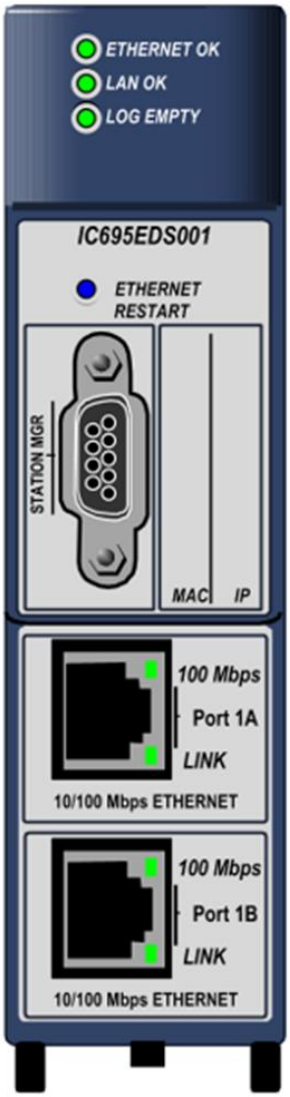
USER MANUAL
GFK-2911E
Sep 2019

PACSystems™ RX3i

RSTI-EP DNP3 OUTSTATION MODULE
USER MANUAL



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Contents

Warnings, Danger Notes as Used in this Publication

Warning

Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury to exist in this equipment or may be associated with its use.
In situations where inattention could cause either personal injury or damage to equipment, a Warning notice is used.

Caution

Caution notices are used where equipment might be damaged if care is not taken.

Notes: Notes merely call attention to information that is especially significant to understanding and operating the equipment.

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Chapter 1 Introduction

This manual describes the RX3i DNP3 Outstation Module, IC695EDS001 (or EDS001 for short). By installing this module in the backplane of an RX3i controller, the controller may be set up as a DNP3 Outstation on a DNP3 Network. This permits RX3i data to be exchanged with the DNP3 Masters on that network.

Introductory material may be found in this chapter.

Chapter 2 provides installation and set-up information.

Chapter 3 provides configuration instructions.

Chapter 4 describes system operation.

Chapter 5 provides diagnostic information.

Chapter 6 covers the use and format of ladder logic COMMREQ instructions used to set up and configure the EDS001 module and its interaction with the DNP3 Masters to which it is connected over Ethernet.

Appendix A: provides a Definition of the Status Area.

Appendix B: defines the Station Manager Status.

Appendix C: provides a Log Messages Table.

Appendix D: provides the Device Profile of the PACSystems RX3i DNP3 Outstation.

1.1 DNP3 Overview

DNP3 is a master/slave communications protocol originally developed for use in the electric utility sector for power transmission and distribution systems. It has migrated to other vertical markets such as water/wastewater, transportation, and oil and gas pipeline sectors. DNP3 is the current specification of DNP (Distributed Network Protocol) which has a long history of being a Remote Terminal Unit (RTU) protocol based on a 3-layer protocol scheme. DNP3 provides a set of communications protocols used between components in process automation systems.

