ADAPTIVE

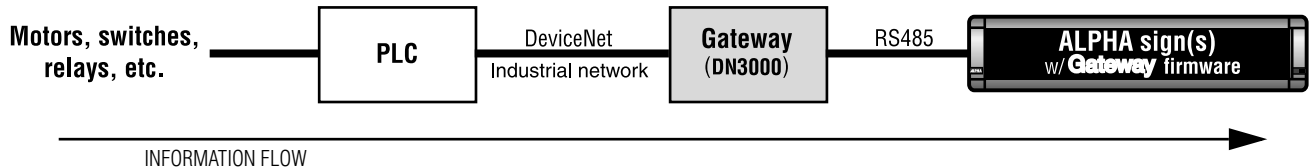# How to connect ALPHA signs to DeviceNet using the DN3000

Introduction

This document explains how to set up the DN3000 to act as an interface between a DeviceNet industrial network and an ALPHA sign network (as illustrated below).

| Motors, switches, relays, etc. | PLC | DeviceNet Industrial network | Gateway (DN3000) | RS485 | ALPHA sign(s) w/ Gateway firmware |

INFORMATION FLOW

NOTE: In the event of a communication failure, caused by any means, messages may not be displayed on a sign.

Specifically, this document describes how to:

*   connect the DN3000 to a DeviceNet PLC

*   connect the DN3000 to one or more ALPHA signs

*   use the **DN3000 Configuration Editor** software to set up the DN3000 so that it interfaces between a DeviceNet PLC and an ALPHA sign network.

Related documents

Document name	Part number	Description
Gateway Messaging Software User Manual	9703-7004	Describes how to use Adaptive's Gateway Messaging Software to store messages in ALPHA signs.
Network Configurations	9708-8046A	Explains how to network ALPHA signs.

DN3000 description

The DN3000 is an intelligent DeviceNet-to-serial communication interface unit. It allows data exchange between a DeviceNet host and ALPHA signs equipped with the Gateway firmware option.
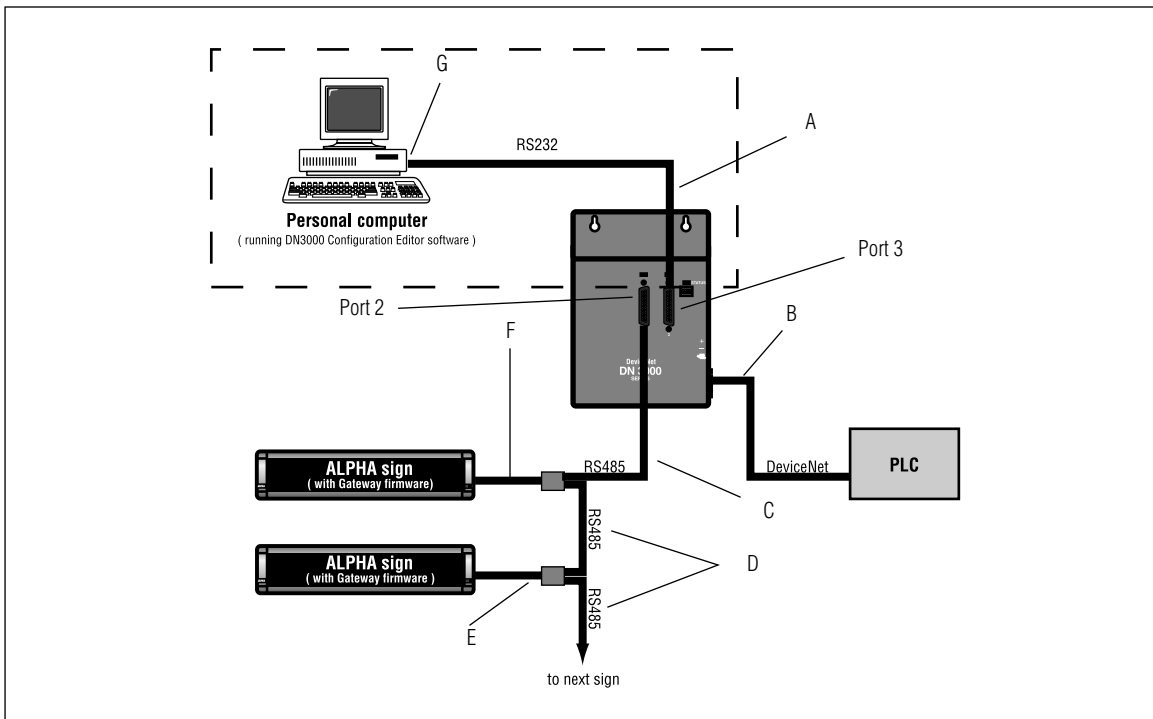
Operating modes

