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GWY-01-DNT-01

Subnet 16 DeviceNet Gateway Interface Module

OPERATOR'S MANUAL

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ESCORT MEMORY SYSTEMS BY DATALOGIC

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ESCORT MEMORY SYSTEMS

GWY-01-DNT-01

Subnet16™ DeviceNet Gateway Manual – Rev. 02

For the GWY-01-DNT-01 Gateway Interface Module

ESCORT MEMORY SYSTEMS

GWY-01-DNT-01

SUBNET16™ DEVICENET GATEWAY INTERFACE MODULE

High frequency, Multi-protocol, RFID Interface Module for DeviceNet

OPERATOR'S MANUAL

How to Install, Configure and Operate

Escort Memory Systems'

Subnet16 DeviceNet Gateway

REGULATORY COMPLIANCE

FCC PART 15.105

This equipment has been tested and found to comply with the limits for a Class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in a residential installation. This equipment uses, generates, and can radiate radio frequency energy and, if not installed and used in accordance with these instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

Reorient or relocate the receiving antenna.

Increase the separation between the equipment and receiver.

Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.

Consult the dealer or an experienced radio/TV technician for help.

FCC PART 15.21

Users are cautioned that changes or modifications to the unit not expressly approved by Escort Memory Systems may void the user's authority to operate the equipment.

This device complies with Part 15 of the FCC Rules. Operation is subject to the following two conditions: (1) This device may not cause harmful interference, and (2) this device must accept any interference that may cause undesired operation.

CE

This product complies with the following regulatory specifications: EN 60950, EN-300-330, EN-300-683, IEC 68-2-1, IEC 68-2-6, IEC 68-2-27 and IEC 68-2-28.

TELEC

This product complies with TELEC Regulations for Enforcement of the Radio Law Article 6, section 1, No. 1.

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CHAPTER 1:
GETTING STARTED

1.1 INTRODUCTION

Welcome to the ***GWY-01-DNT-01 Operator's Manual***. This manual will assist you in the installation, configuration and operation of Escort Memory Systems' Subnet16 DeviceNet Gateway Interface Module.

The DeviceNet Gateway can control up to 16 passive high frequency read/write Radio-Frequency Identification (*RFID*) controllers. In order to meet and exceed the requirements of the industrial automation industry, the DeviceNet Gateway and EMS RFID controllers are designed to be compact, reliable and rugged.

1.1.1 The Subnet16™ Gateway

Subnet16™ is a 16-Node Multidrop bus architecture and protocol that provides connectivity for up to 16 RFID controllers through a single Gateway device.

The DeviceNet Gateway supports DeviceNet standards and is compatible with EMS' C-Series and Cobalt HF-Series RFID controllers, LRP, HMS and T-Series RFID tags. Many of EMS' legacy RFID controllers with MUX32™ capability are also compatible with the Gateway.

1.2 SUBNET16 DEVICENET GATEWAY FEATURES

- Multi-Drop capable; controls up to 16 RFID reader/writers, each functioning independently and simultaneously.
- DeviceNet compliant through ODVA's Independent Conformance Testing Laboratories
- Operational power is supplied directly from the Subnet 16™ network
- Communicates with read/write passive RFID tags
- IP30 Rated Field Mountable metallic enclosure
- Small footprint provides ease of mounting (76mm x 89mm x 33mm).
- Selectable data transfer rate (125K baud, 250K baud, 500K baud). 10/100 Mbps
- Selectable DeviceNet node addressing (0 to 63), default is 63
- LED status indicators for network status, module status, command execution, tag presence, error indication, and power
- FCC/CE Agency compliant (for noise immunity)
- Supports controller macro functionality
- Flash memory for software updates
- Real-time Calendar/Date functions
- *OnDemand Utilities* for legacy support of PLC5E and RA SCL5/05 PLCs
- Downward compatible with most EMS Mux32™ compliant products

- Auto configuration of RFID controllers, automatic Node ID number assignment
- Node Fault Detection
- Isolated power and bus interfaces
- ARM7 processing power

1.3 ABOUT THIS MANUAL

This manual provides guidelines and instructions for installing, configuring and operating Escort Memory Systems' Subnet16 DeviceNet Gateway Interface Module (GWY-01-DNT-01).

This document does NOT include explicit details regarding each of the Gateway's RFID commands. Specific RFID command related information is available in the ***CBx Command Protocol – Reference Manual***, which is available at www.ems-rfid.com.

However, this manual does explain the process of issuing commands from a host PC or Programmable Logic Controller (PLC) to a Subnet16 Gateway, Subnet network and attached RFID controllers.

NOTE:

-Throughout this manual, the GWY-01-DNT-01 is referred to as the "*Subnet16 Gateway*" or simply "*the Gateway"*.

- C -Series RFID Controllers and Cobalt HF-Series RFID Controllers are referred to as *C-Series Controllers, Cobalt Controllers,* or just "*the Controller."*

-In addition, the terms "*Subnet Node Number*", "*Node ID*" and "*Controller ID*" are used interchangeably.

1.3.1 Who Should Read this Manual?

This manual should be read by those who will be installing, configuring and operating the Gateway. This may include the following people:

- Hardware Installers
- System Integrators
- Project Managers
- IT Personnel
- System and Database Administrators
- Software Application Engineers
- Service and Maintenance Engineers

1.3.2 HEX Notation

Throughout this manual, numbers expressed in Hexadecimal notation are prefaced with "**0x**"**.** For example, the number "10" in decimal is expressed as "0x0A" in hexadecimal. See Appendix D for a chart containing Hex values, ASCII characters and their corresponding decimal integers.

1.4 GATEWAY DIMENSIONS

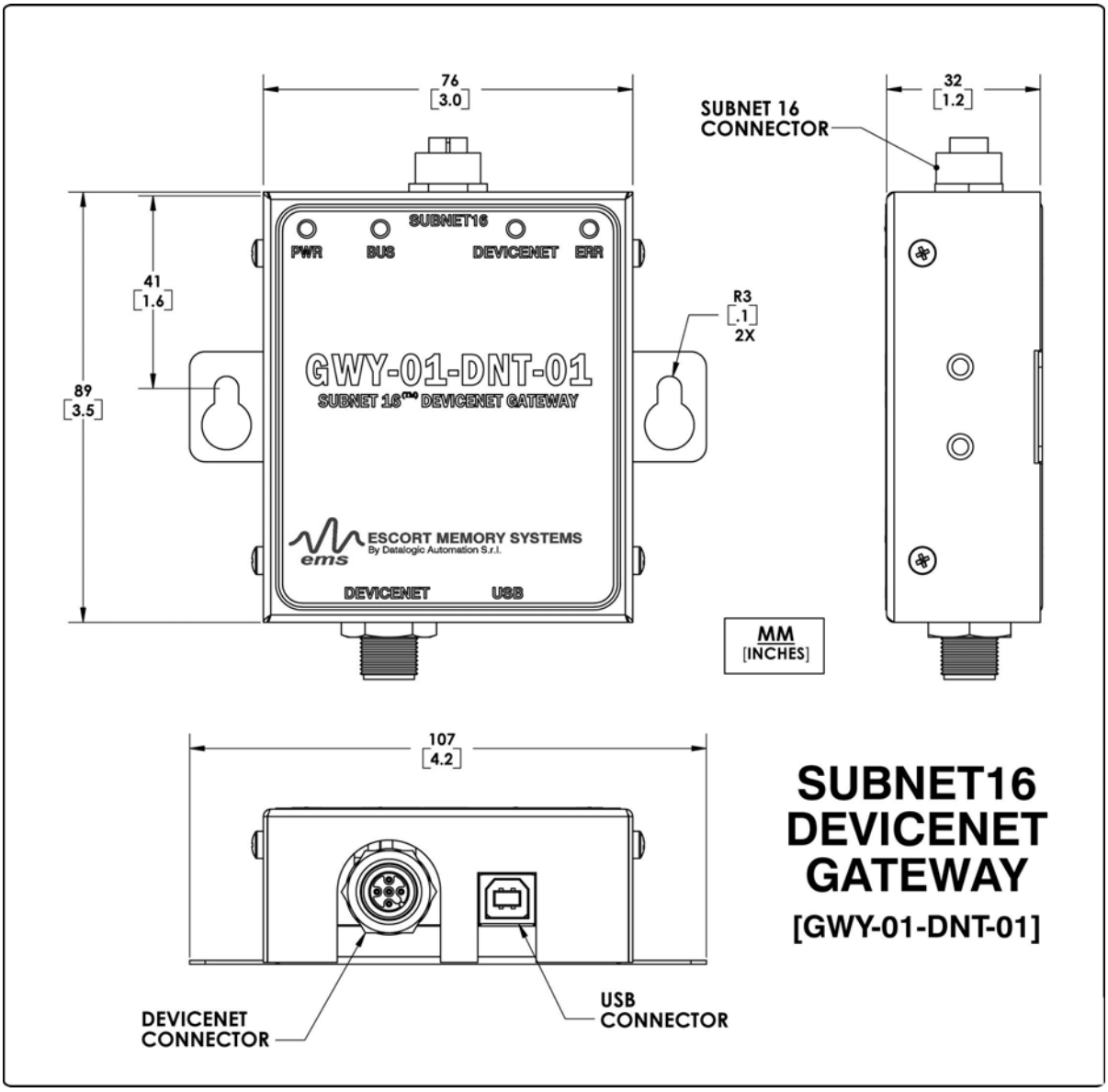


Figure 1-1: GWY-01-DNT-01 Dimensions

1.5 INSTALLATION GUIDELINES

1.5.1 Hardware Requirements

The following components are required for a complete Subnet16 RFID system:

- One Subnet16 DeviceNet Gateway Interface Module
- One ControlLogix PLC or other DeviceNet-capable host
- One to 16 RS485-based RFID controllers (Cobalt or HF-0405-Series)
- Adequate length cabling, connectors and terminators
- Sufficient power, supplied via DeviceNet network cabling, capable of powering the Gateway and its RFID controllers
- EMS' HMS-Series, LRP-Series or T-Series RFID tags

1.5.2 Installation Precautions

- Route cables away from motors, solenoids, unshielded cables and any wiring that carries high voltage or high current.
- Review the power requirements of your RFID network and provide a suitable power supply.
- The Gateway is designed to withstand 8kV of direct electro-static discharge (ESD) and 15kV of air gap discharge. However, it is not uncommon for some applications to generate considerably higher ESD levels. Always use adequate ESD prevention measures to dissipate potentially high voltages.
- Avoid mounting the Gateway or its RFID controllers near sources of EMI (electro-magnetic interference) or near devices that generate high ESD levels.
- Perform a test phase by constructing a small scale, independent network that includes only the essential devices required to test your RFID application (use EMS approved Subnet16 cables and accessories).
- Cables should only cross at perpendicular intersections.

1.5.3 Network & Power Considerations

- Refer to the network diagrams in *Appendix C*. Choose the network architecture (ThickNet vs. ThinNet) that best suits your RFID requirements.
- Construct your chosen network using only EMS approved Subnet16 cables, Drop-T connectors, Terminating Resistors and accessories.
- Review the power requirements of your RFID network and provide a suitable power supply. (See *Appendix B* for power supplies offered by EMS).

IMPORTANT NOTE: It is strongly recommended that power be applied directly to the Subnet16 ™ Network trunk and distributed through drop cables to the Gateway and RFID controllers.

1.6 INSTALLING THE GATEWAY

The ***GWY-01-DNT-01*** supports DeviceNet communications and can be connected to a LAN and/or Programmable Logic Controller (PLC) via DeviceNet-compatible cabling.

Follow the Steps Below to Install the Gateway

1. Note the Installation Guidelines in *Chapter 1, Section 1.5*.

51 Securely mount the Gateway to your chosen location using two M5 (#10) screws, lock washers and nuts. The Gateway may be mounted in any orientation, but should be aligned in such a manner that the LED indicators can be seen during operation.

61 Attach one end of a 5-pin, male-to-male, M12, ThinNet drop cable (***EMS P/N: CBL- 1481-XX)*** to the 5-pin, female, M12 connector on the Gateway. Connect the other end of this 5-pin, male-to-male, M12, ThinNet drop cable to the 5-pin, female, M12 connector on EITHER a ***ThickNet to ThinNet Drop-T Connector*** OR a ***ThinNet to ThinNet Drop-T Connector*** (as per your network and RFID application requirements). See figure below for Drop-T connectors.

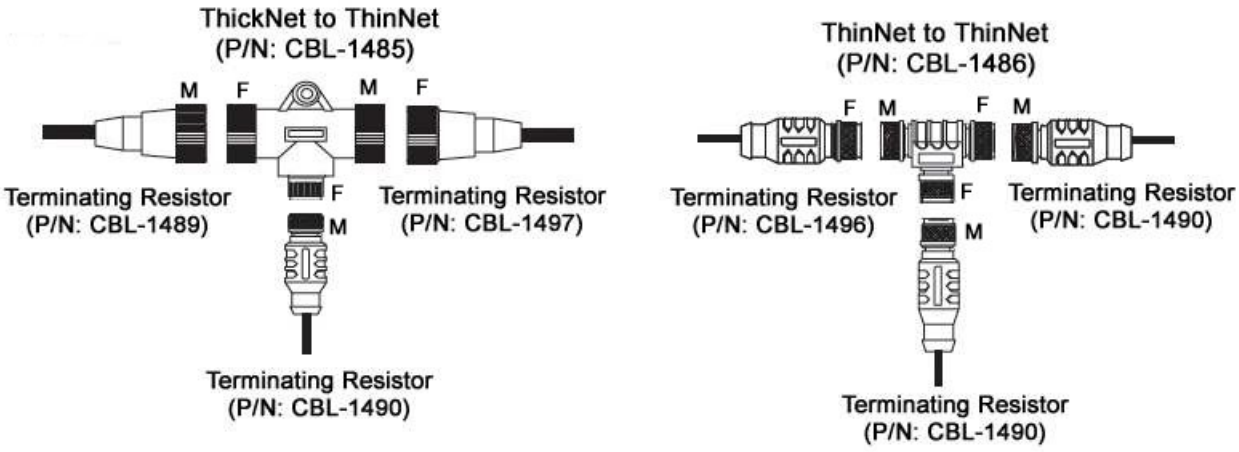


Figure 1-2: Drop-T Connectors and Terminating Resistors

4. Attach one end of a male-to-female trunk cable to each mating connector on the Drop-T Connector. Continue connecting trunk cables and Drop-T connectors as needed. *Note: trunk length should not exceed 300m for ThickNet and 20m for ThinNet.*

5. Connect the male end of a 5-pin, male-to-female ThinNet drop cable to the female end on your Drop-T connector(s). Attach the remaining female end of the ThinNet drop cable to the 5-pin, male, M12 connector on a ***Cobalt HF*** and/or ***C-Series Controller (RS485 models).***

6. Repeat ***Step 5*** for each RFID controller you plan to install. *Note: maximum drop cable length is 2m.*

Figure 1-3: Subnet16 ThinNet Cable

7. ***For ThickNet Networks:*** Using a 5-pin, female, 7/8 - 16, ThickNet to Bare Wire Leads cable (***EMS P/N: CBL-1495-XX***), connect the bare wires to your power supply (SHIELD wire connected to GND). Attach the female, ThickNet end to the 5-pin, male, ThickNet end on a Drop-T connector (***EMS P/N: CBL-1526***).

8. ***For ThinNet Networks:*** Using a 5-pin, female, M12, ThinNet to Bare Wire Leads cable (***EMS P/N: CBL-1494-XX***), connect the bare wires to your power supply (SHIELD wire connected to GND). Attach the female, ThinNet end to the 5-pin, male, ThinNet end on a Drop-T connector (***EMS P/N: CBL-1486***).

Figure 1-4: Subnet16 ThickNet Cable

9. Attach a DeviceNet-compatible data cable to the 5-pin, male M12 interface connector on the Gateway. Connect the other end of this cable to your DeviceNet network.