Figure 1: DNP3 Basic System Architecture

Figure 2: DNP3 Application from Electrical Distribution Industry

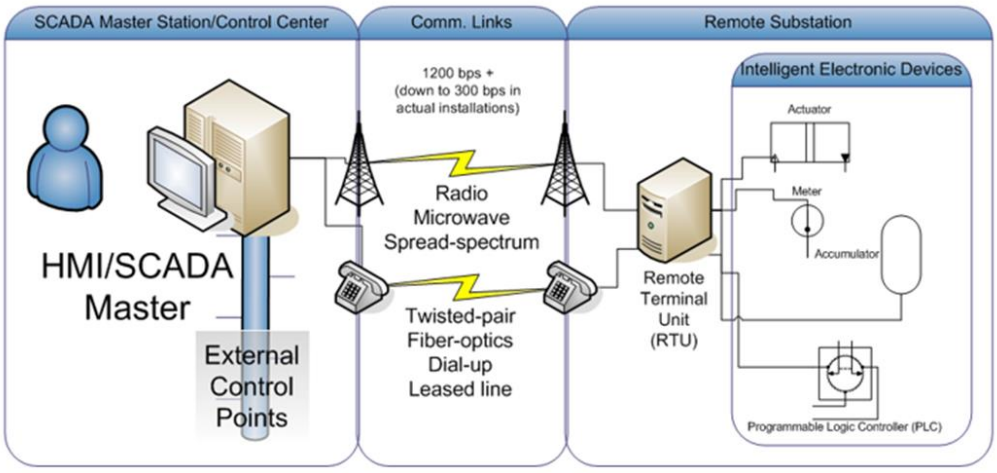
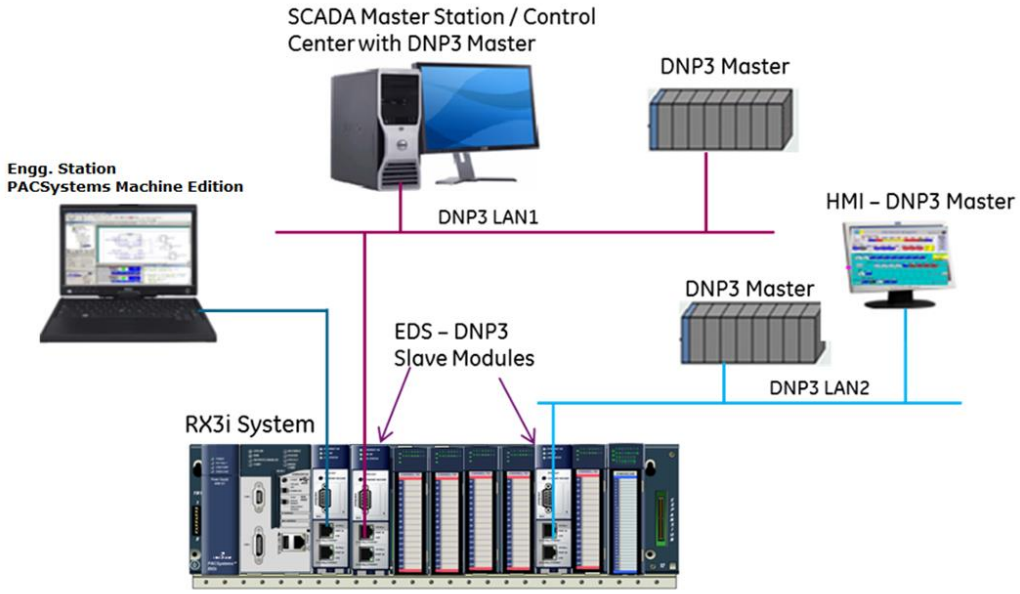


Figure 3: Application Showing Two DNP3 LANs accessing RX3i via Two EDS001 Modules



1.2 Description

The RX3i DNP3 Outstation Module, catalog number IC695EDS001 (or EDS001), hosts the DNP3 Outstation protocol on a common RX3i ETM001 module hardware platform. Thus, many of the specifications and behaviors are shared with the ETM001 module. IC695EDS001 is an Ethernet-connected module which fits in the RX3i backplane and permits the RX3i to behave as an Outstation on the DNP3 network.

The data exchanges between the EDS001 module and up to eight DNP3 Master(s) are configurable, using a single COMMREQ instruction in the ladder logic or Structured Text program, as detailed in Chapter 6.

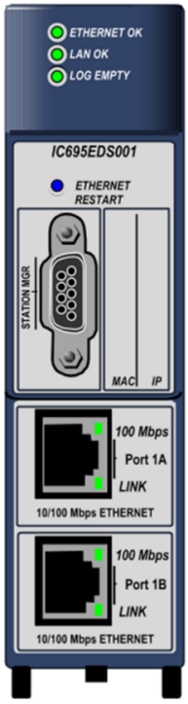
1.3 Product Overview

The RX3i DNP3 Outstation Module IC695EDS001 is an Ethernet-connected module which fits in the RX3i backplane and permits the RX3i to behave as an Outstation on the DNP3 network, where it may interact with up to eight DNP3 masters.