Using the DN3000's DIP switches, the unit can be set to either one of two types of operation: Normal Operation Mode or Configuration Mode.

- *Normal Operation Mode (DIP switch settings: 1, 2, 3, 4 = OFF)* - In this mode, Ports 1,2, and 3 are all active. The DN3000 will first wait for configuration from the DeviceNet host before initiating with the ALPHA signs(s).

- *Configuration Mode (DIP switch settings: 1, 2, 4, = OFF; 3 = ON)* - In this mode, only Port 3 is active. Ports 1 and 2 are *not* active. This mode is used to set up the various DN3000 parameters (e.g., baud rate, PLC address, etc.) with the **DN 3000 Configuration Editor** software.

Front view / Side view

Item	Name	Description	
A	Port 3 LED	Green = transmitting data Red = receiving data	
B	STATUS LED	Flashing green = unit initialized OK and is in Configuration Mode. Flashing red = DeviceNet error.	
C	DIP switches	Use these switches to set the operating mode of the unit: Normal Operation Mode (used to relay PLC data to ALPHA signs): 1, 2, 3, 4 = OFF. Configuration Mode (used to program the DN3000): 1, 2, 4 = OFF; 3 = ON	
D	Port 1 LED	*Left LED* Off = No Power Flashing Green = Device in Standby Green = Device Operational Flashing Red = Minor Fault Red = Unrecoverable Fault Flashing Red-Green = Device Self Testing	*Right LED* Off = Not Powered/Not Online Flashing Green = Online, Not Connected Green = Link OK, Online, Connected Flashing Red One or more I/O Connections are in the Timed-Out state Red = Critical Link Failure (Duplicate MAC ID or Bus-off) Flashing Red-Green = Device Self Testing
E	Port 3 ("passthrough port")	Connect to a personal computer that is running the **DN3000 Configuration Editor** software and the **Gateway Messaging Software**.	
F	Power connector	Connect to a DC power supply of 7 to 28 volts rated at 9 watts.	
G	Port 1	Data input from a DeviceNet host.	
H	Port 2	Data output to one or more ALPHA signs.	
I	Port 2 LED	Green = transmitting data Red = receiving data	

DN 3000 interconnection diagram

Item	Part #	Description
A	1188-0005	DB9-to-DB25 Configuration Cable to Port 3 **Computer** **DN3000** DB9 Female DB25 Male (RS485) (RS485) TXD03 ——————— 03 RXD RXD 02 ——————— 02 TXD GND 05 ——————— 07 GND RTS 07 ⌐ CTS 08 ⌐ DCD 01 ⌐ DTR 04 DSR 06
B	—	DeviceNet cable to Port 1 **DN3000** DB9 Male 03 V- 02 CAN_L 05 Shield 07 CAN_H 09 V+

C	1188-9101	DB25-to-3-wire cable to Port 2

DB25-to-3-wire cable to Port 2

to sign

to Modular Network Adapter
Stripped wires (RS485)

BK   YL

Modular Network Adapter

BL   WH
OR   BR
BK   YL
RD   GN

BLUE WIRE   +

WHITE WIRE   −

DN3000
DB25 Male (RS485)

23 Tx+
24 Rx+
21 Tx−
22 Rx−
01 SHIELD
04 RTS
05 CTS
09
10
11
12

For DN3000 units with revision F or earlier, terminating resistors are provided within the unit. Other terminating resistors in the system must be removed.