10. Turn your power supply ON. The green *PWR (power) LED* on the Gateway will illuminate. After the boot process is complete, the amber *DeviceNet LED* will also glow to indicate that the Gateway is in DeviceNet mode. The "*DeviceNet" LED* may appear green or red (solid or flashing) depending on the status of the connection with your DeviceNet network (see *Table 2-2* in *Section 2.2.1* for the behavior of the Gateway's DeviceNet LED).

OPTIONAL STEPS FOR ADDITIONAL CONFIGURATION

Steps 11 - 12 below are considered optional and only need to be completed by users that wish to modify their Gateway's internal configuration.

11. To modify the Gateway's internal configuration, connect a USB cable to the USB interface connector on the Gateway. Connect the other end of this cable to a USB port on your host computer.

12. Download the ***Cobalt Dashboard Utility*** from www.ems-rfid.com and install the software on your host computer. Use the *Dashboard Utility* to connect, via USB, to the Gateway. You will then be able to use the Cobalt Dashboard Utility to configure the Gateway and send RFID commands for testing purposes.

XX = length in Meters

GWY-01-DNT-01 DEVICENET FACTORY DEFAULTS

Node Address: *63*

Data Rate: *125Kb (via 5-pin DeviceNet connection)*

CHAPTER 2:
GATEWAY OVERVIEW

2.1 OPERATING MODES

Subnet16 Gateways have two modes of operation: **Subnet16™** and **Mux32™**. Operating modes are set by configuring one of the eight DIP-switches on the unit's circuit board assembly (*Refer to Section 2.1.3 for DIP-switch access and setting*).

2.1.1 Subnet16™

Subnet16™ is an advanced feature-rich network protocol that supports a subset of the EMS Mux32 legacy protocol. The advanced features implemented in the Subnet16 protocol allow the Gateway to assign individual Node ID values automatically to each RFID controller connected on the Subnet bus. Subnet16 also allows the Gateway to detect when a new controller is connected to the Subnet or when a controller "falls off the bus" (stops responding).

Through the Subnet16 protocol, the Gateway is able to store a backup copy of each RFID controller's custom configuration settings. In the event that an RFID controller fails, the stored configuration settings can be automatically reassigned to a replacement RFID controller.

Real-time clock functionality is supported in Subnet16 mode. Host-bound data packets are automatically Time/Date stamped as they pass through the Gateway and on to the host.

Many of the RFID commands supported by the Gateway and RFID controllers will only function when the Gateway is in Subnet16 mode.

2.1.2 Mux32™

Mux32 is a well-established, multi-drop protocol incorporated into many of EMS' prior products including HMS-Series and LRP-Series RFID Controllers. Most, but not all, HMS and LRP commands supported by MUX32 are also supported by the Gateway (when in Mux32 mode). Legacy Mux32 controllers must support the "*ABx Fast*" command protocol to work with the Gateway in Mux32 Mode. For more information regarding ABx Fast, please see the *ABx Fast Protocol – Reference Manual* available online at www.ems-rfid.com.

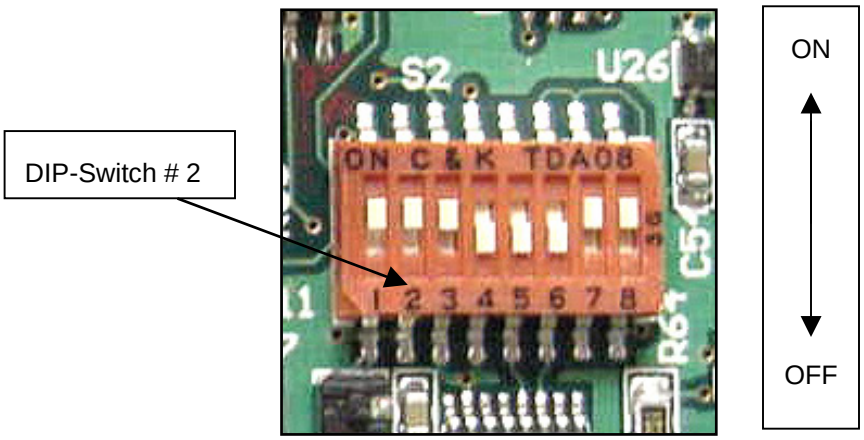
Many advanced Subnet16 features are not available when the Gateway is running in Mux32 mode. RFID controllers must be assigned a unique Node ID number (via *Configuration Tag*) prior to being attached to the Gateway's Subnet.

Note that the Gateway does not support Node IDs 17-31. Node IDs 0 and 32 are reserved for special cases described later in this manual.

NOTE: The Gateway communicates over the RS-485 physical layer using these two protocols only, but it is not a generic RS-485 device.
RS-485 cabling requirements are the same for both protocols.

2.1.3 DIP-Switch Setting

The operating modes are set by configuring one of the eight DIP-switches on the unit's main board. To access these DIP-switches, remove the four screws securing the lid to the base of the enclosure. After removing the lid, locate the DIP-switch block containing eight small DIP-switches.



The **DIP-Switch # 2** selects the Gateway's ***Operating Mode***, thereby determining whether the device powers-up in ***Subnet16*** mode or in ***Mux32*** mode.

- **DIP-Switch 2 ON = Subnet16 (Default Setting)**

  When this DIP-switch is ON, upon power-up, the Gateway will enter Subnet16 mode, enabling the Subnet16 protocol and expanded feature set.

- **DIP-Switch 2 OFF = Mux32**

  When this DIP-switch is OFF, upon power-up, the Gateway will enter Mux32 mode.

The user should NOT modify any other DIP-switch.

2.2 LED INDICATORS

The Gateway has four LED indicators located on the front panel of the unit. The LEDs display everything from bus and DeviceNet activity, to diagnostic information and power status.

2.2.1 Front Panel LEDs

LED NAME	LED COLOR	DESCRIPTION
PWR	**Green**	The ***PWR*** (power) LED will light and remain ON while power is applied to the Gateway.
BUS	**Amber**	The ***BUS*** LED will flash ON and OFF to indicate that data is being transmitted between the Gateway and one or more RFID controllers.
DEVICENET	**Amber**	For the ***DEVICENET*** LED description, see table below.
ERR	**Red**	The ***ERR*** (error) LED will turn ON when the Gateway experiences an error condition. This LED will be cleared when the next valid command is received by the Gateway.

Table 2-1: Front Panel LEDs

The table below describes the behavior of the DeviceNet LED indicator.

DEVICENET LED IS:	INDICATES:
Off	Gateway is not online or not powered
Solid Green	Gateway is operational, online AND a connection is established
Flashing Green	Gateway is operational and online, but with no established I/O connections (idle on the network) or Gateway is online and needs commissioning
Flashing Red	Recoverable fault detected and/or the Gateway's I/O connection timed out
Solid Red	Unrecoverable fault detected (for example, a duplicate node address was encountered rendering Gateway unable to communicate)

Table 2-2: DeviceNet LED Behavior

2.3 EXTERNAL CONNECTORS

The Gateway has the following external connectors:

- **DeviceNet Connector** (5-pin, male, M12 - for DeviceNet connection)
- **USB Connector** (USB type B, female - for establishing a direct serial connection with a host computer for the purpose of configuring the Gateway)
- **Subnet16™ RS485 Connector** (5-pin, female, M12 – for connecting to the Subnet16 network and RFID controllers)

2.3.1 DeviceNet / Power Connector

GWY-01-DNT-01 Five-Pin Interface Connector – Pinout

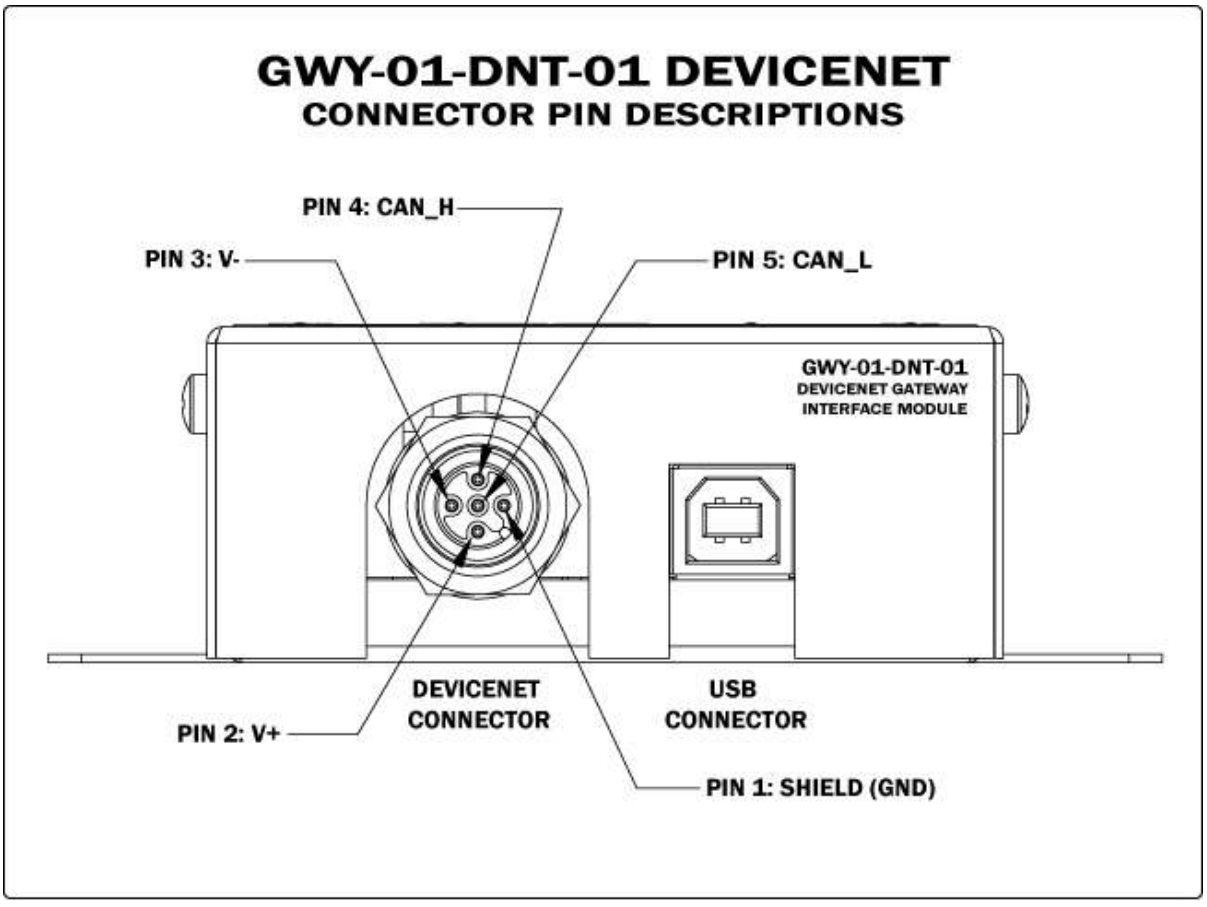


Figure 2-1: GWY-01-DNT-01: DeviceNet Interface Connector - Pinout

See Section 2.4 for more information regarding power and wiring for the Gateway.

2.3.2 Subnet16 RS485 Connector Pin Descriptions

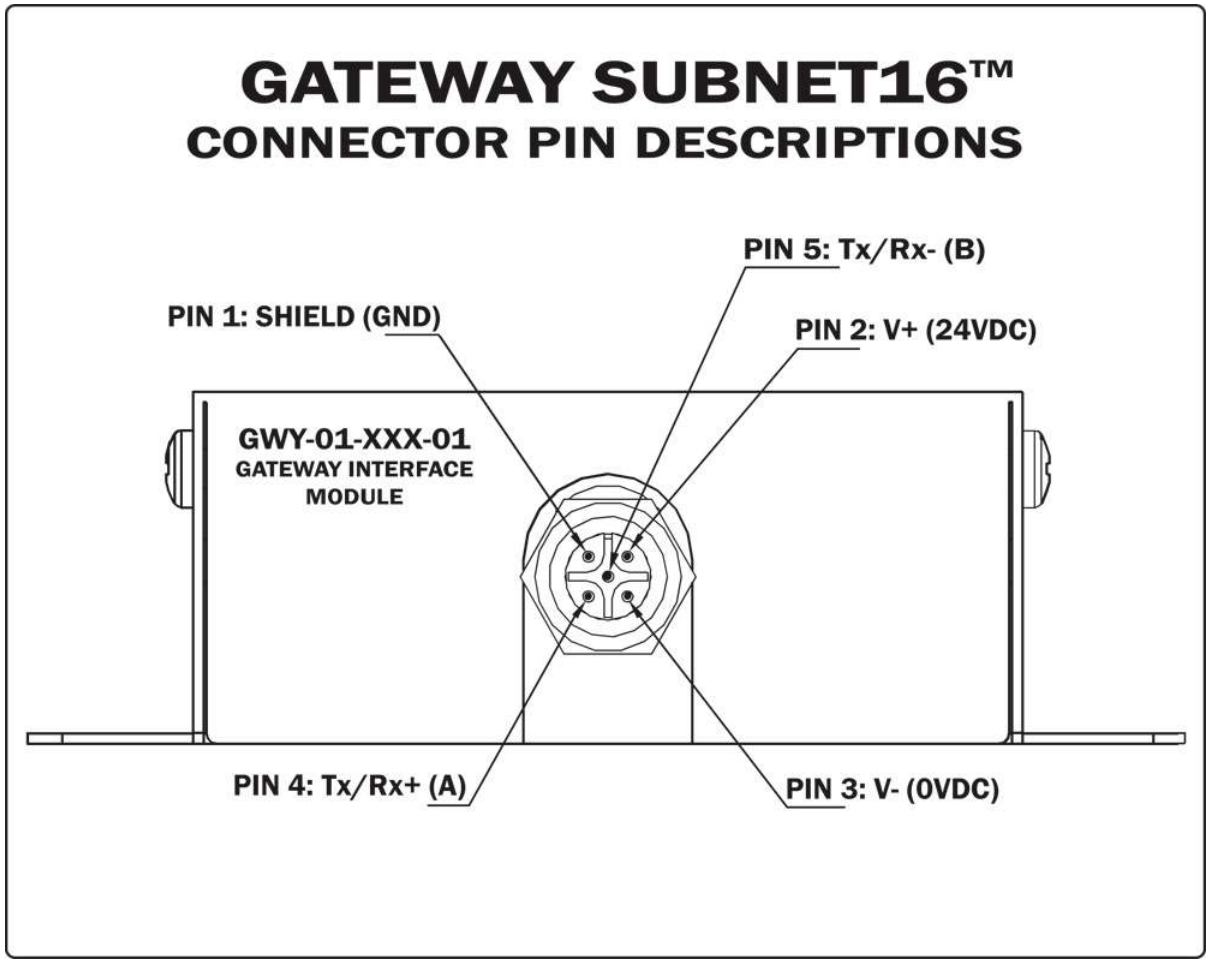


Figure 2-2: Subnet16 RS485 Connector Pin Descriptions

2.4 POWER & WIRING

The information presented below is provided to assist the installer in determining the amount of power that will be required by the Gateway and its Subnet network.

2.4.1 Power Requirements

Power is applied directly to the Subnet16 ™ Network trunk and distributed through drop cables to the Gateway and the RFID controllers attached (*see Appendix C for network diagrams*).
The Gateway requires an electrical supply voltage of 1**8~30VDC** and has a power draw of **2.88W (120mA @ 24VDC, 1 Amp peak)**. Use a regulated power supply that is capable of delivering these requirements.

EMS P/N:	DESCRIPTION
00-1166	45W, 24VDC, 1.88A max
00-1167	100W, 24VDC, 4.17A max
00-1168	120W, 24VDC, 5.0A max

Table 2-3: Power Supplies Part Numbers

In addition, each RFID controller connected to the Gateway via the Subnet16 network will also require power.

The information presented below is provided to assist you in determining the power requirements of your RFID application.

2.4.2 Total System Current Consumption

Maximum Gateway Current = 120mA @ 24VDC (2.88W)

Maximum RFID Controller Current = (refer to controller's specifications for more information)

- C0405-485 controllers = 100mA
- C1007-485 controllers = 150mA
- Cobalt HF-CNTL-485 controllers = 400mA
- HF-0405-485 controllers = 150mA

CALCULATING TOTAL SYSTEM CURRENT CONSUMPTION

To calculate the total amount of current required to operate the Gateway and any number of attached RFID controllers, follow the formula below.

