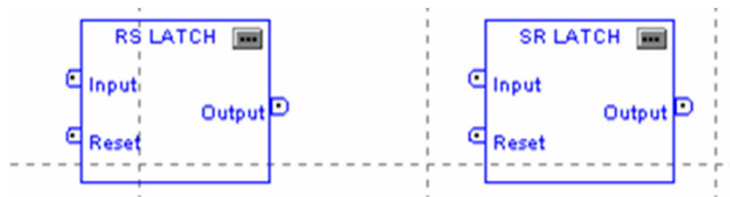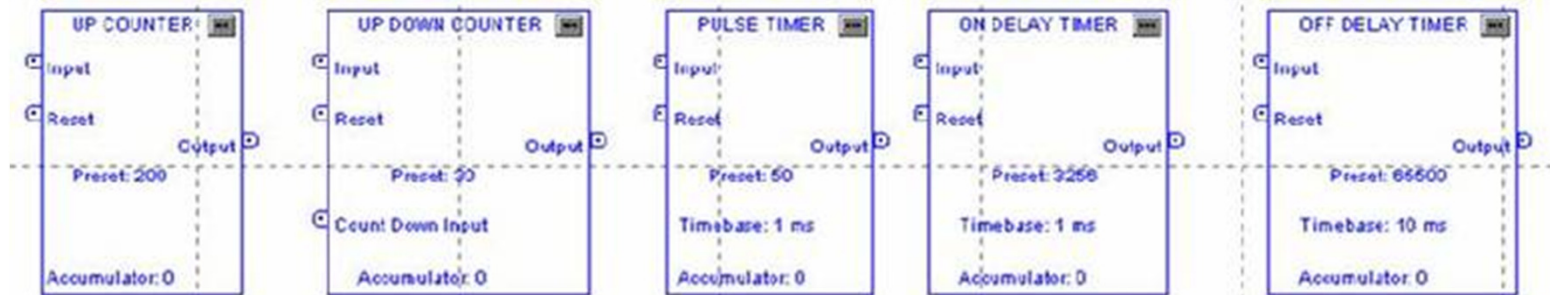
DeviceLogix Function Block Editor
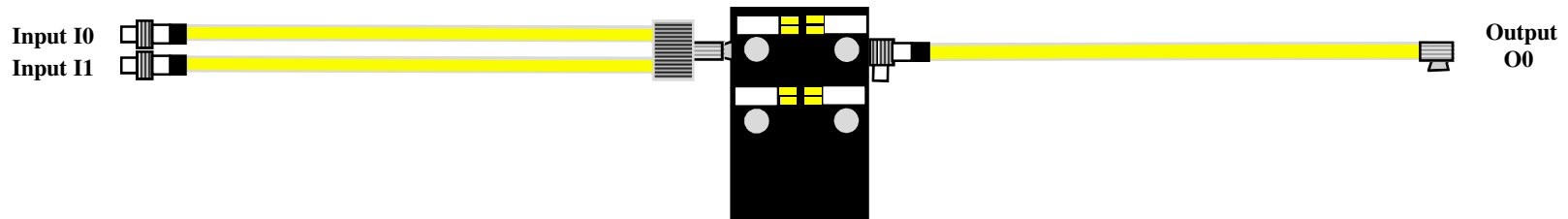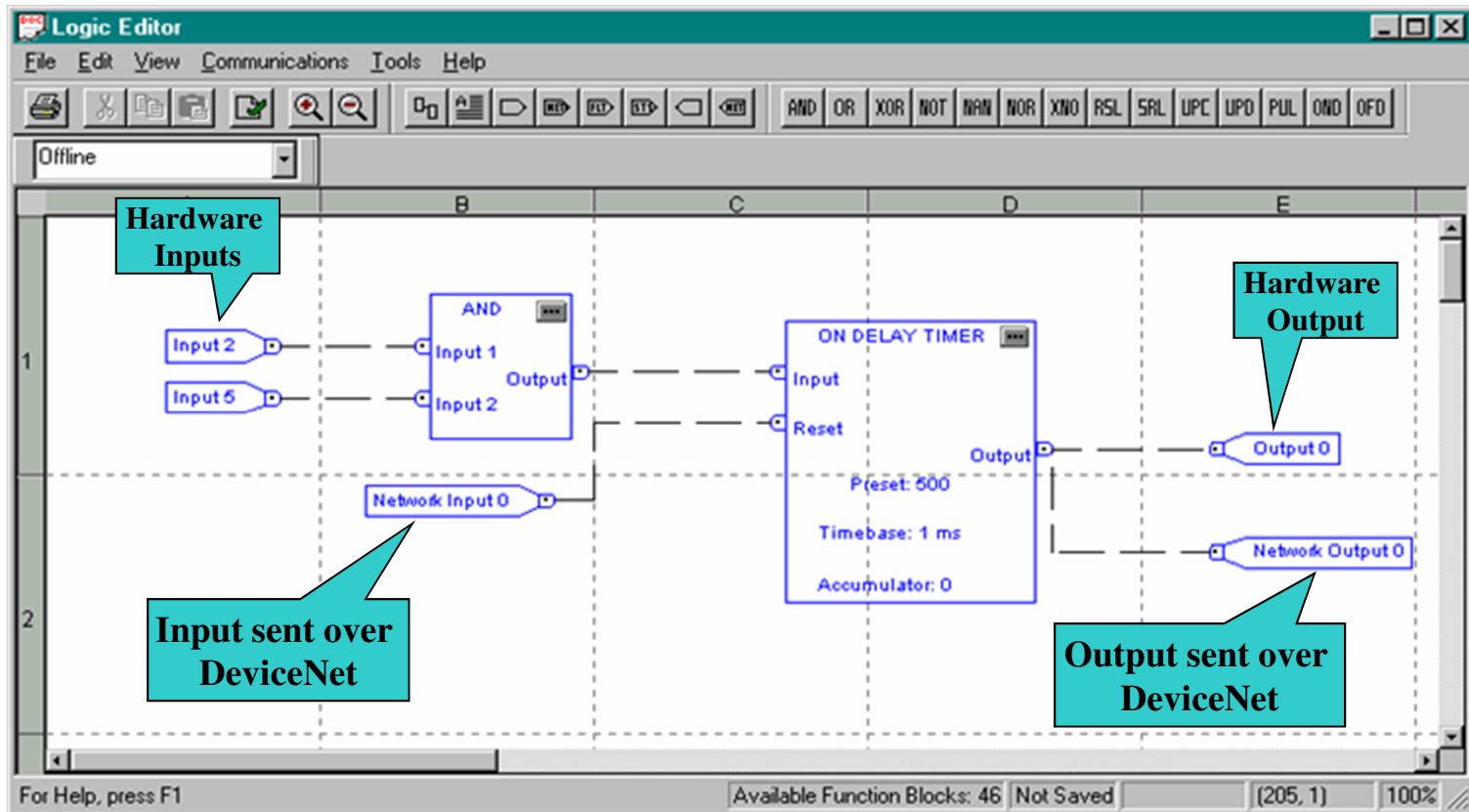
DeviceLogix Ladder Logic Editor

The DeviceLogix Ladder Editor was released in V6.000 of RSNetWorx for DeviceNet Software.

Zone Interlocking Parameters (ZIP)

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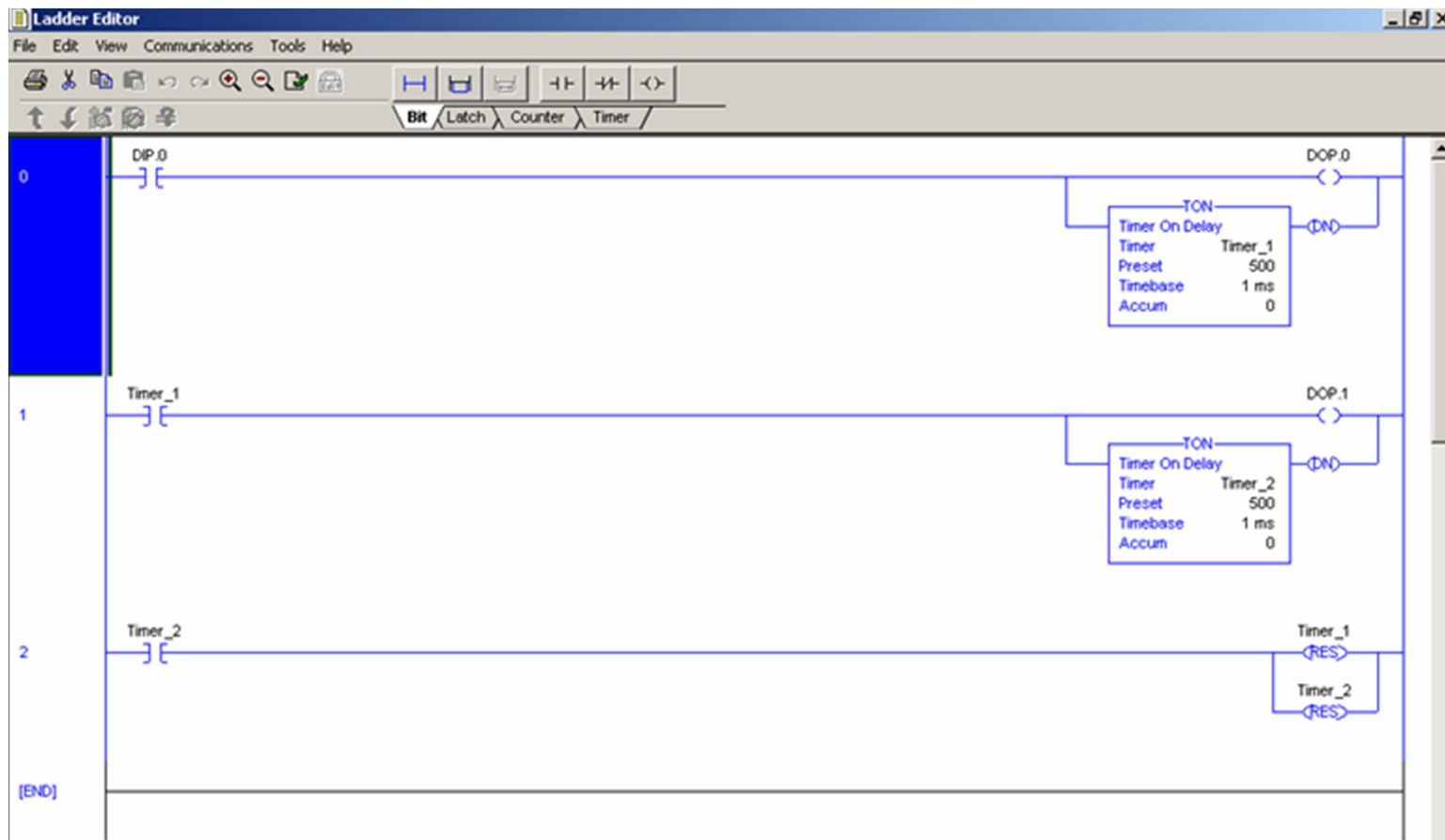
ZIP Description

Zone Interlocking Protocol (ZIP) is a method of having networked IO cards share data directly, without hard wiring them together and without the use of a master scanner on the DeviceNet network. One ZIP Capable IO card can consume data from up to four other ZIP cards. A consumer of ZIP data can also produce ZIP data onto the DeviceNet network to other ZIP cards.

A ZIP card is configured using RSNetworx for DeviceNet software and there are actually two different configuration methods for the card. The first is the DeviceLogix editor to program the actual control logic. The second method is to use the cards Electronic Data Sheet (EDS) to allow all of the ZIP related configuration to be entered.

Each ZIP device will produce 7 bytes of data on the network. Only the first 5 bytes are useable data and are composed of Local Inputs, Local Outputs and Network Outputs of the producing card. The last 2 bytes of the produced data are a CCV, a type of checksum, of the entire configuration inside the producing card. This CCV is used for data security purposes. The Data produced on the network by a ZIP card behaves as Change of State (COS) data. That is whenever the data changes inside a ZIP card, it will be produced on the network. If the data does not change within a configurable time period, then the data will be sent anyway. This is called the heartbeat time. A user configurable Production Inhibit Timer (PIT) has also been provided so that ZIP data, changing very often in a ZIP card, will not flood the network with traffic.

The consuming ZIP device has a configurable timer called the Expected Packet Rate (EPR) timer that determines if the produced data from another device has been received within a certain period of time. If an EPR timeout occurs, there is a status bit accessible within the DeviceLogix program that can be monitored and action taken.

There are up to 8 bytes of total data consumed by a ZIP card. These 8 bytes of data can be selectively filled from each of four producing cards, with up to 5 bytes from a single card. Mask and offset parameters have been provided to allow the user to pick the specific data bytes they want to consume from each ZIP card and pack them where they want, within the 8 bytes available.

ZIP Fun Facts (Cont.)

- Currently devices that support ZIP are the 1799 family 1799-ZCIO Embedded I/O boards 1799-ZCIOV and 1799-ZCIOB along with the ArmorStart product line.

- ZIP consumer can consume data, from up to 4 different producers, but the total consumed data from all producers can NOT exceed 8 bytes

- It is possible to run a master scanner with an I/O connection to ZIP boards at the same time they are producing or consuming ZIP data. The I/O connection returns back the same 7 ZIP data bytes as Input data back to the scanner. The data consumed by the ZIP board, from a master scanner is configurable in the ZIP devices EDS file from 0 to 4 bytes. This data will appear in the ZIP logic board as Network Input bits as compared to Zone Data bits being consumed directly from another ZIP device. With a scanner as a master to a ZIP device, if the master scanner stops communicating, then all ZIP data will also cease to be generated by the devices who were being communicated by the scanner. Re-establishing the scanner communication to the devices will start the ZIP data being produced again.

- Security is also implemented and consists of taking the CCV of the producers configuration and entering it in the consumers Cnxn Security Key Value, for the appropriate producer node using the EDS configuration. The CCV from the producer can be obtained from the Module Security Key Value in the EDS configurator of the producer device. If the CCV from the producer does not match that entered in the consumer zone configuration, then the ZIP connection will be declared unhealthy and the data will not actually be consumed, by the consumer.

- To change any of the ZIP consumer parameters and download then to the device, the Zone Control parameter must be disabled first.

- In order to enable or disable the Zone Control parameter, the DeviceLogix Logic must be disabled first. This makes sense because it would be bad to be running the Logic while changes are being made to the Zip configuration.

- To run the ZIP device stand alone, without a network master, the Network Status Override and Comms Status Override should be set to Override Enabled.

- When running the ZIP device with a network master, the Network Status Override and Comms Status Override should be set to Override Enabled if the logic needs to run if the network master communication fails. These Overrides being Override Disabled will cause the logic execution to cease without a master scanner communicating to the card..

ZIP Fun Facts (Cont.)

- The ladder Logic Editor uses a 96 bit table to combine the Consumed network bits and the 64 ProduceD ZIP bits. The Consumed Network bits are bits 0 – 31 and the ZIP bits are bits 32 though 95.

ZIP ZCIO EDS Set-Up
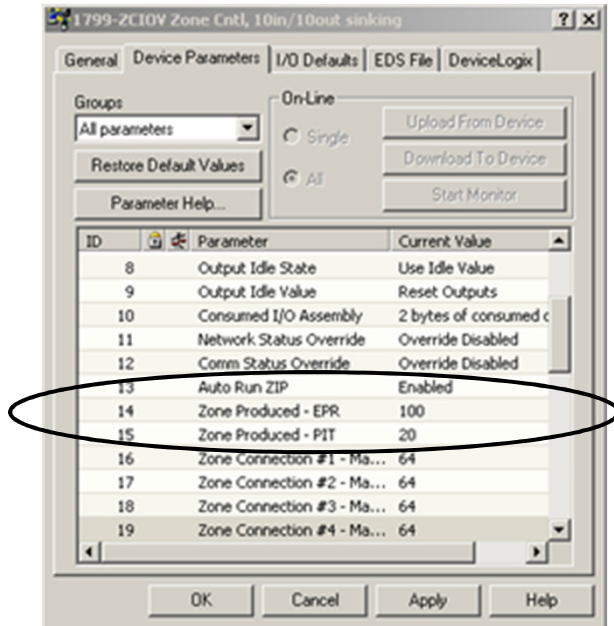
ZCIO Producer EDS Configuration

1. **Set Zone Produced – EPR, (Parameter 14).**
    Another name for COS Hearbeat timeout
    if no data changes in ms.
2. **Set Producer Inhibit Time (Parameter 15).**
    0 is no data inhibit, a number entered here
    is in ms and will keep data from being produced
    any faster than that period, regardless of changes.
3. **Enable ZIP Production (Parameter 13)**

ZCIO Consumer EDS Configuration

1. **Enter Zone Connection # 1 thru 4 – MacID**
    Producer Node Number
2. **Enter Zone Connection #1 thru 4 – Mask**
    Determines which data bytes to use from producer node
3. **Enter Zone Connection #1 thru 4 – Offset**
    Determines where in the 8 byte data table the masked
    bytes will be put.
4. **Enter Zone Connection #1 thru 4 – EPR**
    Connection timeout in ms.
5. **Set Zone Control to Enabled**
    Enables use of ZIP data in the DeviceLogix program.

ZIP Data Mapping Example

Offset Position in ZIP Data Table, Parameter [28-31]	Address of Producing Device Parameter [16-19]	Byte from producer data chosen by Mask Parameter[24-27]
Byte 0	MacID 25	Byte 3
Byte 1	MacID 27	Byte 4
Byte 2	MacID 28	Byte 0
Byte 3	MacID 29	Byte 2
Byte 4	Not used	Not used
Byte 5	Not used	Not used
Byte 6	Not used	Not used
Byte 7	Not used	Not used

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Produced 0	Input 7	Input 6	Input 5	Input 4	Input 3	Input 2	Input 1	Input 0
Produced 1	reserved	Logic Ena	reserved	reserved	reserved	reserved	Input 9	Input 8
Produced 2	Output 7	Output 6	Output 5	Output 4	Output 3	Output 2	Output 1	Output 0
Produced 3							Output 9	Output 8
Produced 4	Net Out 7	Net Out 6	Net Out 5	Net Out 4	Net Out 3	Net Out 2	Net Out 1	Net Out 0
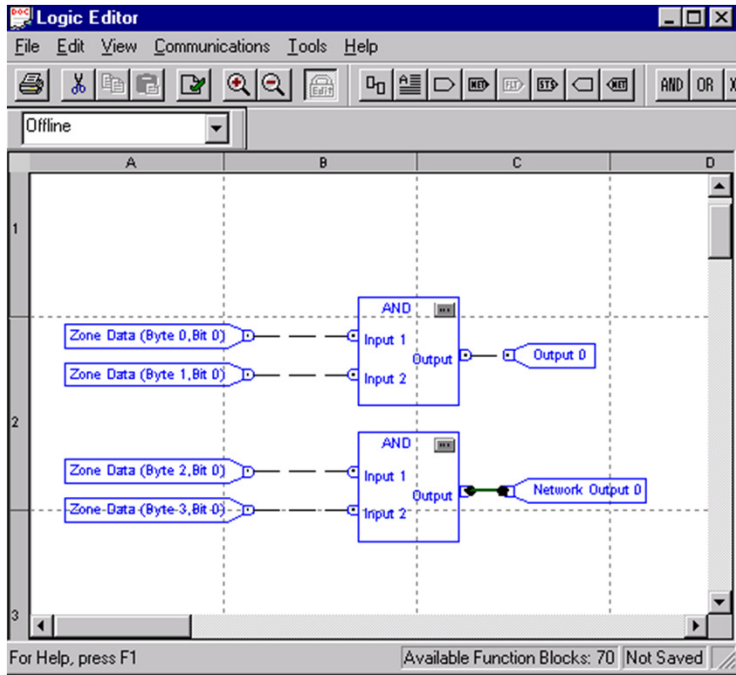
Device Logix

AND
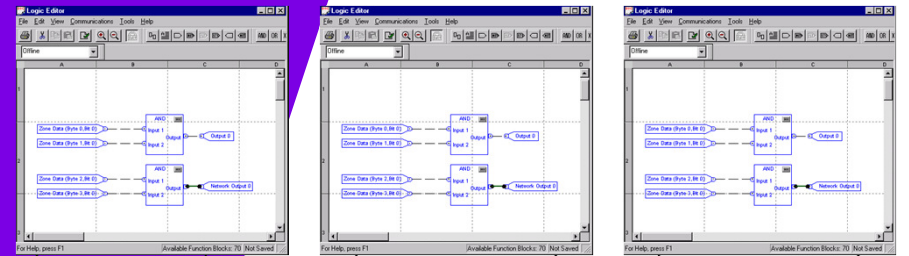
ZIP

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Produced 0	Input 7	Input 6	Input 5	Input 4	Input 3	Input 2	Input 1	Input 0
Produced 1	rsvd	Logic Ena	rsvd	rsvd	rsvd	rsvd	Input 9	Input 8
Produced 2	Output 7	Output 6	Output 5	Output 4	Output 3	Output 2	Output 1	Output 0
Produced 3							Output 9	Output 8
Produced 4	Net Out 7	Net Out 6	Net Out 5	Net Out 4	Net Out 3	Net Out 2	Net Out 1	Net Out 0

Produced Data

Produced · Consumed Data

Produced · Consumed Data

Produced · Consumed Data

Produced · Consumed Data
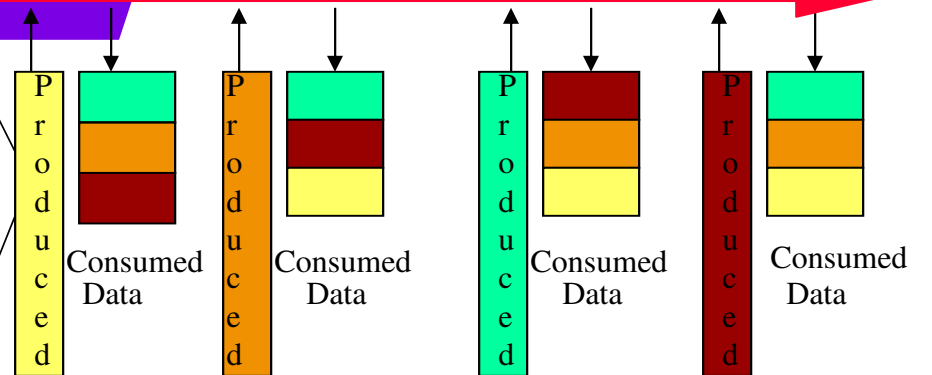
Series 9000 PHOTOEYE DETAILS

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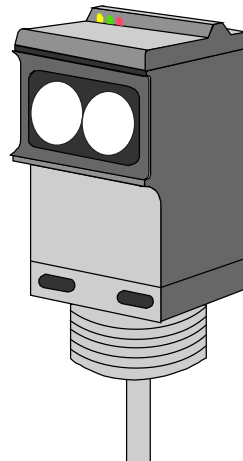
Original Series 9000 PE Fun Facts

- The Node Number and Baud Rate of the Series 9000 PE is set via the Node Commissioning utility in the RSNetWorx or DeviceNet Manager software. These variables can also be changed by using the DeviceView hand held configurator.

- The Series 9000 PE will default to Light Operate Mode out of the box. The allowable settings are Light Operate or Dark Operate. Depending how this parameter is set the In Position bit will act differently. This variable can be altered by running the EDS file within the RSNetWorx software, DeviceNet Manager Software or DeviceView.

- An alternate mode of configuration is also possible be using the pushbutton and LEDs that are mounted on the Series 9000 under the hinged door.

- The infrared sensitivity of the Series 9000 is set by using the potentiometer mounted on the PE and currently cannot be done over the DeviceNet network.

- There are different catalog numbers for Series 9000 photoeyes that support COS (Change of State) or Strobe message types.

- Under some strange electrical noise/brown out conditions the Series 9000 will have its flash memory corrupted, which makes it's node number go back to 63. Its product type and code will both appear as 0 and the PE will NOT hold any configuration changes over a power cycle. The PE needs to be sent back to the factory to be reprogrammed.

- Any revision Series 9000 photoeye manufactured before October 2000 WILL have trouble communicating with a DML based scanner using ANY message type. The symptom is that they will sporadically fall off of the network and will quickly re-establish communication, but the scanner will still declare a fault. 1747-SDN V3.003 or older and the 1771-SDN scanner Series B should still work OK with these photoeyes as these do not use the DML.

- Note; All Series 9000 photoeyes with a 20 as the last 2 digits of the 4 digit 9XXX number, in the catalog number will NOT have the above two problems and can be substituted for the older photoeyes. Ex: 42GNP-9020-QD1. Electronic key of photoeye will be different and will need to be resolved in scan list.

SmartSight 9000 PE Fun Facts

- A SmartSight is identified by the 4 digit 9XXX number in the catalog number. If the last two digits of this number is a 20 then the photoeye is a SmartSight version. Example: 42GNP-9020-QD1.

- The Node Number of the SmartSight is set via rotary switches on the photoeye itself. Baud Rate of the SmartSight is determined via Autobaud detect. Supported message types are Change Of State and Strobe.

- The SmartSight PE fixes the two known issues described at the bottom of the previous page with the original Series 9000 photoeyes.

- COS messaging may not work with certain firmware revisions of the 1747-SDN, 1756-DNB and 1784-PCIDS scanners due to a firmware issue with the SmartSight. The symptom is that the photoeye goes to sleep and will not wake up again until power is cycled to it. Use Strobed mode with a Rx Size of 1 byte instead. Additional fixes are to disable the Ack mechanism in the scan list configuration or set the COS Inhibit Time to 10ms or greater.

SmartSight 9000 DeviceNet Sensors
PHOTOSWITCH® Photoelectric Sensors

I/O Data

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit 5	Bit 6	Bit 7
	Output	Diagnostic	Margin 1	Margin 2	Motion Detect	Counter Output	Not Used	Not Used
0	OFF	OK	OK	OK	Motion	Less Than Preset		
1	ON	ALARM	Margin Unstable	Margin Unstable	No Motion	Preset Reached		

Original Series 9000 Diffused Photoeye I/O Data

Consumes 1 bit of Strobed output data

Not Used

Bit 0

Produces 1 byte of Strobed input data

Byte 0

NOT USED	Low Margin	In Position

Bits 2 thru 7   Bit 1   Bit 0
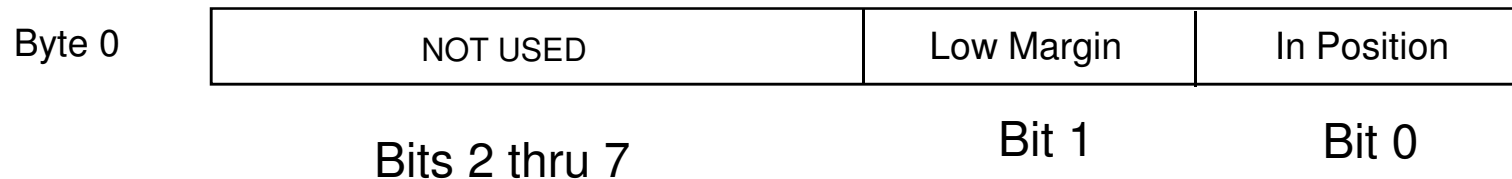
Bit 1 = 0 & Bit 0 = 0   Nothing in Position
Bit 1 = 0 & Bit 0 = 1   Something in front of photoeye and plenty of margin
Bit 1 = 1 & Bit 0 = 0   Invalid
Bit 1 = 1 & Bit 0 = 1   Something in front of photoeye and out of margin

Original Series 9000 Retro Photoeye I/O Data

Consumes 1 bit of Strobed output data

Not Used

Bit 0

Produces 1 byte of Strobed input data

Byte 0

NOT USED	Low Margin	In Position

Bits 2 thru 7   Bit 1   Bit 0
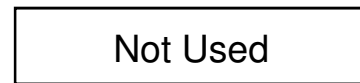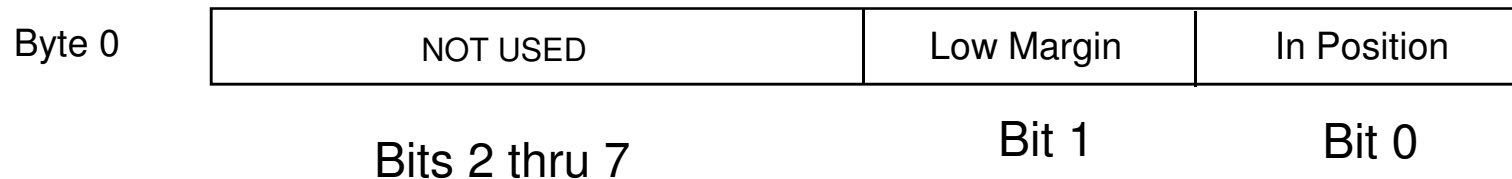
Bit 1 = 0 & Bit 0 = 1   Nothing in Position
Bit 1 = 0 & Bit 0 = 0   Something in front of photoeye
Bit 1 = 1 & Bit 0 = 0   Invalid
Bit 1 = 1 & Bit 0 = 1   Photo eye out of margin

RightSight 42 EF Photoeye DETAILS

DeviceNet 42EF

- Advanced Diagnostics
  - **Two fixed Margins setting**
    - **0.7 to 1.5**
    - **0.7 to 2.0**
  - **Static/Dynamic Low Margin**
  - **Motion Detection**

- Logic
  - **Single 16-bit Counter**
  - **Two 16-bit Timers**
    - **On-Delay**
    - **Off-Delay**
    - **One-Shot**

- I/O Protocol
  - **Change of State**
  - **Strobed**

RightSight Photoeye Fun Facts

- The Node Number is set via the Node Commissioning utility in the RSNetWorx, DeviceNet Manager and DeviceView hand held configurator.

- Baud rate set via autobaud which can be disabled if desired.

- Supports Change of State and Strobing message types.

- COS messaging may not work with certain firmware revisions of the 1747-SDN, 1756-DNB and 1784-PCIDS scanners due to a firmware issue with the RightSight. The symptom is that the photoeye goes to sleep and will not wake up again until power is cycled to it. Use Strobed mode with a Rx Size of 1 byte instead. Additional fixes are to disable the Ack mechanism in the scan list configuration or set the COS Inhibit Time to 10ms or greater. Series A, Revision D sensors fix this problem.

RightSight PE Data Details

Produces 1 byte of Strobe or COS data

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit5		Bit 6	Bit 7
Byte 0	Sensor Output	Diagnostic	Margin 1	Margin 2	Motion Detect	Counter		Unused	Unused

Bit 0 = Sensor Output   0 = Off, 1 = On
Bit 1 = Diagnostic   0 = OK, 1 = Alarm
Bit 2 = Margin 1   0 = OK, 1 = Low Margin
Bit 3 = Margin 2   0 = OK, 1 = Low Margin
Bit 4 = Motion Detect   0 = Motion, 1 = No Motion
Bit 5 = Counter   0 = Value less than Setpoint, 1 = Setpoint Reached

871TM SmartProx
DETAILS

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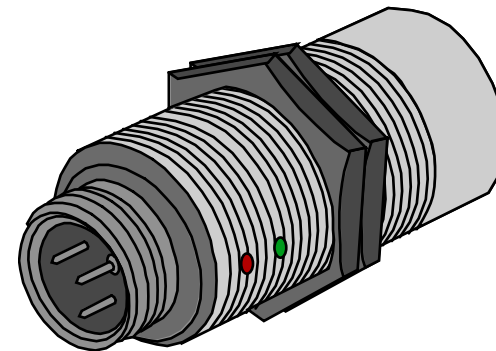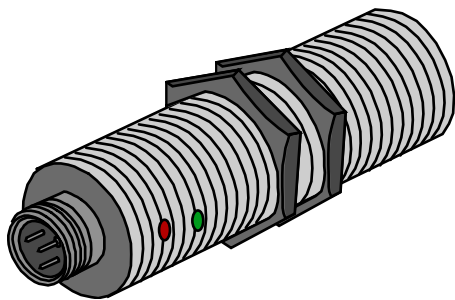
871 TM SmartProx Fun Facts

- **The Node Number is set via the Node Commissioning utility in the RSNetWorx, DeviceNet Manager and DeviceView hand held configurator.**

- **Baud rate set via autobaud which can be disabled if desired.**

- **Supports Change of State and Strobing message types in Series A. Will add Poll message type support in Series B.**

- **Comes in 18mm and 30mm sizes with micro connectors, mini connectors and cable connections to network.**

- **Features include counter capability, motion detect, analog output, On/Off delays and teach/learn mode.**

- **COS messaging may not work with certain firmware revisions of the 1747-SDN, 1756-DNB and 1784-PCIDS scanners due to a firmware issue in the 871TM prox. Use Strobed mode with a Rx Size of 2 bytes instead.**

- **Revision A of the 871 TM prox will NOT work with ADR feature in the scanners.**

871 TM Prox Data Descriptions

Sensor Output – Set when target Detected.
:
Too Close Definition – Target is within 1.5mm of face. Latched on until another target detection is made that doesn't enter 1.5mm of the face.
Too Close Bit – Set when target Too Close

Too Far Definition – Target passes through sensor switch point, but does not pass through user configured Too Far Min Margin point. The default value of the Too Far set point is -20% of the switch point, but can configured from 0% to -20%.   The user may also setup this diagnostic as Static to Dynamic. In static mode the diagnostic is set whenever the target pass in the defined region, while in dynamic mode the diagnostic is latched on.
Too Far Bit – Set when target Too Far

Coil Operational – Set when an open in the coil is detected

Always In Definition– Target pass through sensor switch point, but does not pass through user configured Always In Max Margin point. The default value of the Always In set point is +20% of the switch point, but can configured from 0% to +20%. This diagnostic is latched on until target pass outside of the range.
Always In Bit – Set when target Always In

Motion Detect Output – Set when the sensor output does not change within the Preset time.

Counter Output – Counter Preset value reached

Analog Output – Analog value for relative distance (0 – 255)

871 TM Prox Data Details

Consumes 1 bit of Strobe output data or 0 bytes of COS data

Strobe bit not used.

Produces 1 byte COS data or 2 bytes of Strobe data

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit5	Bit 6	Bit 7	
Byte 0	Sensor Output	Diagnostic	Coil Operational	Too Close	Too Far	Always In	Motion Detect	Counter Output	COS & Strobed

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit5	Bit 6	Bit 7	
Byte 1				Analog Output					Strobed Only

802DN Limit Switch

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802DN Limit Switch

- **Change of State or Strobing**

- **Dual outputs with programmable setpoints**

- **Each output programmable to NO or NC**

- **Programmable travel to reset (hysteresis)**

- **User selectable discrete or analog output**

- **Multiple maintenance warnings**
  - **Overtravel alarm, counter diagnostic, slow lever return alarm**

- **Learn/Teach Mode**

- **Timing - On Delay /Off Delay /One shot**

- **Supports ADR (Auto Device Replacement)**

- **Autobaud**

- **Group 2 Only**

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802DN Limit Switch Fun Facts

- **The Node Number is set via the Node Commissioning utility in the RSNetWorx, DeviceNet Manager and DeviceView hand held configurator.**

- **Baud rate set via autobaud which can be disabled if desired.**

- **Connects to network via mini, micro or cable.**

- **Group 2 Only device.**

- **User manual is publication 802DN-CG001A-US-P.**

802DN Limit Switch Data Details

Consumes 1 bit of Strobe output data or 0 bytes of COS data

Strobe bit not used.