For DN3000 units with revision G or later, jumpers 9-10 and/or 11-12 must be clipped if terminating resistors are elsewhere in the system.

D	1088-8000	RS485 cable
E	4331-0602	Modular Network Adapter (NOTE: On some ALPHA signs, this adapter is inside the sign.)
F	1088-8636	1 foot, 4-conductor RS485 cable (NOTE: If the Modular Network Adapter is inside the ALPHA sign, this cable is not necessary.)
G	1088-9105A	DB25-to-DB9 adapter (for DB25 computer COM port)

DN3000 setup instructions

1. Attach a personal computer to the DN3000. (See "DN 3000 interconnection diagram" on page 3.)

2. Put the DN3000 into Configuration Mode by setting DIP switch 3 to the ON position.

3. If not already installed, install the **DN3000 Configuration Editor** DOS software on the personal computer that will be used to program the DN3000.

Project file creation

4. Start the **DN3000 Configuration Editor** software. A screen similar to the following will appear.

Close box
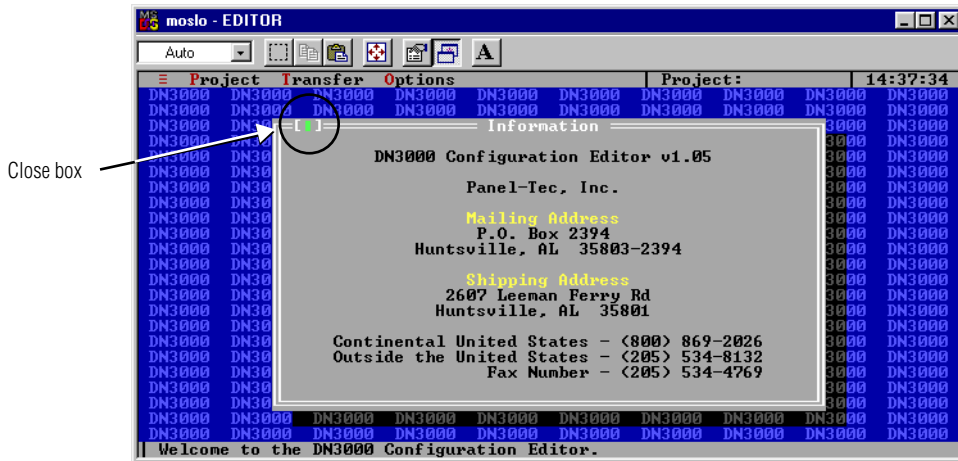
5. Create a new "project" file by selecting *Project > New*:

HINT: You can also choose an existing project by double clicking on the project name shown to get a drop-down list.

Enter a name for the new project file

Select *DeviceNet to PLCs or Devices* for *Project Type.*
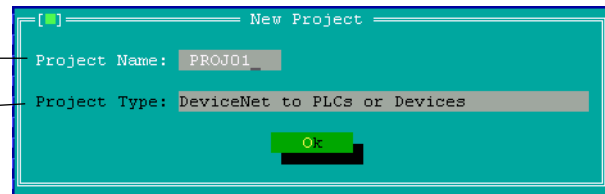
6. Click *Ok* and then save the project by selecting *Project > Save*.

COM port setup

7. Select *Options > Set COM Port* and choose the PC Com Port you will use to communicate with the DN3000. (The default is COM 1.)
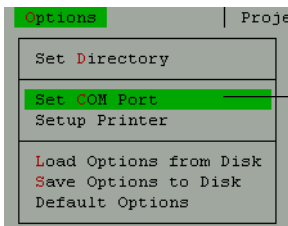
8. Select *Save*. You will be notified that the information was saved. Click *Ok* to exit this screen.

9. (Optional) Once a COM Port is selected, you may wish to save this setting by selecting *Options > Default Options*. If you do not do this, the COM port setting may revert to a former setting. The COM port setting is <u>not</u> part of the project, so saving the project will not save the COM port setting.