Total Current Consumption = [*Maximum Gateway Current* + (*Maximum Controller Current* x *Number of Controllers*)] x 1.1 (to add a 10% safety margin)

EXAMPLE

For a Subnet16 Gateway network with eight C0405-485 RFID Controllers:

Total Current Required = [0.120A + (0.100A X 8)] x 1.1 = **1.012A**

2.4.3 Cable Voltage Drop

In addition, each RFID controller on the Subnet will experience a certain amount of voltage drop depending on the length of the cable.

CABLE RESISTANCE PER METER

- **ThinNet** = .05413 ohms per meter
- **ThickNet** = .0105 ohms per meter

CALCULATING VOLTAGE DROP

Voltage Drop = [(*Max Controller Current* **X** *Number of Controllers)* **X** (*Cable Resistance per Meter* **X** *Cable Length in Meters*)]

EXAMPLE

For a ThinNet network with eight C0405-485 RFID Controllers at a cable length of 20 meters:

Voltage Drop = (0.100A x 8) X (.05413 X 20) = **0.866VDC**

It is recommended that the voltage drop calculation be conducted on the RFID controller that is farthest from the Gateway, as it will experience the greatest voltage drop.

CURRENT RATING FOR CABLES

- ThinNet Cable Current Rating = 6.4A
- ThickNet Cable Current Rating = 17.6A (power and ground); 13.6A (data)
- 12mm Connector Current Rating = 3A

2.4.4 Subnet16 Gateway Hardware Details

The Gateway incorporates an ARM7 micro-controller, a power supply circuit (with protected input and output circuits), a real- time clock and an opto-isolated Subnet16 interface (with diagnostic functionality). Subnet16 serial communication is protected by EMI filters and diodes for fault tolerance.

The outer housing of the Gateway is a fabricated stainless steel enclosure that is rated NEMA 1 and IP30. A mounting bracket is incorporated into the enclosure to provide ease of installation. Four Philips head screws secure the cover to the base. Removing these four screws and the cover is required to access the DIP-switch block.

NOTE:

IP30 – Ingress Protection against solid objects over 2.5mm (tools and wires)

-Ingress Protection (IP) ratings are developed by the European Committee for Electro Technical Standardization (CENELEC) - IEC/EN Publication 60529

NEMA Type 1 - Enclosures are constructed for indoor use, provide a degree of protection to personnel against incidental contact with the enclosed equipment and provide a degree of protection against falling dirt.

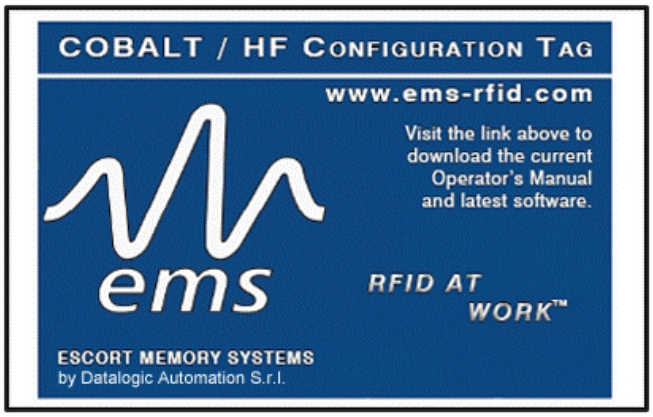
- NEMA Standards Publication 250-2003

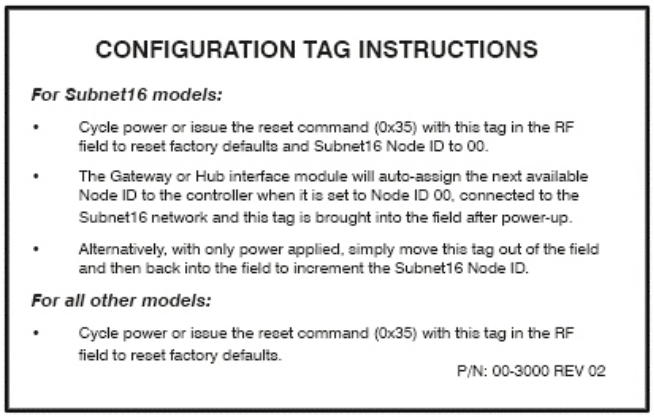
2.5 NODE ID CONFIGURATION & MANAGEMENT

Only RS485-based RFID controllers can be connected to a Gateway's Subnet network and each must be assigned a unique Node ID value between 1 and 16.

When an RFID controller is connected to the Gateway's Subnet network, the Gateway will query the new controller to obtain certain configuration values (specifically the Node ID number). If the Gateway does not detect a Node ID conflict, it will "allow" the RFID controller onto the Subnet network.

By using the ***Cobalt HF Configuration Tag*** that is included with each RS485-based Cobalt and HF-Series RFID Controller, the Node ID value can be dynamically assigned by the Gateway or can be manually assigned by the user.





For the Gateway to dynamically assign a Node ID value to a controller, the controller must first be initialized with the Node ID value of zero. This is the equivalent of having no Node ID assigned (note: all EMS RS485-based controllers ship with their Node ID value set to 0).

When a controller (that is set to Node ID 0) is connected to the Subnet, it will not initially be recognized by the Gateway until the Configuration Tag is placed in the antenna's RF field and power to the controller is cycled. A few seconds after power is cycled to the controller while the Configuration Tag is in RF range, the controller will display its new assigned Node ID value in binary code from right to left using the five amber LEDs on the controller.

When dynamically assigning a Node ID value for a new controller, the Gateway will either assign the next available Node ID value or the value that the Gateway recognizes as offline or "*missing*" – that is, a Node ID value that previously existed, but has since disappeared from the network.

Because the Gateway stores a backup of each Subnet Node's configuration, should an RFID controller ever fail, a replacement controller can be installed quickly and easily. The new controller will be automatically assigned the same Node ID value and configuration as the replaced controller, provided the Configuration Tag is introduced to the antenna field after startup.

2.6 GATEWAY AND SUBNET NODE NAMING

The Gateway can store a 64-byte ASCII string for each of the 16 Subnet Nodes and one 64-byte ASCII string for the Gateway itself. These text strings can be used to assign logical or *"user friendly"* names to the Gateway and its Subnet Nodes.

For example, you could assign the Gateway a logical name such as "*PRODUCTION LINE 1*" and then name the controller connected to Subnet Node 01 "*PRODUCTION STATION 1.*" The controller at Subnet Node 02 could then be named "*PRODUCTION STATION 2*" (and so forth).

Gateway and Node names can be retrieved and edited by issuing specific commands to the Gateway (which are covered later in this manual). See the table below for specific CBx protocol command ID numbers.

Gateway and Node Naming – CBx Command IDs

	GATEWAY	NODE
GET NAME	Command 0x11	Command 0x30
SET NAME	Command 0x21	Command 0x40

Table 2-4: Gateway and Node Naming – CBx Command IDs

Gateway and Node naming can also be accomplished through the *Cobalt Dashboard* software utility (*see* *Chapter 2, Section 2.7.1, "Cobalt Dashboard"* for information).

2.7 CONFIGURATION TOOLS

Escort Memory Systems offers the following powerful RFID configuration utilities for Microsoft Windows XP and Windows 2000 based systems:

- **Cobalt Dashboard**
- **C-Macro Builder**

These configuration tools can be downloaded from the Escort Memory Systems website:

http://www.ems-rfid.com/

2.7.1 Cobalt Dashboard

The **Cobalt Dashboard™** is a Windows-based software application that provides users with complete control over their EMS RFID Solution. Users can monitor their entire RFID system, from the tag level, to the RFID controller, to the Gateway, and to the host.

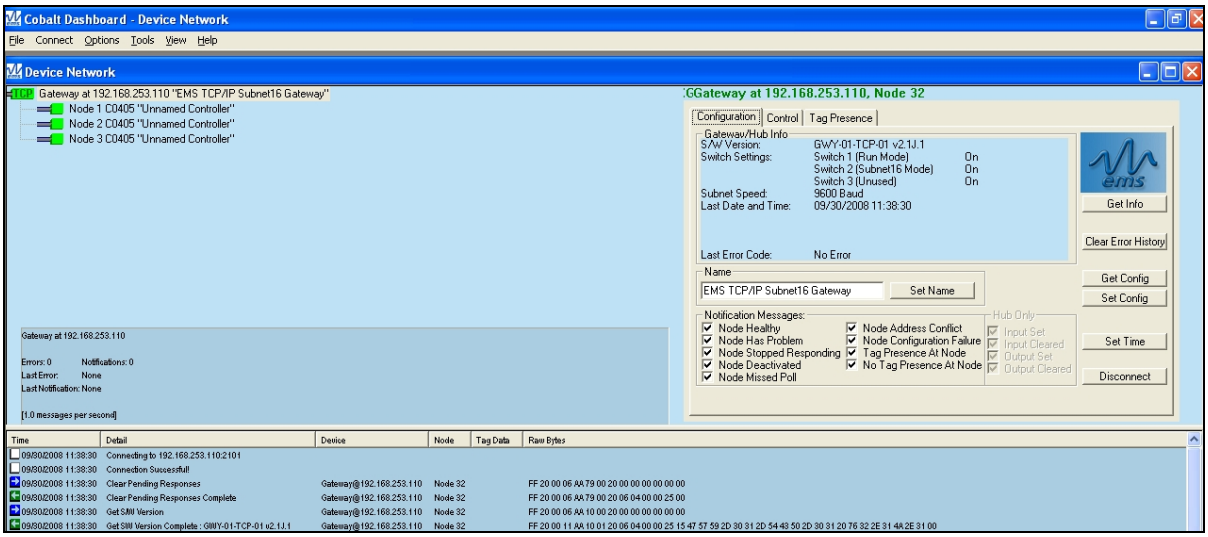


Figure 2-3: Cobalt Dashboard

Cobalt Dashboard Features:

- Complete Subnet Node configuration
- Data packet inspection and Subnet network health monitoring
- Software downloading and firmware upgrade installation routines
- Gateway and Subnet Node “Friendly” Name Assignment (users can quickly and easily assign logical “friendly” names to the Gateway and its Subnet Nodes).
- Supports Ethernet, DeviceNet, Profibus and RS232 interfaces

2.7.2 C-Macro Builder

C-Macro Builder™ is an easy to use GUI-driven utility for Windows that allows users to create powerful RFID command macro programs.

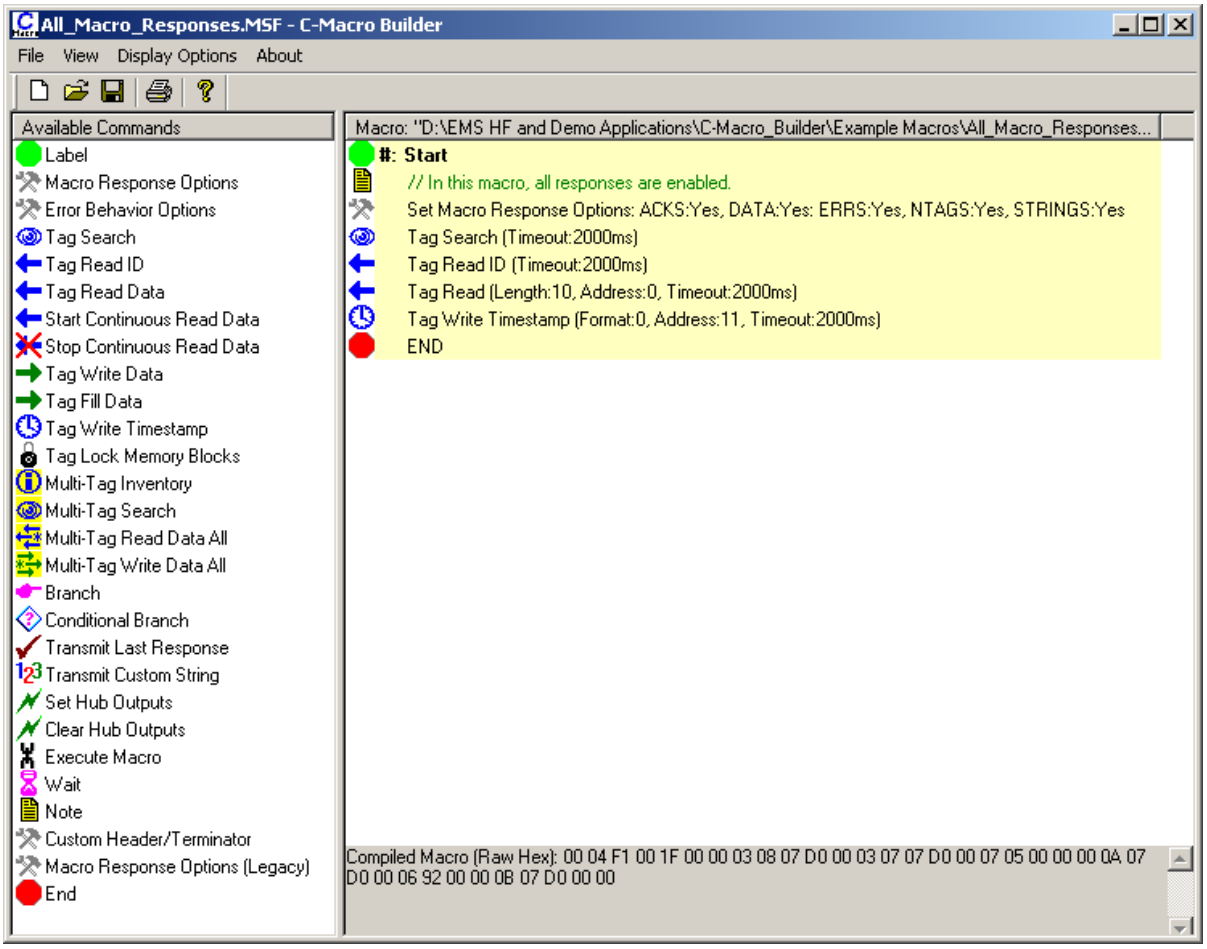


Figure 2-4: C-Macro Builder

When used in conjunction with the Cobalt Dashboard, users can easily download, erase, backup and manage multiple RFID command macros and macro triggers for each Subnet Node.

See *Chapter 3 "RFID Command Macros"* for more on macros.

NOTE:

For specific information regarding the configuration and use of either of these utilities, please see the accompanying documentation included when downloading each software application.

CHAPTER 3:
RFID COMMAND MACROS

What are RFID Command Macros?

RFID Command Macros are a powerful feature of EMS' Cobalt, C-Series and HF-0405-Series Controllers. Macros are simple programs that direct a controller to execute multiple pre-programmed instructions.

Because macros reside within the controller's internal memory, they can be programmed to instruct the controller to automatically read and/or write a specified set of data to an RFID tag without the controller ever having to receive a command from the host. In fact, the controllers do not even require a connection to a host in order to execute macros.

Each macro can contain up to 255 bytes of data and each supported controller can store up to eight macros at a time. Though they are stored locally on the controller, macros are also backed up in the Gateway's flash memory as well.

Why use macros?

The power of macros is in distributed intelligence, the reduction in network bus traffic and the ability to accelerate routine decision making at the point of data collection.

What can macros do?

In addition to the automated reading and writing of data, macro capabilities include:

- The ability to write time stamps to RFID tags
- The ability to filter command responses to only those of interest to the host (such as when an error occurs or when a tag has arrived in the RF field)
- The ability to harness powerful logic and triggering capabilities such as; read, write, start/stop continuous read, data compare, branch, transmit custom string, and set outputs.

What is a macro trigger?

Macros are initiated by "triggers." Triggers can be configured in numerous ways. A simple command from the host, such as "*execute macro number three*" can be considered a trigger.

Triggers can be configured, for example, to activate a macro when a tag enters or leaves a controller's RF field.