Produces 1 byte COS data or 2 bytes of Strobe data

	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit5	Bit 6	Bit 7	
Byte 0	Output 1	Output 2	Maintenance Diagnostic	Over Travel	Slow Return	Counter 1 Output	Counter 2 Output	Not Used	COS & Strobed
Byte 1	Bit 0	Bit 1	Bit 2	Bit 3	Bit 4	Bit5	Bit 6	Bit 7	Strobed Only
	Analog Output								

DeviceLink DETAILS

DeviceLink

DeviceLink Fun Facts

- The Node Number and Baud Rate of the DeviceLink is set via the Node Commissioning utility in the RSNetWorx or DeviceNet Manager software. These variables can also be changed by using the DeviceView hand held configurator.

- The DeviceLink has two configurable parameters called On Filter and Off Filter. These parameters allow the debouncing of an input connected to a DeviceLink both on a rising and falling edge if desired. Allowable values are 0 and 25 ms of filter time per parameter and they default to 0 ms. These parameters can be altered by running the EDS file within RSNetWorx, DeviceNet Manager Software or DeviceView.

- If the +24VDC (Brown Wire) and OVDC (Blue Wire) on the 3 wire side are shorted together, a DeviceLink internal fuse will blow. The discrete input will no longer be seen by the DeviceLink, but the DeviceLink will stay on the network with no external indication the fuse blew. Use the EDS file in the RSNetWorx or DeviceNet Manager Software to test the input. If fuse is blown the whole DeviceLink will need to be replaced.

- The Rockwell Automation DeviceLink is officially obsolete, but there is a company named Huron Networks that does manufacture a replacement called the DN-100. The DN-100 also has the advantage of having a 24VDC discrete output that the DeviceLink did not have. Here is the URL of the product is http://www.huronnet.com/products/DN-100_Series.htm

DeviceLink Connection Details

Red (+24VDC)
White (CAN-H)
Bare (Shield)
Blue (CAN-L)
Black (OVDC)

DeviceNet Side

DeviceLink

Discrete Side

Brown (+24VDC)

Blue (0 VDC)

Black (Input)

DeviceLink Wire Colors and Definitions

Red
White
Shield
Blue
Black

DeviceNet Side

DeviceLink

Discrete Side

Brown

Blue

Black

Standard Electronic
Proximity Detector
or Photoeye

Connection of An Electronic Sensor to DeviceLink

Red
White
Shield
Blue
Black

DeviceNet Side

DeviceLink

Discrete Side

Brown (+24VDC)

Blue

Black (Input)

Connection of a Limit Switch or other "Dry" Contacts

243

DeviceLink I/O Data

Consumes 1 bit of Strobed output data

Not Used

Bit 0

Produces 1 byte of Strobed input data

Byte 0

NOT USED	In Position

Bits 1 thru 7   Bit 0
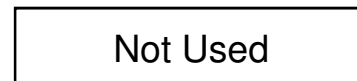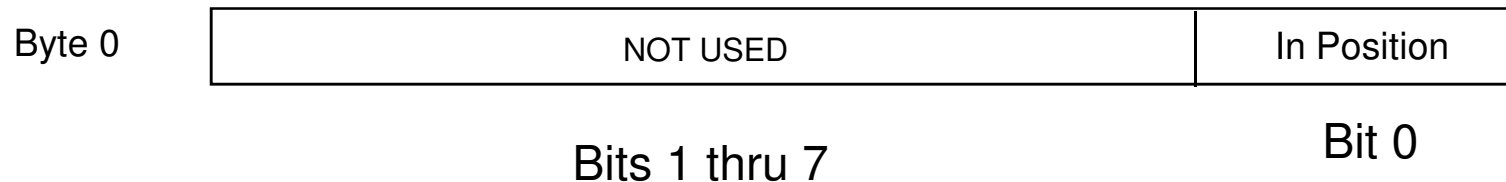
Bit 0 = 0   There is a low (No Voltage) sensed on DeviceLink input wire
Bit 0 = 1   There is a high (+24VDC) sensed on DeviceLink input wire

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800E Pendant Station

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Pendant Station Fun Facts

- The Node Number and Baud Rate of the Pendant Station is set via the Node Commissioning utility in the RSNetWorx or DeviceNet Manager software. These variables can also be changed by using the DeviceView hand held configuration tool.

- The pendant station contains a single pushbutton and a single output which is used normally to drive a light mounted on the bottom of the unit. It is designed to be hung from above and is used on assembly lines to start and stop the line from individual, assembly stations.

- Pendant Station is Group 2 only device.

- Supports Change of State or Strobe messaging.

- Supports DeviceLogix capability.

- User manual publication is 800E-UM001A-US-P

Pendant Station I/O Data

Consumes 1 bit of Strobed output data

Output 1

Bit 0

OR

Consumes 1 byte of COS data

Byte 0

NOT USED	Output 1

Bits 2 thru 7   Bit 0

Produces 1 byte of COS or Strobed input data

Byte 0

NOT USED	Output 1 Status	Not used	Not used	Input 1

Bits 4 thru 7   Bit 3   Bit 2   Bit 1   Bit 0

800E Pushbutton Station DETAILS

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800E Fun Facts

800E Pushbutton Stations have been obsoleted as of 2006 and replaced with the 800F. Refer to the 800F slides for more details.

Product Profile Publication 800E-PP006A-EN-P is helpful when ordering.

User Manual is Publication 800E-UM002A-EN-P.

800F Pushbutton Station
DETAILS

800F Fun Facts

Selection Guide is Publication 800F-SG001-EN-P which is very helpful when ordering.

User Manual is Publication 800-UM002-EN-P.

RediSTATION DETAILS

800T RediSTATION Dip Switches

SW1

On = 1

Off = 0

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 |

Switches 1- 6 = DeviceNet Node Address   0 - 63   **(63 is Factory Default)**

Switches 7- 8 = DeviceNet Data Rate

00 = 125Kbs   **(Factory Default)**
01 = 250Kbs
10 = 500Kbs
11 = Invalid

Switches 9 = Output Fault State

0 = Turns outputs Off when   **(Factory Default)**
    fault detected

1 = Leaves outputs in "last state" when
    fault detected

Switches 10 = Output Blink Rate

0 = 1Hz (0.5sec ON, 0.5 sec OFF)   **(Factory Default)**

1 = 2Hz (0.25 sec ON, 0.25 sec OFF)

RediSTATION Fun Facts

- The RediSTATION contains a printed circuit card that has 4 inputs and 2 outputs. The 2 outputs also have current detect capability and 1 status bit per output is available for low current detect.

- This printed circuit card is available with cables as a separate product for making custom RediSTATIONS.

- The outputs of this printed circuit card are NOT rated for any usage other than driving a light bulb type output.

- The RediSTATION card has a built in blink feature which allows the user to set a single bit to the card to blink an output. The blink rate is set via dip switches between 1 Hz and 2 Hz.

- Current revision of firmware does not allow Explicit Message reading of inputs unless a network master is communicating to the RediSTATION. The output can never be turned on solely by explicit messaging.

- Replacement light bulb is catalog number A-B 800T-N157 or ANSI 757 Incandescent Lamp (24 - 28V).

- The 2705-DN42 printed circuit is contained inside the 2705 RediSTATION. This card has four 24DC inputs and two 24VDC outputs that can source 100ma each. The electrical specifications of the card state that it draws a maximum of 7 watts from the DeviceNet power. The interesting thing about this is that the 7 watts includes the I/O devices contained in a normal RediSTATION, which are two inputs and one output. Using the specifications that each input can draw a maximum of 24ma and an output can source up to 100 ma, lets do some math and deductive reasoning. If you take 7 watts and divide it by 24VDC you get a maximum current of .292 amps. This maximum power assumes that one output and two inputs are on at the same time. If you subtract 100ma for one output and 2 X 24ma for the inputs, you get a total operating current of the board of 144ma with no inputs or outputs energized. Now the interesting thing is that as a voltage drop on the cable occurs, the 24VDC voltage reduces and the 2705-DN42 current goes up proportionately. So at the minimum DeviceNet voltage of 11 volts, the maximum current of the board could be 7/11 = .642 amps. So you can see the RediSTATION current can go up dramatically depending on the voltage, on the cable, at any point. If all four inputs and both outputs are used, then the total current at 24VDC would be (2 X 100) + (4 X24) + 144 = 400 ma and multiplied by 24VDC gives a total maximum total power consumption of 10.56 watts.

- User Manual is Publication 2705-804.

- **This product was officially declared obsolete in December of 2003. The designated replacement device is an 800F pushbutton station. Catalog 800F-VBJ4AABB gets a comparable unit physically, but the data sizes and content will be different than a RediSTATION.**

800T RediSTATION I/O Data

Consumes 1 byte of Polled output data

Byte 0

NOT USED	Blink Output 2	Output 2 On	Blink Light (1)	Turn Light On (1)
Bits 4 thru 7	Bit 3	Bit 2	Bit 1	Bit 0

Blink Bit = 0 & On Bit = 1   Output is on solid
Blink Bit = 1 & On Bit = 1   Output is on blinking
Blink Bit = X & On Bit = 0   Output is off

Produces 1 byte of Polled input data

Byte 0

NOT USED	Low Current Output 2	Light Bulb burnt out (1)	Input 4	Input 3	Start Button Pressed (2)	Stop Button Pressed (1)
Bits 6 and 7	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Bit 0   1 if Stop button pressed, 0 if Stop button NOT pressed
Bit 1   1 if Start button pressed, 0 if Start button NOT pressed
Bit 2,3   1 if input energized, 0 if input not energized
Bit 4,5   1 if Bulb burnt out or missing, 0 if Bulb is OK

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1792D MaXum ArmorBlock I/O DETAILS

MaXum ArmorBlock Fun Facts

- Node number is set via either Rotary Switches or Node Commissioning in the RSNetWorx or DeviceNet manager Software. Baud rate is handled via autobaud automatically by the ArmorBlock.

- MaXum ArmorBlock I/O modules are actually has two separate pieces. The first piece is the Active Top which contains the electronics of the device. The second part is the Media Base that makes the connection to the DeviceNet network and attaches to the Active Top. Media Bases exist to connect to standard round media and also to connect directly onto the KwikLink flat media.

- Has short circuit and no load diagnostics for outputs. Has short circuit and open circuit diagnostics for inputs. Note: For connectors with 2 inputs per connector, the open circuit detect and short circuit occurs for the entire connector, NOT individual inputs.

- ArmorBlock MaXum is rated Nema 4, 4x, 6P and IP67. It also has the UL, CE, Marine and CSA Class 1 Div 2 certifications.

- Outputs are user configurable to reset, hold last state or individually go to a desired fault state, on or off.

- The 4 Input/4 Output (1792-4BVT4D), 8 Input/8 Output (1792-8BVT8D), 16 Input (1792-16BVT0D), 12 Input/4 Output (1792-12BVT4D), 8 Input/0 Output (1792-8BVT0D) and 0 Input/8 Output (1792-0VT16E), modules will require splitter cables or a Splitter Tee 1485P-P1R4-DR4 to make maximum use of available discrete Inputs and Outputs on these products.

- With dry contacts connected to an input, connect a 27K ohm resistor between pin 1 (Sensor Source Voltage) and 3 (Return Logic Ground) of the input connector to be able to use the open circuit feature for the input.

- Some MaXum I/O bases are available with a -JP at the end of the catalog number that will jumper the DeviceNet Network Power to the Output power, inside the base.

- Very Important: The current draw of MaXum, with input sensors attached, are much higher on the DeviceNet Power than anticipated. Refer to manual 1792-TD001B-EN-P for graphs and current draws for various MaXum Blocks.

- ArmorBlock I/O Product Data Manual is Publication 1492D-1.4.

Low Cost DeviceNet
KwikLink Connectivity

Blocks consist of:

1) Active Top with 12mm connectors, LEDs, electronics, and cable markers.

2) 2 piece Terminal Base to secure the media.
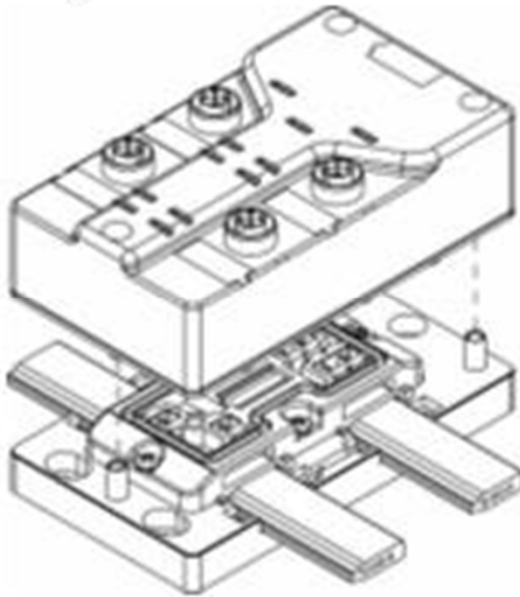
DeviceNet and Output Power Cables Pass Through the Terminal Base

MaXum ArmorBlock Diagnostics

Inputs

- Short-circuit and open-wire.

- Open-wire can be disabled thru EDS.

- Selectable filter times 0ms, 2ms, 4ms, 8ms, 16ms.

- Special Alarm Input for use with Series 9000 Diagnostic PHOTOSWITCH and other 4 wire devices(1792D-2BVA2D)

Point LEDs indicates on/off and input/output faults

Outputs

- Short-circuit and no-load.

- Can be disabled thru EDS.

- Can be configured to Latch Off or Auto-Restart if faulted.

- All outputs electronically protected, no fusing needed.
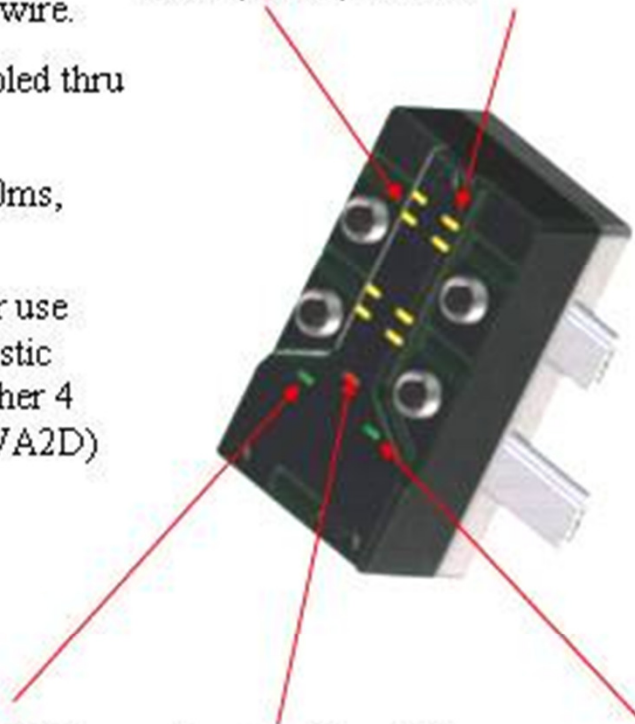
Module Status LED indicates the health of the Block as dictated by DeviceNet specs

Auxiliary Power LED indicates presence of output power to the block.

Network Status LED indicates the health of the Block on the network as dictated by the DeviceNet specs.

All Status and Diagnostic information is reported back over DeviceNet whether Polled, Cyclic or Change-of-State

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MaXum I/O Data Format

Bit	07	06	05	04	03	02	01	00
Produces 0	I7	I6	I5	I4	I3	I2	I1	I0
Produces 1	OW-D	OW-C	OW-B	OW-A	ISC-D	ISC-C	ISC-B	ISC-A
Produces 2	OFLT7	OFLT6	OFLT5	OFLT4	OFLT3	OFLT2	OFLT1	OFLT0
Produces 3	RSVD	OPWR	RSVD	RSVD	RSVD	RSVD	RSVD	RSVD
Consumes 0	O7	O6	O5	O4	O3	O2	O1	O0

8BVT8D

Bit	07	06	05	04	03	02	01	00
Produces 0	OW-B	OW-A	ISC-B	ISC-A	I3	I2	I1	I0
Produces 1	RSVD	OPWR	RSVD	RSVD	OFLT3	OFLT2	OFLT1	OFLT0
Consumes 0	RSVD	RSVD	RSVD	RSVD	O3	O2	O1	O0

4BVT4D

Bit	07	06	05	04	03	02	01	00
Produces 0	OW-B	OW-A	ISC-B	ISC-A	A1	A0	I1	I0
Produces 1	RSVD	OPWR	RSVD	RSVD	RSVD	RSVD	OFLT1	OFLT0
Consumes 0	RSVD	RSVD	RSVD	RSVD	RSVD	RSVD	O1	O0

2BVA2D

Bit	07	06	05	04	03	02	01	00
Produces 0	I7	I6	I5	I4	I3	I2	I1	I0
Produces 1	I15	I14	I13	I12	I11	I10	I9	I8
Produces 2	ISC-H	ISC-G	ISC-F	ISC-E	ISC-D	ISC-C	ISC-B	ISC-A
Produces 3	OW-H	OW-G	OW-F	OW-E	OW-D	OW-C	OW-B	OW-A

16BVT0D

Bit	07	06	05	04	03	02	01	00
Produces 0	ISC-D	ISC-C	ISC-B	ISC-A	I3	I2	I1	I0
Produces 1	RSVD	RSVD	RSVD	RSVD	OW-D	OW-C	OW-B	OW-A

4BV0D

Bit	07	06	05	04	03	02	01	00
Produces 0	OW-B	OW-A	ISC-B	ISC-A	RSVD	RSVD	I1	I0

2BV0D

ISC = Input Short Circuit; **OW** = Open Wire; **OFLT** = Output Fault; **I** = Input; **O** = Output; **A** = Alarm; **OPWR** = Aux Power

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ArmorBlock Patchcords and Cables
* Ordered from PSB Group in Chelmsford, MA

Sensor End   Block End

DC Micro Patchcords

Female Connector (Sensor End)		Male Connector (Block End)		Length	Part Number New 889/879 series
DC Micro Female 5-pin (4 conductor)	Straight	DC Micro Male 4-pin	Straight	1	889D-F4ACDM-1
				2	889D-F4ACDM-2
				5	889D-F4ACDM-5
			Rt. Angle	1	889D-R4ACDM-1
				2	889D-R4ACDM-2
				5	889D-R4ACDM-5
	Rt. Angle		Straight	1	889D-F4ACDE-1
				2	889D-F4ACDE-2
				5	889D-F4ACDE-5
			Rt. Angle	1	889D-R4ACDE-1
				2	889D-R4ACDE-2
				5	889D-R4ACDE-5

Y-Cables, DC Micro to DC Micro

DC Micro Female 4-pin x2	Straight	DC Micro Male 4-pin	Straight	0.3	879D-F4ACDM-0M3
				1	879D-F4ACDM-1
				2	879D-F4ACDM-2
	Rt. Angle			0.3	879D-R4ACDM-0M3
				1	879D-R4ACDM-1
				2	879D-R4ACDM-2

DC Micro Male 4-pin Cordset

Cable	None	DC Micro Male 4-pin	Straight	2	889D-M4AC-2
				5	889D-M4AC-5
				10	889D-M4AC-10
			Rt. Angle	2	889D-E4AC-2
				5	889D-E4AC-5
				10	889D-E4AC-10

Pico to DC Micro Patchcords

Pico Female 3-pin	Straight	DC Micro Male 4-pin	Rt. Angle	1	889P-F3ABDR4-1
				2	889P-F3ABDR4-2
				5	889P-F3ABDR4-5
	Rt. Angle		Rt. Angle	1	889P-R3ABDR4-1
				2	889P-R3ABDR4-2
				5	889P-R3ABDR4-5
Pico Female 4-pin	Straight		Rt. Angle	1	889P-F4ABDR-1
				2	889P-F4ABDR-2
				5	889P-F4ABDR-5

1732D ArmorBlock I/O DETAILS

1732D ArmorBlock

DeviceNet

Address switches under caps
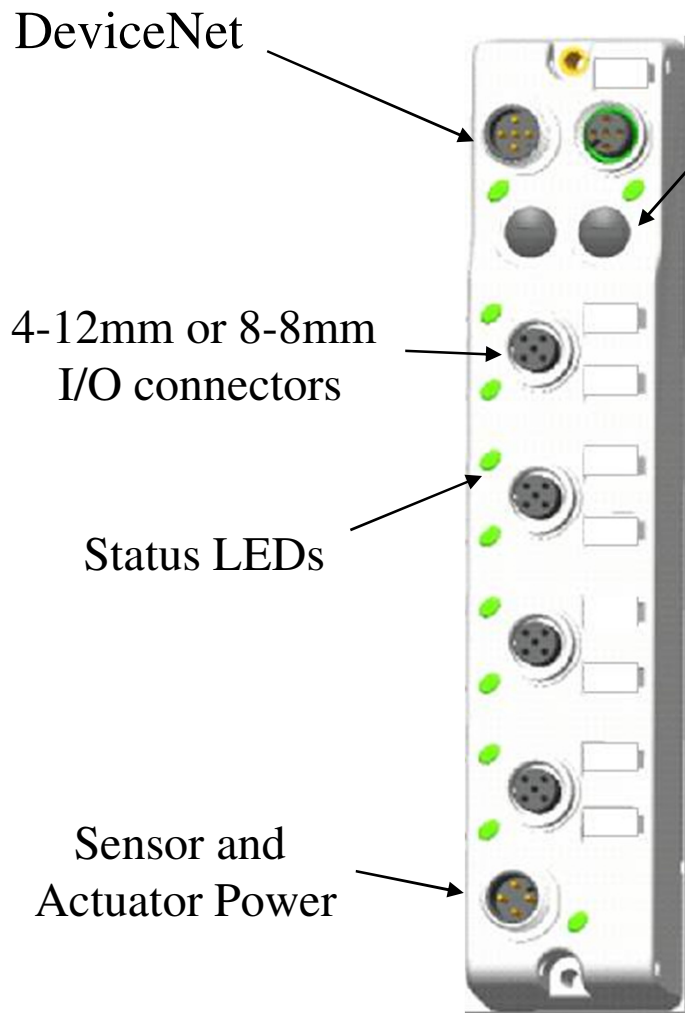
- 24V dc
- 3 versions
    1) 8 Input
    2) 8 Output
    3) **8 Self-configuring**
        - **Any mix of 8(7x1, 3x5)**
- Quick-Connect
- Output Short Circuit Protected
- Output monitoring in "I or O" style

4-12mm or 8-8mm
I/O connectors

Status LEDs

Sensor and
Actuator Power

Turn output on

Output
Circuit

Scan List

Device

Connector pin

Input is on
(or Output is on)

Input
Circuit

I/O Point in Block
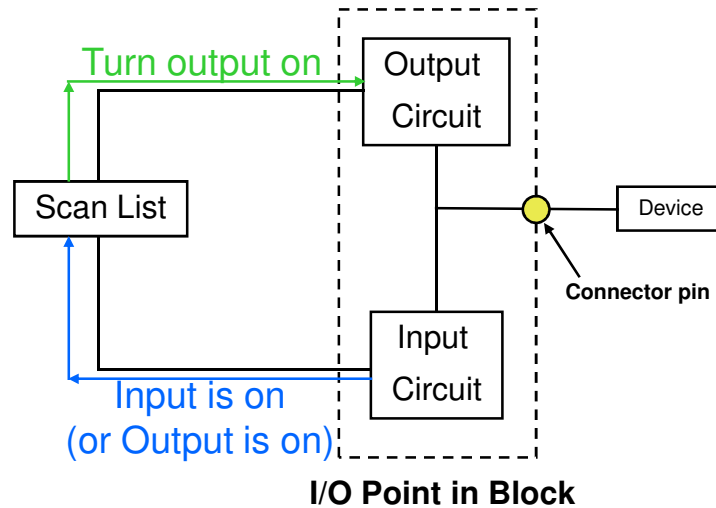
ArmorBlock Fun Facts

- **Node number is set via rotary switches. Baud rate set via Autobaud.**

- **1732D ArmorBlock comes with versions that have eight 24VDC Inputs, eight 24VDC Outputs and eight configurable 24VDC I/O points.**

- **The Input modules have data sizes of 1 byte of Rx data and 0 bytes of Tx Data.**

- **The Output modules have data sizes of 0 bytes of Rx data and 1 byte of Tx Data.**

- **The Configurable I/O modules have data sizes of 1 byte of Rx data and 1 byte of Tx Data. The input for any I/O point on the configurable modules, will also give back the status of the Output, when the output is used.**

- **Unlike most other I/O products, the power for the Input devices on the ArmorBlock, such as Photoeyes and Proximity Detectors, are NOT powered from the DeviceNet power. These input devices are powered separately from the Auxiliary Power connector. Cables are available to easily go from the female DeviceNet connector on the ArmorBlock to the Input power pins on the male pin Aux Power connector. Cables such as 889D-F2ACDM-K0M3 can be used.**

- **Normal 5 pin micro field installable connectors (exp: 871A-TS5-DM1 and 871A-TS5-D1) are too big in diameter (20mm) to be used for daisy chaining through the ArmorBlock to each connector simultaneously.**

- **Wiring details are in publication 1732-WD001A-EN-P.**

- **Installation instructions are publication 1732D-IN001B-EN-P for 8 bit modules and 1732D-IN002A-EN-P for 16 bit modules.**

Auxiliary Power Pinout

Auxiliary pinout is shown below.

4-pin micro (12mm)
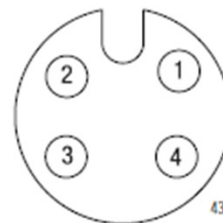
(view into connector)
Pin 1 24V dc Output
Pin 2 24V dc Input
Pin 3 Return Input
Pin 4 Return Output

43587

Classic ArmorBlock I/O DETAILS
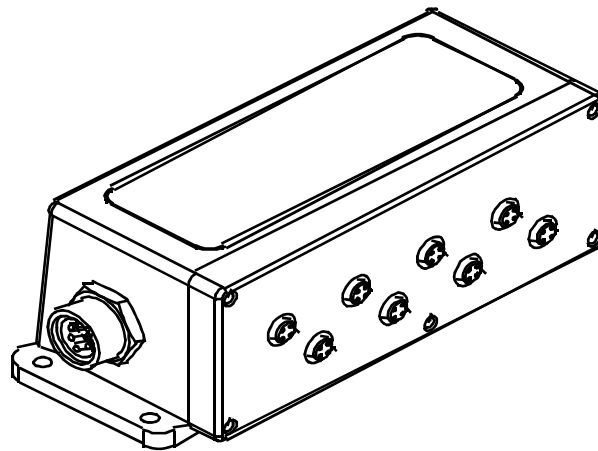
Classic ArmorBlock Fun Facts

- **Node number is set via Node Commissioning in the RSNetWorx or DeviceNet manager Software. Baud rate is handled via autobaud automatically by the ArmorBlock.**

- **ArmorBlocks have an electronic fuse on the supply voltage being put to their input connectors. There is only one fuse for the entire group of inputs. Should one or more channels have their Positive and Negative lines shorted the electronic fuse will trip and the Input Fault LED will go on solid red.**

- **Resetting the input electronic fuse will need to use an explicit messaging write. Service code = 50 decimal, Class = 29 decimal, Instance = 1 and Attribute = 0. Write 0 as a data byte.**

- **ArmorBlocks have an electronic fuse for each output on the module. Should an output channel that is energized, have its Signal and Negative lines shorted the electronic fuse will trip and the appropriate Output I/O Status LED will go on solid red. <u>Note: There could be 20 amps drawn before an electronic output fuse trips. So size output power supply accordingly using the graph in Pub. 1792-2.1</u>**

- **Resetting the Output electronic fuses will need to use an explicit messaging write. Service code = 50 decimal, Class = 9, Instance = 1, 2, 3 or 4 (Channel Output fuse you want to reset) and Attribute = 1. Write 0 as a data byte.**

- **Series B ArmorBlocks will allow Electronic Fuses to be reset from the EDS file and also allow COS and Cyclic operation. <u>The 4 Output Armor does NOT allow fuse reset from the EDS.</u>**

- **ArmorBlocks with outputs, have a 3 pin mini connector to apply a source of 24VDC power for the Outputs ONLY.**

- **ArmorBlock I/O Product Data Manual is publication 1792-2.1.**

Low Profile ArmorBlock I/O DETAILS
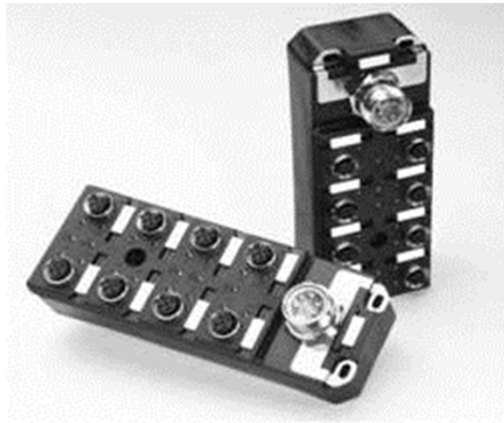
Low Profile ArmorBlock-LP

DeviceNet Features

- 125, 250, 500KBaud
- Change-of-State I/O
- Complies with ODVA conformance testing software FT 1.3/1.1

I/O Device Interface

- 12mm "micro" connectors
- 1-2 channels per connector depending on cat. #.
- 3-wire sensors require no additional voltage source

DeviceNet Port

- 18mm "mini" connector
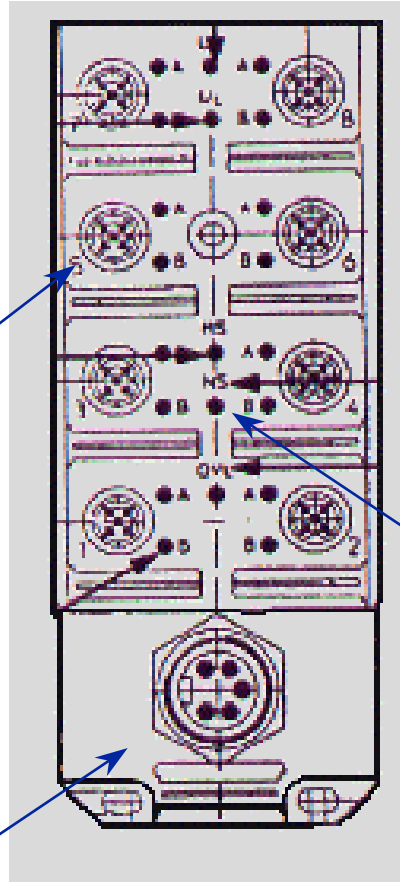
Operating Environment

- 0 to 60 Degrees Celsius
- IEC IP67

Physical Housing

- Potted Enclosure
- 50% Smaller than standard ArmorBlock

Agency Certifications

- CE Mark

Diagnostic & LED's

- Module Status LED
- Network Status LED
- Individual I/O Status LED
- Sensor short circuit LED
- Module Power Status LED

LP ArmorBlock Fun Facts

- **Node number and baud rate is set via Node Commissioning in the RSNetWorx or DeviceNet Manager Software.**

- **ArmorBlocks have an electronic fuse on the supply voltage being put to their input connectors. There is only one fuse for the entire group of inputs. Should one or more channels have their Positive and Negative lines shorted the electronic fuse will trip and the Input Fault LED will go on solid red. The fuse will reset automatically when the short circuit goes away.**

- **ArmorBlocks have an electronic fuse for each output on the module. Should an output channel that is energized, have its Signal and Negative lines shorted the electronic fuse will trip and the appropriate Output I/O Status LED will go on solid red. <u>Unlike Classic ArmorBlock I/O, there is only one status bit in the I/O data for the entire group of output fuses. Important Note: There could be 20 amps drawn before an electronic output fuse trips. So size output power supply accordingly using the graph in Pub. 1792-2.1.</u> The fuses will reset automatically when the short circuit goes away.**

- **ArmorBlocks with outputs, have a 3 pin mini connector to apply a source of 24VDC power for the Outputs ONLY.**

- **ArmorBlock I/O Product Data Manual is publication 1792-2.1.**

1792-IB4 I/O Details
4 Input Module

Produces 1 byte of Polled Receive Data

BIT	07	06	05	04	03	02	01	00
Byte 0	IS	Reserved			I3	I2	I1	I0

IS = Electronic Fuse Status (1 = Fuse Tripped)

1792-IB8 I/O Details
8 Input Module

Produces 2 bytes of Polled Receive Data

BIT	07	06	05	04	03	02	01	00
Byte 0	I7	I6	I5	I4	I3	I2	I1	I0
Byte 1	IS	Reserved						

IS = Electronic Fuse Status (1 = Fuse Tripped)

1792-IB16 I/O Details
16 Input Module

Produces 3 bytes of Polled Receive Data

BIT	07	06	05	04	03	02	01	00
Byte 0	I7	I6	I5	I4	I3	I2	I1	I0
Byte 1	I15	I14	I13	I12	I11	I10	I9	I8
Byte 2	IS	Reserved						

IS = Electronic Fuse Status (1 = Fuse Tripped)

Note: Each micro connector contains 2 inputs so an A-B "splitter Y cable" 871A-CS4-DM5X is used to Y off of each connector to two cables with conductors.

1792-OB4E I/O Details
4 Output Module

Produces 1 byte of Polled Receive Data

BIT	07	06	05	04	03	02	01	00
Byte 0	Reserved				OS3	OS2	OS1	OS0

OS = Output Electronic Fuse Status (1 = Fuse Tripped)

Consumes 1 byte of Polled Transmit Data

BIT	07	06	05	04	03	02	01	00
Byte 0	Reserved				O3	O2	O1	O0

1792-IB2XOB2E I/O Details 2 Input/2 Output Module

Produces 1 byte of Polled Receive Data

BIT	07	06	05	04	03	02	01	00
Byte 0	IS	Reserved			OS1	OS0	I1	I0

OS = Output Electronic Fuse Status (1 = Fuse Tripped)

IS = Input Electronic Fuse Status (1 = Fuse Tripped)

Consumes 1 byte of Polled Transmit Data

BIT	07	06	05	04	03	02	01	00
Byte 0	Reserved						O1	O0

1792-IB16LP I/O Details
16 Input Module

Produces 3 bytes of Polled Receive Data

BIT	07	06	05	04	03	02	01	00
Byte 0	I7	I6	I5	I4	I3	I2	I1	I0
Byte 1	I15	I14	I13	I12	I11	I10	I9	I8
Byte 2	IS	Reserved						

IS = Electronic Fuse Status (1 = Fuse Tripped)

Note: Each micro connector contains 2 inputs so an A-B "splitter Y cable" 871A-CS4-DM5X is used to Y off of each connector to two cables with conductors.

1792-OB8PLP I/O Details
8 Output Module

Produces 1 byte of Polled Receive Data

BIT	07	06	05	04	03	02	01	00
Byte 0	OF	Reserved						

OF = Output Electronic Fuse Status (1 = Fuse Tripped)

Consumes 1 byte of Polled Transmit Data

BIT	07	06	05	04	03	02	01	00
Byte 0	O7	O6	O5	O4	O3	O2	O1	O0

1792-IB8XOB8PLP I/O Details
8 Input/8 Output Module

Produces 2 bytes of Polled Receive Data

BIT	07	06	05	04	03	02	01	00
Byte 0	I7	I6	I5	I4	I3	I2	I1	I0
Byte 1	IS	OF	Reserved					

OF = Output Electronic Fuse Status (1 = Fuse Tripped)

IS = Input Electronic Fuse Status (1 = Fuse Tripped)

Consumes 1 byte of Polled Transmit Data

BIT	07	06	05	04	03	02	01	00
Byte 0	O7	O6	O5	O4	O3	O2	O1	O0

Note: Each micro connector contains 2 inputs or 2 outputs so an A-B "splitter Y cable" 871A-CS4-DM5X is used to Y off of each connector to two cables with conductors.