PLC communication (Port 1) setup

10. Select *Edit > Port 1 (DeviceNet)* to set up Port 1 on the DN3000.

```
Edit  Transfer  Options          ┌─[■]════ Port 1 (DeviceNet) ════
┌──────────────────────────┐      │ MAC ID of DN3000:  2
│ Port 1 (DeviceNet)  ──    │      │
│ Port 2 (PLCs/Devices)     │      │ Baud Rate
│ Port 3 (Passthrough)      │      │ (•) 500 Kbps
│                           │      │ ( ) 250 Kbps
│ I/O Data Configuration    │      │ ( ) 125 Kbps
└──────────────────────────┘      │
                                   │   Ok      Save      Revert
```

This is a number from 0 to 63 which is a DeviceNet unique MAC ID address. See your industrial network administrator for the *MAC ID of DN3000*.

Select the baud rate used by your DeviceNet network.

11. Select *Save*. You will be notified that the information was saved. Click *Ok* to exit this screen.

ALPHA sign communication (Port 2) setup

12. Select *Edit > Port 2 (PLCs/Devices)* to set up the DN3000 so that it can communicate with ALPHA signs equipped with the Gateway firmware option:

```
Edit  Transfer  Options          ┌─[■]══════════ Port 2 (PLCs/Devices) ══════════
┌──────────────────────────┐      │ PLC/Device Protocol: Modbus ASCII
│ Port 1 (DeviceNet)        │      │
│ Port 2 (PLCs/Devices) ──  │      │ [X] 2-wire RS422 or RS485 Communications   DN3000 Address:  0
│ Port 3 (Passthrough)      │      │     (Requires RTS-CTS loopback in cable)
│                           │      │
│ I/O Data Configuration    │      │   Baud Rate       Data Bits  Parity     Stop Bits   RTS Control
└──────────────────────────┘      │ ( ) 187500  (•) 9600  (•) 7   ( ) None   ( ) 1     (•) None
                                   │ ( ) 115200  ( ) 4800  ( ) 8   (•) Even   (•) 2     ( ) RTS/CTS
                                   │ ( ) 93750   ( ) 2400          ( ) Odd              ( ) RTS Delay
                                   │ ( ) 57600   ( ) 1200
                                   │ ( ) 38400   ( ) 600
                                   │ ( ) 19200   ( ) 300
                                   │                      Response Time-Out:  500   ms
                                   │     Ok              Save              Revert
```

Use these settings for Port 2:
- *PLC/Device Protocol*: **Modbus ASCII**
- *Communications*: **2-wire RS422 or RS485**
- *DN3000 Address*: **0**
- *Baud Rate*: **9600**
- *Data Bits*: **7**
- *Parity*: **Even**
- *Stop Bits*: **2**
- *RTS Control*: **None**
- *Response Time-Out*: **500 ms** (recommended)

13. Save the settings for Port 2. You will be notified that the information was saved. Click *Ok* to exit this screen.

"Passthrough" port (Port 3) setup

14. Select *Edit > Port 3 (Passthrough)* to set up Port 3.

```
Edit  Transfer  Options          ┌─[■]═══ Port 3 (Passthrough) Configuration ═══
┌──────────────────────────┐      │ Passthrough to: Port 2 (Modbus ASCII)
│ Port 1 (DeviceNet)        │      │ [ ] 2-wire RS422 or RS485 Communications
│ Port 2 (PLCs/Devices)     │      │     (Requires RTS-CTS loopback in cable)
│ Port 3 (Passthrough)      │      │ Baud Rate   Data Bits  Parity     Stop Bits   RTS Control
│                           │      │ ( ) 19200   ( ) 7    (•) None   (•) 1      (•) None
│ I/O Data Configuration    │      │ (•) 9600    (•) 8    ( ) Even   ( ) 2      ( ) RTS/CTS
└──────────────────────────┘      │ ( ) 4800             ( ) Odd               ( ) RTS Delay
                                   │ ( ) 2400
                                   │ ( ) 1200
                                   │ ( ) 600
                                   │ ( ) 300    Intermessage Time-Out:  100   ms
                                   │     Ok              Save              Revert
```

Use these settings for Port 3:
- Passthrough to: Port 2 (Modbus ASCII)
- *Communications*: Leave unchecked for **RS232**
- *Baud Rate*: **9600**
- *Data Bits*: **8**
- *Parity*: **None**
- *Stop Bits*: **1**
- *RTS Control*: **None**
- *Intermessage Time-Out*: **100 ms**

15. Select *Save*. You will be notified that the information was saved. Click *Ok* to exit this screen.

ALPHA sign register setup

16. Select *Edit > I/O Configuration* window and select *Use I/O Data* to set up what data the DN3000 will transmit to the ALPHA signs.