EMS RFID controllers can store up to eight separate triggers in addition to the eight macros they can also house. Any trigger can activate any of the eight stored macros.

How are macros created?

Macros are created using the powerful, yet simple, C-MacroBuilder™ utility from EMS. The tool's easy to use GUI allows the user to create powerful RFID macro programs quickly and easily.

When used with EMS' Cobalt Dashboard™ utility, users can effortlessly download, erase, and manage their macros and triggers, as well as set the operational configurations of their RFID controllers and Subnet16™ Gateways.

Which communication interfaces support the use of macros?

Macros (and the Dashboard and C-Macro Builder utilities) support communications with Cobalt, C-Series and HF-0405-Series Controllers across Ethernet, DeviceNet, Profibus, RS232 and USB interfaces.

What happens to existing Macros if a controller must be replaced?

When using a Subnet16 Gateway, users do not need to worry. Macros and triggers normally residing in an RFID controller's *flash* memory are always backed up in the Gateway's *flash* memory as well. Therefore, if a controller should ever require replacement, all existing macro and trigger settings are automatically exported from the Gateway to the new RFID controller.

In short, when an RFID controller is initially connected to the Gateway, macro and trigger data from the controller's flash memory is compared to the macro and trigger data backed up in the Gateway from the previous RFID controller. If the data does not match that which is stored on the Gateway, the controller's flash memory will be overwritten with the backed up data stored in the Gateway's flash memory.

How can I learn more about the Dashboard and C-Macro Builder?

More information regarding macros, triggers, uploading, downloading, configuring and monitoring EMS RFID equipment is available in the respective User's Manuals for these products, which are available on the EMS website at: *www.ems-rfid.com*.

CHAPTER 4:
COMMAND MAPPING

A command is initiated by a host PC or *Programmable Logic Controller* (PLC) and is distributed to the Gateway over a network connection. Once issued, the command is then executed directly by the Gateway or is otherwise routed to the appropriate RFID controller (specified by its numerical "*Node ID*" value, for which there are 16).

In general, there are two types of commands that can be issued:

- **Controller Commands -** commands intended for one of the attached RFID controllers. "*Read Data*" and "*Write Data*" are two common controller commands.
- **Gateway Commands** - commands intended for the Gateway itself. Gateway commands are those commands that query the Gateway for information or instruct the Gateway to perform a task. The commands "*Get Node Status List*" and "*Set Notification Mask*" are examples of Gateway commands.

4.1 CBx COMMAND PROTOCOL OVERVIEW

In order to execute RFID commands properly, the RFID device and host computer must be able to communicate using the same language. The language that is used to communicate is referred to as the ***Command Protocol***. The command protocol used by GWY-01-DNT-01 is called ***"CBx."***

The ***CBx Command Protocol*** is an advanced protocol that supports Multi-drop Subnet16 networking with TCP/IP, DeviceNet and Industrial Ethernet applications. It is based on a double-byte oriented packet structure where commands always contain a minimum of six data "words" (12 bytes) - even when one or more packet elements are not applicable to the command.

The CBx packet structures described herein are protocol independent and can be implemented the same for all protocols (Ethernet/IP, Modbus TCP, DeviceNet, etc.).

ATTENTION: For complete command and response packet structures and examples of each RFID command, please refer to the ***CBx Command Protocol – Reference Manual*** available at www.ems-rfid.com

4.2 CBx - COMMAND PACKET STRUCTURE

Below is the packet structure of a standard CBx command.

WORD #	COMMAND PACKET ELEMENT	MSB	LSB
01	**Overall Length**: 2-byte value indicating the number of "***words***" in the command packet. This value will always be at least ***6 words.***	0x00	0x06 + (number of any additional words)
02	**Command ID**: 0xAA + 1-byte value indicating command to perform.	0xAA	<Command ID>
03	**0x00** in MSB, **Node ID** in LSB	0x00	<Node ID>
04	**Timeout Value**: 2-byte integer for the length of time allowed for the completion of the command, measured in 1 millisecond units, where *0x07D0 = 2000 x .001 = 2 seconds.*	0x07	0xD0
05	**Start Address**: 2-byte integer indicating the location of tag memory where a Read/Write operation will begin (when applicable).	<Start MSB>	<Start LSB>
06	**Block Size**: 2-byte integer indicating the number of bytes that are to be read from or written to a tag beginning at the specified Start Address (when applicable).	<Length MSB>	<Length LSB>
07	**Additional Data Byte Values 1 & 2**: holds 2 bytes of data used for fills, writes, etc. (when applicable)	<D1>	<D2>
08	**Additional Data Byte Values 3 & 4**: (when applicable)	<D3>	<D4>

Table 4-1: CBx Command Packet Structure

4.3 CBx - RESPONSE PACKET STRUCTURE

After performing a command, the Gateway or RFID controller will issue a host-bound response packet. Below is the packet structure of a standard CBx response message.

WORD #	RESPONSE PACKET ELEMENT	MSB	LSB
01	**Overall Length**: 2-byte integer indicating the number of "***words***" in the response packet. This value will always be at least ***6*** (+ number of any data words retrieved).	0x00	0x06 + (number of any retrieved words)
02	**0xAA** in MSB **Command Echo** in LSB	0xAA	<Command Echo>
03	**Instance Counter**: 1-byte value indicating the number of responses generated by the Node ID identified in the LSB (*see details below*). **Node ID Echo**: 1-byte value indicating the Node ID of the controller that performed the command.	<IC>	<Node ID Echo>
04	**Month and Day Timestamp**	<Month>	<Day>
05	**Hour and Minute Timestamp**	<Hour>	<Minute>
06	**Second Timestamp** in MSB **Additional Data Length** in LSB: 1-byte value indicates number of additional bytes retrieved.	<Second>	<N-bytes>
07	**Retrieved Data Bytes 1 and 2:** holds 2 bytes of retrieved data from tag reads, serial numbers, etc. (when applicable)	<D1>	<D2>

Table 4-2: CBx - Response Packet Structure

INSTANCE COUNTER

The ***Instance Counter*** is a one-byte value used by the Subnet16 Gateway to track the number of responses generated by the controller at a given Node ID. The Gateway tallies, in its internal RAM, separate Instance Counter values for each Node ID.

A Node ID's Instance Counter will be incremented by *one* following each response. If, for example, the controller at Node 01 has generated 10 responses, its Instance Counter value will read 0x0A. However, when the Gateway is rebooted or power-cycled, the Instance Counter values for all Node IDs will be reset to zero (0x00).

4.4 CBx COMMANDS TABLE

The table below lists the CBx protocol RFID commands supported by the Gateway and EMS' RFID Controllers.

COMMAND ID	COMMAND NAME	DESCRIPTION
RFID Tag Commands		
0x02	Lock Memory Block	Write protects a block of tag memory
0x04	Fill Tag	Writes a specified data byte value to all defined tag addresses
0x05	Read Data	Reads a specified length of data from a contiguous (sequential) area of tag memory
0x06	Write Data	Writes a specified number of bytes to a contiguous area of tag memory
0x07	Read Tag ID	Reads a tag's unique tag ID number
0x08	Tag Search	Instructs the controller to search for a tag in its RF field
0x0C	Execute Macro	Instructs the controller to execute one of its eight possible macros
0x0D	Start Continuous Read	Instructs the controller to start or stop Continuous Read mode.
0x0E	Read Tag ID and Data	Reads a tag's ID and the requested number of bytes from tag memory
0x0F	Start Continuous Read Tag ID and Data	Places the controller into (or out of) Continuous Read mode and (when evoked) will retrieve a tag's ID.
Gateway Information Commands		
0x10	Get Gateway Software Version	Retrieves the version number of the firmware code installed on the Gateway
0x11	Get Gateway Name	Retrieves the Gateway's user-defined ASCII name
0x12	Get Dipswitch Settings	Retrieves the status of the Gateway configuration dipswitches

COMMAND ID	COMMAND NAME	DESCRIPTION
0x13	Get Node Status List	Retrieves the operational status of the Gateway Subnet Nodes
0x14	Get Notification Mask	Retrieves the user-defined 16-bit "*Notification Mask*" that determines for which events the Gateway notifies the host PC
0x15	Get Last Gateway Error	Retrieves information from the Gateway regarding the last or most recent error that was experienced
0x16	Get Gateway Time	Retrieves the current date and time as set internally on the Gateway
0x1C	Get Subnet Baud Rate	Retrieves the baud rate of the Subnet network
0x21	Set Gateway Name	Writes to flash memory, a user-defined "friendly" name for the Gateway
0x24	Set Notification Mask	Used to customize or modify the Gateway's 16-bit Notification Mask
0x26	Set Gateway Time	Used to set the Gateway's internal clock and calendar
0x2C	Set Subnet Baud Rate	Used to modify and store changes to the Subnet network baud rate
RFID Controller Commands		
0x30	Get Controller Name	Retrieves the controller's user-defined name
0x33	Get Controller Configuration	Retrieves the controller's configuration settings
0x38	Get Controller Info	Retrieves hardware, firmware and serial number information from the controller
0x40	Set Controller Name	Used to set (create or modify) the user-defined name for the controller
0x43	Set Controller Configuration	Used to set (configure or modify) the controller's configuration parameters and settings

COMMAND ID	COMMAND NAME	DESCRIPTION
0x4E	Set Controller Time	Used to set the time for the controller
0x53	Initialize Controller	Removes all configuration settings stored for the controller
0x54	Reset Controller	Resets power to the controller
Gateway Subnet Commands		
0x60	Initialize Gateway	Clears all Subnet Node configuration information stored in the Gateway's flash memory
0x61	Reset Gateway	Performs an electrical reset of the Gateway
0x62	Initialize All Nodes	Removes all stored configuration information for all nodes and reconfigures them to factory defaults
0x63	Initialize All Node Macros	Removes all stored macros from all nodes
0x70	Start Subnet	Instructs the Gateway to begin "polling" the Subnet network
0x71	Move Controller	Used to move all stored configuration data for a particular Node ID to another specified Node ID
0x79	Clear Pending Response	Deletes all pending or buffered responses in the Gateway and resets all Instance Counters to zero
Multi-Tag RFID Commands		
0x92	Multi-Tag Read ID and Data All	Retrieves the tag ID number and a contiguous segment of data from all RFID tags in range
0x95	Multi-Tag Block Read All	Retrieves a contiguous segment of data from all RFID tags in range
0x96	Multi-Tag Block Write All	Writes a contiguous segment of data to all RFID tags in range
0x97	Multi-Tag Get Inventory	Retrieves the tag ID number from all RFID tags found in range

COMMAND ID	COMMAND NAME	DESCRIPTION
0x98	**Multi-Tag Search All**	Checks for the presence of RFID tags in RF range and returns only the number of tags found
0xA5	**Multi-Tag Block Read by ID**	Reads a contiguous segment of data from a specific RFID tag identified by its tag ID
0xA6	**Multi-Tag Block Write by ID**	Writes a contiguous segment of data to a specific RFID tag identified by its tag ID

Table 4-3: CBX Commands Table

4.5 CBx Command Protocol Examples

4.5.1 CBx - Controller Command Example

In the example below, *Command 0x05 (Read Data*) is issued to the RFID controller at Node 01. The controller is instructed to read four bytes of data from a tag beginning at tag address 0x0020. The Timeout Value, measured in milliseconds, is set for two seconds for the completion of this command (*0x07D0 = 2000 x .001 = 2 seconds*).

WORD	PACKET ELEMENET	MSB	LSB
01	**Overall Length of Command** (*in* "*words*")	0x00	0x06
02	**0xAA** in MSB **Command ID** in LSB: (*0x05 - Read Data)*	0xAA	0x05
03	**0x00** in MSB **Node ID** in LSB: (*0x01*)	0x00	0x01
04	**Timeout Value**: (*2 seconds*)	0x07	0xD0
05	**Start Address**: (*0x0020*)	0x00	0x20
06	**Read Length**: (*4 bytes*)	0x00	0x04

4.5.2 CBx - Controller Response Example

Below is a controller's response after successfully completing the *Read Data* command (as issued in the previous example).

WORD	PACKET ELEMENT	MSB	LSB
01	**Overall Length of Response** (*in "words"*)	0x00	0x08
02	**0xAA** in MSB **Command Echo** in LSB: (*0x05 - Read Data)*	0xAA	0x05
03	**Instance Counter** in MSB **Node ID Echo** in LSB	<IC>	0x01
04	**Month and Day Timestamp** (*March 19th*)	0x03	0x13
05	**Hour and Minute Timestamp** (*10:11: AM*)	0x0A	0x0B
06	**Seconds Timestamp** in MSB: (*36 seconds*) **Additional Data Length** in LSB (*4 bytes*)	0x24	0x04
07	**Retrieved Data** (*bytes 1 and 2*)	0x01	0x02
08	**Retrieved Data** (*bytes 3 and 4*)	0x03	0x04

4.5.3 CBx - Gateway Command Example

In this example, the host issues Command 0x13 (*Get Node Status List),* which retrieves from the Gateway, a list that indicates the operating status of the 16 Nodes.

WORD	DESCRIPTION	MSB	LSB
01	**Overall Length of Command** (*in "words"*)	0x00	0x06
02	**0xAA** in MSB **Command ID** in LSB: (*0x13 - Get Node Status List*)	0xAA	0x13
03	**0x00** in MSB **Node ID** in LSB: (*0x20 = Gateway Node 32*)	0x00	0x20
04	**Not Used**: 0x00, 0x00 (*default*)	0x00	0x00
05	**Not Used**: 0x00, 0x00 (*default*)	0x00	0x00
06	**Not Used**: 0x00, 0x00 (*default*)	0x00	0x00

Note that even though the last three words (6 bytes) of this command are not used, these parameters still require zero's (*0x00, 0x00*) and are to be included when calculating *Overall Length*.

4.5.4 CBx - Gateway Response Example

Below is the Gateway response to the command "*Get Node Status List*" (as issued in the previous example).

WORD	DESCRIPTION	MSB	LSB
01	**Overall Length of Response** (*in "words," not including the previous 2-bytes – CBx Header and Node ID Echo)*	0x00	0x0E
02	**0xAA** in MSB **Command Echo** in LSB: (*0x13*)	0xAA	0x13
03	**Instance Counter** in MSB **Node ID Echo** in LSB (*0x20 = Gateway Node 32*)	<IC>	0x20
04	**Month and Day Timestamp** (*March 19th*)	0x03	0x13
05	**Hour and Minute Timestamp** (*10:11: AM*)	0x0A	0x0B
06	**Seconds Timestamp** in MSB: (*36 seconds*) **Additional Data Length** in LSB: (*16 bytes*)	0x24	0x10
07	**Status of Node ID 1 and 2**	0x00	0x00
08	**Status of Node ID 3 and 4**	0x04	0x00
09	**Status of Node ID 5 and 6**	0x00	0x04
0A	**Status of Node ID 7 and 8**	0x00	0x00
0B	**Status of Node ID 9 and 10**	0x00	0x00
0C	**Status of Node ID 11 and 12**	0x00	0x00
0D	**Status of Node ID 13 and 14**	0x00	0x00
0E	**Status of Node ID 15 and 16**	0x00	0x00

In the above example, the *Node Status Byte* "0x04" (meaning "*Controller Healthy*") was reported for Nodes 03 and 06, indicating that the Gateway recognizes functioning RFID controllers at Node 03 and Node 06. (See the *Node Status Byte Definition Table* below for more information).