1792 Connector Details
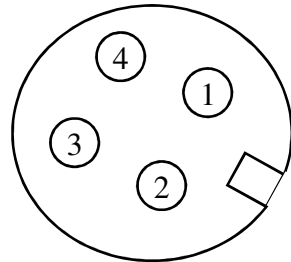
Pin 1 = Sensor Voltage Positive

Pin 2 = Signal 2 (Only used on 1792-IB16)

Pin 3 = Negative/Return

I/O Input Micro Connector

(View into Socket)

Pin 4 = Signal 1
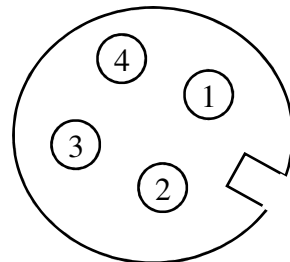
Pin 1 = Not Used

Pin 2 = Not Used

Pin 3 = Negative

I/O Output Micro Connector

(View into Socket)

Pin 4 = Output

Output Power Mini Connector
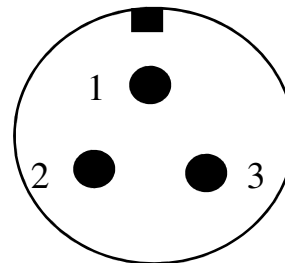
(View into Pins

Pin 1 = Not Used

Pin 2 = Positive

Pin 3 = Negative

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1792 Connector Details (Cont)
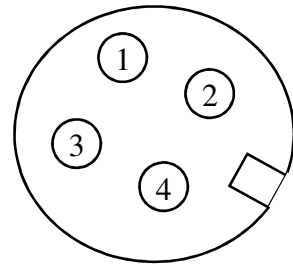
Aux Power Mini Connector
(View into Sockets)
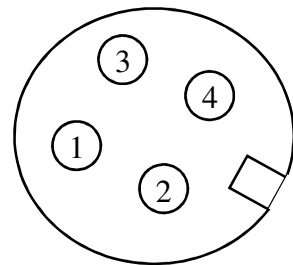
Aux Power Mini Connector
(View into Pins)

Pin 1 = +24VDC Voltage (Red wire)

Pin 2 = Alternate V+ (Green wire)

Pin 3 = Alternate V- (White wire)

Pin 4 = 24VDC Return (Black Wire)

1790D and 1791D CompactBlock I/O and LDX DETAILS

1791D CompactBlock I/O Fun Facts

- Node number is set via either Rotary Switches or Node Commissioning in the RSNetWorx or DeviceNet manager Software if switches are set for node 64 though 99. Baud rate is handled via autobaud automatically by the CompactBlock.

- Supports Polled, Change of State or Cyclic messaging.

- Outputs have electronic short circuit protection. Outputs can also be programmed to go to a 0, a 1 or hold last state on a fault.

- CompactBlock I/O can support up to 32 discrete points of I/O per node number. The stand alone base module can have 16 discrete 24VDC inputs, 16 Discrete 24VDC outputs or 8 discrete 24VDC inputs and 8 discrete outputs. The expansion module can have 16 discrete 24VDC inputs or 16 discrete 24VDC outputs and connects to the base module with a ribbon cable.

- The terminal strips for wiring are attached to the Compact I/O module. So to replace a module, the wires must be removed from the terminal strips.

- The new 1791D-N4CV2X expansion module gives 2 analog outputs and 4 analog Input capability. This module adds 10 bytes of RX size and 6 bytes of TX size to I/O data format. **Note: There have been some EDS incompatibilities with the expansion module in the past which could keep configurations from being uploaded/downloaded to the 1791D device. This specifically involves the V3.001 version of these products. The EDS files for V3.002 and V3.003 modules are not compatible with V3.001 versions. See Knowbase document 28192 for more details.**

- When removing the IO power to the 1791D-N4CV2X expansion module, the CompactBlock base module will major fault and fall off of the DeviceNet network. Power cycling the DeviceNet 24VDC to the base module will recover it back on the network.

- **With Series B CompactBlocks with a Analog Expansion module connected, if the analog ranges are set to anything other than 0-20ma the DeviceLogix logic enable will disable on a power cycle. Ladder logic exists to mask this issue and can be found in Knowbase record 466403.**

- **The I/O points on the expansion modules are NOT accessible to the DeviceLogix editor or to DeviceLogix in general**

- CompactBlock I/O Installation Manual is Publication 1791D- 5.42. Product Profile document is Publication 1791D- 1.4. Product Data document is Publication 1791D- 2.1.

CompactBlock I/O

- CompactBlock I/O for the DeviceNet communication network is a compact, low-cost block I/O for use in a variety of distributed applications

- Delivers ease of installation and expandability in a compact, flexible package

- 0-55°C temperature range, IEC IP20 rating
- Standards of compliance
  - IEC1131 -2
  - NEMA Type 1+ Inputs
  - UL 508
  - CUL Class I Division 2, Groups A-D
  - CE marked
  - ODVA conformance

CompactBlock I/O Details

Modules	I/O Points	Produce (Rx Size)	Consume (Tx Size)
Base Input	16 Inputs	2 bytes	0 bytes
Base Output	16 Outputs	0 bytes	2 bytes
Base Combination	8 Input/ 8 Output	1 byte	1 byte
Base input with expansion input	32 Input	5 bytes	0 bytes
Base output with expansion output	32 Output	1 byte	4 bytes
Base input with expansion output	16 Inputs/ 16 Outputs	3 bytes	2 bytes
Base output with expansion input	16 Outputs/ 16 Inputs	3 bytes	2 bytes
Combination module with expansion input	24 Inputs/ 8 Outputs	4 bytes	1 bytes
Combination module with expansion output	24 outputs/ 8 Inputs	2 bytes	3 bytes

Notice that for every 8 inputs a byte of data is added to the Rx size and for every 8 outputs a byte is added to the Tx size.

The only magic is that when an expansion module is used, it adds 1 extra byte to the Rx size and puts this byte as the last byte of the Input data. This extra byte has only bit 7 being used as a status for the expansion module. Bit 7 = 1 means expansion module bad or missing, bit 7 = 0 means the expansion module is functioning correctly.

1790D CompactBlock LDX Fun Facts

- Node number is set via either Rotary Switches or Node Commissioning in the RSNetWorx or DeviceNet manager Software if switches are set for node 64 though 99. Baud rate is handled via autobaud automatically by the CompactBlock.

- Supports Polled, Change of State or Cyclic messaging.

- All 1790D modules with Terminal blocks will have a 1790-T at the beginning of their catalog numbers. These modules use the same EDS files as the normal module with the D shell connectors, which are all found on the EDS web page. For example the 1790D-TOB16 uses same EDS file as 1790D-OB16 and the 1790D-TOV16 uses same EDS file as 1790D-OV16.

- Use V1.3 of the EDS file for the 1790D-T4R0 or 1790D-4R0 module with V9 of RSNetWorx for DeviceNet software to allow the Notch Filter to be changed in the device.

- The table below shows the IO Class Objects to read the Inputs and turn on the outputs with the LDX when no scanner is communicating to the LDX. These operations can be done via the CIA editor in RSNetWorx or via a 193-DNCT.

class 4 attribute 3 for data note that instance numbers are in decimal

Table 6.4.1. Instance Type for Input Assemblies

Discrete Input size	1byte	2bytes	3bytes	4bytes	5bytes	6bytes	7bytes	8bytes
Input Instance Type #	4	5	100	6	101	102	103	104

Table 6.4.2. Instance Type for Output Assemblies

Discrete Output size	1byte	2bytes	3bytes	4bytes	5bytes	6bytes	7bytes	8bytes
Output Instance Type #	34	35	120	36	121	122	123	124

1790D CompactBlock LDX Fun Catalog Numbers

1790D-16BV0	16 Universal In Base
1790D-8BV8V	8 Universal In / 8 Sinking Out Base
1790D-8BV8B	8 Universal In / 8 Sourcing Out Base
1790-0W8X	8 Relay Out Expansion
1790-16BV0X	16 Universal In Expansion
1790-0V16X	16 Sinking Out Expansion
1790-0B16X	16 Sourcing Out Expansion
1790-8BV8BX	8 Universal In / 8 Sinking Out Expansion
1790-8BV8VX	8 Universal In / 8 Sourcing Out Expansion
1790D-0B16	16 Sourcing Out Base
1790D-0V16	16 Sinking Out Base
1790D-0W6	6 Relay Out Base
1790D-T8A0	8 In 110 Vac Base, terminal block only
1790D-T0A6	6 Out Base, terminal block only
1790-T8A0X	8 In 110 Vac Expansion, terminal only
1790-T0A8X	6 Out Expansion, terminal block only

Bulletin 100 DSA Auxiliary Starter DETAILS

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DSA Features & Benefits

Feature	Benefit
Available with up to 4 inputs and 2 outputs.	Flexible for use in a wide variety of applications
24 VDC or 120VAC inputs , and relay or solid-state outputs	Compatible with global requirements and capable of switching contactor coils of up to 240VAC.
Programmable on/off delay time.	Clear recognition of input status (contact bouncing)
Compatible with 2 wire proximity switches and 3 wire photoswitches	Inputs can be a variety of sources, not just hard contacts
Inputs are powered from the network power source	No additional power supply required
Autobaud	Simplifies commissioning and installation
Supports I/O polling and change of state messaging	Reduces network traffic

Bulletin 100 DSA Fun Facts

- On Series A modules, Node number and is set via Node Commissioning in the RSNetWorx Software. <u>On Series B, Node number is set via rotary switches.</u> Baud rate is handled via autobaud automatically by Bulletin100 DSA.

- DeviceNet network connection is via a standard open style Phoenix connector on the top of the module. (Connector included with module.)

- Small compact size allows mounting directly inside an MCC bucket. Inputs can be brought in from disconnect switch, motor starter relay auxiliary contacts, overload contacts or any other input. Outputs normally used to pull in coil of motor starter relay.

- The Bulletin 100 has electronic fuses on each of its outputs that are resettable through the EDS and also explicit messaging. The 24 VDC modules have an electronic fuse on the input source voltage that is resettable through the EDS and also explicit messaging. Service = 32 hex, Input class = 1D hex, Output class = 9, Input instance = 1, Output instance = Output Number, Output/Input Attribute = 0.

- V4.005 of the firmware has an issue where the DSA will not allow a COS connection. Replace DSA with a version V4.007.

- V4.008 of the firmware has an issue where the DSA may drop a COS connection. Work arounds are use polled connection, make COS Production Inhibit Time = 0ms in scanner scan list configuration or replace DSA with a version V5.001.

- V5.001is the recommended, firmware revision for this product and also gets you DeviceLogix capability.

- Bulletin 100 DSA User Manual is publication 0100-5.1.

Bulletin 100 DSA Wiring Details 22.5 mm.

Dnet V+ Red   Dnet V- Black

V+
24 V DC
IN 0
IN 1
IN 2
IN 3
COM

24 V DC Inputs

L2
110 V AC
L1

Vcom
IN 0
IN 1
IN 2
IN 3

110 V AC Inputs

1
2   Out A
3
4   Out B

Relay Outputs

+
24 V P.S.
C
C
−

1
2   Out A
3   Out B
4
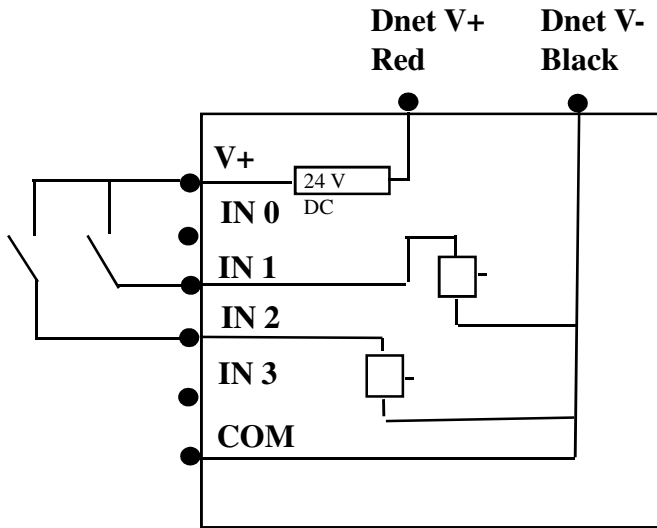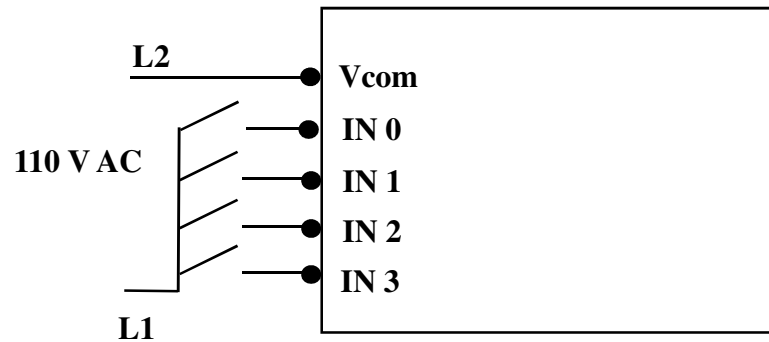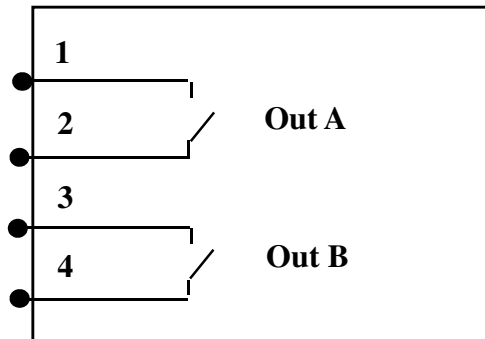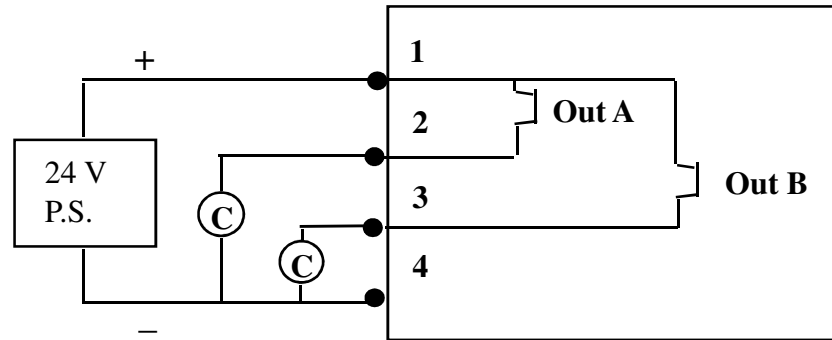
DC Solid State Outputs

100-DNX4YY I/O Details
4 Input/2 Output Module

Produces 1 byte of Polled Receive Data

BIT	07	06	05	04	03	02	01	00
Byte 0	IS	RES	OS B	OS A	IN 3	IN 2	IN 1	IN 0

OS = Status of Output Electronic Fuse

IS = Status of Input Electronic Fuse (24 VDC Modules Only)

Consumes 1 byte of Polled Transmit Data

BIT	07	06	05	04	03	02	01	00
Byte 0	Reserved						Out B	Out A

100-DNX2YY I/O Details
2 Input/1 Output Module

Produces 1 byte of Polled Receive Data

BIT	07	06	05	04	03	02	01	00
Byte 0	IS	Reserved				OS A	IN 1	IN 0

OS = Status of Output Electronic Fuse

IS = Status of Input Electronic Fuse (24 VDC Modules Only)

Consumes 1 byte of Polled Transmit Data

BIT	07	06	05	04	03	02	01	00
Byte 0	Reserved							Out A

Discrete and Analog 1799 Embedded I/O Boards
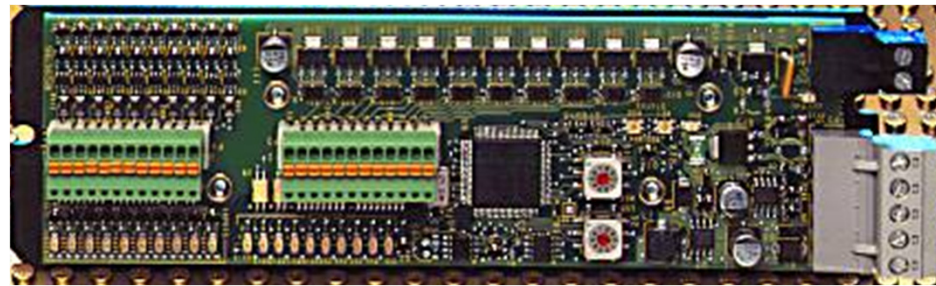
Embedded I/O Fun Facts

- **Node number is set via either Rotary Switches or Node Commissioning in the RSNetWorx or DeviceNet manager Software if switches are set for node 64 though 99. Baud rate is handled via autobaud within the device.**

- **Supports Polled, Change of State or Cyclic messaging.**

- **Board is completely exposed and comes with NO enclosure.**

- **I/O data sizes are 2 bytes Tx size and 2 bytes Rx size for the 10 In/10 out version.**

- **I/O data sizes are 2 bytes Tx size and 3 bytes Rx size for the 16 In/16 out board with no analog IO.**

- **I/O data sizes are 6 bytes Tx size and 11 bytes Rx size for the 16 In/16 out board with analog IO.**

- **<u>Embedded I/O cards DO NOT ship with ANY connectors!!</u> For the 1799-D10U10, you will need 2 of the 12 pin I/O connectors which are 1799-12SPCON. These have solderless, quick release, pins. You will need 1 of the 5 pin DeviceNet connector which is 1799-DNETCON (without jack screws) or 1799-DNETSCON (with jack screws) and 1 of the 2 pin auxiliary power connector which is 1799-AUXCON.**

- **For the 1799-D16U16, you will need 1 of the 50 pin I/O connectors 1799-DSSCON (solder cup) or 1799-DSCCON (crimp pins). You will also need 1 of the 5 pin DeviceNet connector which is 1799-DNETCON.**

- **1799-ZCIOB and 1799-ZCIOV boards support the Zone Interlocking Parameter (ZIP) feature. See ZIP section for additional details. All 7 bytes of ZIP data are read via Class 4, Instance 153 (99 Hex) and Attribute 3.**

- **1799-D16V16BAGL and 1799-D16V16VAGL boards now support 2 analog input and 2 analog output channels, along with 16 discrete inputs and 16 discrete outputs. The analog IO can also be controlled via DeviceLogix on the board.**

- **All Series B 1799 boards have a bug where a board can go into the weeds and cause other devices on the network to go Bus Off. Firmware should be version V4.02 or greater for reliable operation. Boards are flash upgradeable using ControlFlash.**

- **Embedded I/O Installation Manual is Publication 1799-IN003A-EN-P.**

Embedded I/O Fun Facts Cont.

Communicating to a Master Scanner and using ZIP simultaneously.

- Version V3.001 of the 1799 ZCIO Embedded I/O Boards firmware can only accept a Change of State (COS) connection with a master scanner. An important note is that when using a COS connection to a master is, that if that I/O connection is broken, such as if the scanner is removed from the DeviceNet network, the ZIP data is no longer generated. This is inconvenient, because the ZIP data is the normal data transfer method between the 1799 boards and any control based off of this data will cease when the ZIP data production ceases. The power will then need to be cycled to a 1799 board or the I/O connection with a scanner re-established before the ZIP data will resume. Also, when using a COS connection with a master scanner, the ZIP Heartbeat (EPR) of the 1799 board gets overridden with the COS heartbeat value by the scanner. Since the default COS heartbeat is 250ms and the ZIP Consumed Zone Timeout (EPR) defaults to 300 ms, an otherwise working ZIP connection could begin timing out when a COS connection is established with the ZIP producer for that connection.

- Version V3.003 of the 1799 ZCIO Embedded I/O Boards firmware can ONLY accept a Polled I/O connection with a master scanner. This V3.003 also eliminates all of the disadvantages of V3.001 and using COS along with ZIP on a 1799 Board. Also, the huge advantage of V3.003 is that if the Polled I/O connection to a master scanner is broken, for any reason, the ZIP data production still occurs. Note: Be aware that some network tuning may need to be done when combining a Polled and COS network, depending on the number of ZIP packets being produced due to 1799 board data changes. It may be necessary to increase the Interscan Delay (ISD) in the master scanner to give more network idle time for the ZIP data. Or the individual Production Inhibit Timer (PIT) of some 1799 ZIP boards may need to be increased so any excessive ZIP data production on the network does not starve the Polled data.

- Version V3.006 allows both COS and Polled connections back to the master scanner.

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Embedded I/O Boards

I/O Module	Description
1799-D10U10B	24V DC, 10 Universal Input/10 Sourcing Output Module
1799-D10U10BL	24V DC, 10 Universal Input/10Sourcing Output Module with DeviceLogix
1799-D10U10V	24V DC, 10 Universal Input/10 Sinking Output Module
1799-D10U10VL	24V DC, 10 Universal Input/10Sinking Output Module with DeviceLogix
1799-D16U16B	24V DC, 16 Universal Input/16 Sourcing Output Module
1799-D16U16BL	24V DC, 16 Universal Input/16 Sourcing Output Module with DeviceLogix
1799-D16U16V	24V DC, 16 Universal Input/16 Sinking Output Module
1799-D16U16VL	24V DC, 16 Universal Input/16 Sinking Output Module with DeviceLogix
1799-D12G12GL	24V DC, 12 TTL Input/12 TTL Output Module with DeviceLogix
1799-CDD16B20BK	24V DC, 16 Universal Inputs/20 Sourcing Outputs (4 outputs @ 2 amps)
1799-D16V16BAGL	24V DC, 16 Universal Inputs/16 Sourcing Outputs/2 Analog Inputs/2 Analog Output Module with DeviceLogix
1799-D16V16VAGL	24V DC, 16 Universal Inputs/16 Sinking Outputs/2 Analog Inputs/2 Analog Output Module with DeviceLogix

Zone Control Cards	Description
Zone Control I/O cards include Zone Interlocking Parameters (ZIP) and DeviceLogix Smart Component Technology and ship with a DeviceNet connector, auxiliary power connector, and mounting plate. Input signal delay is user-selectable for 0, 2, 4, 8 or 16 ms, off-to-on or on-to-off. The delay time is set through RSNetWorx for DeviceNet, DeviceNet Manager software or a similar configuration tool.	
1799-ZCIOB	1799 Embedded I/O for DeviceNet — 10 Input/10 Sourcing Output ZCIO Card
1799-ZCIOV	1799 Embedded I/O for DeviceNet — 10 Input/10 Sinking Output ZCIO Card
1799-D10U10BZC	1799 Embedded I/O for DeviceNet — 10 Input/10 Sourcing Output ZCIO Card with Relative Node Addressing
1799-D10U10VZC	1799 Embedded I/O for DeviceNet — 10 Input/10 Sinking Output ZCIO Card with Relative Node Addressing

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1799 I/O Details

1799-D10U10

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Produced 0	Input 7	Input 6	Input 5	Input 4	Input 3	Input 2	Input 1	Input 0
Produced 1	Reserved						Input 9	Input 8
Consumed 0	Output 7	Output 6	Output 5	Output 4	Output 3	Output 2	Output 1	Output 0
Consumed 1	Reserved						Output 9	Output 8

1799-D16U16

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Produced 0	Input 7	Input 6	Input 5	Input 4	Input 3	Input 2	Input 1	Input 0
Produced 1	Input 15	Input 14	Input 13	Input 12	Input 11	Input 10	Input 9	Input 8
Produced 2	Reserved						OFLT 1	OFLT 0
Consumed 0	Output 7	Output 6	Output 5	Output 4	Output 3	Output 2	Output 1	Output 0
Consumed 1	Output 15	Output 14	Output 13	Output 12	Output 11	Output 10	Output 9	Output 8

Where: OFLT 0 = Output Fault on one or more outputs in GRP 0
OFLT 1 = Output Fault on one or more outputs in GRP 1

1769-ADN Remote IO Adapter for CompactLogix IO
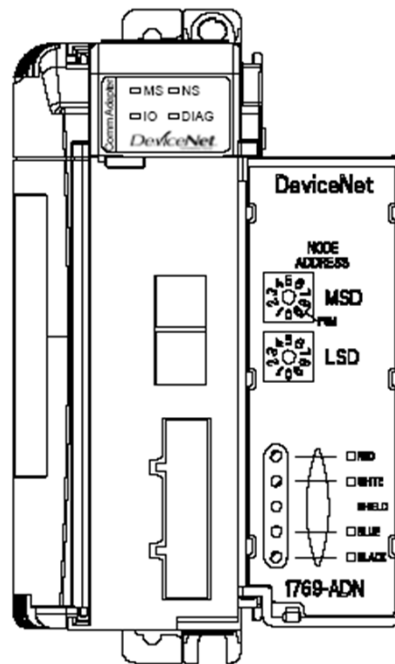
1769-ADN Fun Facts

- **The 1769-ADN is a remote IO adapter that can interface to up to thirty 1769 based IO modules in a chassis back over DeviceNet to a controller. The configuration of the 1769-ADN is done using RSNetWorx for DeviceNet software and when the configuration is finished, the 1769-ADN will produce Input and consume Output blobs of IO data, the same as any DeviceNet slave device on the network. This means that the 1769-ADN can interface directly to ANY DeviceNet master scanner over the DeviceNet network. The 1769-SDN has no advantage interfacing to the 1769-ADN and only acts like any other master scanner to transfer data with it.**

- **The first two words (4 bytes) of the input data are reserved for Adapter Status Bits, with the first 30 bits used as an error bit for each IO slot. The bit will be a 1 for a slot if the module is invalid, failed of incorrectly configured.**

- **The 1769-ADN must be situated all the way to the left in the chassis which will be slot 0 of Bank 1.**

- **The I/O Summary tab will display the transmit (Output) size and receive (Input) size of the 1769-ADN once the chassis is completely configured.**

- **Node number is set via either Rotary Switches on the front of the module.**

- **Baud Rate defaults to autobaud.**

- **An issue exists with RSNetWorx for Dnet software declaring an illegal member or other error with the V2.1 1769-IT6 module. A V2.2 EDS file for the 1769-IT6 was created which cures this issue. Knowbase document 458914 describes the remediation and contains the EDS file and installation instructions.**

- **Installation manual is 1769-in001B-EN-P and the User manual is 1769-um001B-EN-P.**

1769-ADN Configuration

RSNetWorx Module Configuration Applet
for 1769-ADN with example chassis.
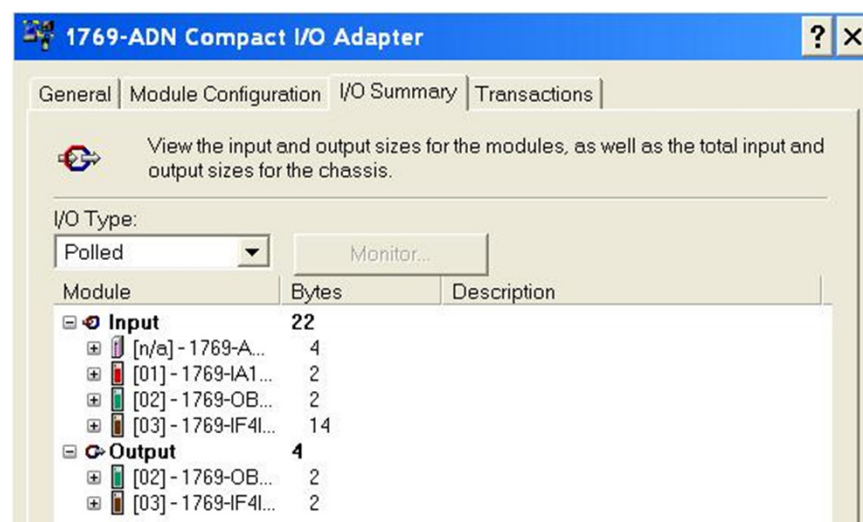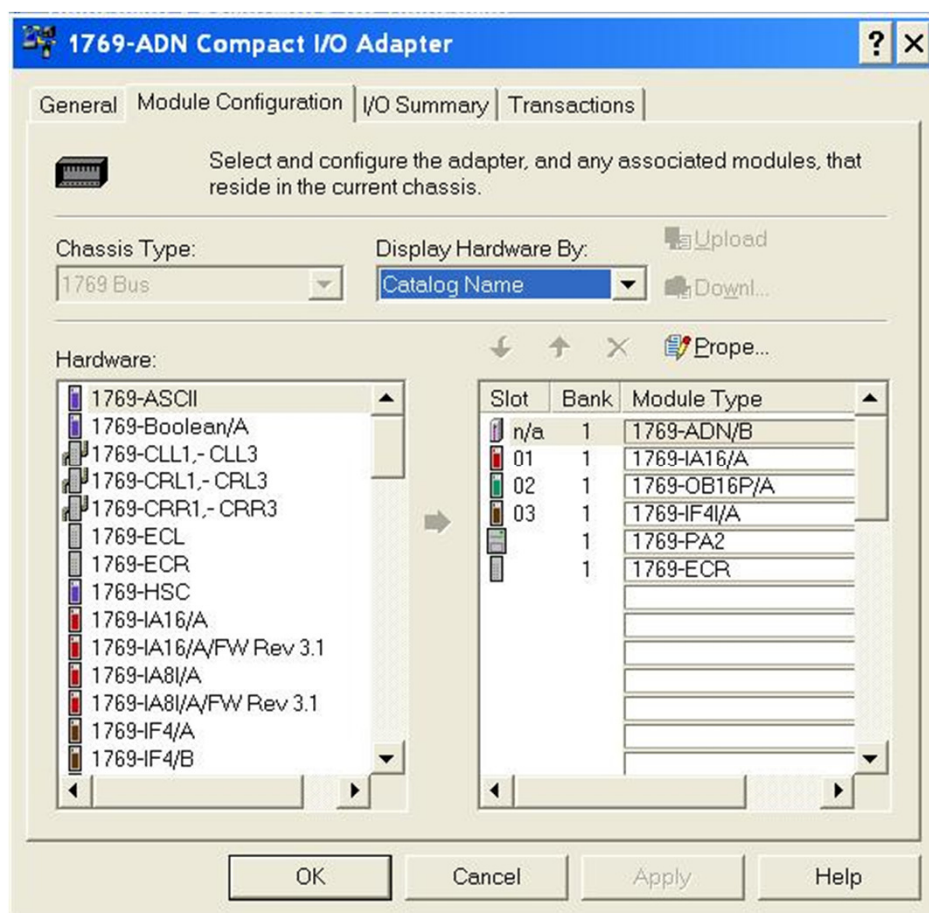
I/O Summary screen from RSNetWorx
showing Input and Output data sizes
being transferred with master scanner
over DeviceNet for example chassis.

Point I/O 1734 and PointBlock I/O 1734D Details
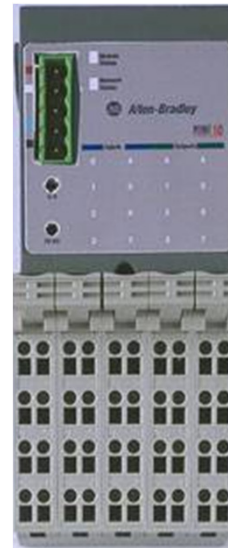
POINT I/O Module Diagnostics

Node-level Diagnostics

Network status LED indicates the health of the backplane.

Module status LED indicates the health of the module.

Channel status LED indicates I/O status:

Solid Yellow	= ON
Solid Red	= Faulted
Flashing Red	= Recoverable fault/alarm
Dark	= OFF

Module Status

Network Status

NODE:

24VDC SOURCE OUTPUT
Channel Status

0

1

2

3

1734 OB4E
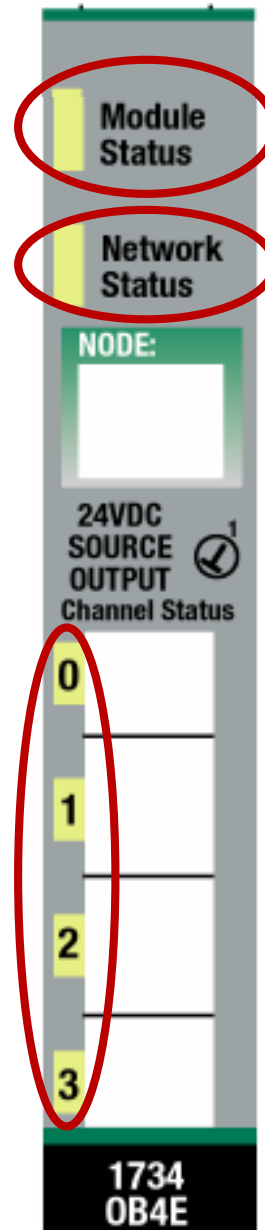
Point-level Diagnostics

Point status LED indicates

Digital Outputs:
    Short circuit for ON state
    Open wire for OFF state
Analog Input/Output:
    Short circuit
    Low, Low-Low
    Open-wire
    High, High-High

Note: All status and diagnostic information is reported back over the communication network whether polled, cyclic or change-of-state

A single point of failure is detected and reported!