Check *Use I/O Data.*
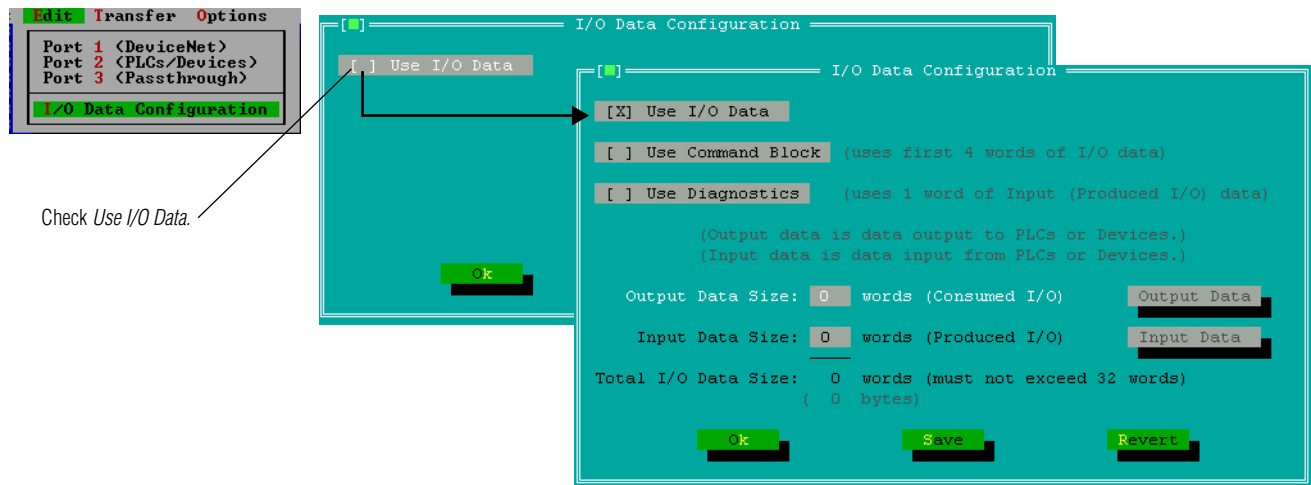
17. Enter the total number of words you will need to use (3 in this example). Select **Save**.

Enter the total number of words.
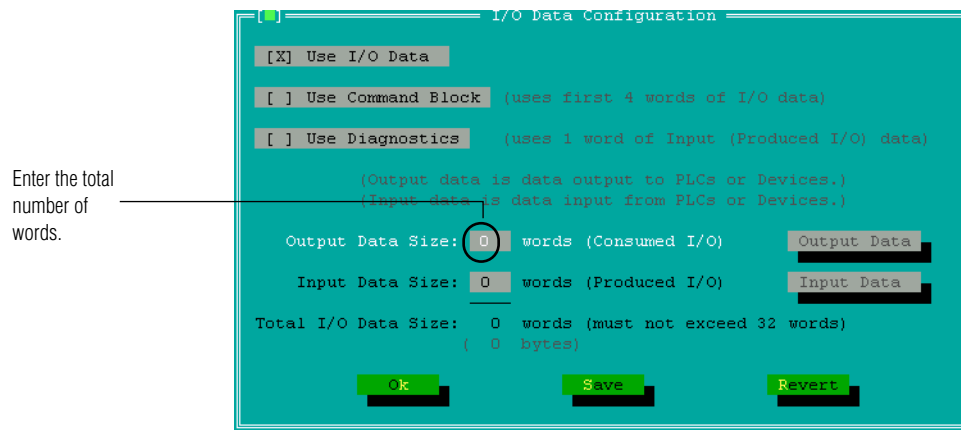
18. After you select **Save**, you can then select **Output Data**. This will bring up the *Output Data Table* screen.