Node Status Byte Definition Table

NODE STATUS BYTE	NODE STATUS	STATUS DESCRIPTION
0	CONTROLLER INACTIVE	The controller at this node has not responded to a poll for at least 40 seconds. If a controller does eventually respond at this Node ID, its status will be changed to “0x04 - CONTROLLER HEALTHY.”
1	CONTROLLER STOPPED RESPONDING	The controller at this node has not responded to a poll in over 10 seconds. If the controller does not respond to a poll within another 30 seconds, its status will be changed to “0x00 - CONTROLLER INACTIVE.” If the controller does eventually respond to a poll, its status will be changed back to “0x04 - CONTROLLER HEALTHY”
2	CONTROLLER HAS PROBLEM	The controller at this node has missed at least 3 consecutive polls. If the controller does not respond to a poll within another 10 seconds, its status will be changed to “0x01 - CONTROLLER STOPPED RESPONDING.” If the controller does eventually respond to a poll, its status will be changed back to “0x04 - CONTROLLER HEALTHY.”
3	CONTROLLER EXPECTED SOON	This Node Status indicates that a controller is temporarily disconnected or that it is being moved to another Node ID. Because a controller is “expected” to appear soon, the Gateway will poll this node more frequently than other ‘inactive’ nodes.
4	CONTROLLER HEALTHY	The controller at this node is healthy and responding to polls. However, if the controller misses 3 consecutive polls, its status will be changed to “0x02 - CONTROLLER HAS PROBLEM.”
5	CONTROLLER DOWNLOADING	This status is only applied to a controller that is currently downloading and installing new firmware to its flash memory. To optimize polling and allow for the fastest possible firmware installation, the Gateway will temporarily halt the polling of this node until the controller has finished its installation.

Table 4-4: Node Status Byte Definition Table

4.6 CBx ERROR RESPONSE PACKET STRUCTURE

Below is the packet structure of a CBx error response. Note that the one-byte **Error Code** value is returned in the MSB of the seventh data word.

ERROR RESPONSE ELEMENT	MSB	LSB
Overall Length: 2-byte value indicating the number of "*words*" in the Response Packet. This value will always be at least *7* words (6 + 1 for the error code).	0x00	0x07
Error Flag: 0xFF in the MSB indicates that an error occurred. **Error Information Byte**: 0xFF in the LSB indicates that a controller-based error occurred. Any value other than 0xFF indicates that a Gateway-based error occurred (and indicates the command that was attempted when the error occurred).	0xFF	0xFF
Instance Counter: This 1-byte value tallies the number of responses from a given Node ID. **Node ID Echo**: The 1-byte LSB value indicates the Node ID of the controller for which the command was intended.	<IC>	0x01
Month and Day Timestamp	<Month>	<Day>
Hour and Minute Timestamp	<Hour>	<Minute>
Seconds Timestamp in MSB **Number of Additional Bytes Retrieved** in LSB (*0x01 for error responses*)	<Seconds>	0x01
Error Code: 1-byte Error Code in MSB **0x00** in LSB	<Error Code>	0x00

Table 4-4: CBx Error Response Packet Structure

4.7 CBX ERROR CODE TABLE

ERROR CODE	ERROR	DESCRIPTION
0x04	FILL TAG FAILED	Fill Tag Command Failed
0x05	READ DATA FAILED	Read Data Command Failed
0x06	WRITE DATA FAILED	Write Data Command Failed
0x07	READ TAG ID FAILED / TAG SEARCH FAILED	Read Tag ID Command Failed, Tag Search Command Failed and/or No Tag Found
0x21	INVALID SYNTAX	Command Contained a Syntax Error
0x23	INVALID TAG TYPE	Invalid Tag Type Specified
0x30	INTERNAL CONTROLLER ERROR	Generic Internal Controller Error
0x31	INVALID CONTROLLER TYPE	Invalid Controller Type (when Setting Configuration)
0x34	INVALID VERSION	Invalid Software Version Specified (when Setting Configuration)
0x35	INVALID RESET	Invalid Hardware Reset
0x36	WRITE CONFIGURATION FAILED	Set Configuration Command Failed
0x37	READ CONFIGURATION FAILED	Get Configuration Command Failed
0x80	UNKNOWN GATEWAY ERROR	Generic Gateway Error – an undetermined error occurred.
0x81	COMMAND MALFORMED	Generic Command Syntax Error
0x82	COMMAND PROTOCOL MISMATCH	An invalid protocol value was specified in the command
0x83	COMMAND INVALID OPCODE	An invalid Opcode (Command ID number) was specified in the command
0x84	COMMAND INVALID PARAMETER	A parameter specified in the command was invalid
0x85	COMMAND INVALID CONTROLLER ID	A Controller ID (Node ID) specified in the command was invalid, or no controller detected/present at the specified node
0x86	COMMAND INACTIVE CONTROLLER ID	A Controller ID (Node ID) specified in the command is currently inactive.

0x87	SUBNET DEVICE SELECT FAILED	Internal Subnet Error – the specified Subnet device failed.
0x88	SUBNET DEVICE FAILED TO ACKNOWLEDGE	Internal Subnet Error - the specified Subnet device failed to respond to the Gateway's polling.
0x89	SUBNET RESPONSE MALFORMED	Internal Subnet Error – a controller returned a malformed response.
0x8A	SUBNET RESPONSE TIMEOUT	Internal Subnet Error – a controller was unable to generate a response before timeout was reached.
0x8B	SUBNET RESPONSE INVALID CHECKSUM	Internal Subnet Error – a controller generated a response that has an invalid checksum.
0x8C	SUBNET DEVICE CONFLICT DETECTED	Internal Subnet Error – a Node ID conflict has been detected
0x8D	BUFFER OVERFLOW	Internal Gateway Error – Gateway buffer limit was exceeded
0x8E	FLASH FAILURE	Internal Gateway Error – Gateway flash memory failure
0x92	SUBNET16 ONLY COMMAND	A Subnet16-only command was issued when in MUX32 mode.
0x93	NODE MISMATCH ERROR	The Node ID specified in the command did not match the Node to which the command was sent.
0x94	CRC ERROR	Cyclic Redundancy Check Error
0x95	PROTOCOL ERROR	Internal Communications Error

Table 4-5: CBx Error Code Table

4.7.1 CBx - Error Response Example

Below is an example of a typical controller generated error response following a failed *Read Data Command*. For this example, a "*tag not found*" error was generated.

ERROR RESPONSE PARAMETER	MSB	LSB
0x00 in MSB **Overall Length of Response** in LSB (*in words*)	0x00	**0x07**
Error Flag in MSB **Error Information Byte** in LSB	0xFF	**0xFF**
0x00 in MSB **Node ID Echo** in LSB	0x00	**0x01**
Month and **Day Timestamp**: (*March 19th*)	0x03	**0x13**
Hour and **Minute Timestamp** (*9:30: AM*)	0x09	**0x1E**
Seconds Timestamp in MSB (*:03 seconds*) **Number of Additional Bytes Retrieved** in LSB (*0x01 for error responses*)	0x03	**0x01**
Error Code in MSB: (***0x07 = "Tag not Found"***) **0x00** in LSB	**0x07**	**0x00**

4.8 NOTIFICATION MESSAGES

Notification Messages are small host-bound informational packets of data that are issued by the Gateway when a specified ***Notification Event*** (or series of events) occurs within the Gateway or on the Subnet network. For example, the Gateway can be configured to send the host a Notification Message when a controller is attached, or removed, or experiences a problem.

The Gateway stores nine different Notification Messages internally (all of which are enabled by default). A 16-bit value, called the ***Notification Mask***, controls which Notification Events trigger Notification Messages to the host. Bits 01 through 09 in the 16-bit Notification Mask correspond to the nine possible Notification Messages. The remaining 7 bits (bits 10-16) are not implemented at this time (default value is zero for each bit).

Notification Messages are enabled by changing the associated bit from zero to one within the Notification Mask. A bit is either set to "0" (OFF – disabled) or "1" (ON – enabled). When a bit is turned ON, the related Notification Message will be enabled. The next time the enabled Notification Event occurs, the corresponding Notification Message will be generated and immediately delivered to the host.

When a Notification Message is generated, it is written to the ***Node Output Page*** of the controller that triggered the Notification Event. Notification Messages include a one-byte value indicating which of the nine possible Notification Events occurred. Notification Messages also contain a one-byte value that identifies the affected Node ID.

For Notification Messages, a handshaking scheme of enabling and clearing a specific bit in the Output Data Ready Mask is implemented (as previously explained).

To enable all nine Notification Messages, the 2-byte Notification Mask would read:

0x01FF.

16-bit Notification Mask - Binary Representation
-when enabling all nine Notification Messages:

(0 0 0 0 0 0 0 1) (1 1 1 1 1 1 1 1) = 0x01FF

[Bit 16 - - Bit 09] [Bit 08 - - Bit 01]

4.8.1 Notification Message Table

The following table contains a listing of the nine possible *Notification Messages.*

BIT	NOTIFICATION MESSAGE	EVENT DESCRIPTION
1	CONTROLLER IS HEALTHY	Sent whenever the status of a controller changes to '*Healthy*'
2	CONTROLLER HAS PROBLEM	Sent whenever a controller is marked '*Has Problem*'
3	CONTROLLER STOPPED RESPONDING	Sent whenever a controller is marked '*Stopped Responding*'
4	CONTROLLER DEACTIVATED	Sent whenever a controller is deactivated (is marked '*Inactive*')
5	CONTROLLER MISSED POLL	Sent whenever a controller misses a poll
6	CONTROLLER ADDRESS CONFLICT	Sent whenever the Gateway detects a Node ID conflict
7	CONTROLLER CONFIGURATION FAILURE	Sent whenever the Gateway fails to configure a controller
8	TAG PRESENT AT NODE*	Sent whenever a tag is first recognized in the RF field of the specified node
9	TAG NOT PRESENT AT NODE*	Sent when no tag is recognized or when a previously recognized tag is no longer acknowledged in the specified node's RF field

Table 4-6: Notification Message Table

* *Tag Presence* must be enabled on the RFID controller.

4.8.2 Notification Mask Example

In the following example, an RFID controller is attached to the Gateway's Subnet network. After power is applied to the controller, the Gateway immediately attempts to determine its Node ID (*Node 04 in this example*). After recognizing a stored Node ID configuration, the Gateway allows the device onto the Subnet network.

Now if bit 01 in the Notification Mask was enabled (set to one = ON), Notification Event 01 would be triggered and the Gateway would immediately write Notification Message 01 to Node Output Page 36 (the Node Output Page number for Node ID 04). The Notification Message would indicate that a new controller was recognized at Node 04 and is functioning properly (i.e. the controller is healthy).

If, on the other hand, the recently connected controller does not power-up, or fails to initialize properly, and bit 02 in the Notification Mask is enabled, Notification Event 02 will be triggered, in which case the Gateway will write Notification Message 02 to Node Output Page 36. This message informs the host that the controller at Node 04 is experiencing a problem.

4.8.3 Notification Message Packet Structure

DESCRIPTION	MSB	LSB
Overall Length of Notification Message (in *words*)	0x00	0x06
0xFE in MSB = Notification Message Flag **Notification Event** in LSB	0xFE	<Notification Event>
Instance Counter in MSB (*a Notification Message is considered a response; therefore the Instance Counter will be incremented by one*) **Node ID** in LSB (*04 for the above example*)	<IC>	0x04
Month and Day Timestamp	<Month>	<Day>
Hour and Minute Timestamp	<Hour>	<Minute>
Seconds Timestamp in MSB **0x00** in LSB	<Second>	0x00

Table 4-7: Notification Message - Packet Structure

CHAPTER 5:
DEVICENET INTERFACE

5.1 DEVICENET OVERVIEW

DeviceNet is a digital, multi-drop network based on the CAN (Controller Area Network) specification, which permits easy connectivity between industrial controllers and I/O devices.

When the Gateway is connected to a DeviceNet network, it is considered an individual node for which a unique Node Address number between 1 and 63 is assigned (this is not to be confused with a Subnet Node ID number, for which the Gateway has 16). The DeviceNet Gateway conforms to the standards set by the Open DeviceNet Vendor Association (ODVA).

5.2 DEVICENET CONFIGURATION

5.2.1 Importing the Gateway *.EDS* File

After making all necessary hardware connections, the next step in configuring the GWY-01-DNT-01 for DeviceNet is to import the .EDS file.

NOTE: *Electronic Data Sheets (*.EDS)* are basic text files that are utilized by network configuration tools to identify and configure hardware devices for DeviceNet networks. A typical .EDS file contains a description of the product, its device type, hardware version and configurable parameters.

The .EDS file (filename: "***DeviceNet EDS.zip***") for the GWY-01-DNT-01 is available on Escort Memory Systems' Web site (*www.ems-rfid.com*).

1. Download the .EDS file to the computer running your network's Rockwell Automation software (i.e. the host computer).
2. Using the ***EDS Hardware Installation Tool,*** located in the ***RSLinx™ Tools*** program group, import the .EDS file into your RSNetWorx/DeviceNet system. Refer to Rockwell Automation's documentation for specific instructions.
3. After you have imported the .EDS file, close and restart all Rockwell Automation programs. If you are uncertain which programs to close, cycle power to the host computer after importing the .EDS file.

5.2.2 Configuring Gateway and PLC DeviceNet Communications

After importing the .EDS file and rebooting the host computer (or after restarting your Rockwell Automation software), follow the steps below to continue configuring DeviceNet network communications between the Gateway and a *ControlLogix* PLC.

1 On the host computer, start ***RSNetWorx for DeviceNet***.

2 Go online (click ***NETWORK*** and select ***ONLINE***).

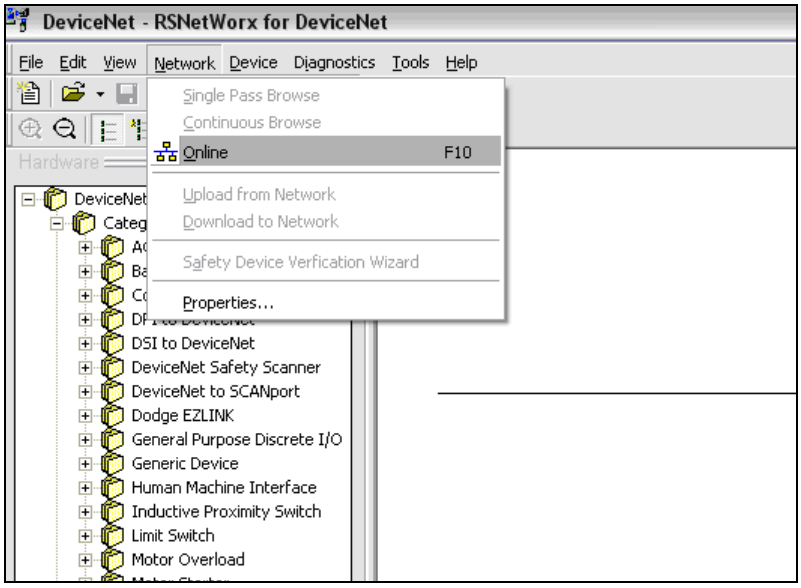
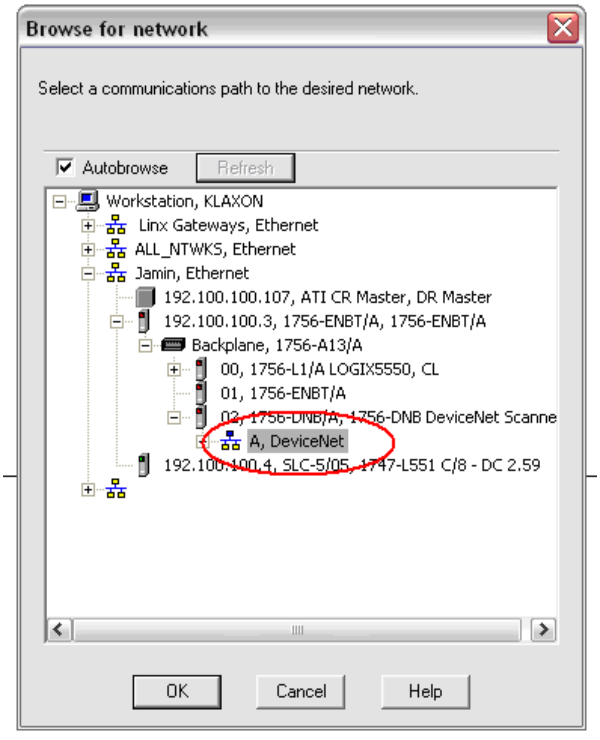


Figure 5-1: Configuring Gateway for DeviceNet - Going Online

3 Select the appropriate DeviceNet network and then click "***OK***."



The *Scanner Configuration Applet* in *RSNetWorx* will begin scanning the specified network. This procedure may take some time depending on the speed of the bus and the number of devices connected.