Module features include:

- Two auto-sensing RJ-45 Ethernet ports with LED indicators
- Connects via Ethernet at 10BaseT or 100BaseTX
- Internal network switch with Auto-negotiate, Sense, Speed, and crossover detection
- Supports Linear (daisy-chained) and Star network configurations
- TCP/IP and LLA protocols supported
- One Ethernet MAC Address and one IP Address per module
- Time synchronization to SNTP Time Server

Figure 4: EDS001 Front View



- Recessed Ethernet Restarts pushbutton to manually restart the Ethernet firmware without power-cycling the module.

Dedicated RS-232 Station Manager Port for network supervision

LED behavior same as ETM001

DNP3 configuration via a single COMMREQ command

- Data exchanges up to 12,072 points and 24,000 events supported
- Eight DNP3 Objects supported: DI, DI w/time, DO, DO w/time, CROB, analog output values, time setting, and class polls
- Multiple RX3i memory types may be utilized for DNP3 data exchange
- Binary DI/DO
- Analog (32-bit signed, 16-bit signed, or single-precision floating point)
- Supports unsolicited data communications with DNP3 Master
- Compatible with any RX3i CPU1[1] , including redundant controllers
- Up to 4 EDS001 per RX3i, as allowed by available power and slots
- Module can be installed in any available RX3i main rack I/O slot
- Module supports insertion into and removal from an RX3i backplane which is under power.
- Firmware upgrade via RX3i CPU using WinLoader software utility

[1] Exception: Since EDS001 occupies a slot in a CPU rack, it is not compatible with Rackless CPUs such as CPE400.