Select *Output Data.*
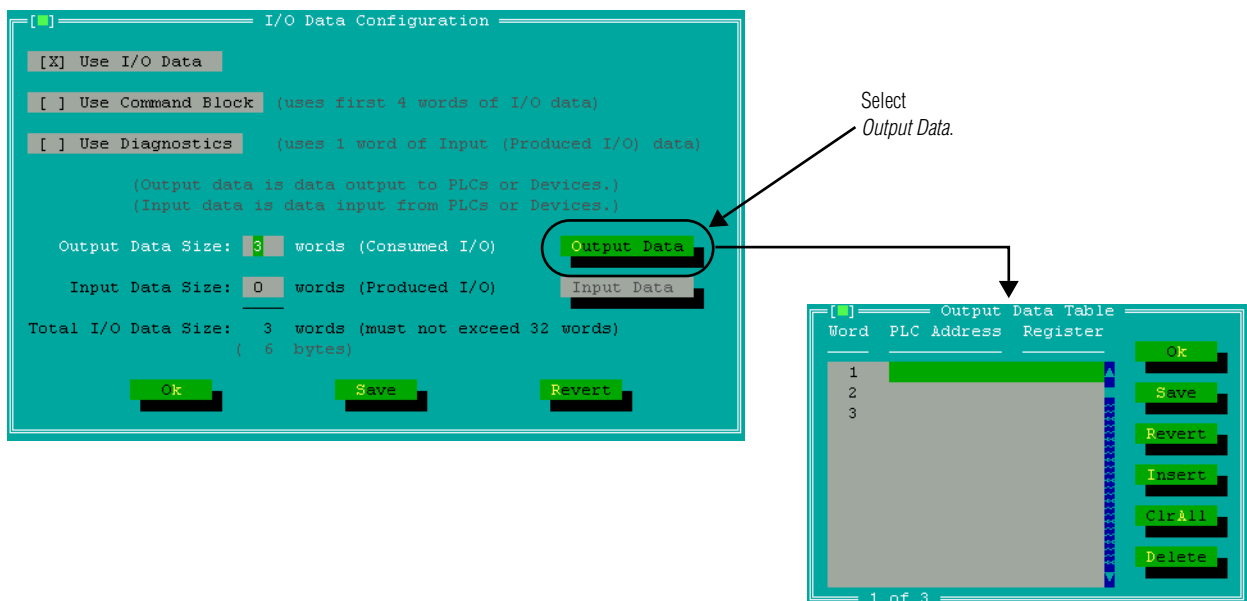
19. In the *Output Data Table*, you can press **Return** for the specific *Word* to use, or you can double click on that line. Then check the box to see the entries for that *Word*.

To assign a new register, use the arrow keys or the mouse to move the highlight bar to an empty space and then press **Return**.

Check *Use Output Word 1*.

This screen shows the ALPHA sign address and one of the sign's registers of where information is going to be stored.

20. Here is an example of several settings.

Example Output Data Table settings

In this table, *PLC Addresses* are actually ALPHA sign addresses.

In these example settings,
- ALPHA sign address #2 Register 101 = activation register for this ALPHA sign.
- ALPHA sign address #2 Register 102 = deactivation register for this ALPHA sign.
- ALPHA sign address #2 Register 1 = a variable value stored in this ALPHA sign.

21. Select *Save* for the *Output Data Table* window to save all the register settings you just entered. Then select **Ok** twice.

Check the PC's communication port

22. Before downloading your project settings to the DN3000, double-check your PC's COM Port settings. To do this, select *Options > Set Com Port* and verify that the *Port* is correct. Change if necessary, then select **Ok**.

Download the project settings to the DN3000

23. If you haven't already done so, put the DN3000 into Normal Operating Mode by setting all DIP switches to the OFF position.