Node addresses are scanned from zero to 63. The default node address for the Gateway is 63.

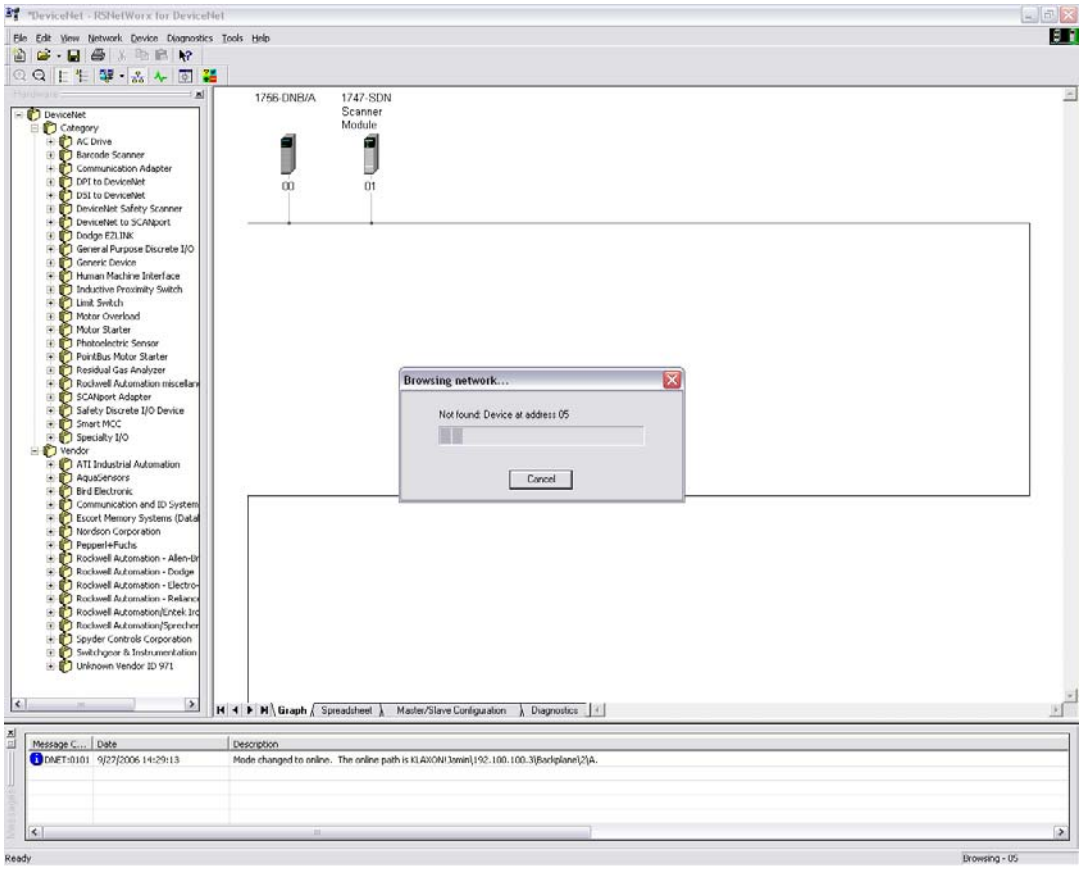


Figure 5-2: Scanning Node Addresses on a DeviceNet Network

4 When the scan operation has completed, click "***UPLOAD***", in the *Scanner Configuration Applet* dialog box, to update the configuration of the *RSNetWorx* software.

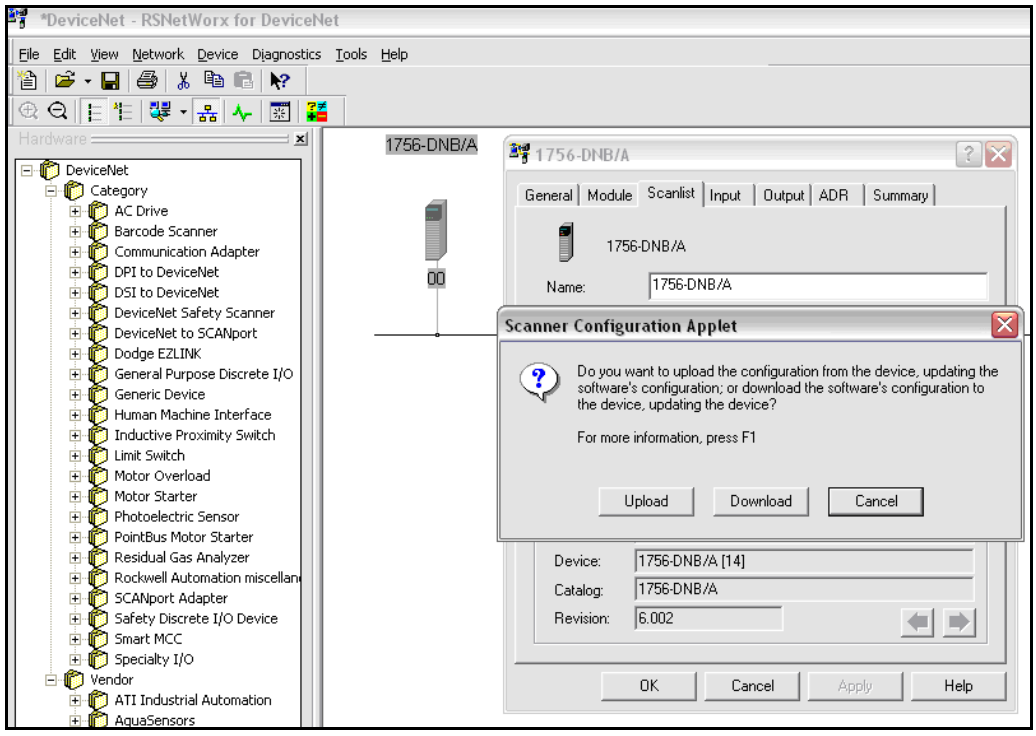
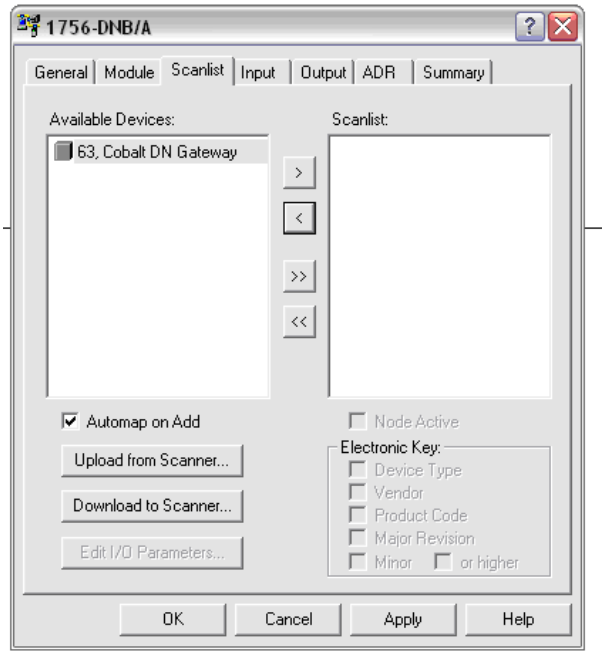


Figure 5-3: Updating Configuration in RSNetWorx

NOTE: The 1756-DNB/A is a *Series A DeviceNet Bridge / Scanner Module*.

After updating the software, the Gateway should be recognized on the network and the device name, "***63***, ***Cobalt DN Gateway***", should be displayed under "*Available Devices*."

5 Highlight the *Gateway* in the *Available Devices* list, and add it to the *Scanlist* field on the right hand side of the dialogue box. Click "***Apply***" and then "***OK***."



The Gateway will be added to the list of DeviceNet hardware in RSNetWorx.

6 Next, select the *Gateway* from the list of DeviceNet hardware and edit its *I/O Parameters.* Set the *Input Size* and *Output Size* parameters according to your application requirements, then click "***OK.***" In the example below, 30 input bytes and 30 output bytes will be scanned per polling cycle.

7

NOTE: Strobed mode is not supported by the GWY-01-DNT-01.

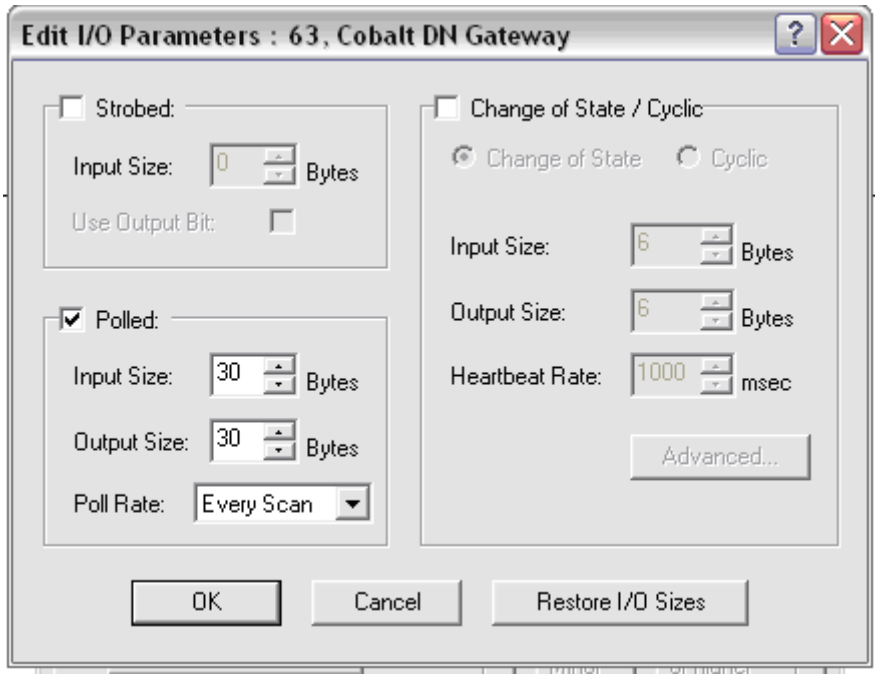


Figure 5-4: Editing the Gateway's DeviceNet I/O Parameters

The following images display the **Input** and **Output** properties tabs (in *RSNetWorx for DeviceNet)* for the *1756-DNB/A DeviceNet Bridge / Scanner Module* after running the *Scanner Configuration Applet* for a second time. The scanner module, in this case, only identified one node, the Gateway, at node address 63. The tabs are used to identify where input and output data is mapped for each identified node. In the image below, input data is mapped to start at **1:I.Data(0).0** on the PLC.

8 Run the *Scanner Configuration Applet* and verify the mapping of the address where the PLC will write input data for the Gateway.

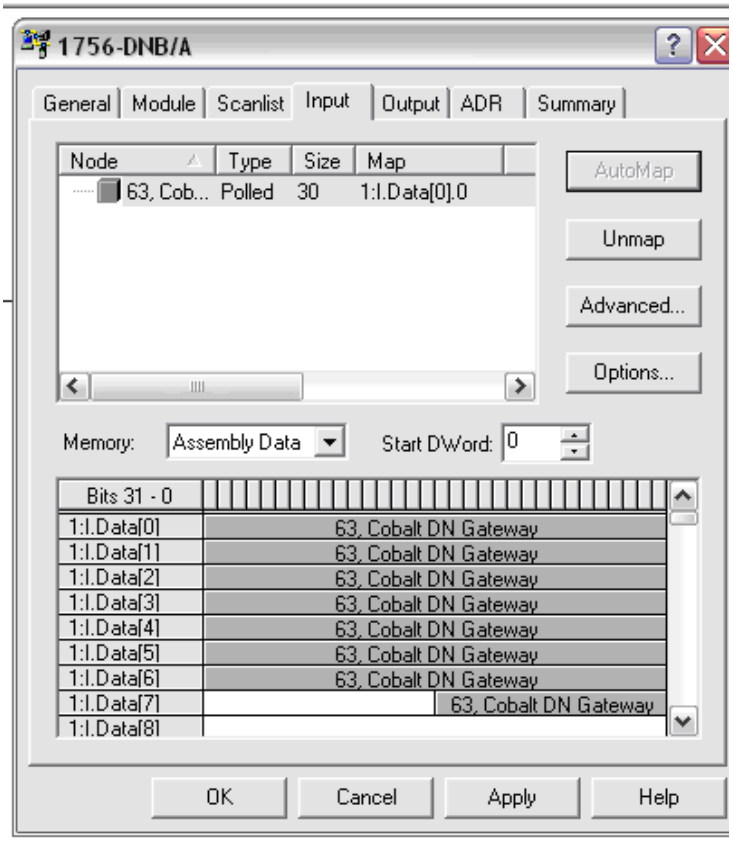


Figure 5-5: 1756-DNB/A Input Properties Tab

9 Next, verify the mapping of the address where the PLC will retrieve output data from the Gateway. In the image below, output data is mapped to start at **1:O.Data(0).0** on the PLC.

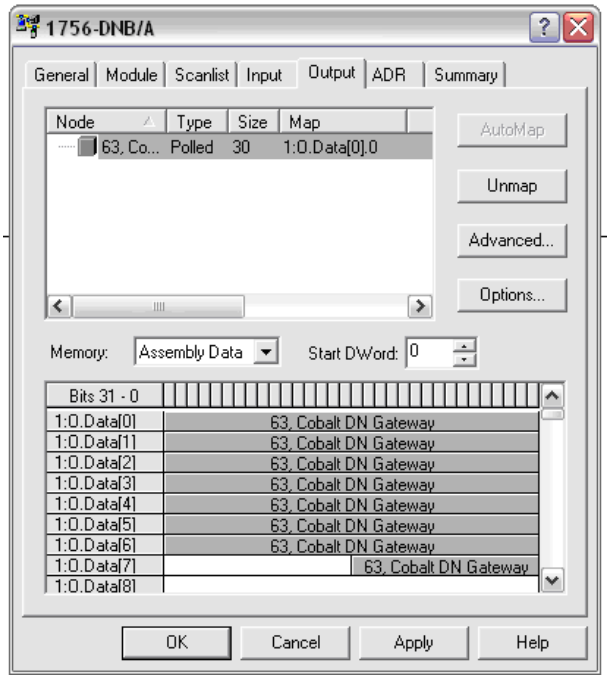
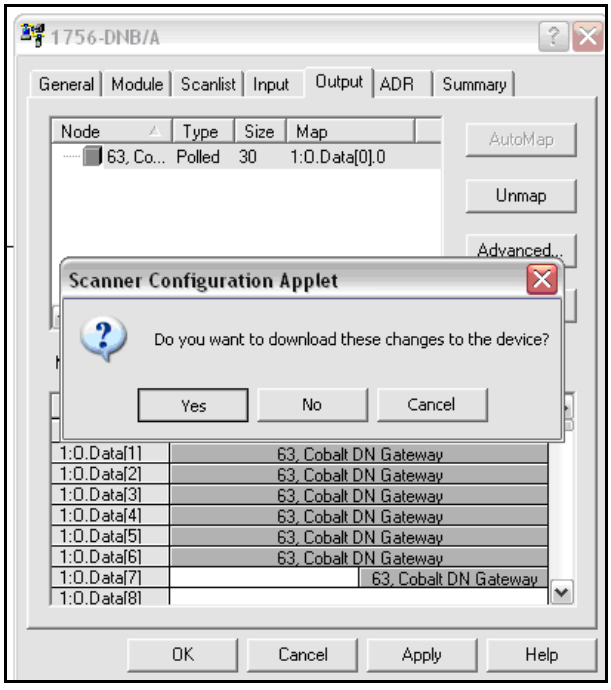


Figure 5-6: 1756-DNB/A Output Properties Tab

10 Lastly, click "***Apply***" and select "***YES***" to download the configuration and mapping settings from *RSNetWorx* to the PLC.



5.2.3 Configuring Data Rate and Node Address

As noted, each device, computer and controller on a DeviceNet network is considered an individual node for which a unique *Node Address* number (between 0 and 63) is assigned. The node address provides a means of numerically identifying each device on a DeviceNet network.