1.4 Specification

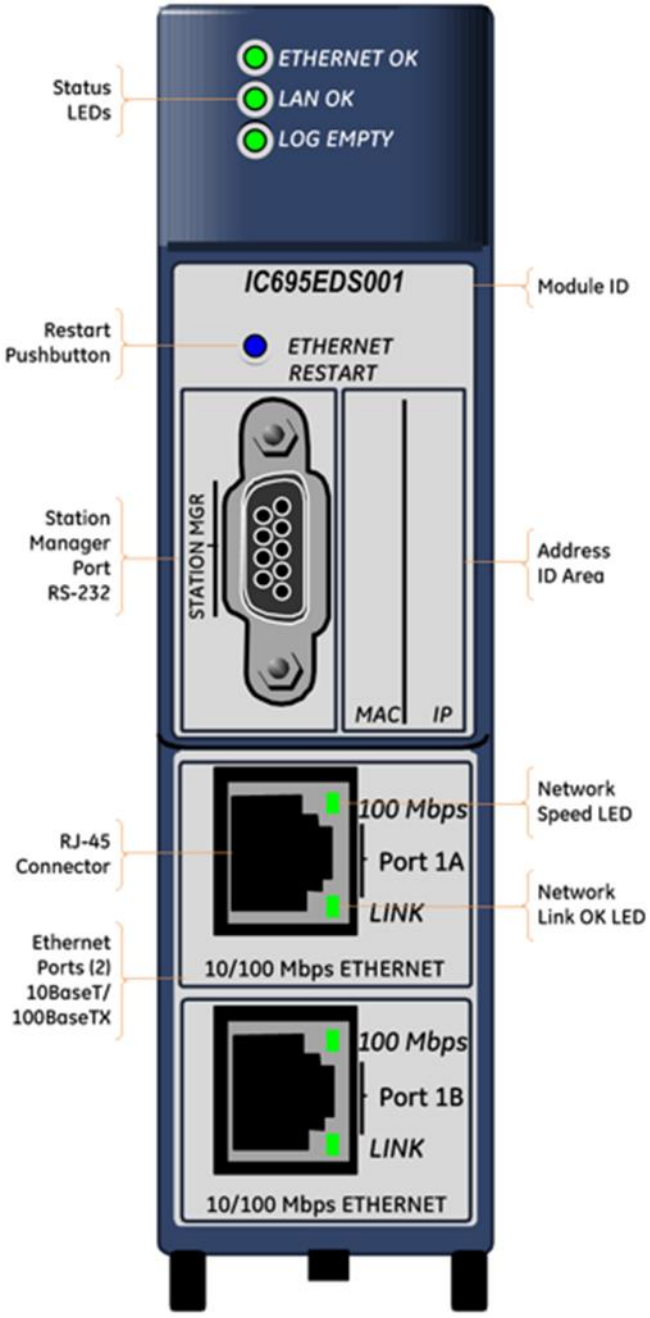
Specification	Description
Module Name	PACSystems RX3i DNP3 Outstation Module
Catalog	IC695EDS001
Protocol Supported	DNP3 Outstation
CPU Compatibility	CPU320/CPU315, CPU310/CMU310/NIU001, CRU320/CRU320QP, CPE310 firmware version 6.0 or later CPE302, CPE330
Programmer Compatibility	PAC Machine Edition 8.5 SIM7 or later
Connectors	Station Manager (RS-232) Port: 9-pin female D-connector
	Two 10BaseT / 100BaseTX Ports: 8-pin female shielded RJ-45
LAN	IEEE 802.2 Logical Link Control Class I
	IEEE 802.3 CSMA/CD Medium Access Control 10/100 Mbps
Number of IP addresses	One
Number of Ethernet Port Connectors	Two: both 10BaseT / 100BaseTX with auto-sensing RJ-45 connection.
Embedded Ethernet Switch	Yes – Allows daisy chaining of Ethernet nodes. Ring networks not permitted.
Serial Port	Station Manager Port: RS-232 DCE, 1200 - 115200 bps.
Modules per RX3i CPU	4 (max - depends on power and slots available)
No. of DNP3 Masters supported per module	8 per module (max)
No. of DNP3 Masters supported per RX3i CPU	32 per RX3i CPU (max)
No. of DNP3 points per module	12,072
No. of DNP3 events per module	24,000
Network Topology supported	Star, Line, Daisy Chain
RX3i Slot Location	Any I/O Slot in Main Rack.
Hot Swappable	Yes. Refer to Chapter 2 of the *PACSystems RX3i System Manual*, GFK-2314E or later for instructions & restrictions.
Time Synchronization	SNTP Client, DNP3 Time Synchronization
Power Requirements	3.3Vdc: 840 mA maximum
	5Vdc: 614 mA maximum

For system standards, general operating specifications, and installation requirements, refer to the PACSystems RX3i System Manual, GFK-2314.

1.5 Controls and Indicators

Figure 5 shows the front of the module and identifies its controls and indicators.

Figure 5: DNP3 Outstation Module EDS001 Front Panel Features



1.6 RX3i DNP3 Outstation Specifications & Restrictions

The following tables document the DNP3 Outstation capabilities of the EDS001 module. Refer to the DNP3 standard for details.

Class 0 Poll	Yes, returns all class 0 data and any buffered event data to the master station, also referred to as static Poll
Class 1 and 2 Poll	Yes, returns event data format
Class 3 Poll	Yes, no event data configured

Object Group	Variance	Description	Static / Event Data
1	2	Binary Input with Flag	Static
10	2	Binary Output with Flag	Static
30	1	Analog Input 32-Bit Signed with Flag	Static
30	2	Analog Input 16-Bit Signed with Flag	Static
30	3	Analog Input 32 Bit without flag	Static
30	4	Analog Input 16Bit without flag	Static
30	5	Analog Input 32-Bit Real with Flag	Static
40	1	Analog Output 32-Bit Signed with Flag	Static
40	2	Analog Output 16-Bit Signed with Flag	Static
40	3	Analog Output 32-Bit Real with Flag	Static
2	2	Binary Input with Flag and Time	Event Class 1
2	1	Binary Input Event - Without time	Event Class 1
11	2	Binary Output with Flag and Time	Event Class 1
32	1	Analog Input Event 32Bit without time	Event Class 2
32	2	Analog Input Event 16Bit without time	Event Class 2
32	3	Analog Input 32-Bit Signed with Flag and Time	Event Class 2
32	4	Analog Input 16-Bit Signed with Flag and Time	Event Class 2
32	5	Analog Input Event 32Bit Real without time	Event Class 2
32	7	Analog Input 32-Bit Real with Flag and Time	Event Class 2
42	1	Analog Output Event Status - 32bit without time	Event Class 2
42	2	Analog Output Event Status - 16 bit without time	Event Class 2
42	3	Analog Output 32-Bit Signed with Flag and Time	Event Class 2
42	4	Analog Output 16-Bit Signed with Flag and Time	Event Class 2