24. After you have completed making changes to the setup parameters, download the project settings to the DN3000 by selecting *Transfer > Download project to DN3000* and follow the prompts, such as shown here.
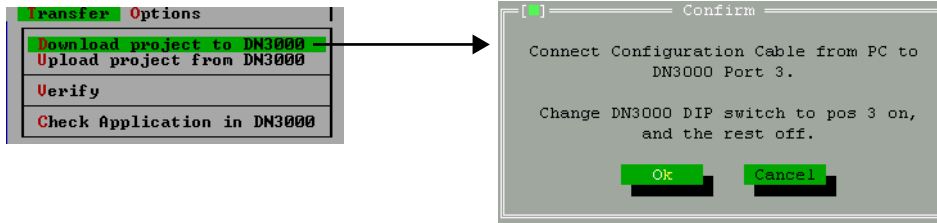
Safety and troubleshooting

When successfully connected to a DeviceNet industrial network, there should **always** be some type of message on each ALPHA sign connected to this network:

PROBLEM:	No message appears on ALPHA sign	"No Network Activity" message appears on ALPHA sign	"NO BACKGROUND MESSAGE"[1] appears on ALPHA sign
Possible Cause:	• Network wiring fault • PLC fault • DN3000 fault • ALPHA sign fault possible sign hardware failure or a PLC is trying to display a message that was not programmed into the sign. • Message(s) too long for preset file size • Sign not plugged in or turned on	• Network wiring fault • PLC fault • DN3000 fault • ALPHA sign fault • ALPHA sign timeout because there was no network activity for at least 3 seconds	• Sign address not correct. • The sign has not received any message to display. (This is not an error condition). • Sign is receiving information, but the information is not for this sign.

[1] This is called the "background message". The Gateway Messaging Software can be used to change the wording of this message.

Messaging Example

To help you understand how to program the DN3000 and how it works with a PLC and ALPHA signs, a complete messaging example follows.

The big picture

How to get PLCs to communicate with ALPHA signs

	What	How
1.	Program Gateway device (Map messages and variables to one or more ALPHA signs)	Gateway device (e.g., DeviceNet) software (different for each manufacturer)
2.	Create messages and variables and store them in ALPHA sign(s)	Gateway Messaging Software (created by Adaptive)
3.	Program the PLC (associate machine "actions" with the messages and variables created in Step 1 above)	PLC software (different for each manufacturer)

The example

Here's the situation:

- In this example factory, there's a conveyor belt and an automated lathe connected to a DeviceNet PLC (whose address = 5). This PLC is connected to a DN3000 (whose address = 3) and to two ALPHA signs (whose addresses are 7 and 8).

  NOTE: Sample PLC register addresses are used below.

- On the ALPHA sign with addresses = 7, you want to display messages about the conveyor belt: *Conveyor Belt Speed = [a number representing the belt speed]*, *Conveyor Belt Off*, and *Motor Overload*.

- On the ALPHA sign with address = 8, you want to display messages about the automated lathe: *Lathe On* and *Lathe Off*.

These are the steps to follow for this example:

1. Using the **DN3000 Configuration Editor** software, program the DN3000.

2. Using the **Gateway Messaging Software**, program the messages - and the one variable - into each of the two ALPHA signs. The illustration below represents the type of information stored in each sign:

How messages and variables are stored inside ALPHA signs

ALPHA sign
(with Gateway DP firmware)

Variable & Message storage	
Register #	**Description**
1	Variable #1 (+ or - integer value)
2	Variable #2 (+ or - integer value)
3	Variable #3 (+ or - integer value)
.	.
.	.
.	.
100	Variable #100 (+ or - integer value)
101	Message Activation Register (the Message # to turn on)
102	Message Deactivation Register (the Message # to turn off)
103	Message queue
.	.
.	.
.	.
167	.
Message #	**Description**
1	Message #1 (100-characters)
2	Message #2 (100-characters)
3	Message #3 (100-characters)
.	.
.	.
.	.
2000	Message #2000 (100-characters)

3. Using the software that came with it, program the DeviceNet PLC that will be sending information to the DN3000.

4. The complete setup for the PLC, DN3000, and ALPHA signs looks like this:

Network speed

125 to 500 kbps | 9.6 kbps

Network configuration

DeviceNet industrial network | RS485

Conveyor belt / Automated lathe / Motor starter

PLC (Address = 5)

DN3000 (Address = 3)

Conveyor Belt Speed = 34 (Address = 7)

Lathe On (Address = 8)

Setup software

Depends on the type of PLC used.