1734D Series - POINTBLOCK I/O

- **The entire PointBlock I/O product line has gone to Silver Series and is no longer available for sale.**

- **Appears as one DeviceNet node**
  - rotary switches set starting address

- **PDN functionality**
  - each additional POINT I/O module appears as an additional node

- **Removable terminations**

- **DC pulls power from DeviceNet or auxiliary power supply**

- **AC routes power across the terminals**

- **Expand system with POINT I/O modules**

4 configurations are currently available with either IEC screw or spring terminations:

•24V dc 8 Sink In x 8 Diagnostic Source Out @ 0.5A

•120V ac 8 In x 8 Triac Out @ 0.5A

•24V dc 8 Sink In x 8 N.O. Relay Out @ 2 Amp Resistive

•120V ac 8 In x 8 N.O. Relay Out @ 2 Amp Resistive
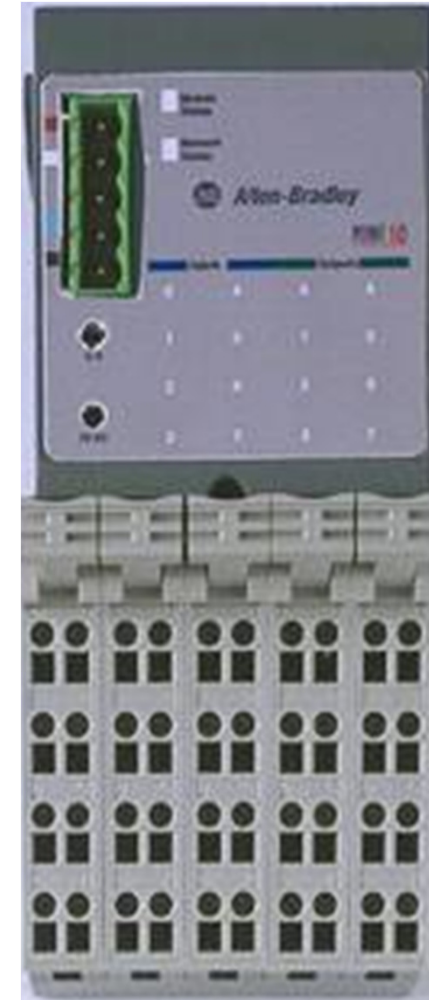
1734-ADNX Details

- The 1734-ADNX can reduce system node count by "hiding" other DeviceNet components on a POINT I/O subnet.
    - **Up to 63 total nodes per ADNX (Note: Each POINT I/O module, directly coupled with the ADNX, also counts as one node)**
    - **Each ADNX has a limited amount of Input and Output datatable. All nodes on the subnet must share this data space. It is possible to run out of datatable space in the ADNX before you run out of node numbers. Remember that ultimately the ADNX datatable used, must be mapped back to a scanner module, so be sure you do not exceed the scanners data capacity also. See the last bullet of the next page for more data sizing details.**
    - **Another 1734-ADNX can NOT be attached to the subnet Phoenix connector of an ADNX as only one "hop" is allowed through the module. Besides the data table size in the ADNX is limited.**

- The 1734-ADNX can be used to extend the overall length of a DeviceNet network. **Note: The external subnet Phoenix connector must have it's own 24VDC power supply and termination resistors. All normal DeviceNet installation rules apply to the cabling of the subnet.**

- **It is very important that the Max Backplane MACID value in the EDS configuration of the ADNX Adapter configuration be set correctly. This value must be set to the maximum node number of the PointIO modules residing on the backplane of the ADNX. Any node numbers greater than this will be scanned for on the subnet Phoenix connector. If no PointIO modules exist on the backplane then set this value to 0.**

Main DeviceNet Trunk to Controller

1734-ADNX DeviceNet Sub-Net (up to 500 Meters Maximum)
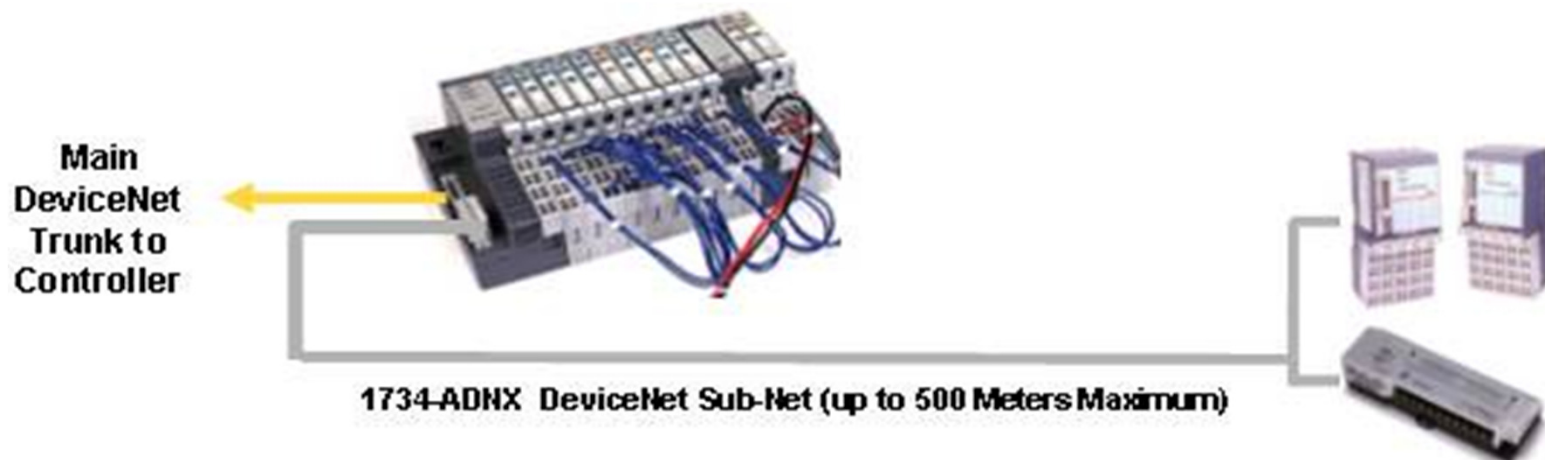
Point I/O and PointBlock I/O Fun Facts

- Each Point I/O module is a DeviceNet capable device with a unique node number. To connect these devices to a DeviceNet network will require a 1734-PDN or 1734-ADN adapter. A 1734-PDN is purely a connection mechanism and each Point I/O module connected to the PDN will count against your total node count of the entire network. A 1734-ADN will treat all of the Point I/O modules, connected to it, as a subnet and then will look like a single node number to the DeviceNet network.

- A 1734-PDN and it's subnet is powered from the DeviceNet Phoenix connector and the maximum current drawn will be 400ma on the 24VDC from the DeviceNet cable. <u>This allows a total of 1.3 amps of 5VDC to be provided on the subnet to the various PointI/O modules on it. There is presently no way to increase this current capability beyond the 1.3 amps</u>. FYI. Most discrete and analog I/O modules draw 75 ma which means only 17 of these modules can be operated off of the 1.3 amp subnet power.

- A 1734-ADN draws only 30ma off of it's DeviceNet Phoenix connector to power it's transceivers and the rest of it's electronics power and subnet power is supplied by the the 1734-ADN terminal strip. The maximum 24VDC power to be drawn on the terminals is 400ma which equates to a total of 1.0 amps of 5VDC on the subnet. If more subnet power is required, due to increased number of I/O modules, then a 1734-EP24DC DC Expansion Power Supply module will be needed. The power feeding the EP24DC module should be isolated from the DeviceNet power to keep the DeviceNet power load to an absolute minimum, to limit common mode effect. If a conversion is needed with the field power to isolate AC and DC voltages, a 1734-FPD Field Potential Distributor is used to isolate the AC and DC field power power. FYI. Most discrete and analog I/O modules draw 75 ma which means only 13 of these modules can be operated off of the 1.0 amp subnet power without using a 1734-EP24DC.

- A 1734-ADN is combination of a bridge and a DeviceNet scanner module. On the PointI/O subnet the 1734-ADN acts as a scanner with a scan list and I/O mapping of the PointI/O modules connected on the subnet. On the main DeviceNet network, the 1734-ADN looks like a slave to the master scanner and the I/O data gets passed as blocks of data to/from the scanner. To enter the scan list, the RSNetWorx for DeviceNet software must bridge through the 1734-ADN and do a browse of the network. When the ADN icon appears, double click on it and the scan list can be entered.

- The 1734-ADN and 1734-ADNX has 3 input buffers and 1 output buffer to map data into. The first 2 bytes of each of these buffers are reserved as status information from the 1734-AND(X). The three input buffers are the Instance 2 (Polled) buffer size of 248 bytes + 2 bytes of status, the COS/CYC buffer size of 248 bytes + 2 bytes of status and the Strobe buffer size of 6 bytes + 2 bytes of status. The single output buffer is called the Instance 2 buffer and it's first two bytes are reserved for a command register. The Instance 2 output buffer has a size of 248 bytes + 2 bytes of command register. Depending on which message style is going to be used on the main network connection, the data on the subnet must be mapped into the appropriate input buffer, Instance 2 (Polled), COS/CYC or Strobed. The output data will always be mapped from the Instance 2 output buffer.

Point I/O and PointBlock I/OFun Facts

- **Important!! Do NOT put more the three of the 1734-IT2I or 1734-IR2 modules on the Point/IO bus drawing power from the same power source. This includes either communications adapters, 1734-PDNs, the PointBlock modules, EPAC or EP24DC modules. The inrush current will current limit the DC to DC converter of the power source.**

- All of these ADN buffer sizes, on the main network side, can be viewed by browsing the network with RSNetWorx for DeviceNet. DO NOT bridge through the 1734-ADN and double click on the 1734-ADN icon and it's EDS file will display the configured sizes of all four buffers. The sizes of these buffers will determine the Transmit and Receive sizes of the scan list of the master scanner communicating with the 1734-ADN, depending on the message type desired (Polled, COS/CYC or Strobed).

- All PointI/O nodes connected to the 1734-ADN subnet, need to have node numbers that sequentially increase from the lowest node number, in the module closest to the ADN, to the highest node number, in the module farthest from the ADN.

- A PointBlockI/O combines 8 discrete Inputs and 8 discrete Outputs together into one package. These inputs and outputs all act as a single node number on the DeviceNet network. Each PointBlock I/O also acts as a 1734-PDN module for additional PointI/O modules that can be attached to the PointBlock I/O. However, unlike a 1734-PDN, the subnet current is capability is 1.0 amps instead of 1.3 amps. Remember, each additional Point I/O modules node number counts against the network total of 64.

- Point I/O modules have a nice feature called "Sequential Auto Address (SAA)". This feature is enabled on a Point I/O module and the node number of that module is used as a base node number. All modules to the right of this base module will have their node number automatically set sequentially, starting from the base node address. When using a 1734-PDN node commission the first PointIO module in the rack and then use that modules SAA feature to do the rest of the PointIO rack. The rest of the DeviceNet Point I/O adapters allow the feature to be run from their configuration.

- 1734-ADN and explicit messaging to modules on Point Bus. Example for an L1 in slot 1, DNB in slot 4, 1734-ADN = node 20 on main network, end node number on subnet = 6: path = 1, 4, 2, 20, 3, 6. The magic is the number 3 which means go through the 1734-ADN to the subnet.

- Only V3.006 or higher of the 1756-DNB can bridge through to the 1734-ADN. Passing through from SDN modules is not supported yet.

- The lower 5 bits of the first two bytes of Input data returned back to the scanner contain status bits of the scanner side of the ADN on the subnet. Bit 1 is the device failure bit for the subnet.

- Supports "Quick Connect" feature with our scanner modules.

- Supports Faulted Address recovery.

- EDS file can be uploaded from the devices through the PDN module

Point I/O and PointBlock I/O Fun Facts

- If a PointI/O 1734-ADN(X) adapter has a scanlist loaded in it for the subnet and a module is replaced or switched in the rack, the following rules will apply. If a single module is replaced in the rack with an identical module, the new module will automatically have its node number set to the value of the original module. If two identical modules are swapped in the rack, they will then have their node addresses swapped also, automatically. So the IO connections will stay the same to the rack. Note: In order for the node addresses to be changed automatically in the previous two situations, the electronic keys of the modules must be identical.

- The PointI/O 1734-ADNX adapter has a value called Max Backplane MACID that MUST be set to the highest node number of the 1734 module on the PointI/O backplane. This is so the adapter knows which nodes are 1734 modules on the PointI/O backplane and which nodes to look for on the DeviceNet subnet connector.

- V3.014 of PointIO and ArmorPoint IO modules have an anomoly where the configuration checksum may become corrupted and cause the MODule LED to go on solid red. This especially can happen after a power cycle, with ADR being used in the ADN communication adapter. The module can be considered bricked and will need to be replaced. It is recommended to firmware upgrade all V3.014 modules to V3.017 firmware to avoid this issue.

- UCMM Capable only with 1734-ADN and 1734-ADNX interface, Group 2 otherwise.

- POINT Guard I/O modules can be used with a 1734-PDN on DeviceNet, using a Generic DeviceNet Safety Module profile.

- 1734-IE2C and 1734-IE2V connected to a 1734-PDN or PointBlock will cause an error 89 when using ADR with a DeviceNet scanner. Also, doing a download all from the RSNetWorx software will also error. New EDS files have been developed and will be incorporated into V10 of RSNetWorx for DeviceNet software. See Knowbase record 64996 for more details.

- 1734/1738-IE4C and 1734/1738-IE8C modules have an issue where the return back bogus data when being Polled on the subnet. Will only happen with 1734-PDN, PointBlockIO and the 1734/1738ADN(X). COS messaging works fine. V3.002 firmware in date code 15-Jun-2011 or later modules fixes the problem.

- 1734-ADN V3.3 or before, when being refreshed from the main network via ADR, will cause the scanner to display an error 89 on its front display. When the ADR tries to write to parameter 3 in the list of the ADN, the ADN reports back an error. The ADR feature really has no use to the ADN from the main side and should be disabled anyways to get around this PLOI.

Node Number Details on Subnet

- Every I/O module on the Point I/O subnet must have a unique node address from 0 to 63.

- The 1734-PDN does not need a node number, so I/O modules connected to it can contain any unused node address from 0 through node 63. Note. Generally leave node 0 open for the network master.

- The 1734D PointBlock does use a node number to control its 16 points of IO. Any nodes connected to it can start at node 0 and go through node 63. Note. Generally leave node 0 open for the network master.

- The 1734-ADN and 1734-ADNX adapters are master scanners on the Point I/O subnet and will always have node 0 on the subnet. The I/O modules on the subnet can then have nodes 1 through 63 and they do NOT need to be unused node numbers of the main network.

- On the 1734-ADNX adapter, it is very important that the Max Backplane MACID value in the EDS configuration be set correctly. This value must be set to the maximum node number of the PointIO modules residing on the backplane of the ADNX. Any node numbers greater than this will be scanned for on the subnet Phoenix connector. If no Point I/O modules exist on the backplane then set this value to 0.

- An easy way to set all of the node numbers on the subnet is to use Sequential Auto Address feature, which sets all of the node addresses in one operation. See the next slide for details.

Sequential Auto Address on Subnet

- Point I/O modules have a nice feature called "Sequential Auto Address (SAA)". This feature is enabled on a Point I/O module and the node number of that module is used as a base node number. All modules to the right of this base module will have their node number automatically set sequentially, starting from the base node address.

- When using a 1734-PDN to do SAA, node commission the first PointIO module in the rack and then use that modules SAA feature to do the rest of the PointIO rack. FYI. Remember that PointIO modules right out of the box all have node address 63. Power up the module immediately to the right of the PDN first and then add the rest of the modules to the rack. The first module will be seen on the main network and will have a blinking Network Status LED. The rest of the modules will fail the duplicate node test and will have a solid red Network LED. Node commission the first module to the desired node number, then trigger the SAA feature from that modules configuration to sequentially address the rest of the rack.

- The 1734D PointBlockIO modules all contain a configuration parameter that will use SAA to address the entire PointIO chassis starting at the 1734D's node address.

- Important!! When using a 1734-PDN or 1734D adapters, it is important that the node addresses that will be allocated using the SAA feature are open on the main network. If this node addresses range is not free, then one or more of the modules in the Point I/O rack may come up with a solid red Network LED, having failed the Duplicate Node Check.

- The 1734-ADN and 1734-ADNX both allow the subnet to be sequentially addressed from any node number starting from 1 through 63 from inside their configuration parameters.

Auto Start Mode on Subnet

- The 1734-ADN and 1734-ADNX has a great feature called Auto Start Mode, which allows an autoscan function on the subnet to be triggered from the main network. This feature simplifies the configuration of the subnet, by not requiring a user to run RSNetWorx software to the subnet to configure it. With Auto Start Mode (ASM) the ADN(X) automatically determines what devices are connected to the subnet and reads data from them so a scanlist can be automatically created for the subnet. When enabling ASM from the main network, the user needs to select whether the data from the subnet devices should be mapped on a Byte, Word or Dword boundary. Note: When using any mapping other than a Byte boundary, significant data space could be wasted in the ADN(X) data table to put it on the selected boundary. Ultimately this data wastage will effect the main network, due to wasted space in the data table of the master scanner.

- The diagram below shows how the mapping would be generated if there were 4 modules on the subnet and they were mapped on a byte boundary.
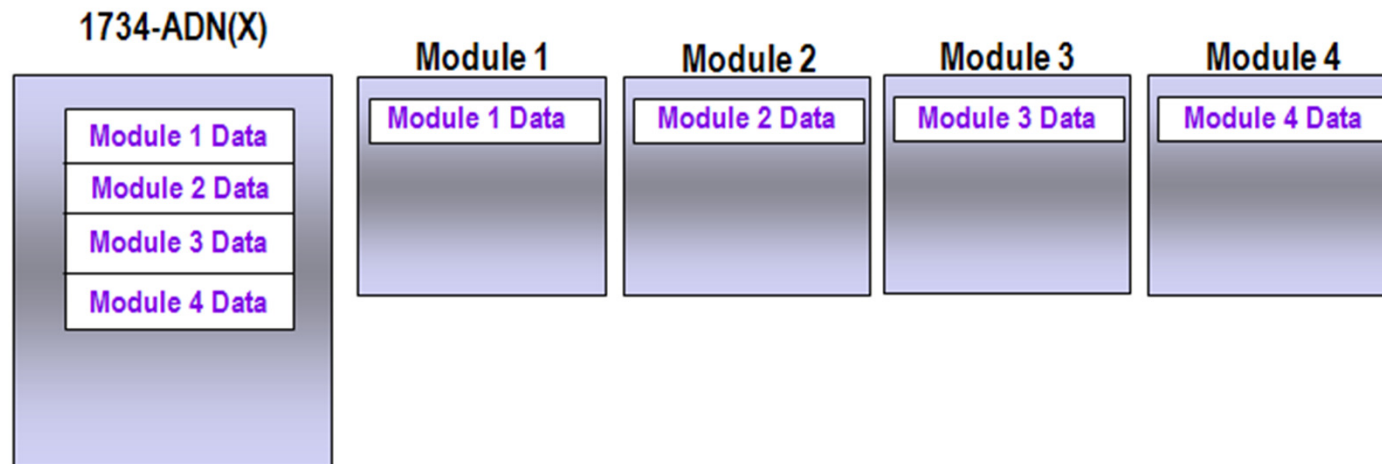
Decision Making Process on Selecting a PointIO DeviceNet Adapter.

General Guidelines and Comments

For ease of use of this document a few terms will be described first. Each 1734 to DeviceNet adapter has a Phoenix connector on it that connects the adapter to a DeviceNet network. This network connection will be called the Main network for this document. Each 1734 Adapter also has a connection mechanism on its side that allows standard 1734 PointIO modules to be attached to it. This connection will be called the Subnet network for this document.

The 1734-PDN is the less expensive and easiest to use 1734 PointIO to DeviceNet Adapter. The 1734-PDN acts solely as a way of electrically connecting the main DeviceNet network to the 1734 modules connected to the PointIO subnet. The modules on the subnet are all DeviceNet capable and count against the allowable limit of 62 slave nodes on the DeviceNet main network. There is no configuration necessary for the 1734-PDN. All PointBlockIO modules also act as a 1734-PDN, but will use a DeviceNet node number for the built in 8 Inputs and 8 Outputs. The maximum current allowable on the subnet 5VDC power, to power the I/O modules is 1.3 amps **TOTAL.**

The 1734-ADN behaves as a slave device on the main DeviceNet network and a master on the PointIO subnet. This allows all of the PointIO modules on the subnet to only count as one node number on the DeviceNet main network. The RSNetWorx for DeviceNet software is needed to configure the 1734-ADN for both its operation as a slave on the main network and as a master on the subnet. The 1734-ADN configuration on the subnet, consists of a scan list that is very similar to those used in all of the DeviceNet master scanner modules.

The 1734-ADNX module behaves just like a 1734-ADN except for a few additional capabilities. The 1734-ADNX has a second Phoenix style connector that extends the PointIO subnet off the module, so that any DeviceNet capable device could be connected to the subnet and scanned by the 1734-ADNX. This means that the node numbers of the devices on the subnet would not count against the 62 slave nodes allowed on the DeviceNet main network. The data from these devices would be included in the data being sent to/from the 1734-ADNX on the main network. The second capability of the 1734-ADNX is that the network on this second connector, is electrically isolated from the main network and can be used to extend the total DeviceNet trunk line distance. For example: With Thick round media at 125Kbits/sec, you could run a maximum of 500 meters to a 1734-ADNX on the main network. You could then wire an additional 500 meters of cable on the subnet connector and realistically double the distance of the network. <u>Remember that this subnet needs terminating resistors and a 24VDC power connection, the same as any other DeviceNet network.</u>

Decision Making Process on Selecting a PointIO Device Net Adapter (Cont.)

With the introduction of the 1734-232ASC PointIO module, the amount of data to be transferred over the subnet could become substantial. This could also occur with the 1734-ADNX and the standard, DeviceNet devices connected to its subnet, connector. So it is important that the total amount of data coming from the subnet does not exceed the data capability of either the 1734-ADN or 1734-ADNX. The data sizes allowed by the 1734-ADN and 1734-ADNX are as follows:

250 bytes (248 data + 2 bytes command info) for output data (used as either COS, Cyclic or Poll)

250 bytes (248 data + 2 bytes status info) for Polled input data

250 bytes (248 data + 2 bytes status info) for COS/Cyclic input data

8 bytes (6 data + 2 status info) for Strobe input data

It is also important that the data coming through the 1734 adapter combined with the other data from the main network, does not exceed the data capability of the main network, master scanner. If this occurs, then multiple master scanners will need to be used on the main network and the PointIO modules on the subnet will need to be split between multiple 1734-ADN or 1734-ADNX modules. If using the 1734-PDN adapter, the multiple masters on the main network will be able to communicate to separate groups of modules on its subnet, through the SAME 1734-PDN so NO additional adapters would be necessary.

1734-PDN Selection Criteria

Do you need greater than 62 total slave nodes, including PointIO modules? **If Yes, go to 1734-ADN Selection Criteria.**

Do you need greater than 1.3 amps of 5VDC power on the subnet to power I/O modules? **If Yes, go to 1734-ADN Selection Criteria.**

Do you need to extend the network beyond its cable maximum? **If Yes, go to 1734-ADNX Selection Criteria.**

Use the 1734-PDN as your adapter card.

1734-ADN Selection Criteria

Do you need to extend the network beyond its cable maximum? **If Yes, go to 1734-ADNX Selection Criteria.**

Do you have other DeviceNet capable devices in the vicinity of the PointIO that could be connected through the adapter? **If Yes, go to 1734-ADNX Selection Criteria.**

Use the 1734-ADN as your adapter card.

1734-ADNX Selection Criteria

Use the 1734-ADNX as your adapter card.

1734-232ASC Module

- **Used to interface a 3 wire RS232 ASCII device to a Device Net network. <u>USE only V1.11 firmware or above!!</u>**

- **User Manual is Publication Number 1734-UM009A-EN-P.**

- **The 1734-232ASC module is configured using an EDS file. The following parameters should be set as indicated for the description on the rest of this page to match.**

Receive Data type	**= Short String (1 byte length)**
Handshaking Mode	**= No Handshake(Produce Immediate)**
Transmit String Data type	**= Short String (1 byte length)**
Transmit Handshake Mode	**= Send Data on Change of TXID**

- **The Rx size of the module is the value of the Max. Receive Characters parameter defined in the EDS file + 4. The Tx size of the module is the value of the Transmit Maximum Length parameter defined in the EDS file + 4. These extra bytes form a header that appear at the beginning of the data.**

- **To receive data from the master scanner through the 1734-232ASC, the user should look for the transaction ID in byte 1 to change value. When this happens, it means that a new data buffer is available for storage. Read the length of the data from byte 4 and copy that amount of bytes from the data buffer starting at byte 5 into a file.**

- **To send data from the master scanner through the 1734-232ASC, the desired data should be written into the data area, starting at byte 5 after the header. Next, the number of bytes to be transmitted is put into byte 4 of the header. Lastly, the transaction ID byte 2 needs to be changed from it's previous value to trigger the transmission. Incrementing the ID value by 1, each time a message is to be sent, works fine.**

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5-X (max 128 bytes)	Byte X+1 (max = 132)
Transaction ID Byte	Status Byte	Reserved	Length	ASCII Data (following the length byte)	<CR> (Terminator)

Receive Data Format – **Short_String** Data Type

Byte 1	Byte 2	Byte 3	Byte 4	Byte 5-X (max 128 bytes)	Byte X+1 (max = 132)
RX ID Byte (Handshake Mode only)	Transaction ID Byte	Reserved	Length	ASCII Data (following the length byte)	<CR> (Terminator)

Transmit Data Format – **Short_String** Data Type

RS232 Connector Signals

Pin -- Signal		Signal - - Pin	
0	TX	RX	1
2			3
4			5
6		SG	7

New 1734-8CFGDLX Module

1734 DeviceLogix Point I/O Module

– **8 Channel "Self Configuring" (can be input or output)**

– **Very fast screw-to-screw response time of 2mSec(100 Function Blocks).**

– **Up to 144 function blocks or ladder logic can be programmed**

– **Most suitable for high-speed packaging applications that requires fast actuation time, can also provide "graceful" shut done of batch processes.**

– **Stand-alone Control applications (Used with a 1734-PDN)**

– **Also available in IP67 ArmorPoint in 3 different connector size (M8, M12 & M23)**

DeviceLogix™ is a function that has been added to a number of Rockwell Automation devices to control outputs and manage status information locally within the device.

Point I/O and PointBlock I/O Module Data Size Defaults

Module	Rx Size (Bytes)	Tx Size (Bytes)
1734-IB4 /1734- IV4	1	0
1734-IB2 /1734- IV2	1	0
1734-OB4E	1	1
1734-OB2E	1	1
1734-OW2	0	1
1734-IE2C	6	0
1734-OE2C	2	4
1734D-IB8XOB8E	1	1
1734D-IB8XOW8	1	1

ArmorPoint I/O 1738

1738-ADN12
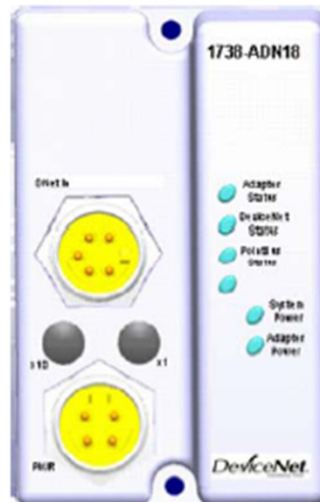
1738-ADN18
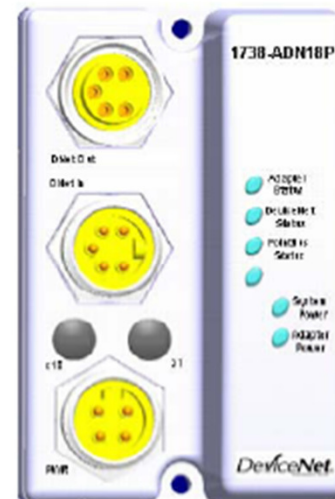
1738-ADN18P

1738-ADNX

315
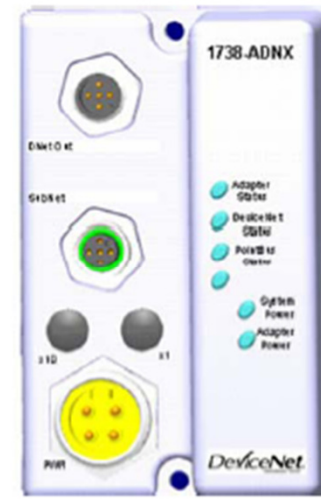
1738-ADN Fun Facts

- Node Number is set via rotary switches on the 1738 adapters. Note: Rotary switches are only read on powerup.

- Baud rate is handled via autobaud automatically.

- The 1738 adapters are 1738-ADN12, 1738-ADN18, 1738-ADN18P and the 1738-ADNX.

- The 1738-ADN12 has two 12mm micro connectors for the DeviceNet connection, one male and one female. This allows the drop cable to be daisy chained through the module.

- The 1738-ADN18 has one male pin 18mm mini connector for the DeviceNet connection.

- The 1738-ADN18P has two 18mm mini connectors for the DeviceNet connection, one male and one female. This allows the drop cable to be daisy chained through the module.

- The 1738-ADNX has two 12mm micro connectors, one male pin for the main DeviceNet connection and a female pin for the subnet connection.

- The PointI/O 1738-ADNX adapter has a value called Max Backplane MACID that MUST be set to the highest node number of the 1734 module on the PointI/O backplane. This is so the adapter knows which nodes are 1734 modules on the PointI/O backplane and which nodes to look for on the DeviceNet connector subnet connector.

- The auxiliary power connectors on all 1738, DeviceNet adapters are a four pin, 18mm mini male pin connector. Two pins feed the Adapter Power which includes the operating power for the ArmorPoint modules on the backplane/internal subnet AND AS IMPORTANTLY THE EXTERNAL SUBNET M12 CONNECTOR!! The second pair of pins feed the User Power, which includes the power for input and output devices.

- 1738 DeviceNet Adapters Installation manual is 1738-UM001A-EN-P

- 1738 DeviceNet Adapters User manual is 1738-IN014A-EN-P

1738 ArmorPoint Pin Outs

1738-ADN12 and 1738-ADNX

Male In Connector
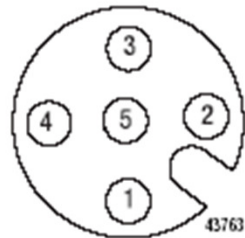
Female Out Connector
(Subnet out - 1738-ADNX only)

(view into connector)
Pin 1 - Drain
Pin 2 - +V
Pin 3 - -V
Pin 4 - CAN_High
Pin 5 - CAN_Low

43763

43764
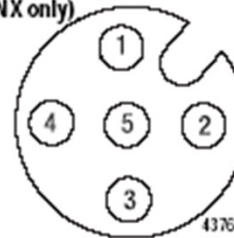
1738-ADN18 and 1738-ADN18P

Male In Connector
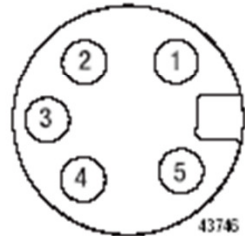
Female Out Connector
(1738-ADN18P only)

(view into connector)
Pin 1 - Drain
Pin 2 - +V
Pin 3 - -V
Pin 4 - CAN_High
Pin 5 - CAN_Low

43746

43749
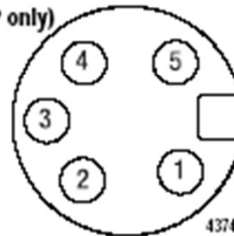
1738 ArmorPoint DeviceNet, ControlNet, and Ethernet Auxiliary Power

Male In Connector

(view into connector)
Pin 1 - User Power +
Pin 2 - Adapter Power +
         Adapter/Subnet + (1738-ADNX only)
Pin 3 - Adapter Power -
         Adapter/Subnet - (1738-ADNX only)
Pin 4 - User Power -

43587

317

FlexI/O DETAILS

318
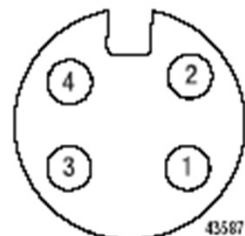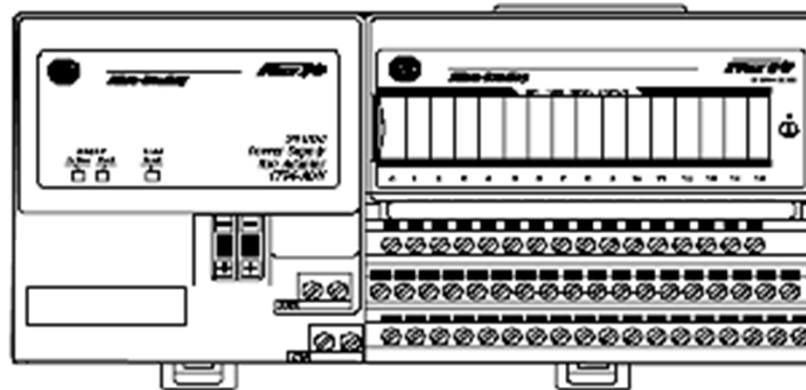
1794-ADN FlexI/O Fun Facts

- Node Number is set via pushwheels on the 1794-ADN adapter. Note: Pushwheels are only read on powerup.

- Baud rate is handled via autobaud automatically by the 1794-ADN.

- Current firmware revision is V2.05 as of 2006.

- 1794-ADN User Manual is Publication 1794-6.5.5. This manual shows how to configure the ADN and shows data sizes for most FlexI/O modules.

- Latest 1794-AND module is a Series C hardware with V3.001 firmware. The Series C hardware is brand new and can not be back flashed to firmware prior to V3.001.

- For Series A and B modules, firmware can only be upgraded over the DeviceNet network using the older GTS Toolkit NVS update tool on a PC. This currently can only be done using a 1770-KFD module interface. The Series C 1794-ADN firmware V3.001 or higher can now be flashed using Controlflash!!

- V2.002 firmware implements the Quick Connect feature. However, an anomaly was introduced where on powerup, outputs may glitch for a short amount of time. V2.003 firmware fixes this issue.

- The 1794-ADN prior to V2.004 does not support 32 bit Discrete IO modules using Fresh out of Box mode. The upper 16 IO points of 32 bit modules are not accessible unless the IO sizes are manually changed from 2 bytes to 4 bytes using RSNetWorx for DeviceNet software and downloaded back to the 1794-ADN. Remember again that any configuration download will also automatically disable Fresh out of Box mode.

- Do NOT supply power to the 1794-ADN adapter from the network 24 VDC power, as tempting as it looks. The 1794-ADN and other FlexI/O modules draw a lot of power (up to 400mA) and you could run out of current quickly or get bitten by Common Mode Voltage at longer distances.

- Firmware V2.003, V2.004 and V2.005 will sometimes cause the DeviceNet scanner to display an error 83 when attempting to Poll the ADN. An easy way to get around this is to use Change of State communications (COS). To correct this error condition, see the slide in this document called "Procedure to Recover a 1794-ADN from an Error 83", a few slides down from here.

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1794-ADN Fun Facts (Cont)

- In January of 2006 a new hardware revision of the 1794-ADN was rolled with the new Serbus 3 ASIC. With all versions of the firmware, this hardware causes the Input data coming back to any scanner, from the 1794-ADN, to flicker in the high byte, of each word. The modules affected are 1794-ADN/B Rev K01, K02, K03 (package level marketing, outside box) and/or part number 96494871 REV. C01 (product ID label marking sticker, on module). Modules manufactured after 05/06 will either have the Serbus 1 ASICs or will have firmware V2.005 loaded, which will ultimately fix the problem. Once V2.005 firmware is released, ALL effected 1794-ADN modules MUST be flash updated, to be operational. PSA ACIG 2006-06-02 gives more details.

- Be careful when assembling the 1794 Terminal Bases to the 1794-ADN adapter, as the pins in the side of the ADN and Terminal Bases are fragile and bend over easily causing erratic operation in the FlexI/O rack. A good way to determine if a pin is bent over is to remove each module from the FlexI/O rack and note if the Module/Net LED blinks red until the module is replaced. This is desirable behavior and if the LED does not blink upon module removal, then a pin is bent over.

- Series B hardware is electrically identical to Series A except for a few cosmetic differences. Series B Phoenix connector has jack screws and there is a 3rd LED to show power on the module.

- 1794-VHSC and 1794-IE8H modules are NOT supported by the 1794-ADN on DeviceNet.

- When the external 24VDC is killed to the 1794-ADN, it seems like the I/O modules power down first and the 1794-ADN has an opportunity to send it's inputs back to the scanner at least once during this mode. The problem is that the I/O inputs will be sent back to the scanner as ALL zero's no matter what the last state was of the actual inputs. So the scanner, which is designed to hold last state on network inputs, will hold the last state of the inputs as all zero's. Changing any of the fault/idle action configuration settings of the input modules will NOT alter this behavior!!

- UCMM Capable Device

Procedure to Recover a 1794-ADN from an Error 83 when being Polled.

Summary of Issue

This is a Bob Law tested and proven procedure to recover a 1794-ADN FlexIO adapter from an error 83 on the scanner after a flash update from the original V2.002 firmware to a V2.003, V2.004 or V2.005 revision. The error 83 happens if you attempt to Poll the ADN module from a scanner. If you change the message type to COS, the error 83 will go away

Reason Why This Happens

The Error 83 mode occurs when you are running a Change of State connection from a DNet scanner to a 1794-ADN, with a FlexIO rack, and you do a save of the configuration back to the ADN via RSNetWorx software. This sets a bit in Flash memory that keeps a Polled connection from working in the future.

Procedure to Recover the 1794-ADN

1) Stop any IO connections that are enabled to the 1794-ADN by any DeviceNet scanner. This can be done by pulling the cable off of the scanner or disabling the scanlist entry in the scanner using RSNetWorx software.

2) Power cycle to the 1794-ADN so the Mod/Net Status LED is flashing green.

3) Reset the Module using the Class Instance Attribute Editor inside RSNetWorx for DeviceNet software. Use Service Code 5, Class F, Instance 0, with NO Attribute, put a 1 in Data Field to send. In the RSNetWorx CIA editor, you must uncheck the "Send the Attribute ID" check box IMPORTANT: This operation should complete with no errors.