Object Group	Variance	Description	Static / Event Data
42	5	Analog Output Event Status - single precision real without time	Event Class 2
42	7	Analog Output 32-Bit Real with Flag and Time	Event Class 2
60	1, 2, 3, 4	Class Poll 0, 1, 2, 3[2]	N/A
50	1	Set Absolute Time at Outstation	N/A
12	1	Control Relay Output Bit (CROB)	N/A
41	1	Analog Output Value 32-Bit Signed	N/A
41	2	Analog Output Value 16-Bit Signed	N/A
41	3	Analog Output Value 32-Bit Real	N/A

1.7 Performance and Limitations

1.7.1 General Restrictions

Topic	Notes
Filter Time of DNP captures	This is a shutter type of filter for DNP3 point change detection that is implemented in the code, per DNP3 specifications. Refer to Section 6.3.4.DNP3 Polled Object Parameters –Push-Back Messages (Section b) It is a WORD denominated in milliseconds. Value: 10 to 32000; default is 250ms. The filter value is set in the COMMREQ instruction when the station is parameterized.
Duplicate LLA Addresses	Each master station communicating with the Outstation must have a unique LLA address. The DNP3 code manages the connections using the LLA address and as such the Outstation cannot handle duplicate LLA Source (Master Station) addresses.
DNP3 Code will not start with NO Network connected	The EDS001 module will not start the DNP3 Outstation portion of the application if NO network is connected to the EDS001 module. This can be worked around by using a Loopback style of RJ-45 Ethernet connector to indicate a network presence to the EDS001 module.

1.7.2 Point Count / Event Count Restrictions

Maximum Point Counts

I/O Data	Object Group	Variance	Maximum Point Count
Digital Inputs	1	2	3000
Digital Outputs	10	2	3000
Analog Inputs	30	1, 2, 5	1024
Analog Outputs	40	1, 2, 5	1024
CROB (Digital)	12	1	3000

[2] There is no data configured for a Class 3 event poll.

I/O Data	Object Group	Variance	Maximum Point Count
Analog Output Values	41	1, 2, 3	1024

Maximum Event Counts

Event Data	Object Group	Variance	Maximum Event Count
Digital Inputs	2	2	8000[3]
Digital Outputs	11	2	8000[3]
Analog Inputs	32	3, 4, 7	8000[3]
Analog Outputs	42	3, 4, 7	8000[3]

1.8 Glossary

Analog Output Value Data Object	A means by which the DNP3 Master Station can set an analog value at the Outstation. The EDS001 Outstation supports signed 16-bit and 32-bit data, as well as 32-bit PLC Real variables.
AUP	Advanced User Parameters for Ethernet configuration, a file which contains specific parameter overrides and options for the Ethernet Module.
Class 0 Data Poll or Integrity Poll	A request from a master station to an Outstation for all the data for all points, Data Object Group 60, Variance 1.
Class 1, 2, or 3 Data Poll or Event Poll	A request from a master station to an Outstation for the event data which is stored in the Outstation, typically with time and status information. This data can be further organized by groups, representing the class number. Specifying the Class Number ensures that only those points that are part of the group are returned. The EDS001 groups digital data into class 1 and analog data into class 2.
COMMREQ	A Communications Request Instruction supported by RX3i CPUs. Conveys data from the RX3i CPU to a designated target device. In this application, a single COMMREQ conveys all the DNP3 Outstation parameters to the EDS001.
CROB Data Object	A Control Relay Output Block (Data Object Group 12, Variance 1) is the method used to set a bit in the PLC from a Master Station. It represents a physical action of select before operating for an Outstation to set a bit over DNP3.
DNP	Distributed Network Protocol
DNP3	Specific implementation of DNP
Flags	Indicators that are returned to the Master Station from the Outstation, in general to describe point-related conditions which may exist at the Outstation.
Group	A specification sub-group of Object that refers specifically to a data type, point action, or Outstation action as defined in the DNP3 Specification. Group is a macro sub-category of Object and is unique when describing DNP3 Objects.