Prior to operating the GWY-01-DNT-01, you must verify that it has been configured for the same Data Rate as your network and that it has been assigned a suitable node address value. The Gateway supports data rates of 125Kb (default), 250Kb and 500Kb and supports node addresses 1 – 63 (default: 63).

FACTORY DEFAULT CONFIGURATION:

Data Rate = 125Kb

Node Address = 63

To change the data rate or node address, use either the "*Node Commissioning*" tool in *RSNetWorx for DeviceNet* or Escort Memory Systems' "*Cobalt Dashboard*" utility running on a host computer that is connected to the USB port on the Gateway. The *Cobalt Dashboard* utility is available online at *www.ems-rfid.com*.

NOTE: When using node commissioning in *RSNetWorx for DeviceNet*, modify only one parameter at a time (either data rate or node address). After changing the data rate, you must manually cycle power to your DeviceNet network for the change to take effect.

5.2.4 DeviceNet - Exchanging Data and Handshaking

After the Gateway has been properly configured for your DeviceNet network, it will be possible to send the Gateway commands using Escort Memory Systems' ***CBx RFID Command Protocol***. For reference, the *CBx Protocol – Reference Manual* is available online at *www.ems-rfid.com*.

However, to ensure that messages to and from the Gateway are properly delivered and received, a handshaking mechanism has been implemented that uses a pair of dedicated words in the exchange.

The first two words in the *Input Controller Tag* and *Output Controller Tag* are dedicated to handshaking. When new information is generated, the data-producing device increments the counter value stored in the second word of a controller tag (either Input or Output, depending on the device). The data-consuming device, copies that same value to the counter in the first word of the reciprocal (or opposite) controller tag. This handshaking scheme signals to the data producer that the information has been received.

The image below displays an example of the data contained in the two I/O Controller Tags for the Gateway.

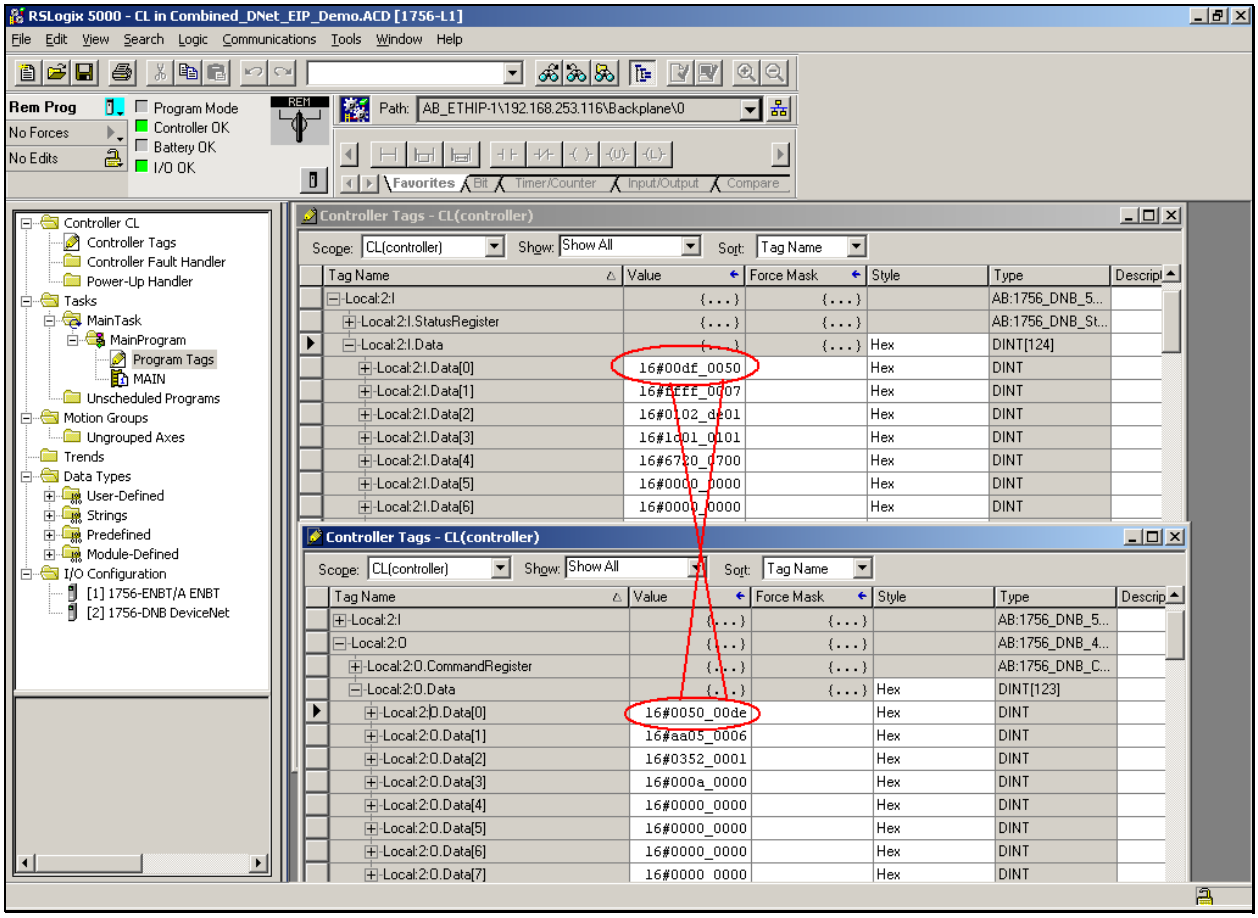


Figure 5-7: Gateway I/O Controller Tags (in RSLogix 5000)

5.2.5 DeviceNet - Handshaking Example

This example describes the sequence of events for a simple command and response. All data is written in 2-byte *WORD* format and stored in 2-byte "*registers.*"

The ***Output Controller Tag*** holds command data written by the PLC. The ***Input Controller Tag*** holds response data generated by the Gateway. Handshaking is implemented using the first two words (*Words 0 and 1*) in both *Input Controller Tag* and *Output Controller Tags*.

1. The PLC writes a command to the *Output Controller Tag*, starting with the 2-byte *Consume Data Size* value at **Local:2:O.Data [2]** (which is the third register of the *Output Controller Tag*). The remainder of the command packet is then written, 2-byte per register, to the *Output Controller Tag,* starting at the fourth register, **Local:2:O.Data [3].** After writing the command packet data to the appropriate registers, the PLC increments the counter value stored at **Local:2:O.Data [1]** (the second register in the *Output Controller Tag*).

2. The counter at **Local:2:O.Data [1]** is copied by the Gateway to **Local:2:I.Data [0]** (the first register of the *Input Controller Tag*) which signals the PLC that the command has been received by the Gateway.

3. Following execution of the command, the Gateway writes its response to the *Input Controller Tag,* starting with the 2-byte *Produce Data Size,* at **Local:2:I.Data [2]** and the actual data beginning at **Local:2:I.Data [3]**. It then increments the counter value at **Local:2:I.Data [1]**. This alerts the PLC to the new data available (the Gateway generated response, in this case).

4. After processing the response information, the PLC copies the counter from **Local:2:I.Data [1]** to **Local:2:O.Data [0]**, which signals to the Gateway that the PLC has retrieved the response data.

OUTPUT CONTROLLER TAG

CONTROLLER TAG LOCATION AND DATA	DESCRIPTION
Local:2:O.Data [0]	(4) The PLC copies the value at **2:I:Data[1]** here to acknowledge receipt of the response
Local:2:O.Data [1]	(1) The PLC increments this counter value after copying a command in Consume Data
Local:2:O.Data [2]	Consume Data Size
Local:2:O.Data [3]	First WORD of Consume Data (*Command from PLC*)
Local:2:O.Data [xxx]	xxx WORD of Consume Data

INPUT CONTROLLER TAG

CONTROLLER TAG LOCATION AND DATA	DESCRIPTION
Local:2:I.Data [0]	(2) The value at **2:O:Data[1]** is copied here by the Gateway to acknowledge receipt of a command
Local:2:I.Data [1]	(3) The Gateway increments this counter to signal that a response is available
Local:2:I.Data [2]	Produce Data Size
Local:2:I.Data [3]	First WORD of Produce Data (*Response from Gateway*)
Local:2:I.Data [xxx]	xxx WORD of Produce Data

NOTE: A ladder logic example illustrating the implementation of this handshaking strategy can be downloaded from the technical support area of the EMS website.

APPENDIX A:
TECHNICAL SPECIFICATIONS

ELECTRICAL

Supply Voltage	10~30VDC
Power Consumption	120mA @ 24VDC (2.88W)

COMMUNICATION

Communication Interfaces	Point-to-Point: *RS485* Multi-drop: *Subnet16, MUX32* DeviceNet
RFID Interface:	Gateway HF-Series RFID System
RF Output Power:	1W
Air Protocols	ISO 15693, ISO 14443 A
Air Protocol Speed:	26.5kBaud / 106kBaud with CRC error detection
RS485 Baud Rates	9600 (default), 19.2k, 38.4k, 57.6k, 115.2k

MECHANICAL

Dimensions	76mm x 89mm x 33mm
Weight	.24 KG (.53 lbs)
Enclosure:	Stainless Steel 304 (18-8)

ENVIRONMENTAL

Operating Temperature	-20° to 50°C (-4° to 122°F),
Storage Temperature	-40° to 85°C (-40° to 185°)
Humidity	90% Non-Condensing
Protection Class	IP30
Shock Resistance	IEC 68-2-27 Test EA 30g, 11 milliseconds, 3 shocks each axis
Vibration Resistance	IEC 68-2-6 Test FC 1.5mm; 10 to 55Hz; 2 hours each axis

NOTE: Specifications are subject to change without notice.

APPENDIX B: MODELS AND ACCESSORIES

Datalogic Automation designs, manufactures and distributes a wide range of high frequency (HF) RFID equipment including RFID controllers, network interface modules (Gateways and Hubs), RFID tags and the cables needed to make it all work.

This portion of the manual lists the products and accessories available for the Gateway and HF-Series RFID product family. To purchase any of the items listed below contact your EMS distributor or visit our Web site: http://www.ems-rfid.com.

SUBNET16™ GATEWAY INTERFACE MODULES

GWY-01-DNT-01

Subnet16™ DeviceNet Gateway

GWY-01-232-01

Subnet16™ RS232 Gateway

GWY-01-IND-01

Subnet16™ Industrial Ethernet Gateway

GWY-01-TCP-01

Subnet16™ TCP/IP Gateway

RFID CONTROLLERS

Cobalt HF-Series RFID Controllers

There are **six** models of the **Cobalt HF RFID Controller**:

HF-CNTL-232-02	for RS232 interface connections
HF-CNTL-485-02(*)	for Subnet16 Multidrop connections
HF-CNTL-USB-02	for USB interface connections
HF-CNTL-IND-02	for Industrial Ethernet and standard TCP/IP connections
HF-CNTL-DNT-02	for DeviceNet connections
HF-CNTL-PBS-02	for Profibus connections

Cobalt HF-Series Antennas (compatible with the Cobalt HF-Series Controllers above)

There are **four** models of the **Cobalt HF Antenna**:

HF-ANT-1010-01	10cm x 10cm
HF-ANT-2020-01	20cm x 20cm

HF-ANT-3030-01	30cm x 30cm
HF-ANT-0750-01	7cm x 50cm (for conveyor applications)

Cobalt C0405-Series RFID Controllers

There are **three** models of the **Cobalt C0405 RFID Controller**:

C0405-232-01	for RS232 interface connections
C0405-485-01(*)	for Subnet16 Multidrop connections
C0405-USB-01	for USB 2.0 interface connections

Cobalt C1007-Series RFID Controllers

There are **three** models of the **Cobalt C1007 RFID Controller**:

C1007-232-01	for RS232 interface connections
C1007-485-01(*)	for Subnet16 Multidrop connections
C1007-USB-01	for USB 2.0 interface connections

HF-0405-Series RFID Controllers

There are **three** models of the **HF-0405 RFID Controller**:

HF-0405-232-01	for RS232 interface connections
HF-0405-422-01	for RS422 interface connections
HF-0405-485-01(*)	for Subnet16 Multidrop connections

(*) *Models compatible with GWY-01-232-01*

SOFTWARE & DEMONSTRATION KITS

Software Applications

Cobalt Dashboard

Communicate in real time with one or more readers directly or via Multi-drop network. Allows users to configure, monitor and control their RFID devices from anywhere on their network.

C-Macro Builder

An easy to use GUI-driven utility that provides rapid development and implementation of custom RFID macros.

NOTE:

Software utilities and User's Manuals are available at www.ems-rfid.com

Demonstration Kits

00-1182

RS485 Industrial Ethernet Gateway Demo Display Kit (includes three C0405-485-01 controllers, one GWY-01-IND-01 Gateway, one HMS150 tag, one LRP125S tag, one LRP250 tag, display board, cables, power supply and carrying case).

00-1219

RS485 TCP/IP Gateway Demo Display Kit (includes three C0405-485 controllers, one GWY-01-TCP-01 Gateway, one HMS150 tag, one LRP250 tag, one LRP125S tag, display board, cables, power supply and carrying case).

POWER SUPPLIES

00-1166

1.88A max @ 24VDC (45W), Universal Input (90-264VAC, 47-63Hz), 5.5x2.5mm plug, positive tip; Note: Requires country specific power cord to mate to IEC 320 power cord receptacle.

00-1167

4.17A max @ 24VDC (100W), Universal Input (90-264VAC, 47-63Hz), 5.5x2.5mm plug, positive tip; Note: Requires country specific power cord to mate to IEC 320 power cord receptacle.

00-1168

5.0A max @ 24VDC (120W), Universal Input (88-132VAC/176-264VAC switch selectable, 47-63Hz) DIN Rail Mount; Note: AC wire receptacles are spring clamp for direct wire connection.

EMS RFID TAGS

Escort Memory Systems designs and manufactures several lines of RFID tags. LRP-S, HMS and T-Series passive read/write RFID tags are specially suited for the Gateway and EMS RFID Controllers.