4) Power cycle to the 1794-ADN again.

5) Re-enable the IO connection to the 1794-ADN, by re-connecting the DeviceNet cable to the scanner or re-enabling the scanlist entry.

The Mod/Net Status LED on the 1794-ADN should be solid green and no error for the ADN node number should be showing on the scanner display.

1794-ADN Fun Facts (Cont)

- **DeviceNet can be used with Flex Ex with a 1797-CEC and 1797-BIC module in the chassis with the 1794-ADN in the safe area. The 1797-CE3 cable coming off of the 1797-BIC module can go 1 meter directly to a Flex Ex chassis in the hazardous area. Please consult Publication 1797-in513-en-p for further details**

Mixing Systems in the Safe Area
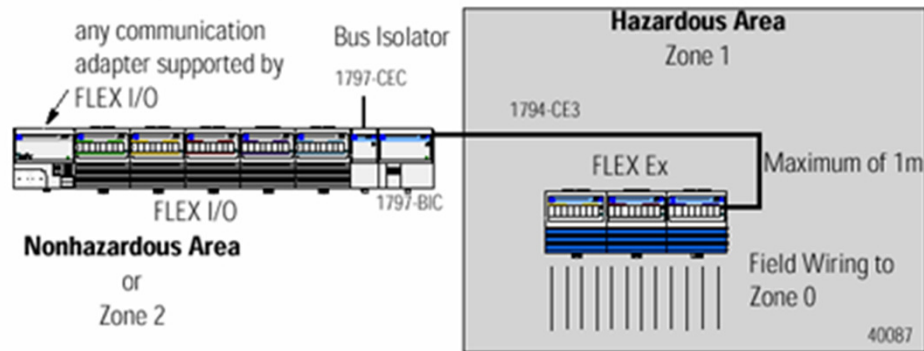
Mix Systems in the Hazardous Area
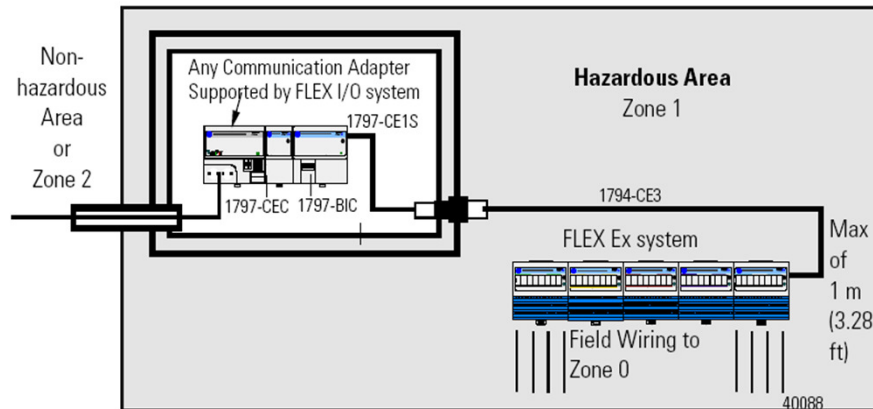
1794-ADN Fresh Out of Box Mode

A 1794-ADN module fresh out of the box is already configured to factory defaults and this gives it a very unique behavior. After each power cycle, the 1794-AND goes out on the FlexI/O rack and will identify what I/O modules are there. It will then use the default sizes shown in a later slide for each module contained in its rack to determine the total Rx and Tx size for the entire rack. If the rack contents change, the 1794-ADN will declare an error, until the rack is either put back to its previous state or power is cycled to the 1794-ADN. If power is cycled to the 1794-ADN, it will dynamically reconfigure itself to the current contents of the rack. Be aware that this true "Fresh Out of the Box" mode is disabled whenever a Clear/Reset Memory & Upload function or a configuration download is done via the RSNetWorx for DeviceNet software. The only way to get the mode operational again, is to go into the Class Instance Editor of the RSNetWorx software and do a Reset Service 05, to Class 0xF, Instance 0, with a 1 as data. This takes the ADN back to Factory Defaults, thus re-enabling the Fresh Out of the Box mode.

The behavior of the 1794-ADN changes slightly after a Clear/Reset Memory & Upload function is done at least once to the 1794-ADN from the FlexI/O applet inside the RSNetWorx software. The 1794-ADN will retain its configuration of the current FlexI/O rack, until another Clear/Reset Memory & Upload Function is done, at which time the 1794-ADN will re-configure itself depending on the new rack contents. It still uses the default sizes to determine its Tx and Rx sizes, so this configuration will be identical to that determined by the true Fresh Out of the Box mode, described in the first paragraph. Cycling Power will no longer have any effect on the 1794-ADN configuration. If a custom configuration is needed, such as trimming the Tx or Rx sizes of individual modules in the FlexI/O rack, then this can be easily done using the RSNetWorx software. Once this custom configuration is downloaded to the 1794-ADN, it will lock in that configuration. This configuration is stored in the 1794-ADN and if the ADN needs to be replaced later there are two scenarios possible. The first is to use the ADR feature in the master scanner to reconfigure the ADN. The second scenario is that the configuration will have to be downloaded, via RSNetWorx software, to the replacement 1794-ADN before it will operate the same as the original ADN. <u>Important Note: You must disconnect the master scanner from the network or disable the scanlist entry for the FlexI/O adapter, in the master scanner, before attempting a Clear/Reset Memory & Upload function or a configuration download to the 1794-ADN. Otherwise the 1794-ADN will ignore the request.</u>

Flex I/O 1794-ADN
DeviceNet Adapter Data Usage

Consumes 0 words of output data

Produces 1 word of input data

word 0	Not Used	PUSHWHEELS CHANGED BIT	Module Status (1 bit per slot)
	Bits 9 thru 15	Bit 8	Bits 0 through 7
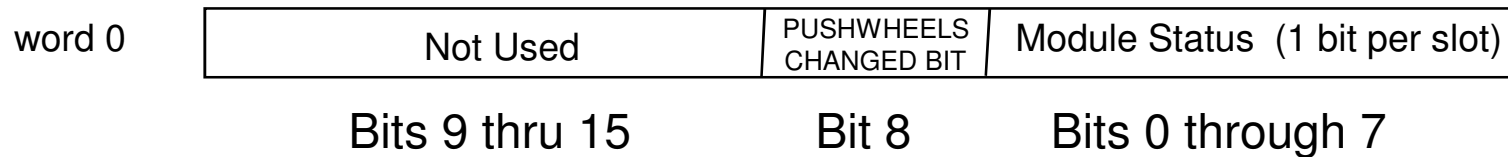
There are 8 Module Status bits starting at bit 0 of the 16 bit word produced by the 1794-ADN. Bit 0 though 7 of this area corresponds to slot 1 through slot 8 of the Flex I/O rack. Should a module in a slot of the Flex I/O rack be bad or missing the corresponding Module Status bit will go to a 1. The bit will be 0 if a module exists in the slot and is healthy. Also, Bit 8 goes to a 1 if the pushwheels have changed and returns to 0 when the pushwheels are the same as read during powerup.

Flex I/O 1794-OB16 and Other Discrete Outputs Data Usage

Consumes 1 word of output data

word 0 | 16 Bits of Output (1 bit per output) |

Produces 1 word of input data

word 0 | Fuses blown (1 bit per output)
(May not be applicable with all Modules) |

Flex I/O 1794-IB16 and Other Discrete Inputs Data Usage

Consumes 1 word of output data

Bits			Description	
02	**01**	**00**	**Delay Times 00-11 (00-13)**	**Maximum**
05	**04**	**03**	**Delay Times 12-15 (14-17)**	**Delay Times**
0	0	0	Delay Time 0 (default)	512µs
0	0	1	Delay Time 1	1ms
0	1	0	Delay Time 2	2ms
0	1	1	Delay Time 3	4ms
1	0	0	Delay Time 4	8ms
1	0	1	Delay Time 5	16ms
1	1	0	Delay Time 6	32ms
1	1	1	Delay Time 7	64ms

word 0 | Input Delay Times

Produces 1 word of Input Data

word 0 | 16 Bits of Input (1 bit per input)

Flex I/O 1794-IE8 Analog Inputs Data Usage

Consumes 6 words of Output Data

word 0	C7 C6 C5 C4	C3 C2 C1 C0	F7 F6 F5 F4	F3 F2 F1 F0	
word 1-5	Not used (Should be set to Zero)				

Cn = bipolar select; n represents the channel number
Fn = full range; n represents the channel number.

Cn	Fn	function
0	0	Off (Inputs will read 0)
0	1	0-10v or 0-20mA
1	0	4-20mA selected
1	1	+/- 10V

Produces 9 words of input data

Un = under range; only valid in 4-20mA configuration; usually indicative of a broken wire; n represents the channel number

word	channel	Bit15															
word 0	ICH0	S	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 1	ICH1	S	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 2	ICH2	S	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 3	ICH3	S	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 4	ICH4	S	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 5	ICH5	S	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 6	ICH6	S	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 7	ICH7	S	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 8	Under	PU	0	0	0	0	0	0	0	U7	U6	U5	U4	U3	U2	U1	U0

Bit 15

S = Sign bit
D = Analog value
PU = Power Up Bit

12 bit left justified twos complement number; unused lower bits are zero; 4-20mA uses 16 bits.

Included only on Series B modules Only

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Flex I/O 1794-OE4
Analog Outputs Data Usage

Consumes 14 words of output data

word 0	OCH0	S	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 1	OCH1	S	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 2	OCH2	S	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 3	OCH3	S	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 4		0	0	0	0	0	0	0	0	0	0	0	0	OE3	OE2	OE1	OE0
word 5		0	0	0	0	C3	C2	C1	C0	0	0	0	0	F3	F2	F1	F0
word 6-13		NOT USED (SHOULD BE SET TO ZERO)															

C_n = bipolar select; n represents the channel number
F_n = full range; n represents the channel number.

C_n	F_n	function
0	0	Off (Outputs will return to 0V)
0	1	0-10v or 0-20mA
1	0	4-20mA selected
1	1	+/- 10V

OE_n = Output Enable Bits;
 n = channel number (Make these bits always 1)

S = Sign bit
D = Analog value

12 bit left justified twos complement number; unused lower bits are zero; 4-20mA uses 16 bits

Produces 1 word of input data

word 0	PU	0	0	0	0	0	0	0	0	0	0	0	W3	W2	W1	W0

Bit 15

W_n = wire on current output broken or load resistance too high; not valid on voltage outputs; n represents the channel number

PU = Power Up Bit - included in series B modules only.

Flex I/O 1203-FM1 SCANport Interface Data Usage

Consumes 9 words of output data

Bit 15   **Bit 0**

		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
word 0	Enable	0	0	0	0	0	0	0	E2	0	0	0	0	0	0	0	E1
word 1	Logic 1	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 2	Analog 1	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 3	Logic 2	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 4	Analog 2	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 5-8		NOT USED (SHOULD BE SET TO ZERO)															

Ex = Enable for channel denoted by x. 1 means enable.
D = Data Bits. Use determined by device connected to SCANport.

Produces 6 words of input data

Bit 15   **Bit 0**

		15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
word 0	Reserved	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
word 1	Connection	0	0	0	0	V2	ID2	ID2	ID2	0	0	0	0	V1	ID1	ID1	ID1
word 2	Status 1	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 3	Feedback 1	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 4	Status 2	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D
word 5	Feedback 2	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D	D

IDx = SCANport device port ID. 3 bit field
7 means no communication to Scanport Device

Vx = Valid data bits. 1 = data valid
D = Data Bits. Contents determined by device connected to SCANport.

FlexI/O Module Data Size Defaults

Module	Rx Size (Words)	Tx Size (Words)
1794-ADN	1	0
32 bit Input Module	2	0
32 bit Output Module	0	2
All 16 bit Discrete Modules	1	1
1794-IE8	9	6
1794-OE4	1	14
1794-IF4I	7	8
1794-OF4I	6	9
1794-IF2XOF2I	7	8
1794-IE4XOE2/B	5	10
1794-IRT8	11	4
1794-IJ2	7	8
1794-IT8	11	4
1794-IR8	11	4
1203-FM1	6	9

Let's Do Some FlexI/O Math

Individual Word Count sent From the FlexI/O Rack	Individual Word Count sent to the FlexI/O Rack
1 Word From 1794-ADN Adapter	0 Words to 1794-ADN Adapter
1 Word From 1794-OB16	1 Words to 1794-OB16
1 Words From 1794-IB16	1 Word to 1794-IB16
9 Words From 1794-IE8	6 Words to 1794-IE8
1 Word From 1794-OE4	14 Word to 1794-OE4
13 Total Words / 26 Bytes of data Produced by theFlexI/O	**22 Total Words / 44 Bytes of data Consumed by theFlexI/O**

How Does the FlexI/OData Map??

1794 ADN	1794 OB16	1794 IB16

Input Data Format

N10:21	0	**1794-ADN Status Word**
N10:22	1	**1794-OB16 Input Word**
N10:23	2	**1794-IB16 Input Word**

Output Data Format

N11:12	0	**1794-OB16 Output Word**
N11:13	1	**1794-IB16 Filter Word**

855 Tower Light DETAILS
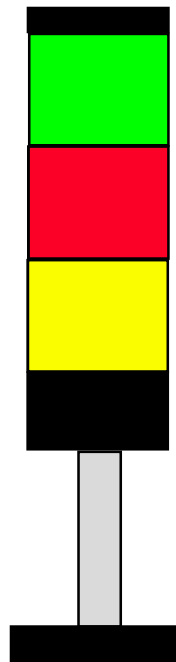
855 Tower Light Fun Facts

- Node number and baud rate is set via rotary switches or Node Commissioning in the RSNetWorx or DeviceNet Manager Software.

- Tower Light takes all of its power off of the DeviceNet network power.

- DeviceNet network connection is via an extremely small screw terminal strip that requires a jewelers screwdriver to tighten the screws.

- Tower Light has many operating profiles that are user configurable through the EDS to make lights operate in prearranged lighting patterns.

- The Tower Light can handle up to 5 lighting/accessory modules. If an incandescent bulb is burnt out, in a lighting module, the status is reported back over the DeviceNet network.

- Tower Light DeviceNet base with V1.2 firmware does NOT handle COS messaging well. Use Polled messaging if a COS error occurs.

- When using LED modules, make sure you select LED mode in the EDS based configuration or erratic module operation will occur.

- Some towerlight bases with revision V1.02 firmware, have been observed to lose their configuration for individual modules after a power cycle. The Module Type will default back to invalid Module. FYI. This will cause a fault bit to be set in the towerlight base, that is monitored by RSNetWorx MD software. The MD software will then declare the Towerlight "faulted" even though the modules may be operating correctly.

- 855 Tower Light User Manual is publication 855T- 5.0.

855T Tower Light I/O Data

Consumes 1 byte of Polled or COS output data

Byte 0

NOT USED	Output 5	Output 4	Output 3	Output 2	Output 1
Bits 5 thru 7	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Output Bit = 0   **Output is idle**
Output Bit = 1   **Output is executing**

Produces 1 byte of Polled or COS input data

Byte 0

NOT USED	Position 5 Status	Position 4 Status	Position 3 Status	Position 2 Status	Position 1 Status
Bits 5 and 7	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0

Output Bit = 0   **Position is Normal**
Output Bit = 1   **Position Idle, Not Present or Burned Out**

BULLETIN 160 SPEED CONTROLLER

Bulletin 160 Fun Facts

Catalog 160 - DN1 and 160 -DN2 are used to connect Bulletin 160 Speed Controllers to DeviceNet Network. User Manual is Publication 160-5.5.

The 160-DN1 will NOT operate with a Series C drive unit. The 160-DN2 will work with ALL drives, including the Series C.

Only the 160-DN2 allows the EDS files to be uploaded from the drive unit into the configuration software.

Node Number and Baud rate are set via dip switches on 160-DN1 or via the DeviceNet network if baud rate switches are both set on. Address and baud rate via network can only be done using the 160-DN1 or 160-DN2 EDS configuration, not by using Node Commissioning in the RSNetWorx or DeviceNet Manager software. Dip switches 1 - 6 set the node address. All OFF is node 0 and all ON is node 63. Switches 7 & 8 are the baud rate switches. Both OFF is 125Kbits, 8 ON is 250 Kbits and 7 ON is 500 Kbits. Both ON is baud rate and node number setting over the DeviceNet network.

V1.2 of the 160-DN1 will not work with a version V2.002 or earlier 1756-DNB scanner or some firmware versions of the 1747-SDN and 1784-PCIDS cards. COS will also not work with some versions of the 1747-SDN, 1756-DNB and 1784-PCIDS cards. Use Polled mode if problems with COS occur with any particular scanner.

Bulletin 160 Fun Facts

In EDS file for the Bulletin 160 set INPUT MODE = Network Control, INTERFACE SELECT = 160-SSC STANDARD and if applicable the FREQUENCY SELECT parameter should be set to INTERNAL. <u>Be sure to save the updated parameters back to the 160 drive and cycle AC power to the drive for the changes to take effect.</u>

160-DN1 is a polled device with Tx and Rx data sizes and data formats being selected also using the EDS file. INPUT ASSEMBLY and OUTPUT ASSEMBLY parameters of EDS file are used to determine these sizes. The default for INPUT ASSEMBLY is 20 and the OUTPUT ASSEMBLY default is 70.

When using Output Assembly 21, make sure Network Control and Network Reference bits are set to a 1 to get the drive to react from the DeviceNet network. If a bit is not set then the function will be controlled from the terminal strip TB3, <u>NOT</u> from the network.

Make sure there is a jumper between terminals 7 and 8 on TB3 or else the drive will not start for any reason from the network. This jumpers the STOP terminal on the 160 drive itself.

A parameter exists in the Bulletin 160 called PWM Frequency and this defaults to 4 kHz. (PWM stands for Pulse Wave Modulation) This parameter determines how many times a second the out put pulses are updated to the motor. In rare instances, these pulses can cause noise on the network and adversely effect devices on the network. To reduce this noise, you can change this value to 2 kHz.

Bulletin 160 I/O Assemblies

Output Assembly 20

	Bit 7		Bit 2	Bit 1	Bit 0
Byte 0			Clear Fault		Run Fwd
Byte 1					
Byte 2	LSB of Desired Speed in RPM's				
Byte 3	MSB of Desired Speed in RPM's				

Output Assembly 20

Output Assembly 21

	Bit 6	Bit 5		Bit 2	Bit 1	Bit 0
Byte 0	Net Ref	Net Ctrl		Clear Fault	Run Rev	Run Fwd
Byte 1						
Byte 2	LSB of Desired Speed in RPM's					
Byte 3	MSB of Desired Speed in RPM's					

Output Assembly 21

Input Assembly 70

	Bit 7		Bit 2	Bit 1	Bit 0
Byte 0			Running		Faulted
Byte 1					
Byte 2	LSB of Actual Speed in RPM's				
Byte 3	MSB of Actual Speed in RPM's				

Input Assembly 70

Input Assembly 71

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	At Ref	Ref Net	Ctrl Net	Ready	Going Rev	Going Fwd	Warning	Faulted
Byte 1								
Byte 2	LSB of Actual Speed in RPM's							
Byte 3	MSB of Actual Speed in RPM's							

Input Assembly 71

193 E3 Smart Motor Protector and 193-EDN E1 Plus Sidecar

340
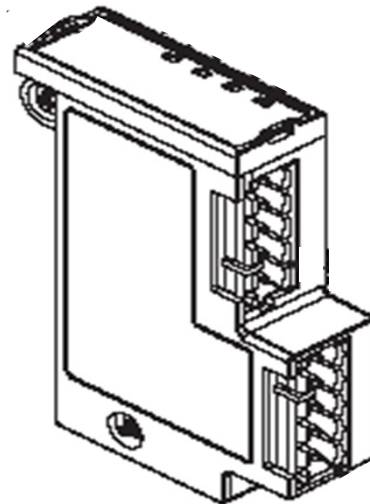
MCS-E3 Protective Functions and Features

Basic Version

- **Protective Functions**
  - Overload
  - Underload
  - Jam
  - Phase loss/Imbalance

- **Inputs and Outputs**
  - 2I/1O

Plus Version

- **Protective Functions**
  - Overload
  - Underload
  - Jam
  - Phase loss/Imbalance
  - Ground fault (1~5A)
  - PTC

- **Inputs and Outputs**
  - 4I/2O

193 E3 Fun Facts

User Manual is Publication 193-UM001A-US-P.

Node number is set via node commissioning and E3 has AutoBaud capability. E3 can be firmware upgraded over the DeviceNet network.

The E3 supports the parameter object so its EDS file can be uploaded directly from the device if necessary.

The E3 will default to Output Assembly 103 and Input Assembly 100 out of the box. The E3 Plus will default to Output Assembly 105 and Input Assembly 100 out of the box. This determines that the E3 will send back 8 bytes of data as receive data back to the master and the E3 will receive 1 byte of data as transmit data from the master. Bit zero of the data byte sent from the master will energize the output A, Bit 1 will energize Output B (E3 Plus Only) and Bit 2 will Clear Faults.

Discrete Inputs are 24VDC rated and their I/O connector has a pin with 24VDC already on it. This 24VDC originates from the DeviceNet power pair so any current drawn should be added to total network current for power calculations.

The E3 operating power originates from the DeviceNet cable. So if the DeviceNet power is lost to the E3, while a motor starter is energized through it's internal overload contacts, the motor starter will drop out as the relay contacts open. This can be a problem because the DeviceNet power is linked to the E3 capability to act as an overload relay. However, the 2100-DNBPS redundant power supply can be used to either get power from the DeviceNet network power or an external AC power source. Publication 2100-TD022A-EN-P describes this power supply in more detail.

193 E3 Fun Facts (Cont)

IMPORTANT!! With V4.002 E3 overloads and high traffic situations on the DeviceNet network, the E3 overloads may drop off of the network and come back on sporadically. Series C and D 1756-DNB scanners handle the network faster and seem to annoy the E3 more into misbehaving. V4.003 firmware fixes this anomaly and can be flashed into any scanner of Major Revision 4 and Major Revision 2 or earlier.

Series B version of E3 has the following new features.

Flash Update capability

UCMM (Unconnected Message Manager) support

Rotary node address switches

DeviceLogix component technology

Ground fault trip inhibit selection

2nd FLA setting for 2-speed applications

Remote trip function

193 E3 Wiring Details

Full-Voltage Non-Reversing (with Network Control)

Figure 2.12 Full-Voltage Non-Reversing Starter Wiring Diagram (NEMA Nomenclature)


```
        E3                                    E3
       Out A                              Trip Relay (1)

   13 |  | 14          A1 /    \ A2   95 | /| 96
   ---| |---------------( M )--------------|/|------
                         \    /

(1) Contact shown with supply voltage applied.
```
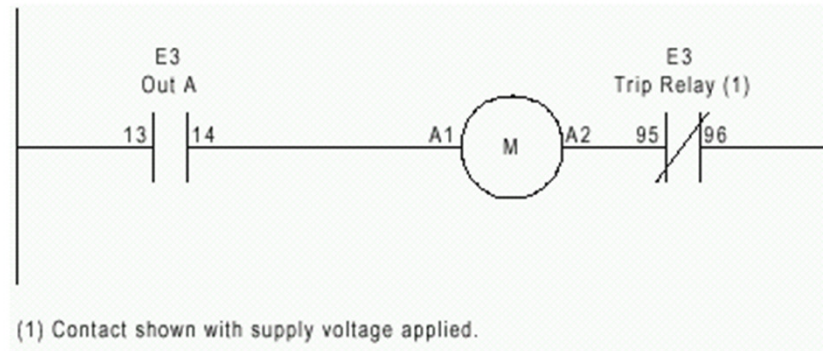
The local inputs on the E3 overloads are referenced to an internal 24VDC power source in the E3. If external 24VDC is desired to be used to feed the inputs, a jumper must be applied from terminal 8 (IT2) on the E3 to the V- of the external 24VDC power supply. This effectively connects the V- of the internal power source and the V- of the external power supply together so either supply can power the inputs on the E3. This is handy when the same contact strings feeding an E3 input may also need to feed indicators, relays, motor contactors, etc.

193-EDN (E1 Plus) Fun Facts

Installation Manual is Publication 41053-318-01.

The 193-EDN is UCMM capable.

Node number is set via node commissioning and has AutoBaud capability. EDN can be firmware upgraded over the DeviceNet network.

The EDN supports the parameter object so its EDS file can be uploaded directly from the device if necessary.

The EDN is designed as a sidecar type module to screw onto the side of a standard E1 Plus overload device. The EDN has one relay output and two, discrete 24VDC inputs.

The discrete Inputs are 24VDC rated and their I/O connector has a pin with 24VDC already on it. This 24VDC originates from the DeviceNet power pair so any current drawn should be added to total network current for power calculations.

The EDN will default to Output Assembly 103 and Input Assembly 110 out of the box. Data formats are shown below.

Instance 103 - Similar to Basic Motor Starter Output Assembly in ODVA Starter Profile								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0						Trip Reset		Output A

Instance 110 – Extended Motor Starter Input Assembly								
Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0			Input2	Input1		Out A Stat	Warning	Tripped
1	unused							
2	Average %FLA							
3								
4	%Therm Utilized							
5								

ArmorStart Products

ArmorStart Bul. 280/281 Ratings

- **Motor Horsepower Range .5- 10 HP (.37-7.5 kW)**

- **200-480 VAC line voltage**

- **Control power ratings 24VDC, 120VAC or 240VAC**

- **50/60 Hz**

- **0-40° C Operating Temperature**

- **Approval Ratings: cULus and CE**

- **Available with optional keypad**

- **DeviceLogix is standard**

- **Motor cable provided as standard**

- **Can be programmed with only DeviceNet power available**

Bulletin 284 Product Ratings

- **Variable Frequency AC Drive using PowerFlex™ Technology**

- **Available with Sensorless vector control and Sensorless vector performance**

- **Voltage Ratings**
  - **240 V AC, 50/60 Hz, Three Phase**
  - **480 V AC, 50/60 Hz, Three Phase**

- **Horsepower Ratings**
  - **0.5-2.0 @ 240 V AC**
  - **0.5-5.0 @ 480 V AC**

- **Motor cable provided as standard**
  - **3 meter unshielded 4 conductor singled ended cordset**

- **Robust IP 67/Nema Type 4 enclosure rating**

- **0-40° C Operating Temperature**

- **Approval Ratings: cULus and CE**

- **DeviceLogix is standard**

- **Three phase power required to program Drive**

- **Keypad is optional**

ArmorStart Fun Facts

Node number is set via internal rotary switches and ArmorStart has AutoBaud capability.

Default data sizes for ArmorStart 280/281 is consume 1 byte and produce 2 bytes.

Table 5.2   Instance 160 — Default Consumed data for Standard Distributed Motor Controller (1 byte)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	User Out B	User Out A	Not Used	Not Used	Not Used	Fault Reset	Run Rev	Run Fwd

Table 5.3   Instance 161 — Default Produced data for Standard Distributed Motor Controller (2 bytes)

Byte	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
0	Not Used	Not Used	Not Used	Ready	Running Rev	Running Fwd	Warning	Tripped
1	Not Used	Not Used	140M On	HOA	User In 3	User In 2	User In 1	User In 0

The 284 ArmorStart has an imbedded PowerFlex drive in them. The default data sizes for ArmorStart 284 is consume 4 byte and produce 4 bytes with the data format the same as a PowerFlex Drive.

ArmorStarts now have Zone Interlocking Parameters (ZIP) functionality in them to communicate directly between these units without a master.

1203-GK5 or 1203-GU6 or 2100-GK61 DETAILS

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1203-GK5 Interface to Power Products Dip Switch Layout

On = 1

⬆

Off = 0

1	2	3	4	5	6	7	8

SW1

On = 1

⬆

Off = 0

1	2	3	4	5	6	7	8

SW2
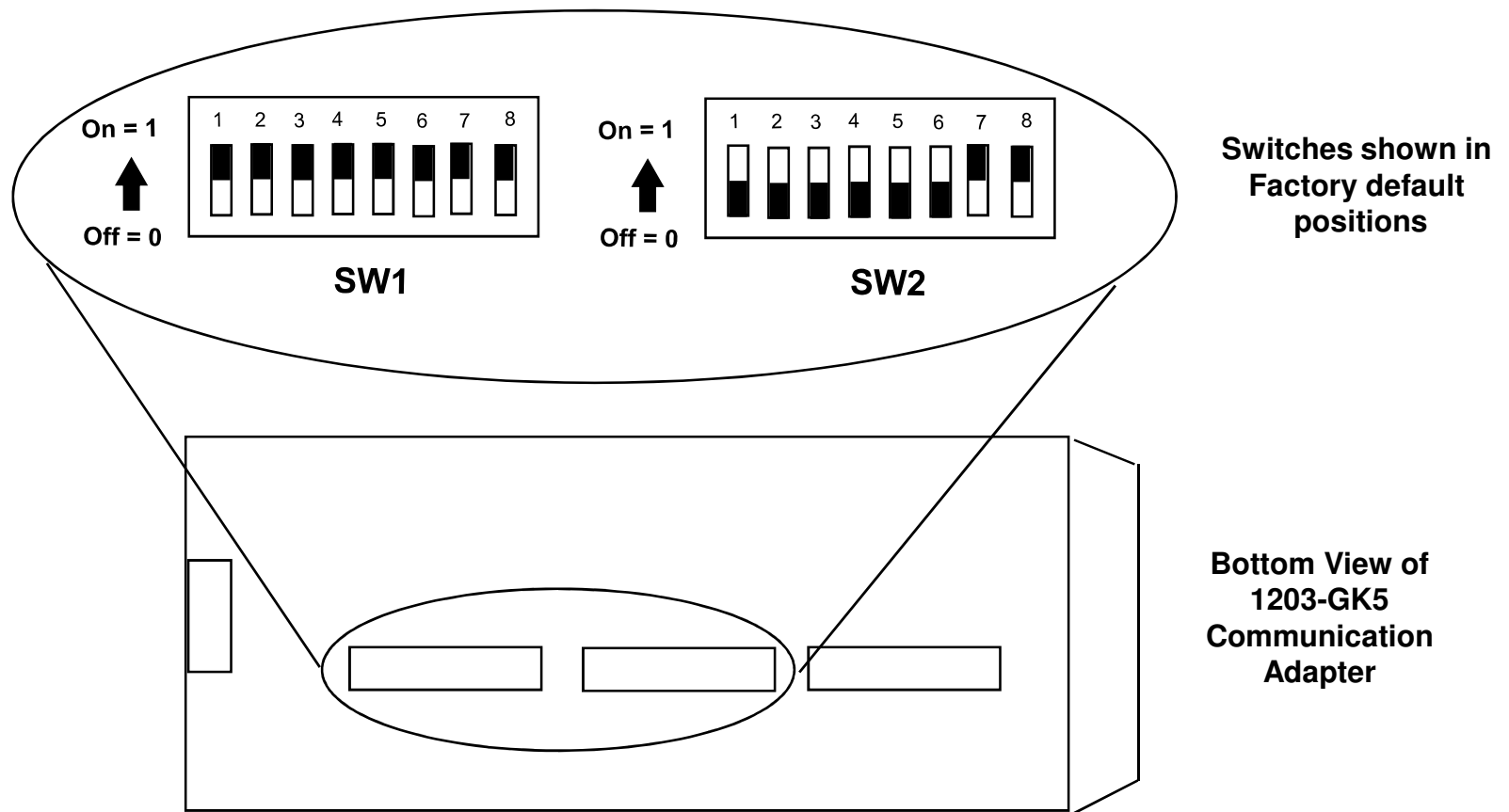
Switches shown in Factory default positions

Bottom View of 1203-GK5 Communication Adapter

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Switch Definitions Appear on Next Slide

1203-GK5 Interface to Power Products Switch Definitions

SW2-1 thru SW2-6 = DeviceNet Node Address   0 - 63   (63 is Factory Default)

SW2-7 and SW2-8 = DeviceNet Data Rate

SW2-7	SW2-8	Data Rate
Off	Off	125Kbs (Factory Default)
Off	On	250Kbs
On	Off	500Kbs
On	On	Node address & Baud Rate Selectable Over Network

SW1-1	Function
Off	Disable Datalink A messaging (Factory Default)
On	Enable Datalink A messaging

SW1-5	Function
Off	Not Used (Factory Default)
On	Not Used

SW1-2	Function
Off	Disable Datalink B messaging (Factory Default)
On	Enable Datalink B messaging

SW1-6	Function
Off	Zero data (Factory Default)
On	Hold last State

SW1-3	Function
Off	Disable Datalink C messaging (Factory Default)
On	Enable Datalink C messaging

SW1-7	Function
Off	Enable Fault on Comm Loss (Factory Default)
On	Disable Fault on Comm Loss

SW1-4	Function
Off	Disable Datalink D messaging (Factory Default)
On	Enable Datalink D messaging

SW1-8	Function
Off	Enable Fault on Program/Idle (Factory Default)
On	Disable Fault on Program/Idle

1203-GK5/1336-GM5 Fun Facts

- 1203-GK5 is an external unit and requires a ScanPort cable to connect to power product. The 1336-GM5 is mounted internal to the larger Drives.

- The 1203-GK5 normally has a Vendor Code = 1 and Product Type = 101. The Product Code will vary depending on what is connected to the GK5. Without a product connected to the SCANport connector the Code = 256, with an SMP3 connected the Code = 20 and with a 1305 connected the code = 23. It must be remembered that should the device connected to the SCANport connector lose power or be disconnected, the Product Code will revert back to 256. Should electronic keying be enabled for the scan list entry for that node, an error 73 will be displayed which says the assign keys no longer match.

- The normal Transmit and Receive size for a 1203-GK5 with a device connected to the SCANport port is 4 bytes in each direction. For each Datalink enabled, via the switches on the GK5, 4 bytes will be added to each size. Note: It must be remembered that should the device connected to the SCANport connector lose power or be disconnected, the Transmit and Receive sizes will revert back to 0 bytes each direction. At this point an error 86 may appear on the error display of the SDN saying that the device is producing idle data in Run mode. That is because the GK5 stops sending any data to the SDN which looks like an idle packet being sent while in Run mode.

- **UCMM Capable Device**

- 1203-GK5 User Manual is Publication 1203-5.3

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1203-GU6/1336-GM6 Fun Facts

– **1203-GU6 is an external unit and requires a ScanPort cable to connect to power product. The 1336-GM6 is mounted internal to the larger Drives.**

– **Peer to Peer Messaging Support**

– **Flash Upgradeable**

– **Software Configurable, No DIP-switches**

– **Change-of-State Support**

– **Cyclic Data Support**

– **User-Configurable Fault Response**

– **Explicit Messaging**

– **Both Internal & External Versions will be SCANport Powered**

– **Individual Configuration for Fault and Idle Network Conditions**

– **Higher Common Mode Noise Rejection**

– **Additional LED for Module Status**

– **DF1 Serial Interface for DriveTools32^{TM} on DeviceNet using 1203-SFC cable**

-- **UCMM Capable Device**

-- **User Manual is Publication 1203-5.12**

1336-GU6

Internal DeviceNet Adapter

1336-GM6

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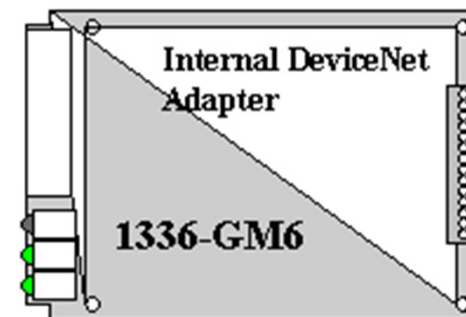
2100-GK61 Fun Facts

- The 2100-GK61 is basically a 1203-GU6 Scanport Adapter with 4 digital, discrete inputs added. These inputs can be 24VDC, 115AC or 230AC with the voltage level set via dip switches.