DN3000 Configuration Editor

Gateway Message Editor
(used to enter messages into the signs)

Example Setup

PLC #5 Data Table

Data source	Address	Data	Data description
PLC counter	MO:1.1	0000	Variable #1 (dummy timeout variable) - see **NOTE 1**
Conveyor belt sensor	MO:1.2	0000	Variable #2 (conveyor belt speed)
Conveyor belt	MO:1.3	0001	Activation Register for Sign Address #7, Message #001 ('Conveyor Belt Speed = ')
Conveyor belt	MO:1.4	XXXX	Deactivation Register for Sign Address #7 - see **NOTE 2**
Conveyor belt	MO:1.3	0004	Activation Register for Sign Address #7, Message #004 ('Conveyor Belt Off')
Conveyor belt	MO:1.4	XXXX	Deactivation Register for Sign Address #7 - see **NOTE 2**
Automated lathe	MO:1.5	0002	Activation Register for Sign Address #8, Message #002 ('Lathe On')
Automated lathe	MO:1.6	XXXX	Deactivation Register for Sign Address #8 - see **NOTE 2**
Automated lathe	MO:1.5	0003	Activation Register for Sign Address #8, Message #003 ('Lathe Off')
Automated lathe	MO:1.6	XXXX	Deactivation Register for Sign Address #8 - see **NOTE 2**
Motor	MO:1.3	0005	Activation Register for Sign Address #7, Message #005 ('Motor Overload')
Motor	MO:1.4	XXXX	Deactivation Register for Sign Address #7 - see **NOTE 2**

Each sign will have a message 'Activation Register' and a 'Deactivation Register' inside the PLC
(e.g., MO:1.3/MO:1.4 for sign address #7 and MO:1.5/MO:1.6 for sign address #8).

If you want multiple messages to appear on one sign, then set up the PLC Data Table so that multiple messages are assigned to the same Activation register (e.g., store messages #0002 and 0003 into PLC address MO:1.5, which is the Activation register for sign address #8).

NOTE 1: A 'dummy timeout variable' is included to make sure that the ALPHA signs do not "timeout". A sign will timeout when it does NOT receive any data for at least 3 seconds. The sign will then display the message: **No Network Activity.** The dummy timeout variable could be just a simple counter that sends data to the ALPHA signs every 0.5 second to avoid a timeout.

NOTE 2: "XXX" = last message number that was deactivated.

DN3000 Output Data Table

Word	Sign #	Sign Register #
1	7	1
2	7	2
3	7	101
4	7	102
5	8	101
6	8	102

ALPHA sign #7

Register #	Description
101	Message Activation Register
102	Message Deactivation Register
1	Variable #1 (dummy timeout variable)
2	**Variable #2 (conveyor belt speed)**

Message #	Description (bold is for this sign)
1	**"Conveyor Belt Speed ="**
2	"Lathe On"
3	"Lathe Off"
4	**"Conveyor Belt Off"**
5	**"Motor Overload"**

ALPHA sign #8

Register #	Description
101	Message Activation Register
102	Message Deactivation Register
1	Variable #1 (dummy timeout variable)
2	Variable #2 (conveyor belt speed)

Message #	Description (bold is for this sign)
1	"Conveyor Belt Speed ="
2	**"Lathe On"**
3	**"Lathe Off"**
4	"Conveyor Belt Off"
5	"Motor Overload"

NOTE: Notice that ALL five of the messages are in all the signs:
"Conveyor Belt Speed = [+ Variable #2]",
"Lathe On", "Lathe Off" , Conveyor Belt Off ,
and "Motor Overload".