SUBNET16 CABLES & ACCESSORIES

EMS P/N	DESCRIPTION
CBL-1478	Cable Assembly: RS232/Power (2.5mm DC Jack), 2m
CBL-1480-XX	Cable: M12, 5-pin, Male/Female, ThinNet
CBL-1481-XX	Cable: M12, 5-pin, Male/Male, ThinNet
CBL-1481-02	Cable: M12, 5-pin, Male/Male, ThinNet, 2m (Gateway to Drop-T)
CBL-1482-XX	Cable: M12, 5-pin, Male/Right-Angle Female, ThinNet
CBL-1483-XX	Cable: 7/8–16, 5-pin, Male/Female, ThickNet
CBL-1484-XX	Cable: 7/8-16, 5-pin, Right-Angle Male/Bare Wire, ThickNet
CBL-1485	Drop-T Connector: 5-pin, 7/8-16 F / M12 F / 7/8-16 M (ThickNet to ThinNet)
CBL-1486	Drop-T Connector: 5-pin, M12, F/F/M (ThinNet to ThinNet)
CBL-1487	Field Mountable Connector: 5-pos, Straight Female M12,
CBL-1488-XX	Cable: 8-pin, Female M12 / Bare Wires
CBL-1489	Termination Resistor Plug: 7/8-16, Male, 5-pin, (ThickNet)
CBL-1490	Termination Resistor Plug: M12, Male, 5-pin, (ThinNet)
CBL-1491	Connector: 5-pos, Right-Angle Female M12, Field Mountable
CBL-1492-XX	Cable: 8-pin, Right-Angle Female M12 / Bare Wires
CBL-1493	Connector: 8-pos, Straight Female M12, Field Mountable
CBL-1494-01	Cable: M12, 5P, F/Bare Wire Leads, ThinNet, 1M
CBL-1495-XX	Cable: 7/8-16, 5P F/Bare Wire Leads
CBL-1496	Plug: Termination Resistor, M12, 5P, F
CBL-1497	Plug: Termination Resistor, 7/8-16, 5P, F
CBL-1498-02	Cable: M12, 5P, M/Bare Wire Leads, THINNET, 2M
CBL-1513	Cable Assembly: M12, 5-Pin, Male, Reverse Keyed to Type A, USB, 3M
CBL-1514	Connector: M12, Male, 5-Pin, Straight, Reverse Keyed (for USB)
CBL-1515-05	Cable: Category 5E Shielded Ethernet/M12, 5-Pin, Male, D-Code, 5M

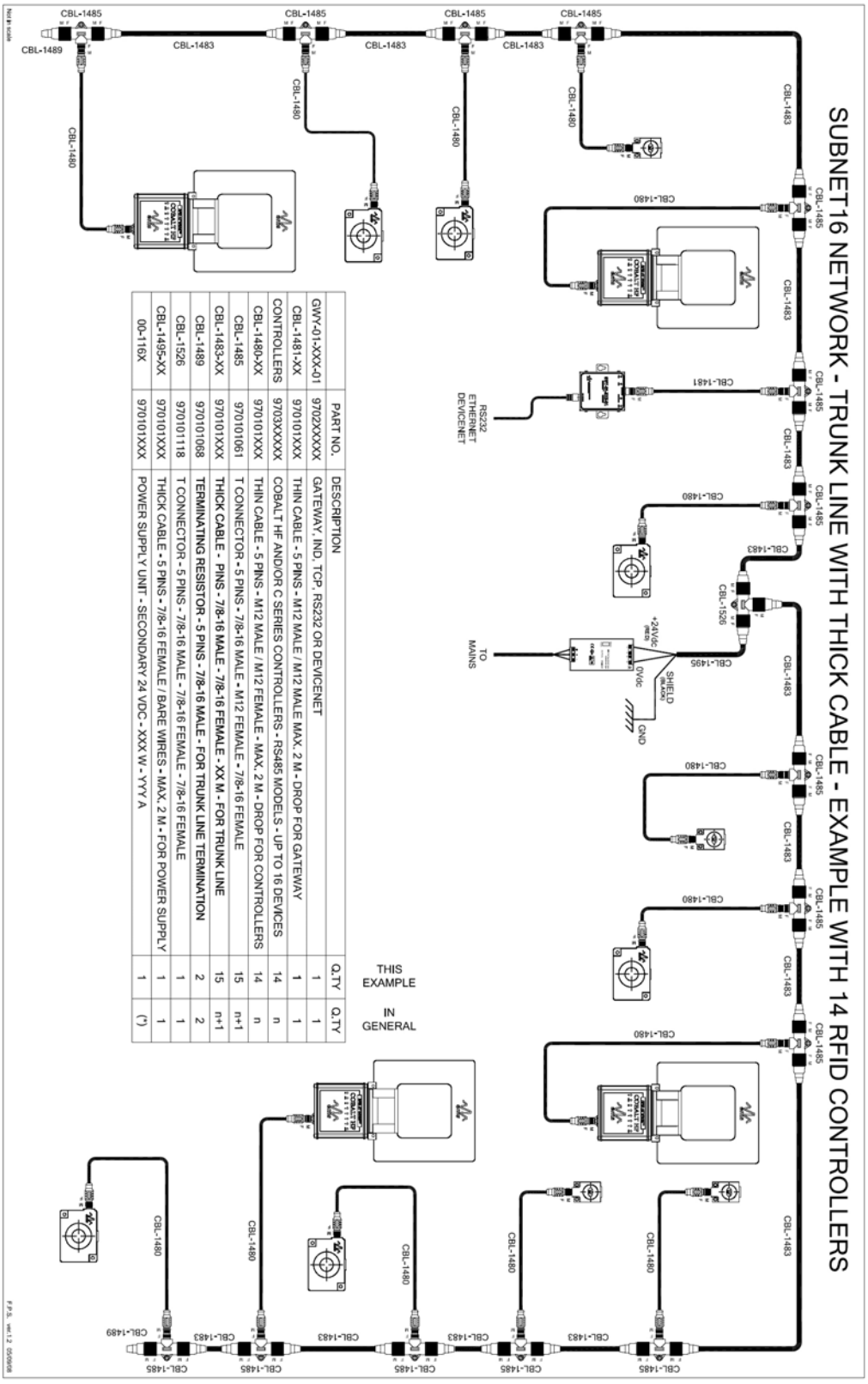
XX = Length in Meters

APPENDIX C:
NETWORK DIAGRAMS

Subnet16 Gateway: ThickNet Network Diagram

Subnet16 Gateway: ThinNet Network Diagram

Subnet16 Gateway –ThickNet Network Diagram

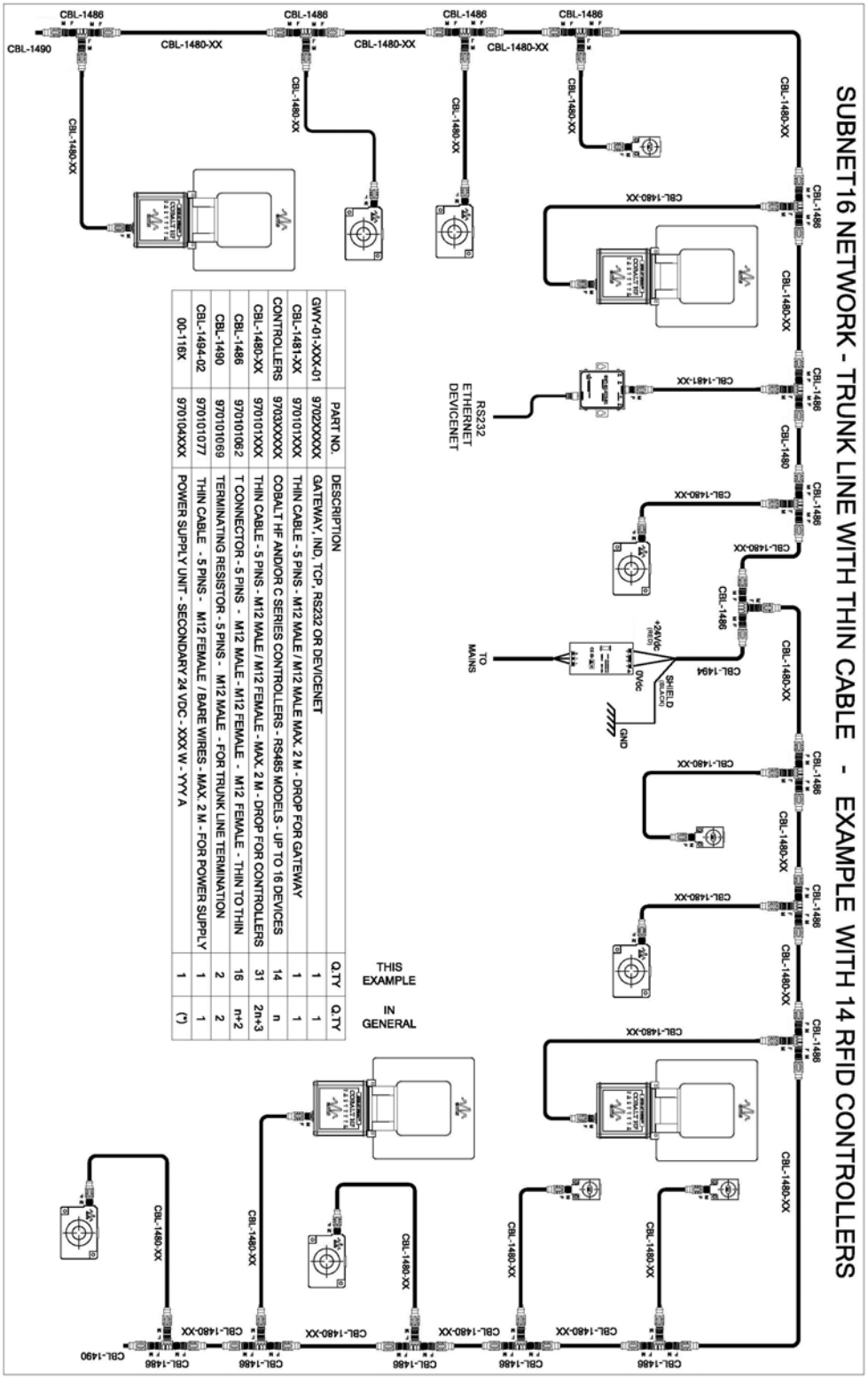


	PART NO.	DESCRIPTION	Q.TY	Q.TY
GWY-01-XXX-01	970ZXXXXX	GATEWAY, IND, TCP, RS232 OR DEVICENET	1	1
CBL-1481-XX	970101XXX	THIN CABLE - 5 PINS - M12 MALE / M12 MALE MAX. 2 M - DROP FOR GATEWAY	1	1
CONTROLLERS	970SXXXXX	COBALT HF AND/OR C SERIES CONTROLLERS - RS485 MODELS - UP TO 16 DEVICES	14	n
CBL-1480-XX	970101XXX	THIN CABLE - 5 PINS - M12 MALE / M12 FEMALE - MAX. 2 M - DROP FOR CONTROLLERS	14	n
CBL-1485	970101061	T CONNECTOR - 5 PINS - 7/8-16 MALE - M12 FEMALE - 7/8-16 FEMALE	15	n+1
CBL-1483-XX	970101XXX	THICK CABLE - PINS - 7/8-16 MALE - 7/8-16 FEMALE - XX M - FOR TRUNK LINE	15	n+1
CBL-1489	970101068	TERMINATING RESISTOR - 5 PINS - 7/8-16 MALE - FOR TRUNK LINE TERMINATION	2	2
CBL-1526	970101118	T CONNECTOR - 5 PINS - 7/8-16 MALE - 7/8-16 FEMALE - 7/8-16 FEMALE	1	1
CBL-1495-XX	970101XXX	THICK CABLE - 5 PINS - 7/8-16 FEMALE / BARE WIRES - MAX. 2 M - FOR POWER SUPPLY	1	1
00-116X	970101XXX	POWER SUPPLY UNIT - SECONDARY 24 VDC - XXX W - YYY A	1	(*)

THIS EXAMPLE

IN GENERAL

Subnet16 Gateway – ThinNet Network Diagram



	PART NO.	DESCRIPTION	Q.TY	Q.TY
GWY-01-XXX-01	9702XXXXX	GATEWAY, IND. TCP, RS232 OR DEVICENET	1	1
CBL-1481-XX	970101XXX	THIN CABLE - 5 PINS - M12 MALE / M12 MALE MAX. 2 M - DROP FOR GATEWAY	1	1
CONTROLLERS	9703XXXXX	COBALT HF AND/OR C SERIES CONTROLLERS - RS485 MODELS - UP TO 16 DEVICES	14	n
CBL-1480-XX	970101XXX	THIN CABLE - 5 PINS - M12 MALE / M12 FEMALE - MAX. 2 M - DROP FOR CONTROLLERS	31	2n+3
CBL-1486	970101062	T CONNECTOR - 5 PINS - M12 MALE - M12 FEMALE - M12 FEMALE - THIN TO THIN	16	n+2
CBL-1490	970101069	TERMINATING RESISTOR - 5 PINS - M12 MALE - FOR TRUNK LINE TERMINATION	2	2
CBL-1494-02	970101077	THIN CABLE - 5 PINS - M12 FEMALE / BARE WIRES - MAX. 2 M - FOR POWER SUPPLY	1	1
00-116X	97010AXXX	POWER SUPPLY UNIT - SECONDARY 24 VDC - XXX W - YYY A	1	(*)

THIS EXAMPLE

IN GENERAL

APPENDIX D:
ASCII CHART

ASCII Chart

Decimal	Hex	Character	Decimal	Hex	Character
000	00	NUL	031	1F	US
001	01	SOH	032	20	(SPACE)
002	02	STX	033	21	!
003	03	ETX	034	22	"
004	04	EOT	035	23	#
005	05	ENQ	036	24	$
006	06	ACK	037	25	%
007	07	BEL	038	26	&
008	08	BS	039	27	’
009	09	HT	040	28	(
010	0A	LF	041	29	)
011	0B	VT	042	2A	*
012	0C	FF	043	2B	+
013	0D	CR	044	2C	,
014	0E	SO	045	2D	-
015	0F	SI	046	2E	.
016	10	DLE	047	2F	/
017	11	DC1	048	30	0
018	12	DC2	049	31	1
019	13	DC3	050	32	2
020	14	DC4	051	33	3
021	15	NAK	052	34	4
022	16	SYN	053	35	5
023	17	ETB	054	36	6
024	18	CAN	055	37	7
025	19	EM	056	38	8
026	1A	SUB	057	39	9
027	1B	ESC	058	3A	:
028	1C	FS	059	3B	;
029	1D	GS	060	3C	<
030	1E	RS	061	3D	=

Decimal	Hex	Character
062	3E	>
063	3F	?
064	40	@
065	41	A
066	42	B
067	43	C
068	44	D
069	45	E
070	46	F
071	47	G
072	48	H
073	49	I
074	4A	J
075	4B	K
076	4C	L
077	4D	M
078	4E	N
079	4F	O
080	50	P
081	51	Q
082	52	R
083	53	S
084	54	T
085	55	U
086	56	V
087	57	W
088	58	X
089	59	Y
090	5A	Z
091	5B	[
092	5C	\
093	5D	]
094	5E	^

Decimal	Hex	Character
095	5F	_
096	60	‘
097	61	a
098	62	b
099	63	c
100	64	d
101	65	e
102	66	f
103	67	g
104	68	h
105	69	i
106	6A	j
107	6B	k
108	6C	l
109	6D	m
110	6E	n
111	6F	o
112	70	p
113	71	q
114	72	r
115	73	s
116	74	t
117	75	u
118	76	v
119	77	w
120	78	x
121	79	y
122	7A	z
123	7B	{
124	7C	|
125	7D	}
126	7E	~
127	7F	DEL

WARRANTY

Datalogic Automation warrants that all products of its own manufacturing conform to Datalogic Automation's specifications and are free from defects in material and workmanship when used under normal operating conditions and within the service conditions for which they were furnished. The obligation of Datalogic Automation hereunder shall expire one (1) year after delivery, unless otherwise specified, and is limited to repairing, or at its option, replacing without charge, any such product that in Datalogic Automation's sole opinion proves to be defective within the scope of this Warranty.

In the event Datalogic Automation is not able to repair or replace defective products or components within a reasonable time after receipt thereof, Buyers shall be credited for their value at the original purchase price. Datalogic Automation must be notified in writing of the defect or nonconformity within the warranty period and the affected product returned to Datalogic Automation factory or to an authorized service center within thirty (30) days after discovery of such defect or nonconformity. Shipment shall not be made without prior authorization by Datalogic Automation.

This is Datalogic Automation's sole warranty with respect to the products delivered hereunder. No statement, representation, agreement or understanding oral or written, made by an agent, distributor, representative, or employee of Datalogic Automation which is not contained in this warranty, will be binding upon Datalogic Automation, unless made in writing and executed by an authorized Datalogic Automation employee.

Datalogic Automation makes no other warranty of any kind what so ever, expressed or implied, and all implied warranties of merchantability and fitness for a particular use which exceed the aforementioned obligation are here by disclaimed by Datalogic Automation and excluded from this agreement.

Under no circumstances shall Datalogic Automation be liable to Buyer, in contract or in tort, for any special, indirect, incidental, or consequential damages, expenses, losses or delay however caused. Equipment or parts that have been subject to abuse, misuse, accident, alteration, neglect, unauthorized repair or installation are not covered by warranty. Datalogic Automation shall make the final determination as to the existence and cause of any alleged defect. No liability is assumed for expendable items such as lamps and fuses.

No warranty is made with respect to equipment or products produced to Buyer's specification except as specifically stated in writing by Datalogic Automation in the contract for such custom equipment. This warranty is the only warranty made by Datalogic Automation with respect to the goods delivered hereunder, and may be modified or amended only by a written instrument signed by a duly authorized officer of Datalogic Automation and accepted by the Buyer.

Extended warranties of up to five years are available for purchase for most Escort Memory Systems products. Contact Datalogic Automation or your distributor for more information.

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