- Most fun facts and features of the 1203-GU6 pertain to this product.

- In firmware prior to V2.001, the addition of the inputs did NOT affect the I/O data format of this product on DeviceNet, which is still identical to the 1203-GU6. The Input data can only be read using explicit messaging, which makes the access of this data much slower than if it were in the I/O data transfer. The location of these Digital inputs is Class 93 (decimal), Instance = 4015 (decimal) and Attribute = 1.

- In firmware V2.001 or higher the discrete inputs are returned as an extra word at the beginning of the receive data coming from the GK61. So instead of a Receive Size of 4 bytes, 6 bytes are actually returned from the GK61. The lower 4 bits of the first word of this data are the 4 discrete inputs, with the extra upper 12 bits of the word being unused. The transmit size, to the 2100-GK61, is still 4 bytes.

- Firmware 2.080 fixes an issue where GK61 will occasionally stop sending data in Polled mode. The master scanner will blink an 86 error when this happens.

- Dip switches are used to determine 24VDC or 120 VAC input selection

- The 2100-GK61 while deriving its operating power off of the DeviceNet cable, will NOT communicate on the network until a scanport device is connected to it and powered up.

- May be ordered ONLY through CIRCE order entry system.

- UCMM Capable

- User Manual is Publication 2100-UM001A-US-P

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1203/2100 Interface to SMP3 Smart Motor Protector I/O Data

Word 0 of Output Data

LOGIC CONTROL BITS																Function	DESCRIPTION / NOP = No State Change
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
															X	Stop Triac A	1=Open, 0=NOP
														X		Stop Triac B	1=Open, 0=NOP
													X			Clear Faults	1=Clear Faults, 0=NOP
												X				Start Triac A	1=Close, 0=NOP
											X					Start Triac B	1=Close, 0=NOP
			X	X	X	X	X	X	X	X						Reserved	Not Used
X	X	X														Par Selection	Select Parameter for Status 000-Default(Ave Current) 001-Average Current 010-Thermal Capacity Utilized 011-Full Load Current Setting 100-Current Unbalance 101/111-Reserved

Word 1 of Output Data

Not Used	Reserved	

1203/2100 Interface to SMP3 Smart Motor Protector I/O Data (Cont.)

Word 0 of Input Data

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Function	DESCRIPTION
															X	Triac A	1=On/Closed, 0=Off/Open
														X		Triac B	1=On/Closed, 0=Off/Open
													X			Control	0=Control Disabled, 1=Enabled
												X				High	Always High (SMP On-Line)
											X					Reserved	
								X	X	X						Selected Par	Selected Parameter in 2nd Word 000-Default(Ave Current) 001-Average Current 010-Thermal Capacity Utilized 011-Full Load Current Setting 100-Current Unbalance 101/111-Reserved
X	X	X	X	X	X	X	X									Fault Code	Definitions On Next Slide

1203/2100 Interface to SMP3 Smart Motor Protector I/O Data (Cont.)

Word 0 of Input Data (Continued)

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Function	DESCRIPTION
LOGIC CONTROL BITS																	
X	X	X	X	X	X	X	X										From Previous Page
																Fault Code to display current fault condition as a hex number value 0 to FF	00 = No Fault
																	01 = Trip/Test
																	02 = Overload Fault
																	03 = Phase Loss Fault
																	04 = Ground Fault
																	05 = Jam/Stall Fault
																	06 = Illegal FLC Set Fault
																	07 = Non-Vol Memory Fault
																	08 = Communication Fault

Word 1 of Input Data

Value of Parameter Selected in Logic Command	Par Value	

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1203/2100 Interface to SMP3 General Information

To make SMP3 energize output A pulse bit 3 of first word of output on and then back off again after a short time.

To make SMP3 energize output B pulse bit 4 of first word of output on and then back off again after a short time.

To make SMP3 de-energize both outputs pulse bits 0 & 1 on in the first word of output and then back off again after a short time.

To make SMP3 clear faults then pulse bit 2 of the first word of output on and when faults have cleared turn bit 2 back off again.

Recommended SMP3 Wiring Diagram to Motor Contactor(s)

Motor Contactor A Coil

Fuse

(C)

Motor Contactor B Coil

Fuse

(C)

(120/240 Vac)

| 10 | 20 | | 30 | 40 | | 50 | | 60 |

AC Out A

AC Out B

Relay

Common Triac Fuse

SMP3 Power Supply

INTERNAL TO SMP3

360
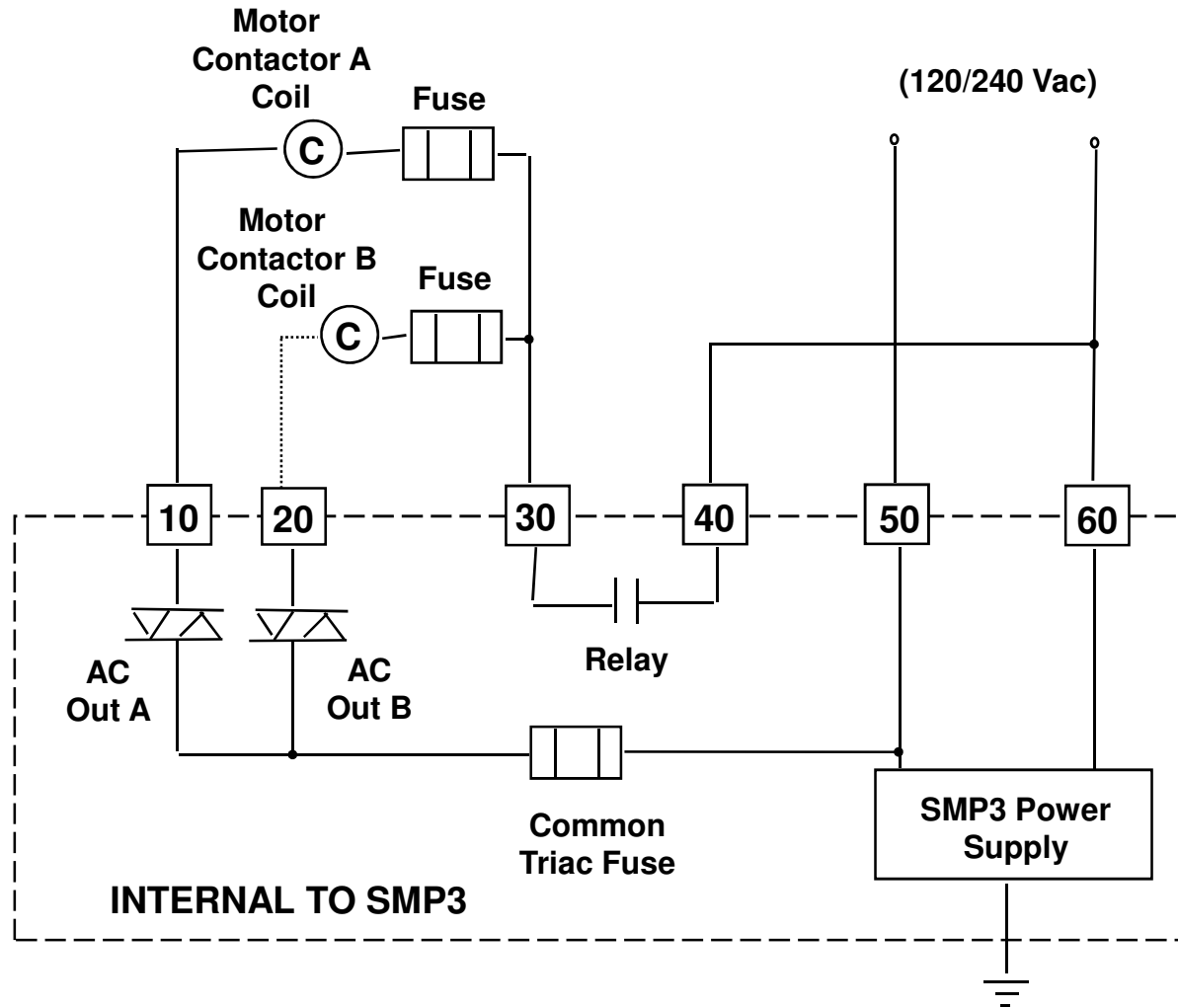
1203/2100 Interface to 1305 AC Drive I/O Data

Word 0 of Output Data

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Function	DESCRIPTION NOP = No State Change
															X	Stop	1=Stop, 0=NOP
														X		Start	1=Start, 0=NOP
													X			Jog	1=Jog, 0=NOP
												X				Clear Faults	1=Clear Faults, 0=NOP
										X	X					Direction	00 = NOP, 01 = Forward 10 = Reverse, 11 = Hold Direction
									X							Local	1=Local, 0=Multiplexed
								X								Mop Increment	1=Increment, 0=NOP
						X	X									Accel Rate	00 = NOP, 01 = Accel Rate 1 10 = Accel Rate 2, 11 = Hold Rate
				X	X											Decel Rate	00 = NOP, 01 = Decel Rate 1 10 = Decel Rate 2, 11 = Hold Rate
	X	X	X													Reference Select	000 = NOP 001 = Ref 1 (Set via Parameter 5) 010 = Ref 2 (Set via Parameter 6) 011 = Preset 3 100 = Preset 4 101 = Preset 5 110 = Preset 6 111 = Preset 7
X																MOP Dec.	1=Decrement, 0=NOP

Word 1 of Output Data

	Speed Reference	0 - 32767 Integer value
Takes Full Speed range (0 - 60HZ normally) and breaks it into 32767 parts		

1203/2100 Interface to 1305 AC Drive I/O Data (Cont.)

Word 0 of Input Data

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Function	DESCRIPTION NOP = No State Change
															X	Enabled	1=Enabled, 0=Not Enabled
														X		Running	1=Running, 0=Not Running
													X			Cmd Direction	1=Forward, 0=Reverse
												X				Rotate Direction	1=Forward, 0=Reverse
											X					Accel	1= Accelerating, 0 = Not
										X						Decel	1=Decelerating, 0=Not
									X							Warning	1=Warning Present, 0=Not
								X								Fault	1= Fault Present, 0=Not
							X									At Reference	1= At Speed, 0 = Not at Speed
				X	X	X										Local	000 = Multiplexed Control 001 = Port 1 has Local Control 010 = Port 2 has Local Control 011 = Port 3 has Local Control 100 = Port 4 has Local Control 101 = Port 5 has Local Control 110 = Port 6 has Local Control 111 = Port 7 has Local Control
X	X	X	X													Reference Selected	0000 = Reference 1 (Parameter 5) 0001/0111 = Presets 1-7 1000 = Ref 2 (Parameter 6) 1001/1110 = Ports 1-6 Direct 1111 = Jog

Word 1 of Input Data

Drives Frequency Feedback	Frequency	16 bit Signed Integer

1203/2100 Interface to 1305 AC Drive
General Information

To make drive go forward, write an 8218 decimal (201A Hex)
to first word of output along with desired speed in the second
output word.

To make drive go reverse, write an 8234 decimal (202A Hex)
to first word of output along with desired speed in the second
output word.

To make drive stop, write an 8201decimal (2009 Hex)
to first word of output.

In 1305 make the following parameter changes to work with 1203.

Parameter   6 = Adapter 2
Parameter 21 = Run FWD/REV
Parameter 92 = 01111110
Parameter 94 = 01111110
Parameter 97 = 01111110

PowerFlex Drives

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PowerFlex Drive Fun Facts

A 20-COMM-D network communication board is used to connect the PowerFlex 70 drive to DeviceNet. Node address and Baud Rate is set via rotary switches. Autobaud is one of the switch selections. Publication 20comm-um002c-en-p is the users manual for the 20-COMM-D

A 22-COMM-D network communication board is used to connect the PowerFlex 40 drive and PowerFlex 4 to DeviceNet. The 22-COMM-D board can NOT be mounted inside a PowerFlex 4 drive, the same as the PowerFlex 40 and can be housed in a 22-XCOMM-DC-BASE unit. This base unit also requires a source of 24VDC power. Also required is a 22-RJ45CBL-CXX serial cable to connect the base to the drive. Consult 22COMM-IN001C-EN-P for more details. Node address and Baud Rate is set via dip switches. Autobaud is one of the switch selections. Publication 22comm-um003a-en-p is the users manual for the 22-COMM-D.

A 20-750-DNET network communication board is used to connect the PowerFlex 755 drive to DeviceNet. Node address and Baud Rate is set via rotary switches. Publication 750com-UM002A-en-p is the users manual for the 20-750-DNET card. NOTE: The Service codes to do scattered reads are different than using a 1203 interface, The service code to do a Scattered Read is 4D hex and to do a Scattered Write is 4E. See chapter 6 of user manual 750com-UM002A-en-p for more details and great explicit messaging examples.

Drives default to an Rx and Tx size of 4 bytes. Datalinks are supported which could add of to 32 bytes of additional data each direction. **Important Note: When using COS messaging and even when enabling Datalinks, the Rx size will always be only 4 bytes.**

Important Note: Both of these boards had a problem uncovered that could cause the board to autobaud at the wrong baud rate. Even with autobaud disabled the boards could change baud rate from what was "locked" in the board. All 22-COMM-D boards should be revision V1.007 firmware or higher!! All 20-COMM-D Series A boards should be revision V1.007 or higher. All 20-COMM-D Series B boards should be revision V2.001 or higher.

PowerFlex Drive Fun Facts

Default data sizes are 4 bytes Tx and 4 bytes of Rx data for most PowerFlex drives <u>except the 700S</u>.
The first 2 bytes of data sent to the most PowerFlex drive are a command word. The second word is the
desired speed/reference word.

Bit 0 of Command Word = Stop
Bit 1 of Command Word = Start
Bit 3 of Command Word = Clear Faults

The first 2 bytes of data received from the PowerFlex drive are a status word and the second word is the
actual speed/feedback word.

PowerFlex 700S drives are 8 bytes of IO data each direction. The lower word of the first DINT is the status or
command data and the upper word is an unused pad word. The second DINT contains the speed feedback or
the reference data as a 32 bit value.

On most PowerFlex 7 class drives, change the following parameters to make the drive work on the network.

Parameter   90 Speed Ref.   = DPI Port 5
Parameter 361 Digital In1 Sel = Not Used
Parameter 362 Digital In2 Sel = Not Used
Parameter 363 Digital In3 Sel = Not Used

CIP Safety on DeviceNet

CIP Safety on DeviceNet Fun facts

- DeviceNet Safety protocol was developed to combine communication to Safety IO products along with standard DeviceNet devices on the same network. There are currently two safety platforms that interface to a DeviceNet Safety network.

- The GuardPLC platform that uses a 1753-DNSI scanner to interface to the network. The DNSI is a stand alone module that communicates back to the GuardPLC via a high speed serial connection. RSNetWorx for DeviceNet software V6.XX or high is used to configure the DNSI for DeviceNet Safety network communications.

- The GuardLogix platform uses a 1756-DNB V6.002 or higher as the network interface. The GuardLogix uses a standard ControlLogix chassis, where the 1756-DNB resides with it. The 1756-DNB is configured using RSLogix5000 software only. This is a major divergence from other DeviceNet scanner modules. See next slide for configuration example.

- As of this date there are only three catalog numbers of IO for a DeviceNet Safety network. A 1791DS-IB8XOB8, 8 inputs, 8 solid state outputs and 4 configurable outputs. A A 1791DS-IB4XOW4, 4 inputs, 4 relay outputs and 4 configurable outputs. A 1791DS-IB12, 12 inputs and 4 configurable outputs.

- DeviceNet Safety communication is RPI triggered, which ultimately causes a COS IO connection to be created on the DeviceNet network. The RPI time, in milliseconds, becomes the heartbeat Input update rate. The DeviceNet Safety packets are Group 1 packets, which reserve the lowest 12 Message ID values, so these packets are always the highest priority of any standard DeviceNet packet on the network.

- CIP Safety has been certified as SIL3/CAT4.

GuardLogix Network Configuration

Below, on the left side you will see the addition of a 1791DS-IB8XOB8/A safety device to the 1756-DNB in RSLogix5000 software. This is the same as EtherNet/IP and ControlNet where the device is found in the IO tree and added under the network master, in this case the 1756-DNB. The image at the right shows one of the configuration tabs within RSLogix5000 to configure the module. RSNetWorx is not needed to configure the DeviceNet network with a GuardLogix system.
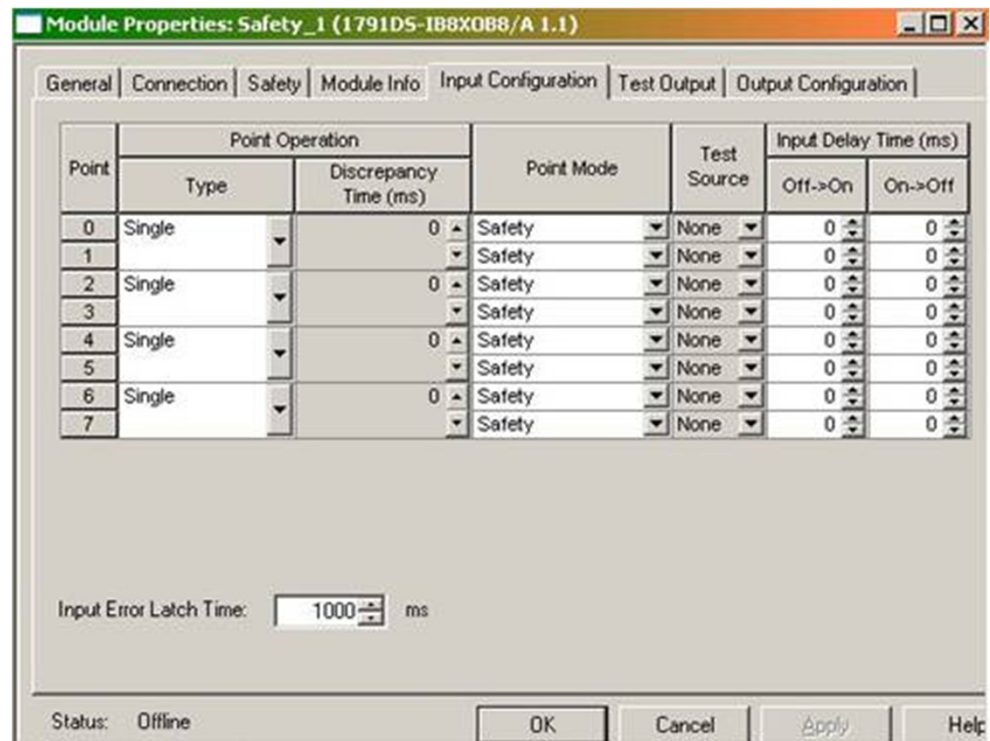
SmartGuard 600

- **Small Safety Controller with built in DeviceNet Support for CIP Safety and Standard DeviceNet devices.**

- **16 In / 8 Out / 4 Pulse Test Sources**

- **CIP Safety on DeviceNet**
  - **Up to 32 connections (DIO blocks)**
  - **Same DIO as for GuardLogix**

- **USB port for DeviceNet configuration and programming**

- **Programs via editor launched from within RSNetWorx**
  - **Uses RSNetWorx to configure DNet**

- **Node address and baud rate switches for easy configuration**

- **UCMM Capable on DeviceNet.**

- **Certified SIL 3, Category 4, UL NRGF, UL Class I Div 2**
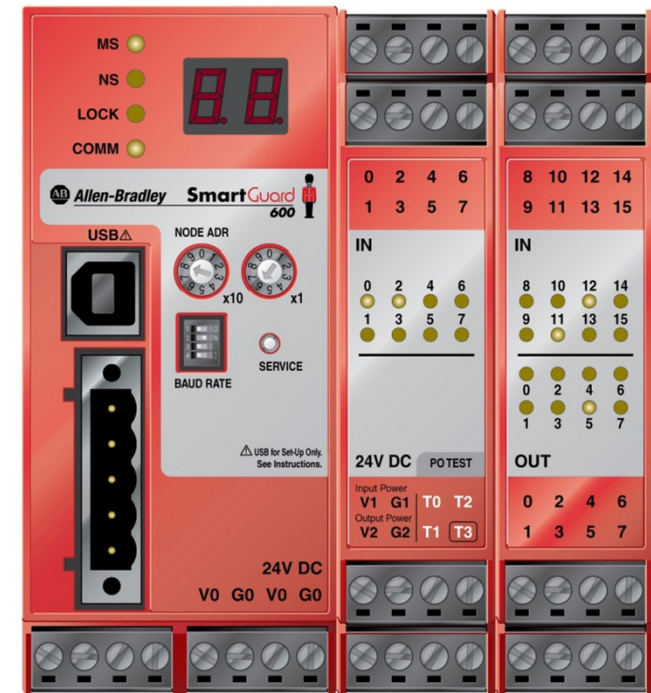
SmartGuard USB Port

- **Program the SmartGuard with RSNetWorx for DeviceNet**

- **Configure the SmartGuard DeviceNet parameters**

- **Configure other devices on DeviceNet**
  - **Limited pass-through capabilities allow you to configure the other devices on DeviceNet, not just the SmartGuard!**

- **Can also a use DeviceNet connection to program and configure the SmartGuard**
  - **PC connected to Ethernet bridging through an ControlLogix ENBT and DNB modules**

- **Programs via editor launched from within RSNetWorx**
  - **Uses RSNetWorx to configure DNet**

- **Simple function block programming**

DeviceNet

CIP Safety
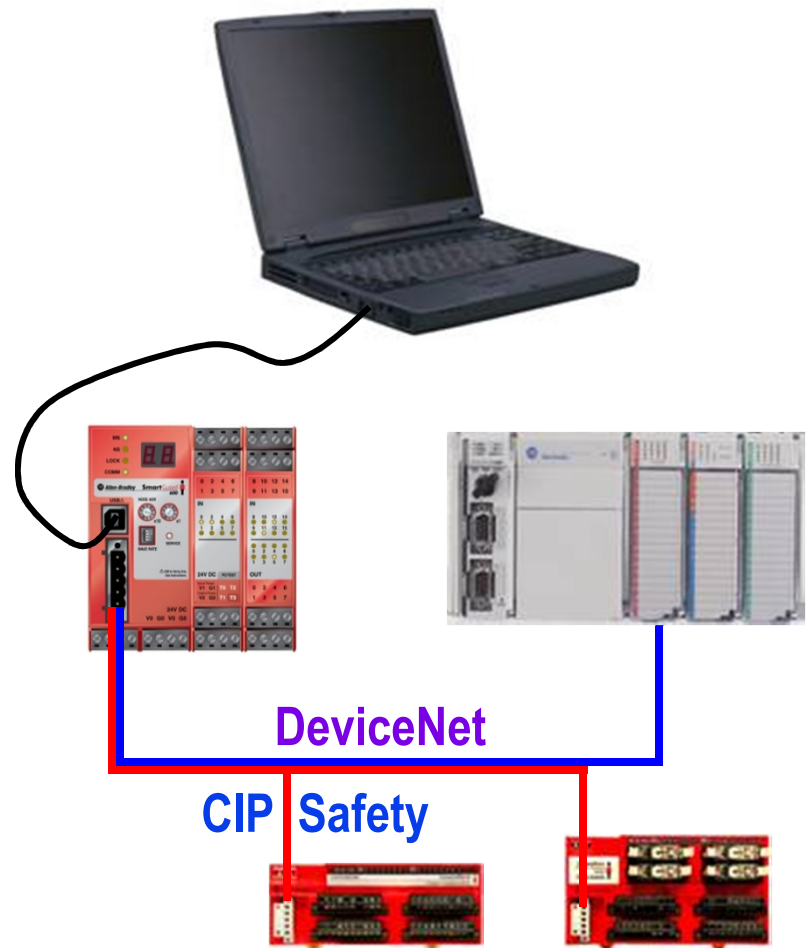
POINT Guard I/O ™

- **GuardLogix V17 with EtherNet/IP communications, provides tight integration**
  - RSLogix 5000 provides the same GuardLogix and Guard I/O user experience for POINT Guard configuration and maintenance
  - Only Compatible with the 1734-PDN adapter when used on a DeviceNet network. Uses the Generic DeviceNet Safety Module profile to configure in RSLogix 5000.

- **Use POINT Guard with other POINT I/O modules and accessories**

- **POINT Guard I/O products available:**

Module	Type
1734-IB8S	8 Pt Safety Sink Input
1734-OB8S	8 Pt Safety Source Output
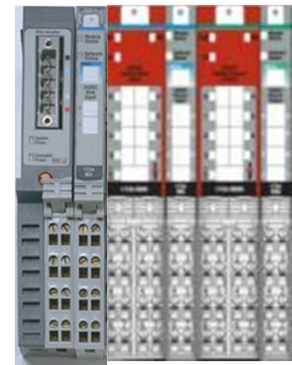
DeviceNet Safety Protocol Details

1 or 2 Byte Single Cast

Mode Byte = 8 bits
Time Stamp = 16 bits

Data Message

| Data 0 | Data 1 | Mode Byte | CRC-8 | CRC-8' | Time_Stamp | CRC-8 |

Producer to Consumer →

1 or 2 byte Data Section

Time Stamp Section

Time Coordination Message

← Consumer to Producer

| Ack_ Byte | Consumer_Time _Value | Ack_ Byte_2 | CRC-16 |

3 to 250 Byte Single Cast

Data Message

| Data 0 | | Data n | Mode Byte | CRC-16 | Data 0 | | Data n | CRC-16 | Time_Stamp | CRC-8 |

Producer to Consumer →

3 to 250 byte Data Section

Time Stamp Section

Time Coordination Message

← Consumer to Producer

| Ack_ Byte | Consumer_Time _Value | Ack_ Byte_2 | CRC-16 |

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Safety Interface Products to Standard DeviceNet

442L-MDNET SafeShield Light Curtain Interface

Presence Sensing Safety Devices

Safety Light Curtain Interfaces
SafeShield DeviceNet Module

DeviceNet CE c(UL)us

Description

The SafeShield DeviceNet interface is a nonsafety rated device that communicates diagnostic information from any SafeShield safety light curtain. In a compact 22.5m DIN rail mounted housing it allows easy wiring and configuration of DeviceNet parameters.

I/O Data

Strobe and Change-of-State Output:

Input Assembly = Status (0)								
Byte 1, Bit	7	6	5	4	3	2	1	0
Status Data	Restart	Beam Strength	Device Warning	Device Fault	0	0	0	OSSD

Input Assembly = Modes (1)								
Byte 2, Bit	7	6	5	4	3	2	1	0
Modes	Restart Mode	Range Mode	Floating Blanking Mode	Fixed Blanking Mode	Resolution Mode	EDM Mode	0	0

Input Assembly = Diagnostic (2)								
Byte 3, Bit	7	6	5	4	3	2	1	0
Diag. Code	Diagnostic Codes							

Input Assembly = Beams (3)								
Byte 4, Bit	7	6	5	4	3	2	1	0
Beam Data	Count of Beams							

440R-H23187/MSR241P Safety Relay

This module interfaces between DeviceNet and a standard MSR200 Safety Relay. The module also has two relay contacts built in that can be controlled over DeviceNet. These contacts could be useful for sending a circuit reset to the MSR200 safety relay.

Node Number and Baud rate are set via DIP switches. DNet connection is via an open style Phoenix connector.

This module consumes 1 byte of data and produces 4 bytes of data.

User manual is MSR241-IN001-EN-P

MSR241 Data Format

Byte Definitions

The table below shows the definition of the module

Consumed output byte

Bit	High	Low
00	K1 energized	K1 de-energized
01	K2 energized	K2 de-energized
02	Reserved	Reserved
03	Reserved	Reserved
04	Reserved	Reserved
05	Reserved	Reserved
06	Reserved	Reserved
07	Reserved	Reserved

Produced Input bytes
Input byte 1: Configuration and status of MSR210 / MSR211

Bit	High	Low
00	Device ready	Monitoring active
01	Interrupt of any input	All inputs valid
02	Cross loop detected	No cross loop
03	Automatic reset	Supervised reset
04	Relay-output active (Safety system)	Relay-output not active (Safety system)
05	EDM dynamic	EDM static
06	EDM-loop open	EDM-loop closed
07	Internal fault or no basic module connected	No internal fault and basic module connected

Input-byte2: Status of Inputs of basic module and extension modules 1, 2 and 3

Bit	High	Low
00	Basic module, input 1 interrupted	Basic module, input 1 valid
01	Basic module, input 2 interrupted	Basic module, input 2 valid
02	Extension module 1, input 1 interrupted	Extension module 1, input 1 valid (or module not existent)
03	Extension module 1, input 2 interrupted	Extension module 1, input 2 valid (or module not existent)
04	Extension module 2, input 1 interrupted	Extension module 2, input 1 valid (or module not existent)
05	Extension module 2, input 2 interrupted	Extension module 2, input 2 valid (or module not existent)
06	Extension module 3, input 1 interrupted	Extension module 3, input 1 valid (or module not existent)
07	Extension module 3, input 2 interrupted	Extension module 3, input 2 valid (or module not existent)

Input-byte3: Status of Inputs of Extension modules 4, 5, 6 and 7

Bit	High	Low
00	Extension module 4, input 1 interrupted	Extension module 4, input 1 valid (or module not existent)
01	Extension module 4, input 2 interrupted	Extension module 4, input 2 valid (or module not existent)
02	Extension module 5, input 1 interrupted	Extension module 5, input 1 valid (or module not existent)
03	Extension module 5, input 2 interrupted	Extension module 5, input 2 valid (or module not existent)
04	Extension module 6, input 1 interrupted	Extension module 6, input 1 valid (or module not existent)
05	Extension module 6, input 2 interrupted	Extension module 6, input 2 valid (or module not existent)
06	Extension module 7, input 1 interrupted	Extension module 7, input 1 valid (or module not existent)
07	Extension module 7, input 2 interrupted	Extension module 8, input 2 valid (or module not existent)

Input-byte4: Status of Inputs of Extension modules 8, 9 and 10

Bit	High	Low
00	Extension module 8, input 1 interrupted	Extension module 8, input 1 valid (or module not existent)
01	Extension module 8, input 2 interrupted	Extension module 8, input 2 valid (or module not existent)
02	Extension module 9, input 1 interrupted	Extension module 9, input 1 valid (or module not existent)
03	Extension module 9, input 2 interrupted	Extension module 9, input 2 valid (or module not existent)
04	Extension module 10, input 1 interrupted	Extension module 10, input 1 valid (or module not existent)
05	Extension module 10, input 2 interrupted	Extension module 10, input 2 valid (or module not existent)
06	Reserved	Reserved
07	Reserved	Reserved

842 Absolute Encoder

842D DeviceNet Absolute Encoder

- Programmable Features
  - Current Position (0 to 67,108,864)
  - Reset to factory default values
  - Counts per revolution (1 to 8192)
  - Revolutions (1 to 8192)
  - Eight Programmable Cams with high/low limits & hysteresis
  - Position change for COS communication
- Diagnostics
  - Cumulative operating time
  - Min/Max acceleration & velocity
  - Current velocity (RPM, RPS or STEPS/SEC)

842D Encoder Fun Facts

Node address and Baud Rate is set via dip switches.

Encoder is NOT UCMM capable and is a Group 2 Only device!!

An additional dip switch can select in a 120 ohm terminating resistor.

A pushbutton is provided to put the encoder back into factory preset mode. Do not push this button unless you consult the user manual first!!!

The encoder supports Polled, Strobed, COS or Cyclic mode of communication.

The Tx size is always zero and the RX size will be either 4, 5 or 8 bytes. The Rx size is determined by parameters 55, 56 and 57 in the EDS file. These parameters allow you to select which assembly you want for any particular message type. The Rx size is 4 bytes if only Position Value is selected, 5 bytes if Position + Flag or Position + Cam State is selected and 8 bytes if Position + Velocity is selected. <u>Note: Position + Velocity is NOT a valid selection for the COS Input Assembly.</u>

Configuration downloads to the 842D only puts the configuration data into ram memory, NOT into nonvolatile memory!! To copy the configuration in ram into the non volatile memory use the CIA editor in RSNetWorx and do a Save service to Class 2F hex and Instance 1 in the 842D. Leave the attribute field blank/Not sent.

With at least V4.001 firmware, if the 842D Encoder is powered up on a network with a Series C or Series D scanner with no scan list entry for the encoder in it, the encoder will always lock up and will cease to communicate on the network. When this happens it will not show up on an RSLinx or RSNetWorx browse. Also, if the scanner has a scan list entry added for the encoder while in this locked up mode, the scanner will display an error 78 error continuously. However, if the encoder is power cycled while the scanner is actively trying to scan it, the I/O connection will establish and the error code 78 will go away.

<u>VERY IMPORTANT: Inside the encoder, the shield pin of the Device Net connector is tied to the encoder case. This could cause ground loops and it is recommended to use KwikLink cables to connect the encoder to the network, which do not have a shield conductor.</u>

1761-NET-DNI DETAILS

1761-NET-DNI

- *Micro*Logix or SLC-500 Slave Data Transfers to DNet Master
    - 32 words of data with Series A DNI and 64 words with Series B DNI.

- Directly Message between other 1761-NET-DNI and other peer to peer capable modules.
    - Standard MSG (read/write) instruction

- Series B module can originate explicit messages

- UCMM Capable Device

- Program/Monitor *Micro*Logix or SLC-500 over DeviceNet
    - DH-485 Functionality

- Fast "local" control on DNet
    - True "distributed" control

- DF1 Full Duplex connection
    - Any existing *Micro*Logix or SLC-500 controller

1761-NET-DNI Fun Facts

Baud Rate is determined via Autobaud and Node address is set via Node Commissioning.

To use RSLogix 500 programming software running over DeviceNet to program a DF1 device connected to a DNI requires V2.0 or higher RSLinx software.

Transmit and Recieve Data sizes are set using the EDS file for the 1761-NET-DNI. <u>Up to 16 words of data each direction with a Series A DNI and up to 32 words each direction with a Series B DNI. Message types supported are COS and POLL.</u>

Series B DNI modules support explicit messages sent onto the network via the user program in the SLC-500 or MicroLogix. The DeviceNet device on other end must be UCMM capable or have an active I/O connection to a master on the network.

When using the 1761-NET-DNI as a slave to another master, a ladder rung is necessary in the MicroLogix to interface to the DNI heartbeat mechanism for proper operation. The least significant byte of both the Transmit and Receive data blocks are reserved for use by the 1761-NET-DNI!!

        Bit 7 of LSB of Input Data   **Bit 7 of LSB of Output Data**

        ────────┤ ├────────────────────────────────( )──────────

The 1761-NET-DNI does not support ADR function in our scanners. The scanners firmware needs to be modified to use the CCV (Configuration Consistency Value) for ADR operations.

Excellent User Manual available   Pub. No. 1761-6.5

XM Product Line DETAILS

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XM Product Offerings

Dynamic

- **XM-120 Standard Dynamic**
  - **XM-120E Eccentricity**
- **XM-121 Low Frequency Dynamic**
  - **XM-121A Absolute Shaft Vibration**
- **XM-122 gSE Vibration**
- **XM-123 Aeroderivative**

- **XM-160 Overall Vibration**
- **XM-161 OA Vibration w/4-20mA Outputs**
- **XM-162 OA Vibration w/ Prox Probe Power**

Speed

- **XM-220 Dual Speed**

Process

- **XM-320 Position**
- **XM-360 Process**
- **XM-361 Universal Temperature**
- **XM-362 Isolated TC Temperature**

Relays

- **XM-440 Master Relay**
- **XM-441 Expansion Relay**
- **XM-442 Voted EODS Relay**

Packaged Products

- **XM-720 Machine Monitor**

Gateways

- **XM-500 Ethernet to DeviceNet**

XM Product Fun Facts

The XM product line is Distributed I/O used for Machine Condition Monitoring and Protection. Io is mounted on the machine and networked back to controller via DeviceNet.

All XM modules have DeviceNet capability built in and needs a separate XM base module to wire to it.

DO NOT connect the V+ from the DeviceNet cable to the DNET V+ pin on the XM module terminal block. This causes possible erratic operation with the XM and module lock ups.

The 24V Common return terminal is DC coupled to earth ground. Do not connect V- from the network cable to this terminal or you could have serious ground loops, which adversely could effect communication.

Each XM module has USB serial capability built into it and by using a 1440-SCDB9FXM2 cable, a computer can be connected to the module. The XM Serial Configuration Utility can be run to configure the XM module.

Baud Rate is determined via Autobaud and Node address is set via Node Commissioning. Node commissioning can also be done via the Serial Configuration Utility. DeviceNet wiring connections are via terminals on the XM base, so a cable with "flying leads" will be necessary.

Multiple XM modules and their bases, together as a rack, will each need a DeviceNet connection. This is normally done via a daisy chaining of the modules in the rack.

XM has their own device that acts as a DeviceNet master scanner on the network. This is called an XM-440 Master Relay. They also have their own Ethernet/IP to DeviceNet gateway called the XM-500.

Interestingly, the XM modules are some of the few devices in DeviceNet land to use multiple IO connection types at the same time. They may use Polled and COS I/O connections at the concurrently to bring back different groups of data back from an XM device. Strobe commands may also be used to trigger an event to an XM module, in parallel with the other Poll and COS connection types.

PanelView and PanelView Plus DETAILS

PanelView Fun Facts

The PanelView on DeviceNet is a UCMM Capable HMI device and supports all 3 DeviceNet baud rates and all PanelView Modes. Connection to the network is via a Phoenix connector attached to the PanelView. PanelBuilder software is used to program the PanelView screens and this software communicates over a serial port to early PanelViews for application transfers. PanelView applications can now be uploaded/downloaded over a DeviceNet network to/from a PanelView. In order to do this make sure that the PanelView communication daughter card is at least firmware revision V1.04 and you must use PanelBuilder32 with at least software revision V3.2 to do this function. If possible use V3.4 for more reliable operation.

The PanelView can be a Polled, Change of State or Cyclic style slave to a network master. It can transfer a maximum of 64 words of data each direction with the TX/RX sizes being determined by the individual application running in the PanelView.

Up to 128 tags in the PanelView can be defined as Client Tags which causes the PV to originate Explicit Messages to another node on the network. Client Tags can only be used for nodes on the network that are UCMM Capable or Group 2 Only that are being proxied for by a UCMM device, such as an SDN or DNB scanner. An Interscan Delay can be set in the PanelView to help throttle these Explicit Messages on the network.

Lastly, tags within the PanelView can also be defined as Server Tags to move data in and out of up 14 data assemblies in the PV. The assembly is defined as Class 4, Instance = 3 thru 16 and attribute always = 3. This data is treated as an array of 64 words for each instance. So if you do an Explicit Message read of an instance you will receive 64 words of data as the reply. If you do an Explicit Message write then you must always write all 64 words. Since the explicit message response block in an SDN scanner is only 32 words long and 3 words are used for overhead, then the first 29 words of each instance is all that can be read into an SDN. Since the explicit message write block in an SDN scanner is only 32 words long and 6 words are used for overhead, then only the first 26 words of each instance is all that can be written to from an SDN scanner.

PanelView Fun Facts

- *All PanelView Models Supported*
- *UCMM Capable Device, All Baud Rates*
- *I/O Slave Messaging*
  - *Change-Of-State/Cyclic/Polled modes supported*
  - *64 words maximum produced/consumed sizes*
- *Explicit Peer-To-Peer Messaging*
  - *Up to 128 Explicit - Client tags*
    - *<u>Can only act as Client to UCMM Capable devices or group 2 only devices being scanned by a master on the network.</u>*
    - *outputs scanned continually using explicit "Get"*
    - *inputs "Set" on change-of-state*
    - *adjustable InterScan Delay*
  - *Explicit - Server tags grouped into any/all of 14 assemblies*
  - *64 words maximum size per tag or assembly*
- *Data is always from scanner point of View. Inputs from screens in PV are designated as I: addresses while display data on PV comes from O: addresses.*

UCMM Capable Devices

UCMM stands for Unconnected Message Manager which is a style of messaging that is supported by a UCMM capable device. These devices can respond to explicit messages directly. Group 2 devices use the predefined message set to communicate and require a master on the network to proxy for them for certain explicit messages.

Device Name	Connection Mechanism
Flex I/O	1794-ADN
PointI/O	ONLY with 1734-ADN, Group 2 with 1734-PDN or PointBlock I/O
1398 ULTRA 100 Servo Drive	Direct
Bulletin 825 Motor Manager	825-MDN Card
MicroLogix Adapter	1760-NET-DNI
AdaptaScan Barcode Reader	Direct
ScanPort Adapter	1203-GK5, 1203-GM5, 1203-GU6, 1203-GM6, 2100-GK61
Bulletin 150 SMC Dialog Plus	ScanPort Adapter 1203-GK5,GU6,GM5,GM6,2100-GK61
1305 AC Drives	ScanPort Adapter 1203-GK5,GU6,GM5,GM6,2100-GK61
1336 AC Drives	ScanPort Adapter 1203-GK5,GU6,GM5,GM6,2100-GK61
1394 Multi-Axis Motion Control	ScanPort Adapter 1203-GK5,GU6,GM5,GM6,2100-GK61
1397 DC Drive	ScanPort Adapter 1203-GK5,GU6,GM5,GM6,2100-GK61
1557 Medium Voltage Drive	ScanPort Adapter 1203-GK5,GU6,GM5,GM6,2100-GK61
Powermonitor II	1403-MDNET
SMartGuard 600	

PanelView Plus Fun Facts

- *The PanelView Plus HMI can be a master or slave on the DeviceNet network. The DeviceNet configuration is done the same as any other scanner on the network using RSNetWorx for DeviceNet software.*

- *The PanelView Plus configuration requires the correct EDS file be registered in the software. When registered, the PanelView Plus shows up under the Communication Adapter of the hardware list.*

- *The PanelView Plus HMI screen configuration is done using RSView Studio software.*

- *As a master scanner the Input and Output Image tables are both 1024 integers (16 bits wide) big.*

- *IMPORTANT!! The new PanelView Plus6 product line does NOT support DeviceNet. A short sighted decision in the eyes of Dr. DeviceNet!! However, there are 15 different, configured DNet capable PanelView Plus versions still available for sale. Catalog numbers are shown below and Knowbase 521346 also contains more important details.*

DeviceNet	
2711P-T7C10D2	PVP 7" Touch, DC, 128 MB, & DNET Card
2711P-T7C10D6	PVP CE 7" Touch, DC, 128 MB, & DNET Card
2711P-B7C10D2	PVP 7" Combo, DC, 128 MB, & DNET Card
2711P-B7C10D6	PVP CE 7" Combo, DC, 128 MB, & DNET Card
2711P-T10C10D2	PVP 10" Touch, DC, 128 MB, & DNET Card
2711P-T10C10D6	PVP CE 10" Touch, DC, 128 MB, & DNET Card
2711P-B10C10D2	PVP 10" Combo, DC, 128 MB, & DNET Card
2711P-T12C10D2	PVP 12" Touch, DC, 128 MB, & DNET Card
2711P-T12C10D6	PVP CE 12" Touch, DC, 128 MB, & DNET Card
2711P-B12C10D2	PVP 12" Combo, DC, 128 MB, & DNET Card
2711P-B12C10D6	PVP CE 12" Combo, DC, 128 MB, & DNET Card
2711P-T15C10D2	PVP 15" Touch, DC, 128 MB, & DNET Card
2711P-T15C10D6	PVP CE 15" Touch, DC, 128 MB, & DNET Card
2711P-B15C10D2	PVP 15" Combo, DC, 128 MB, & DNET Card
2711P-B15C10D6	PVP CE 15" Combo, DC, 128 MB, & DNET Card

EXPLICIT MESSAGING

1756-DNB Explicit Messaging

- Invaluable for accessing information within a device on DeviceNet that is not normally available as I/O data to the 1756-DNB. This data is brought back directly to user program for extra diagnostics and status. Configuration of the device can also be dynamically changed from user program if desired.

CLX Program with MSG instructions to access any of the 76 configuration, status and diagnostic parameters within the E3
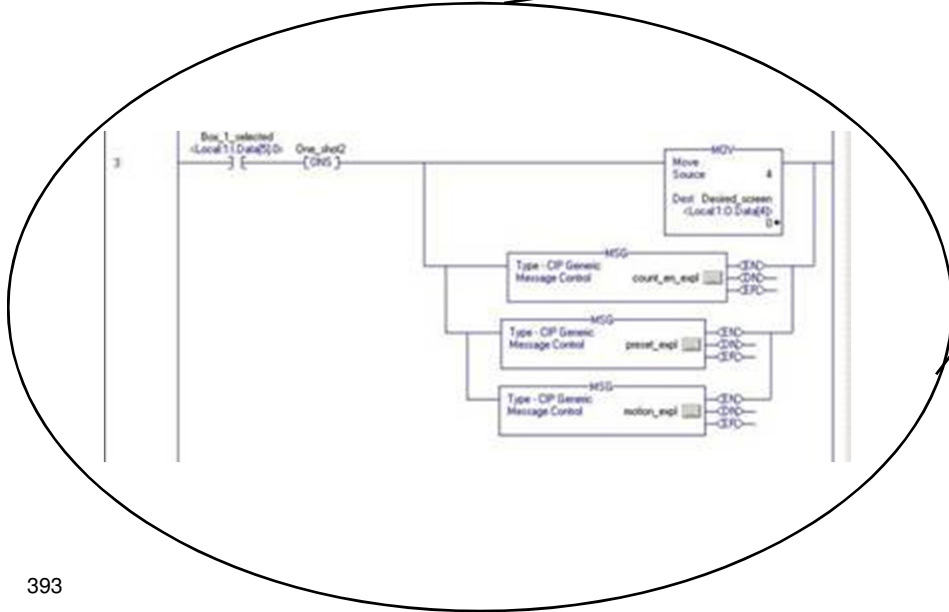
1756-DNB

#33
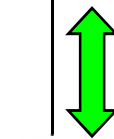
ID			Parameter	Current Value
1			L1 Current	0.00 Amps
2			L2 Current	0.00 Amps
3			L3 Current	0.00 Amps
4			Average Current	0.00 Amps
5			L1 %FLA	0 %
6			L2 %FLA	0 %
7			L3 %FLA	0 %
8			Average %FLA	0 %
9			% Therm Utilized	0 %
10				
11			Current Imbal	0 %
12			OL Time To Trip	9999 Sec.
13			OL Time To Reset	9999 Sec.
14			Trip Status	XXX00000 00000000

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DeviceNet Object Details

DeviceNet Communication uses Class, Instance and Attributes to determine which data areas in a device are accessed.
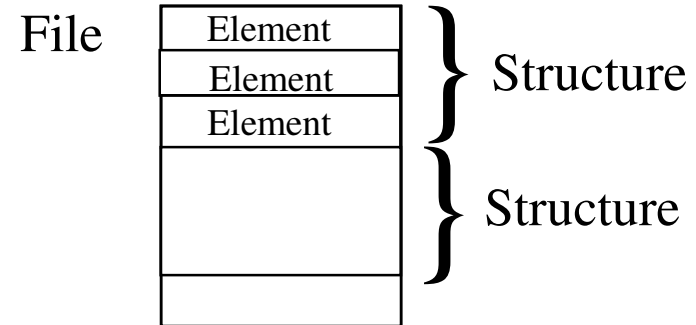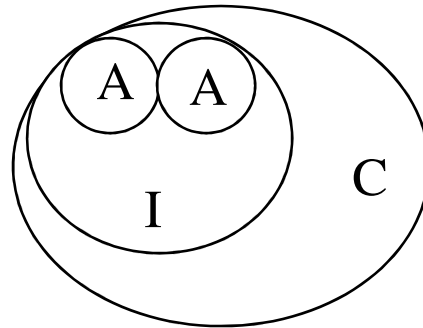
To use a PLC Datatable Format as an analogy Class = File, Instance = Structure and Attribute = Structure Element.

Inside a device's EDS file is all of the Class, Instance, Attribute information used by the configuration software to access data within the device. For each parameter, in the EDS, there will be a path to point to where the data resides in the device. Below is an example of what a path looks like for parameter 1 of a device.

Param1 =	$ Output
0,	$ Data Placeholder
6, "20 04 24 01 30 02",	$ Path size and Path to Output Attribute

The path is in hexadecimal and is inside the " ". The value 20 means the next number is the Class, a 24 means the next number is the Instance and a 30 means the next number is the Attribute. So for this example Class = 4, Instance = 1 and Attribute = 2.

Statement of Compliance

Each device's DeviceNet statement of compliance (Appendix B of most User Manuals) should describe which Class, Instance Attribute combinations are supported and what is the data format.

Identity Object – Class Code 0x01

The following class attributes are supported for the Identity Object:

Table B.C Identity Object Class Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Revision	UINT	1

A single instance of the Identity Object is supported. The following instance attributes are supported.

Table B.D Identity Object Instance Attributes

Attribute ID	Access Rule	Name	Data Type	Value
1	Get	Vendor ID	UINT	1
2	Get	Device Type	UINT	3
3	Get	Product Code	UINT	For -E3 units: product code = current range * 2 + 1 For -E3 Plus units: product code = current range * 2 + 2
4	Get	Revision Major Minor	Structure of: USINT USINT	 1 2
5	Get	Status	WORD	0 = Not owned 1 = Owned by master

DeviceNet Object Examples

For any power product connected through any scanport to DNet adapter such as a 1305 Drive, 1336 Drive or 150 Dialog Plus, the entire parameter list is accessible using the Parameter Object defined below:

Class =   15 decimal (F hex)
Instance = Device Parameter number
Attribute = 1

Bulletin 160 Ac Drive entire parameter list is available through:

Class =   100 decimal (64 hex)
Instance = 1
Attribute = Bulletin 160 Parameter number

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1747-SDN and 1756-DNB Special Data Objects

Any 1747-SDN scanner firmware version V4.01 or greater, 1756-DNB, 1788-CN2DN, and 1784-PCIDS has some special areas of memory accessible by using Explicit Messaging.

Read Slave Device Status :

Class =   144 decimal (90 hex)
Instance = 1
Attribute = 10 decimal   Faulted Node Table   (Byte [8])   1 bit per node
              11 decimal   Idle Mode Table   (Byte [8])   1 bit per node
              12 decimal   Node Status Table   (Byte [64])   1 byte per node (node error)
              13 decimal   Scanner Run/Idle   (Byte)   0 = idle, 1 = run
              14 decimal   Scan Counter   (Byte[4])   32 bit counter value
              21 decimal   Device Active Table (Byte [8])   1 bit per node

Activate Scan List Entry in Scan List:

Class =   145 decimal (91 hex)
Instance = Node Number + 1
Attribute = 1   (Byte)

(Writing a 0 disables the scanlist entry and writing a 1 enables the scanlist entry)

Scanner Special IO Data Objects

Any1747-SDN scanner firmware version V4.01 or greater can have it's I/O data accessible by using Explicit Messaging.

Read 1747-SDN I/O areas using Get Attribute Single service:

Class   4 (assembly object)

Instance 100 (Discrete Output Image)

Instance 101 (Discrete Input Image)

Instance 102 (M0 File)

Instance 103 (M1 File)

Attribute 3

Read all other DML based scanners areas using Get Attribute Single service:

Class   4 (assembly object)

Instance 100 (Output Image)

Instance 101 (Input Image)

Attribute 3

FlexI/O Module Object

Any module installed in a FlexI/O rack with a 1794-ADN can have data accessed using the FlexI/O Module Object

Class =   **125 decimal (7D hex)**

Instance = **Slot Number (1 thru 8)**

Selected
Attributes =   **5**   **Module Bad Flag**   **Boolean**   **0 = Module Good, 1 = Module Bad**

                7   **Module ID Word**

		Upper Nibble | Lower Nibble
8 **Read Sizes Byte**		**Status Size** | **Input Size**
9 **Write Sizes Byte**		**Config Size** | **Output Size**

              10   **Input Data**   **Array of Words**
              11   **Status Data**   **Array of Words**
              12   **Output Data**   **Array of Words**
              13   **Config Data**   **Array of Words**
              14   **Safe State Data**   **Array of Words**

Even More Handy Data Objects

Read the CCV from a DeviceNet device. CCV is the checksum of entire device configuration and may not be supported by all devices.

Class   **1**   **(Identity object)**

Instance   **1**

Attribute 9

Size   **2**   **bytes**

Bus-Off Counter of a device.

Class   **3**   **(DeviceNet object)**

Instance   **1**

Attribute 4

Size   **1**   **byte (0 to 255)**

Node number of device. Remember that on most devices, the new node number is only read on powerup!!

Class   **3**   **(DeviceNet object)**
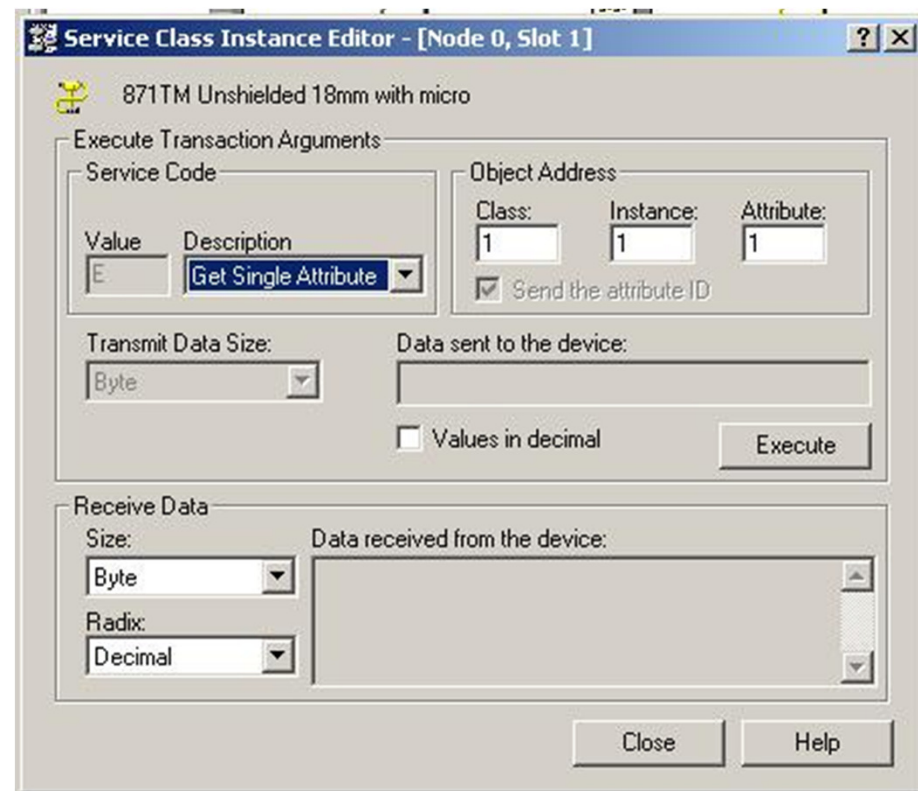
Instance   **1**

Attribute 1

Size   **1**   **byte (0 to 63)**

Class Instance Attribute Editor

The Class Instance Attribute Editor within RSNetWorx for Device Net allows accessing of all Data Objects within a device. Very useful in determining the existence and details of data objects to be accessed from explicit messaging feature.

The Reset Service

The Reset Service, 05 service code is used to reset devices and data objects over the DeviceNet network. This could be a simple power up reset or a complete reset back to factory defaults. The Reset Service, sent to different data objects, could either reset the module or just the data object. When executing a Reset Service DO NOT send any data in the message.

It is of course necessary for the device to be able to receive messages on the network. A device that is the Bus Off condition is normally not be able to receive messages over the network so will not respond to a reset service.

This service can be sent via explicit messaging or the class instance attribute editor in RSNetWorx for Device Net software. If done through explicit messaging, with the ControlLogix, it is best to use the Custom Service Type and enter 05 manually as the Service Code. This will allow you to enter a non-zero attribute. The Source Length must also be a 0 so no data is sent.

Reset Service Examples:

Service	Class	Instance	Attribute	Data	Description
05	1	1	0	None	Power up reset
05	1	1	None	0	Power up reset
05	1	1	1	None	Reset to Factory Defaults
05	1	1	None	1	Reset to Factory Defaults
05	F hex	0	None	1	FlexI/O Factory Default Setting.
05	91 hex	0	1	None	Clear Scanners Scan List in Ram Only
50 hex	91 hex	0	1	None	Commit Scan List from Ram to Flash memory. (Can only be done with scanner in Idle mode)

General Explicit Messaging Info

Knowbase document #16404 has more detailed information about the data object formats used for explicit messaging and is a must read.

1203-GK5 firmware revision V1.8 or later successfully supports Multiple Reads. 1203-GK5 firmware revision V1.9 or later successfully supports Multiple Reads and Multiple Writes.

IMPORTANT: 1203-GK5, 1203-GU6 or 2100-GK61 are the only devices on DeviceNet that support Get Attribute Multiple and Set Attribute Multiple explicit messages. All other devices need to use the Get Attribute Single and Set Attribute Single messages.

**Size field always shows number of bytes and should contain total size of Transaction Body.**

TXID field should be incremented after every explicit message packet.

Each product's DeviceNet statement of compliance (Appendix B of User Manuals) will tell you which Class, Instance and Attributes are available to Explicit Messages. <u>The Class Instance Attribute Editor Utility, in RSNetworx for Device Net software, is invaluable for testing existence and size of data objects in a device.</u>

As a rule, all devices connected to a 1203-GK5 support the Parameter Object which means Class 15, Instance = Device Parameter and Attribute = 1. Some examples follow that show more detail.

Explicit messaging should NEVER be used to transfer real time data for control purposes. Explicit messages are lower priority messages on the wire and devices may respond quite slowly to explicit messages. Also, if explicit messages are being done to a device that has no I/O connection to it from a master scanner, that device will have no knowledge if the explicit message originator falls off the network or stops sending messages. This becomes dangerous if active outputs are being sent to the device as explicit messages.

General Explicit Messaging Info for 1756-DNB
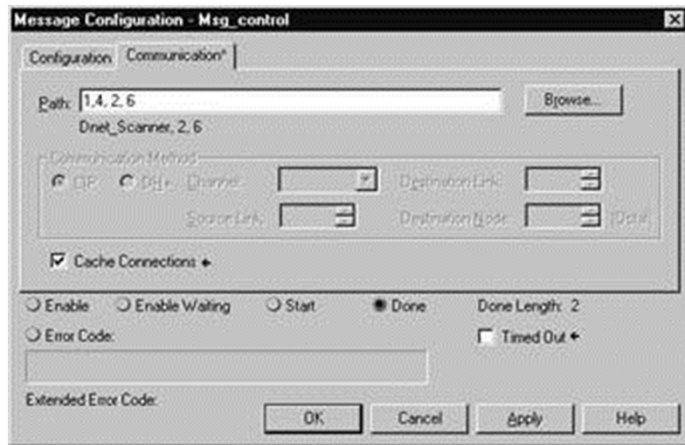
1756-DNB uses a CIP Message instruction in ladder logic to do explicit messaging. The path, under the Communication tab selects which node, through which DNB, will receive the message. The Service Code, Class, Instance and Attribute fields are set in the Configuration tab. The screen captures show a "Get Attribute Single" message configuration which reads data from a device.
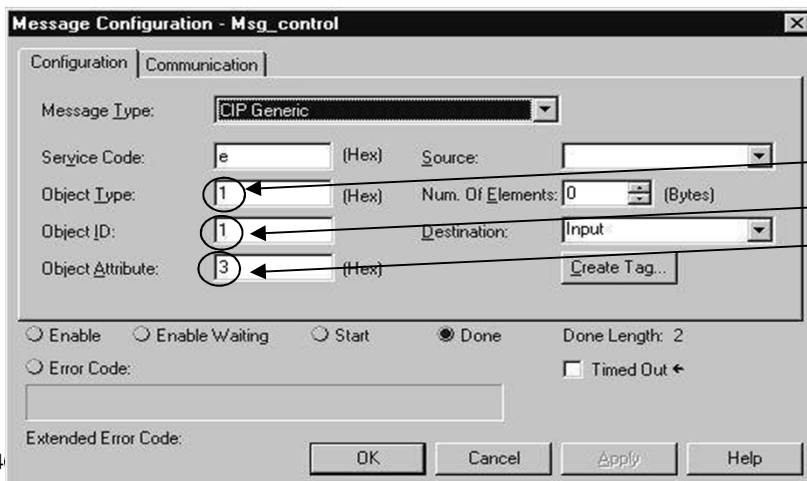
Class Field
Instance Field
Attribute Field

BT/M0 WRITE PACKET

15	0	1771-SDN	1747-SDN
TXID	COMMAND	Word 0	M0 Word 224
PORT	SIZE	Word 1	M0 Word 225
SERVICE	MAC ID	Word 2	M0 Word 226
Transaction Body (29 words)			
		Word 31	M0 Word 256

Port = 0 = Channel A
Port = 1 = Channel B

Command = 1 = Execute the Block
Command = 3 = Clear all Response Buffers
Command = 4 = Clear Response Buffer (1747-SDN Only)

Service = 0x0E = 14 = Get Attribute Single
Service = 0x10 = 16 = Set Attribute Single
Service = 0x32 = 50 = Get Attribute Multiple
Service = 0x34 = 52 = Set Attribute Multiple

Explicit Message Information

BT/M1 READ PACKET

15	0	1771-SDN	1747-SDN
TXID	STATUS	Word 0	M1 Word 224
PORT	SIZE	Word 1	M1 Word 225
SERVICE	MAC ID	Word 2	M1 Word 226
Body of Data (29 words)			
		Word 31	M1 Word 256

Status = 0 = Transaction Block Empty
Status = 1 = Transaction Successful
Status = 2 = Transaction in Progress
Status = 3 = Slave not in scan list
Status = 4 = Slave offline
Status = 5 = DeviceNet port disabled
Status = 6 = Transaction TXID unknown
Status = 7 = Unused
Status = 8 = Invalid Command
Status = 9 = Scanner Out of Buffers
Status = 10 = Other transaction in progress
Status = 11 = Could not connect to slave device
Status = 12 = Response data too large for block
Status = 13 = Invalid port
Status = 14 = Invalid size specified
Status = 15 = Connection Bust

Explicit Messaging General Info for 1747-SDN

1747-SDN scanner should be updated to V3.01 firmware before attempting Explicit Messaging.

M0 file area words 224 through 256 contain a 32 word area to execute an Explicit Message Request write to the 1747-SDN.

M1 file area words 224 through 256 contain a 32 word area to execute an Explicit Message Response read from the 1747-SDN.

Explicit Message Sequence of Events:

1) **Put Explicit Message Request data into a file in the SLC-500 and using the file copy instruction (COP) in the SLC-500, copy the data to the M0 file, words 224 through 256. Minimum data size is 6 words for an Explicit Message Request and maximum size is 32 words.**

2) **Wait until bit 15 of 1747-SDN Module Status Register goes to a 1 which tells you that a response has been received by the 1747-SDN.**

3) **Using the file copy instruction (COP) in the SLC-500, copy the data from M1 file words 224 through 256 into a file in the SLC-500, size of 32 words. This file will contain the Explicit Message Response. Test TXID field of this file to make sure it matches Explicit Message Request TXID value.**

4) **Using the Move instruction (MOV) in the SLC-500, copy a word from a file into M0 file word 224. The upper byte of this word should be the TXID of the Explicit Message just executed and the lower byte should contain a 4 which is the command to clear out the response buffer. After this move is executed, bit 15 of the 1747-SDN Module Status Register should go to a 0 and the next Explicit Message can be executed starting at step 1.**

Explicit Messaging Example Ladder logic for1747-SDN
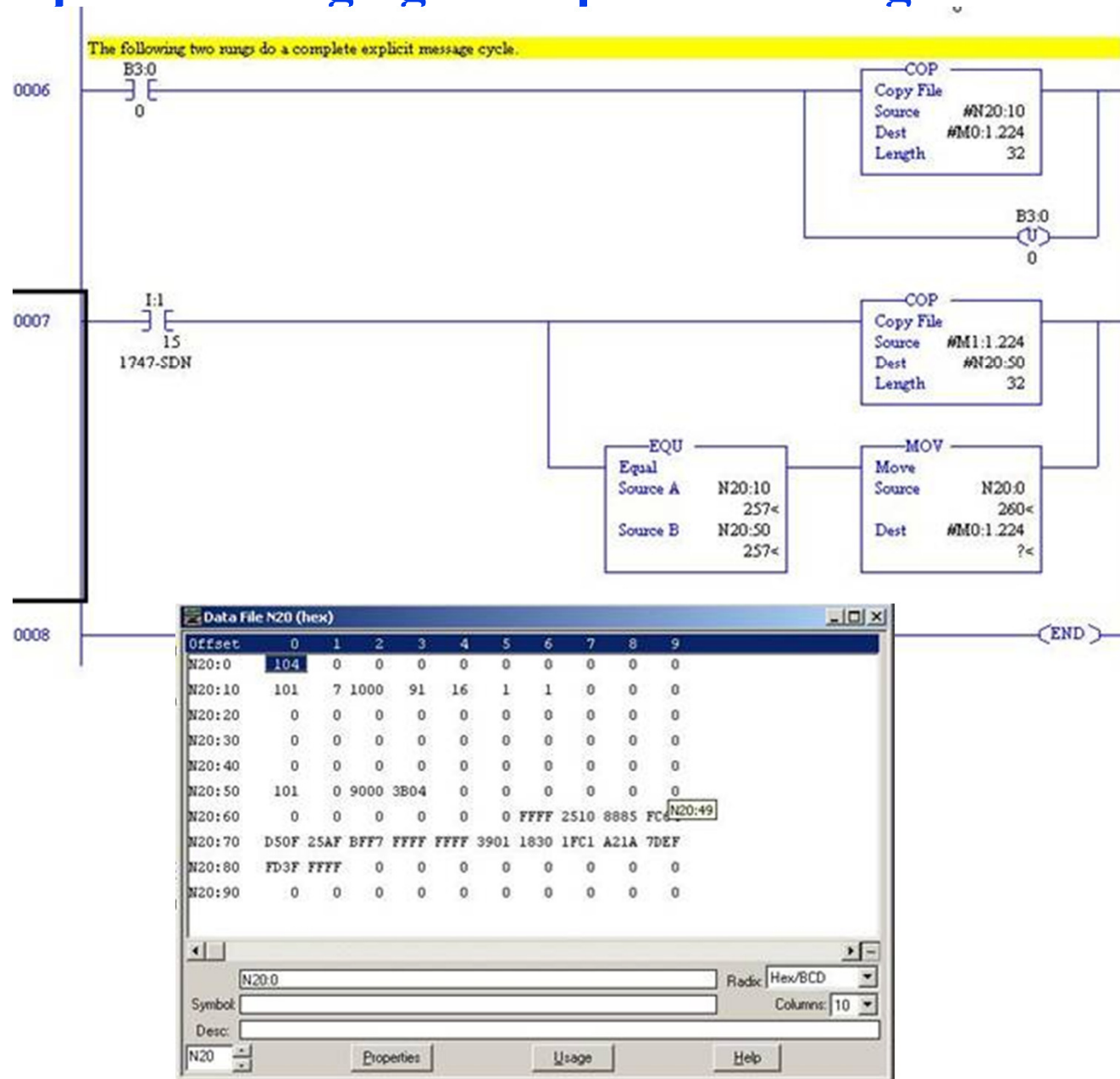
Explicit Messaging Info for MicroLogix 1500 and 1769-SDN

Explicit Messaging is done with a MicroLogix 1500 using a Message instruction in ladder logic. The example below, is a Get Attribute Single read of the Identity Object vender code from node 20 on a DeviceNet network through a 1769-SDN in slot 1.

General Explicit Messaging General Info for 1771-SDN

1771-SDN scanner should be updated to V3.04 firmware before attempting Explicit Messaging.

2 explicit message commands can be sent in each Block Transfer Write. The 64 word BTW is split into two separate 32 word explicit message packets.

Some devices could take seconds to respond to an explicit message. So make sure your logic will constantly allow your BTR to execute until a response packet returns with the same TXID as the outgoing request. Then decode the response.

Explicit Messaging Example Ladder logic for1771-SDN

Figure 6.3, started in Chapter 5, *Ladder Logic Programming*, shows an example PLC ladder logic program that sends an explicit message. The message sent is contained in N30, beginning at word 0. The response data will appear in N30 starting at word 70.

Figure 6.3
PLC Messaging Example

T X I D	C M D / S T A T U S	P O R T	S I Z E	S E R V I C E	M A C I D	C L A S S	I N S T A N C E	A T T R I B U T E	
							Parameter		
01	01	00	06	0E	20	000F	0001	0001	BTW Request for Single read of Parameter number 1 from 1305 node 32
						Data			
01	01	00	02	8E	20	000A			BTR Response of 000A for Parameter 1 from 1305 node 32
							Parameter	Data	BTW Request of Single write of 000B to 1305 Parameter 5
02	01	00	08	10	23	000f	0005	0001	000B
						Status			
02	01	00	02	90	23	0000			BTR Response of Success from 1305
03	01	00	0E	32	15	0093	0000	0000	BTW Request to read multiple 1305 Parameters number 8 and 9

Parameter	Constant	Parameter	Constant
0008	0001	0009	0001

				Parameter	Data	Parameter	Data	
03	01	00 08	B2 15	0008	0005	0009	0002	BTR Response of 0005 for Parameter 8 and 0002 for Parameter 9 from 1305

T X I D	C M D / S T A T U S	P O R T	S I Z E	S E R V I C E	M A C I D	C L A S S	I N S T A N C E	A T T R I B U T E	
04	01	00	0E	34	11	0093	0000		**BTW Request to write to multiple 1305 Parameters number 1 and 4**

Parameter	Data	Parameter	Data
0001	0008	0004	0006

T X I D	C M D / S T A T U S	P O R T	S I Z E	S E R V I C E	M A C I D	Parameter	Status	Parameter	Status	
04	01	00	08	B4	11	0001	0000	0004	0000	**BTR Response to multiple write of Success for Parameter 1 and Parameter 4 from 1305**

T X I D	C M D / S T A T U S	P O R T	S I Z E	S E R V I C E	M A C I D	C L A S S	I N S T A N C E	A T T R I B U T E	
05	01	00	06	10	12	0094	0000	0002	**BTW Request to do an EEPROM burn in the 1305**
05	01	00	02	90	12	0000			**BTR Response to request for EEPROM burn of Success from 1305**

DDE/OPC Data Transfers

DDE/OPC Fun Facts

Version 2.1 or greater of RSLinx has DDE/OPC capability which allows data to be read from devices on a DeviceNet network into other applications running on the PC. Accessing this data can done manually using the Class, Instance, Attribute data designators or more importantly can be done via EDS parameters. If a valid EDS file for a device is installed into RSLinx, then individual parameters for that device can be accessed without having to know the magic values of Class, Instance, Attribute determined by your magic decoder ring.

Important: As late as V2.42 of RSLinx has a behavior when doing DDE/OPC communication that can lock a master scanner off the network to a Group 2 Only device. If an application such as RSView or the IntelliCenter software is doing DDE/OPC communication directly to a Group 2 Only device and the scanner module is removed from the network for more than 10 seconds, the scanner will not be able to reestablish an I/O connection to the device. The scanner will display an error 83 error and the devices node number. The only way to recover is to shut down the application using the RSLinx DDE/OPC topic and wait more than 10 seconds. The scanner will reestablish the I/O connection and the error 83 will go away.

DDE/OPC Fun Facts

The sequence of events to do a DDE/OPC link is as follows:

1) **Select "DDE/OPC" from tool bar of RSLinx.**

2) **Click on "New" and enter new topic name.**

3) **Browse to desired device on your DeviceNet network using RSLinx browse mechanism.**

4) **Under the "Data Collection" tab, select "DeviceNet" for the "Processor Type".**

5) **Click on "Apply" and then "Done".**

6) **Click on "Edit" in the RSLinx tool bar and then on "Copy DDE Link to Clipboard".**

7) **Select desired topic and enter "Data Table Address" of desired data. See next slide for details.**

8) **"Paste Special" the link into desired Application.**

DDE/OPC Datatable Addressing

When copying DDE Link to Clipboard the Datatable Address can be specified from the EDS file if one exists for the device or can be entered manually using the tag format shown here. For manual entry the DDE/OPC topic must be entered first in [].So the address format would be **[DDE/OPC Topic]Class:Instance:Attribute,Type Descriptor**

Copy DDE Link to Clipboard

This sets up an Edit/Copy Link. Other programs may use this to initiate a DDE connection. Use their Edit/Paste Link command.

Current Project: Default

Topic:
- DSA_Stuff
- DSFSDF
- Id_Segment
- NEW_TOPIC

Data Table Address: Analog_Output,L1,C1

- Autobaud
- Fault_State
- Idle_State
- Input_1_Value
- Input_2_Value
- Input_3_Value
- Input_4_Value
- Input_Status
- Off-to-On_Delay
- On-to-Off_Delay
- Output_1_Status
- Output_1_Value
- Output_2_Status

Block Size:

Columns per Row:

OK | Cancel | Help

How to...

Help Topics | Back | Options

Enter a tag for a DeviceNet topic

To manually enter tag for a DeviceNet topic, the format is
<class>:<instance>:<attribute>,<type descriptor>

For example, **14:1:8,u8** reads an unsigned byte of data.

Tip: If you installed RSNetworx for DeviceNet or the EDS files with RSLinx, you can use the EDS file parameter instead of this format. If you use the EDS parameter name, you do not need the <type descriptor>.

The following OPC/DDE item modifiers exist for the <type descriptor>:

u0	Boolean
u8	Byte
u16	Unsigned Word
u32	Unsigned Long
u64	Unsigned Double
s0	Boolean
s8	Char
s16	Word
s32	DWord
s64	Double
str1	short string (1 byte length and string)
str2	string (2 byte length and string)
arr0	Boolean array
arr8	Byte array
arr16	Word array
arr32	DWord array
arr64	Double array
f32	32-bit float
f64	64-bit float
arrf32	32-bit float array
arrf64	64-bit float array

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DTAM PLUS and Micro Details

Dtam Micro Fun Facts

DTAM Micro connects directly to DeviceNet via a 9 pin DB - 9 pin connector on the unit itself. 24VDC also needs to be supplied to Power connector on unit.

Node number, baud rate, Input Size and Output Size are set via the keypad on the DTAM Micro. DTAM Micro is a polled device with Transmit and Receive data sizes being determined by the Input and Output Size entered on its keypad NOTE: Input and Output sizes in the DTAM Plus are entered as number of WORDS.

DTAM Micro Menus are entered using DPS software on a PC and sent serially to the DB-9 RS-232 port located on the unit. The DTAM Micro firmware can be updated using DPS and the serial connection.

DeviceNet Manager 2.0 or higher contains an application note for DTAM Plus in Help screens, which is identical to DTAM Micro except for number of display lines on unit.

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DTAMPlus Fun Facts

DTAM Plus connects directly to DeviceNet via a 5 pin Phoenix connector on the unit itself. Publication 2707 - 800.5 describes the DeviceNet compatible version.

Node number, baud rate, Input Size and Output Size are set via the keypad on the DTAM Plus. DTAM Plus is a polled device with Transmit and Receive data sizes being determined by the Input and Output Size entered on its keypad NOTE: Input and Output sizes in the DTAM Plus are entered as number of WORDS.

DTAM Plus Menus are entered using DPS software on a PC and sent serially to a DB-9 RS-232 port located on the unit. The DTAM Plus firmware can be updated using DPS and the serial connection.

DeviceNet Manager V2.0 or higher contains an application note for this product in Help screens.

BULLETIN 825 SMART MOTOR CONTROLLER DETAILS
& BULLETIN 150
DIALOG PLUS

BULLETIN 825 SMART MOTOR Fun Facts

825-MDN card is used to connect Bulletin 825 Smart Motor Manager to DeviceNet network. Publication 825 - 5.0 contains information for Bulletin 825 only.

UCMM Capable Device

Node number and baud rate are set via the keypad on front of the Bulletin 825. 825-MDN is a polled device with Transmit and Receive data sizes and data formats being selected using the EDS file. INPUT ASSEMBLY and OUTPUT ASSEMBLY parameters of EDS file are used.

Bulletin 825 has a set of dry contacts used in series with motor starter coil to drop out the contactor in case of fault. NOTE: However these contacts can NOT be used to routinely start and stop the motor.

The firmware of the Bulletin 825 is upgraded using the NVS update tool in the GTS Toolkit.

BULLETIN 150 SMC DIALOG PLUS Fun Facts

1203-GK5 or other scanport adapter is used to connect Bulletin 150 Dialog Plus to DeviceNet network. Publication 150 - 5.3 contains information for Bulletin 150.

Node number and baud rate are set via the dipswitches on the 1203-GK5. Bulletin 150 is a polled device with Transmit and Receive data sizes being 4 bytes each.

Bit 0 of Output word 0 is Stop Bit (1 = Stop), Bit 1 is Start Bit (1 = Start) and Bit 3 is Clear Faults Bit (1 = Clear Faults).

Parameter 85 of Dialog Plus (Logic Mask) must be set to a 4 to be enable the starting and stopping of the motor over the network.

Powermonitor Details

Powermonitor II Fun Facts

1403-NDNETcard is used to connect Powermonitor II to DeviceNet network.

Publication 1403-5.4 contains information for DeviceNet communications and is essential to correctly use this device on DeviceNet.

UCMM Capable Device

Node number and baud rate are set via node commissioning via the network using RSNetWorx for DeviceNet or DeviceNet Manager software.

Transmit size is always 4 bytes and Receive data size defaults to 8 bytes out of box. Polled, Change of State and Cyclic communications are supported.

Explicit messaging is used to get the majority of data from Powermonitor II back into the controller. By writing to Class 4, Instance 3, Attribute 3 up to 26 words of data, you can request a maximum of 22 parameters be sent back from the Powermonitor II. The requested data can be returned to the controller by reading Class 4, Instance 49, Attribute 3 using explicit messaging or will come back as I/O data, which will change the device's Receive size. Remember that a lot of the parameters in a Powermonitor II are a floating point type which requires 4 bytes of data space.

Powermonitor II Default I/O Data

Consumes 2 words (4 bytes) of output data

word 0	Reserved
word 1	Reserved

Produces 4 words (8 bytes) of input data

word 0	Relay #1 Status
word 1	Relay #2 Status
word 2	Alarm Word
word 3	Status Inputs

Powermonitor II Assembly Data

Class 4, Instance 3, Attribute 3   (Size always equals 26 words)

word 0	Present PowerMonitor II Password
word 1	Instance to configure. (1 or 49 valid. A 1 selects the parameters to be returned as I/O receive data, which also changes the receive size. A 49 configures the instance 49 to be read by explicit messaging)
word 2	Total parameters being requested in this configuration. (Valid range is from 1 to 22 parameters)
word 3	Total words to be returned in the configurable instance. (Add together sizes of all requested parameters and put total number of words here. Remember that Float variables use 2 words)
word 4	Parameter 1 number selected to be returned. (1 to 1075 Valid)
word 5	Parameter 2 number selected to be returned. (1 to 1075 Valid)
	I I
word 25	Parameter 22 number selected to be returned. (1 to 1075 Valid)

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Powermonitor II Assembly Data

I/O Receive Data or
Class 4, Instance 49, Attribute 3

(Size depends on sum of sizes of parameters
requested and content depends on parameters
requested in Class 4, Instance 3, Attribute 3)

word 0	Parameter Data Requested
word 1	Parameter Data Requested
word 2	Parameter Data Requested
word 3	Parameter Data Requested
word 4	Parameter Data Requested
word 5	Parameter Data Requested
word N	Parameter Data Requested

Powermonitor 3000 Fun Facts

1404-Mxxxx-DNT is the catalog number for a DeviceNet compatible Power Monitor. The xxxx in the catalog number is filled in depending on what size of Power Monitor you desire.

Publication 1403-5.4 contains information for DeviceNet communications and is essential to correctly use this device on DeviceNet.

UCMM Capable Device

Node number and baud rate are set via node commissioning via the network using RSNetWorx for DeviceNet or DeviceNet Manager software.

Transmit size is always 4 bytes and Receive data size defaults to 8 bytes out of box. Polled, Change of State and Cyclic communications are supported.

Explicit messaging is used to get the majority of data from Powermonitor 3000 back into the controller. By writing to Class 4, Instance 3, Attribute 3 up to 26 words of data, you can request a maximum of 22 parameters be sent back from the Powermonitor II. The requested data can be returned to the controller by reading Class 4, Instance 49, Attribute 3 using explicit messaging or will come back as I/O data, which will change the device's Receive size. Remember that a lot of the parameters in a Powermonitor II are a floating point type which requires 4 bytes of data space per parameter.

ULTRA 100 Digital Servo Drive Details

ULTRA 100 Servo Drive Fun Facts

- Node Number is selectable by rotary switches. If switches set > 63 then node and baud rate are settable over the network.

- Baud Rate is set via a rotary switch and can be set for autobaud.

- Supports Change of State, Cyclic and Polled messaging.

- Supports Parameter Object so EDS file can be uploaded and all configuration parameters are accessible to Explicit Messaging.

- Servo cannot be controlled "Real Time" over DeviceNet.

- UCMM capable device.

- User Manual is Publication 1398-5.4.

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ULTRA 100 Servo Drive I/O Data

Produces 4 bytes of Polled, COS or Cyclic input data

	Bit 7	Bit 6	Bit 5	Bit 4	Bit 3	Bit 2	Bit 1	Bit 0
Byte 0	Drive Enabled	At Speed	Negative I Limit	Positive I Limit	Within Speed Window	Zero Speed	Within Position Window	In Position
Byte 1	Drive Ready	Brake Active	Axis Homed	Reserved	Reserved	Reserved	Fault Disable	DC Bus Charged
Byte 2	Preset Select C	Preset Select A	Analog Override	Reverse Clamp	Forward Clamp	Follower Enable	Integrator Inhibit	Drive Mode Input
Byte 3	Enable Active	Reset Faults	Registration Detected	In Dwell	In Motion	Sequence Complete	At Home	Preset Select C

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1394 Motion Controller

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1203/2100 Interface to 1394 Motion Controller I/O Data

Word 0 of Output Data

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0	Function	DESCRIPTION — NOP = No State Change
															X	Axis 0 Stop	1=stop, 0=Not
														X		Axis 0 Start	1=Start, 0=Not
													X			Axis 0 Jog	1=Jog, 0=Not
												X					
											X					Axis 1 Stop	1=stop, 0=Not
										X						Axis 1 Start	1=Start, 0=Not
									X							Axis 1 Jog	1=Jog, 0=Not
								X									
							X									Axis 2 Stop	1=stop, 0=Not
						X										Axis 2 Start	1=Start, 0=Not
					X											Axis 2 Jog	1=Jog, 0=Not
				X													
			X													Axix 3 Stop	1=stop, 0=Not
		X														Axis 3 Start	1=Start, 0=Not
	X															Axis 3 Jog	1=Jog, 0=Not
X																Fault Reset	1=Reset Faults, 0=Not

Word 1 of Output Data

1203/2100 Interface to 1394 Motion Controller I/O Data

Word 0 of Input Data

LOGIC CONTROL BITS																Function	DESCRIPTION NOP = No State Change
15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0		
															X	Axis 0 Enabled	1=Enabled, 0=Not
														X		Axis 0 at I Limit	1=in I Limit, 0=Not
													X			Axis 0 at Speed	1=At Speed, 0=Not
												X					
											X					Axis 1Enabled	1=Enabled, 0=Not
										X						Axis 1 at I Limit	1=in I Limit, 0=Not
									X							Axis 1 at Speed	1=At Speed, 0=Not
								X									
							X									Axis 2 Enabled	1=Enabled, 0=Not
						X										Axis 2 at I Limit	1=in I Limit, 0=Not
					X											Axis 2 at Speed	1=At Speed, 0=Not
				X													
			X													Axis 3 Enabled	1=Enabled, 0=Not
		X														Axis 3 at I Limit	1=in I Limit, 0=Not
	X															Axis 3at Speed	1=At Speed, 0=Not
X																System Faulted	1=Faulted, 0=No Fault

Word 1 of Input Data

825-P Motor Protection Device

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825-P Series A & B

- ## Motor Protection Device
  - **Series A Discontinued May 2010**
  - **Series B Introduced June 2010**

- ## The following part numbers (basic units) were affected by series change
  - **825-PD**
  - **825-PD-CC**
  - **825-PZ**
  - **825-PZ-CC**

- **Firmware R401 in Series A products till May 2010**
- **Firmware R402 in Series A products after May 2010**
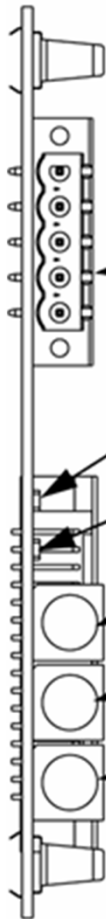- **Firmware R501 with Series B**

825-P Basic Unit

825-PDN DeviceNet Option Card

Refer to 825-UM005A-EN-P for details

Part	Description
❶ DeviceNet Connector	Accepts a 5-pin linear DeviceNet plug.
❷ Bus Status LED	Status indicator for backplane communications.
❸ Network Status LED	Status indicator for DeviceNet communications.
❹ Node Address Switch	Rotary switch for setting the most significant digit (MSD) of node address.
❺ Node Address Switch	Rotary switch for setting the least significant digit (LSD) of node address.
❻ Data Rate Switch	Rotary switch for selecting the DeviceNet data rate at which the card communicates.

825-PDN DeviceNet Option Card

- **UCMM messages are supported with the ability to allocate up to 3 explicit message connections concurrently**

- **DeviceNet Group 2 slave functionality including:**
  - **Explicit connection**
  - **Polled connection**
  - **1 COS (Change of State)/Cyclic connection**

- **Full DeviceNet Parameter Object support allows EDS files to be extracted from all units.**

- **Settings are provided for user-defined behavior of output relays for Comm Fault and Comm Idle conditions**

- **Motor starting and stopping can be controlled via DeviceNet**

- **Group 4 faulted node recovery is supported.**

- **DeviceLogix on board provides the capability to perform logic operations for a total of 80 function blocks**

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193-PCT and 193-DNCT CONFIGURATOR DETAILS

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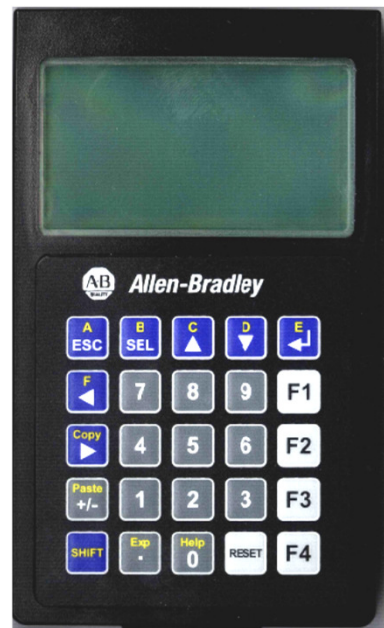
193-PCT Details

193-PCT (E3 Programming and Control Terminal) User Manual is Publication number 193-UM004A-EN-P. This is the best source of information!!!

The 193-PCT design is based on the DeviceView so the devices look almost identical and are the same size/weight. The 193-PCT can do Node Commissioning and device configuration based on Basic Configuration Mode or EDS Configuration Mode. This can be done with 193-PCT fresh out of the box.

Unlike the DeviceView, the 193-PCT does not allow EDS files to be downloaded to it serially. However, it can program the EDS based configuration of ANY device that supports the Parameter object (Class 15). This includes almost all of the power products.

The 193-PCT can also be used to store EDS based device configurations for archiving purposes.

The 193-PCT can also be used as a control module to exercise the Outputs on an E3 overload.

193-DNCT DeviceNet Handheld Configurator

- **Features**
  - **Node Commissioning**
  - **Who Menu**
    - **View all devices on the Network**
    - **Display whether device has a fault or not**
  - **DeviceLogix™ programming**
  - **Copycat**
    - **Copy parameters/setting from one device to another. This also includes scanner Scan Lists, without ADR configuration.**
    - **Copy DeviceLogix™ programs from one device to another**
  - **Works with any DeviceNet device**
  - **Class Instance Attribute Editor**

- **AFS: Available Now!!**
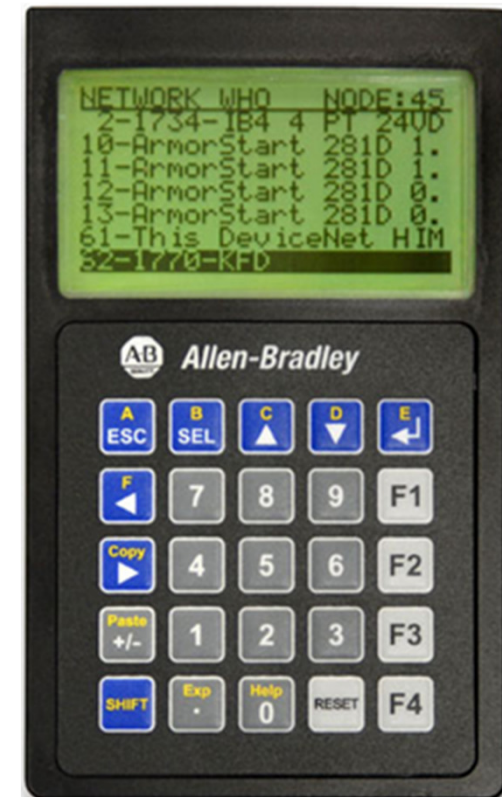
193-DNCT Fun Facts

EDS based configuration possible to any device that supports the full Parameter Object (Class 15). Most Drives and power products support this parameter object, which also allows the EDS file to be uploaded from them.

All other devices will require the Class Instance Attribute Editor feature to configure them.

The 193-DNCT also does some nice network diagnostics, the same as a NetAlert. The 193-DNCT shows Min/Max network voltages, CAN errors, CAN errors/sec and Min/Max bandwidth usage.

Every DeviceNet based system should ship with one of these units.

List price of $350 USD and worth every penny of this.

Network Performance

Performance General Details

Total system performance is defined as the amount of time it takes to bring an I/O Input into a Control System and trigger an I/O Output under program control!!

The formula for calculating this performance for a network based I/O system is:

Input Filter Time + Network Time + Backplane Time + Ladder Scan Time + Backplane Time + Network Time + Output Filter Time.

Because of the way the ladder scanning is done in a controller, the maximum performance would actually contain two ladder scan times. Subtracting out the I/O Filter Times as being very small comparatively, the maximum performance calculation can be reduced to:

2(Network Time) + 2(Backplane Time) + 2(Ladder Scan Time) = Maximum System Performance.

Ladder Scan Time needs to be estimated somewhat accurately as it can be a larger component of performance than Network Time, in some systems.

Backplane Time is the time necessary to get data to/from the network scanner and Processor. This can be discrete I/O transfers, block transfers, M1/M0 transfers and in the ControlLogix an RPI time. In version 4.001 of the 1756-DNB firmware, a 2ms RPI can now be entered for the 1756-DNB, instead of the previous 5ms minimum.

Network Time is probably the hardest component to estimate, but some techniques have been thought out to help calculate the maximum Network Time for a Change of State (COS) only network and a Poll/Strobe only network.

IMPORTANT: Knowbase document 20862 contains a spreadsheet that allows very easy calculation of a Polled only network scan time.

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Network Performance Details

DeviceNet packets contain up to 8 bytes of data per packet. Wire times of each possible packet length, at each possible baud rate follows: (Times include 10% increase for possible stuff bits)

	0	1	2	3	4	5	6	7	8
125 Kbits/sec	.414	.475	.545	.616	.686	.757	.827	.898	.968
250 Kbits/sec	.207	.238	.273	.308	.343	.378	.413	.449	.484
500 Kbits/sec	.103	.119	.136	.145	.171	.189	.206	.224	.242

COS messages are normally sent with an ACK timeout of 16 ms which means an ACK is expected within 16ms. An ACK message is a 0 byte packet and will be sent in response to every COS message.

If one or more Strobe devices are on the network, an 8 byte Strobe message from the master scanner will occur at the top of each poll scan. All strobe devices will send their data back in response. In an all Strobe network, the Strobe message will repeat after every Interscan Delay (ISD) time.

Any data messages larger than 8 bytes will be divided, by fragmentation, into smaller packets. One byte of the fragmented data packet is used as a flags byte, which leaves only 7 bytes maximum per packet for data. So if a data size is greater than 8 then the number of packets is the data size divided by 7, rounded up to next whole number. But the last packet may not be a full packet.

Example: If data size is 30 bytes at 500 Kbits/sec. 30 bytes/ 7 bytes per message = 4 packets of 8 bytes, which leaves 2 data bytes and a flag byte, for a 3 byte packet. So, (4 packets X .220 ms per 8 byte packet) + (1 packet X .140 ms per 3 byte packet) = 1.02 ms minimum wire time for transmission.

Network Performance Facts
Polled/Strobed Only Network

For a Polled and/or Strobed only network, the Network Time can be accurately calculated using the following formula.

Network Time = Total Wire Time + .1(number of Polled slave devices) + ISD.

1) Add together the wire times of all data packets of all devices on the network. Use the table on the previous slide for the times. If there are any Strobe devices on the network, add an additional 8 byte packet to the wire time calculation and don't forget to add all of the Strobe response times also.

2) Take the total number of Polled slave devices and multiple them by .1ms. Add this total with the wire time. This .1ms/device is an estimate of the amount of overhead time it takes for the scanner to determine that a device needs to be polled. Skip this step if network is all Strobe devices.

3) Add the Interscan Delay (ISD) time to the total of steps 1 and 2. The ISD is set in the scanner as a module parameter.

Example: 5 polled devices with 4 bytes of input data and 4 bytes of output data, at 125Kbits/sec and a 10ms ISD. Network Time = ((5 devices X 2 packets/device X .686ms per 4 byte packet) + (5 devices X .1ms) + 10 ms ISD = 17.3ms to do one Poll cycle.

Network Performance Facts
COS Only Network

For a COS network, there are a lot of variables that make performance calculation difficult, such as how often the Inputs and Outputs are changing to the devices. So the best thing we can do is calculate worst case network performance. To do this, we assume that every device on the network needs all of it's input and output data sent at exactly the same time. <u>It is also assumed that no device will transmit more than once during this time. The only way to assure this, is to figure out the worst case network time and set ALL device inhibits greater than this time.</u> This will guarantee the worst case time will not be exceeded. However, during implementation of the real network, the inhibit time can be taken to zero, to disable it, and can then be adjusted up to fine tune the network.

Lastly, since there is an ACK timeout, this timeout should also be added to the worst case wire time to allow an ACK the maximum amount of time to be sent back to the last COS message. FYI. Normally the ACK occurs within a few milliseconds, but it could be delayed

For a COS only network, the Network Time can be estimated by using the following method.

Network Time = Total Wire Time + (Total number of COS packets) X (0 byte packet time)) + ACK timeout

1) Add together the wire times of all data packets of all devices on the network. Use the table on the previous slide.
2) Take the total number packets and multiple them by time for a zero byte packet at the appropriate baud rate. Add this total with the wire time.

Example: 10 devices with 2 bytes of input data and 7 bytes of output data, at 250Kbits/sec with ACK timeout of default 16 ms. Network Time = ((10 devices X .248ms per 2 byte packet) + (10 devices X .408ms per 7 byte packet) + (20 packets X .188ms per 0 byte packet) + 16 ms = 26.32ms to do one maximum COS update. Make sure to set the Inhibit times for each device to a value higher than 26.32, say 30.00 ms.

Network Performance Tuning

1) Set network speed to maximum baud rate possible for system installation.

2) Use Change of State devices on the network for higher priority I/O devices. **Note: The most predictable and repeatable I/O method to use is Polled and it should be used whenever possible. However, some I/O data may need to handled faster on a polled network and can be made using COS messaging. Remember that on COS devices, if I/O data is changing very often, the overall band width of the network will suffer. See step 7 for more details.**

3) Reduce ladder scan time down to a minimum, which allows data from the network to be accessed more often to the controller platform. Another method is to use a STI or Immediate I/O instructions inside the ladder logic to service the data table more often each ladder program scan.

4) Reduce Interscan Delay (ISD) in the scanner to the absolute minimum of 2 ms. Note: ISD is only used during a Polled or Strobed network. Lowering the ISD too much could slow down the reaction of functions within RSNetWorx for Device Net software, such as a network browse or scan list upload/downloads.

5) Reduce data sizes to/from the slave devices on the network to an absolute minimum. Many data sizes in devices are adjustable via the EDS file. Keeping the sizes to 8 bytes or less is desired to prevent fragmentation, which wastes network bandwidth.

6) Set the backplane access time between the controller an master scanner to the minimum amount. The 1756-DNB V4.001 can now be set to a 2ms RPI.

7) On COS networks, inhibit any devices whose I/O data is changing frequently on the network which uses network bandwidth. Bumping up the inhibit time for a device will disallow it from being communicated to/from any more often than the inhibit time value. Note: Setting the Inhibit time too high on time critical I/O devices could adversely effect the performance of the system.

DeviceNet Traffic Analyzer Software

A useful software tool to debug the protocol on a DeviceNet network. Currently requires a 1784-PCD card to function as the network interface with the 32 bit driver installed in PC. **Catalog number is 9220-WINTA which combines the ControlNet Traffic Analyzer with it.**

The 9220-WINTA will not work with the new 1784-U2DN USB adapter. Use the Frontline NetDecoder software with the 1784-U2DN.

What is Integrated Architecture Builder?

- **The Integrated Architecture Builder (IAB) software:**

  - **Aids with initial system configuration, using integrated system-based rules**

  - **Provides a graphical representation of configurations**

  - **Performs DeviceNet system checking**

  - **Generates system-level reports, including a Bill of Materials**

- **It is a "proof-of-concept" tool that provides general "rule-of-thumb" suggestions and recommendations on hardware requirements.**

- **Current release version is V8.0 which handles "Daisy Chaining" media on DeviceNet much nicer!!**

- **DVD available for order via CustomPoint system or software can be downloaded directly from the web at www.rockwell.com. Under the path Products/Configuration and Selection Tools/System Configuration.**

TROUBLE-SHOOTING SUMMARY

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Trouble-Shooting Hints

- On any non-behaving system the first thing you MUST do is verify the installation against the DeviceNet Network Installation Checklist in slide 91. Walk the entire network and verify distances firsthand.

- A happy scanner should be in RUN mode and showing its own node number on display. The errors being displayed on the front of the Master Scanner are very important. Compare observed errors with the Scanner Error Codes in slide 173 to search for details of error cause and cure. Remember error number will alternate with node number exhibiting error.

- The network LED on all slave devices are your friend, verify all network LEDS are solid green. If a network LED is not solid green then refer to the Slave Device Network LED definition slide 176.

- Intermittent errors could be caused by bad connections causing open or short circuit connections. Remember the hint that female pins on media with sealed mini connections will sometimes spread and cause open circuits. This kind of connection could cause devices to Bus Off. A missing CAN-L connection to a device will cause a device to communicate sporadically on the network.

- Rarely, the EPR (Expected Packet Rate), ISD (Interscan Delay) and COS Inhibit Times may need to be tweaked on certain networks to assure reliable network operation.

- Less than 2% of the network issues will be caused by defective or badly designed devices, with hardware or firmware bugs. These problems will require a software package such as Monitor or Traffic Analyzer and maybe a CAN error detector such as the Dearborn Group Monitor or DeviceNet Detective.

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Molex NetAlert/ NetMeter

Scroll through DeviceNet parameters for each active DeviceNet node (MAC ID)

- – **Communication errors** (Rate, Cumulative #)
- – **Bandwidth** (% of full usage)
- – **Power supply and shield voltages** (Mean, Min and Max)
- – **Data bit quality** (Dominant, Recessive, +, -, Differential Voltage, Common Mode Voltage)

Check values (numeric/icons)

- – Happy face = within spec
- – Neutral face = very close to limit
- – Sad face = out of limit

3.23 v

"Absolutely the best product on the market for troubleshooting a DeviceNet cabling system!!!" **Bob Law**

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How to Get a NetMeter of Your Own

DeviceNet™ NetMeter

- Diagnostic/troubleshooting tool
- Analyzes both power and bit stream information
- Hand held with simple user interface

The DeviceNet Netmeter empowers untrained personnel to diagnose and troubleshoot network installations quickly and easily, with-out risk. Completely passive on the network, the meter analyzes the data and power lines on your DeviceNet network. In seconds, both network-wide and device-specific traffic as well as power monitoring information is captured and dis-played on a simple, straightforward user interface. The following modes with user displays are as follows: Auto search – bus errors, bus traffic, bus power voltage, shield voltage, common mode voltage, CAN_H/L Differential, CAN_H and, CAN_L. Voltage with helpful troubleshooting icons.

- Empowers untrained personnel to diagnose and troubleshoot the network quickly and easily
- Network wide and device specific information with simple user interface for fast diagnostics and troubleshooting
- Certifies new DeviceNet installations quickly

PART NUMBER	DESCRIPTION
DN – MTR	NETMETER – MONITORS BITSTREAM TRAFFIC; POWER LINES FOR DEVICENET

Netmeter offers

- simple user interface
- troubleshoots problems faster as it predicts faults prior to them creating downtime – not after failures like other troubleshooting devices
- great value proposition for the features
- passive node on network, cannot create faults or bus errors on network through usage
- links faults found to extensive diagnostic of cross-reference likely network fixes for fast real world troubleshooting
- generates statistics for troubleshooting intermittent faults
- high accuracy – no false positives
- carrying bag with strap included

DeviceNet™ Netmeter
Specifications

POWER SUPPLY:	NETWORK 11 – 30V DC < 150mA BATTERIES 2 X AA ALKALINE BATTERIES 6 HOURS OF OPERATION, 48 HOURS OFFLINE VIEWING, APPROX. 3 WEEKS DATA RETENTION
CONNECTORS:	(1) MICRO PER ODVA (m12), ADAPTOR CABLES (2) INCLUDED FOR MINI-CHANGE AND PLUGGABLE SCREW TERMINAL
BAND RATES:	125K, 250K AND 500K (AUTO –DETECT)
ANALOG ACCURACY	BUS POWER ± 100mV, BUS SIGNAL ± 20mV
ANALOG RANGE:	BUS POWER 0 TO 25V WITH OVER/UNDER RANGE INDICATION BUS SIGNAL -2.25 TO 7.25 WITH OVER/UNDER RANGE INDICATION
ANALOG SAMPLE RATE:	BUS POWER 4 KHZ BUS SIGNAL IDEAL SAMPLE PT+250 nS
SIGNAL ERROR THRESHOLD:	PER DEVICENET SPEC FOR NETWORK POWER
BUS LOAD MEASUREMENT:	DETECTS BUS IDLE IN REAL TIME
BUS MESSAGE RATE MEASUREMENT:	DETECTS 100% OF INDIVIDUAL CAN FRAMES IN REAL TIME
ERROR RATE MEASUREMENT:	DETECTS 100% OF INDIVIDUAL ERROR FRAMES IN REAL TIME

TWO OPERATIONAL MODES OF USE

Electrician Mode (simple)

1. PLUG IN AND SET NETMETER ROTARY SWITCH TO "AUTOSEARCH"
2. IDENTIFY NETWORK HEALTH
   – HAPPY FACE = HEALTHY
   – NEUTRAL FACE = NOMINAL
   – SAD FACE = FAULTY
3. SCROLL THROUGH FAULTS
4. FREEZE AND LOCK SETTINGS FOR THE PLANT CONTROL ENGINEER TO REVIEW

DeviceNet Export Mode (advanced)

1. SCROLL THROUGH DEVICENET PARAMETERS FOR EACH ACTIVE DEVICENET NODE (MAC ID)
   – COMMUNICATION ERRORS (RATE, CUMMULITIVE #)
   – BANDWIDTH (% OF FULL USAGE)
   – POWER SUPPLY AND SHIELD VOLTAGES
   – DATA BIT QUALITY (DOMINANT, RECESSIVE, +, -, DIFFERENTIAL VOLTAGE, CMV)
2. CHECK VALUES (BOTH NUMERIC AND ICONS)
   – HAPPY FACE = WITHIN SPEC
   – NEUTRAL FACE = VERY CLOSE TO LIMIT
   – SAD FACE = OUT OF LIMIT
3. REFER TO USER MANUAL TO LINK THESE FAULTS TO MOST LIKELY NETWORK PROBLEMS

MODES

	PRESET VALUE	MAXIMUM	MINIMUM	PEAK-TO-PEAK
BUS ERROR	x	x	x	
BUS TRAFFIC	x	x	x	
BUS PWR VOLTAGE	x	x	x	
SHIELD VOLTAGE	x	x	x	
COMMON MODE VOLTAGE	x	x	x	x
CAN_H/L DIFFERENTIAL	x	x	x	x
CAN_H VOLTAGE	x	x	x	x
CAN_L VOLTAGE	x	x	x	x

DeviceNet Detective

DeviceNet Detective

Grid Connect has focused on solving the key DeviceNet problems with the DeviceNet Detective, find bad devices, configure MACIDs, find bad wiring, and collect network statistics. The DeviceNet Detective plugs right into a DeviceNet network, using the network power, and is a convenient hand held portable unit. The Detective comes with instructions, and all cables necessary to use any DeviceNet network, a handy carrying case is included.

Features Include:

- Detect network node configurations "On or Off "line
- "Off "line editing of network node configurations
- Display "High, Low & Present" network supply voltage
- Display of "High, Low & Average " CAN bus voltages
- Reference "Help" for Detective Menus, Plus DeviceNet
- Wiring Pinouts & LED Function Screens
- Report CAN "Errors/Second" & "Total" CAN errors detected
- Logs CAN Frame Errors detected at each node
- Critical error "LOG BOOK" menu
- Detects % "Traffic Load" on the network
- Scans & reports current "Node Object" data on the network
- Monitors & identifies group 1, 2, 3 and 4 traffic
- Context sensitive "Help" for explanation wherever possible
- One year warranty
- IP 65 / NEMA 12 protection

gridconnect™

Grid Connect, Inc.
1841 Centre Point Circle #143
Naperville, IL 60565
USA

Phone: (1) 630 245-1445
Fax: (1) 630 245 1717

Web: www.gridconnect.com
e-mail: sales@gridconnect.com