3 Note: Each of the Event data is configurable from 2000 to 8000 with the limitation that the sum of all the events is restricted to 24000. [Refer to Section 6.3.9, Configuring Event Buffer Size (Section f)].

IIN Bits	Indicators that are returned to the Master Station from the Outstation, in general to describe conditions that are not point-related which may exist at the Outstation.
IPv4	Internet Protocol version 4 (IPv4) is the fourth version in the development of the Internet Protocol (IP), and routes most traffic on the Internet. IPv4 is described in IETF publication RFC 791.
LAN	Local Area Network
LED	Light Emitting Diode
LIS	LAN Interface Status Bits are data provided by the module concerning the health and status of its Ethernet interface. The status includes that of the physical module as well as of the attached network.
LLA	The Lower Level Address of a DNP3 node, sometimes called its station address.
Object	A generic term used for referring to a collection of data points, or a single data point, on a DNP device. An object can have a specific action on an Outstation and all objects are defined in the DNP3 Specification.
PACSystems Machine Edition	PAC Machine Edition – used to configure, program and monitor RX3i Systems.
ST	Structured Text: a programing language supported by RX3i CPUs.
ST Block	A program block within ST. In this application one uses a single ST Block to convey a COMMREQ from the RX3i CPU to the EDS001 in order to set up all its DNP3 parameters.
SOE	Sequence of Events: a generic term used to describe a mechanism that can detect data change, then time-stamping each change for the purpose of establishing the sequence in which the changes were detected.
TCP/IP	The Transmission Control Protocol (TCP) is one of the core protocols of the Internet Protocol suite (IP), and is so common that the entire suite is often called TCP/IP. TCP provides reliable, ordered and error-checked delivery of a stream of octets between programs running on computers connected to a local area network, intranet or the public Internet. It resides at the transport layer.
Variance	A specification sub-group of Group that typically refers to a format of the data, or a specific sub-command to an action, as defined in the DNP3 Specification. Variance many times is a micro sub-category of Object and is not unique when describing Objects and Groups.

1.9 Revisions in this Manual

Note: *A given feature may not be implemented on all PACSystems Ethernet interfaces. To determine whether a feature is available on a given model and firmware version, please refer to the Important Product Information (IPI) document provided with the product.*

Table 1:

Rev	Date	Description
E	Sep 2019	Following Emerson's acquisition of this product, changes have been made to apply appropriate branding and registration of the product with required certification agencies. No changes to material, process, form, fit or functionality.
D	Sep 2018	Updated the Appendix C with more log messages Added new Configuration parameter- PLC Access Wait Time [19] Added Bit 9 of Optional Parameter word [17] for Keep Alive Change in behavior for Unsolicited responses to DNP3 Master with LLA address
C	Mar-2018	Added CPE302 compatibility. Added note on CPE400 incompatibility. Update Contact Info.
B	Dec-2015	Enhancements to configure the Event Buffer size separately for Digital Inputs (BI – Binary Inputs and BO – Binary Output status) and Analog Inputs (AI – Analog Inputs and AOS – Analog Output status) and Support for specific DNP3 object variations.
A	Apr-2015	Addition of support for CROB Control Dword.
-	Oct-2014	Original Issue

1.10 PACSystems Documentation

PACSystems Manuals

PACSystems RX7i, RX3i and RSTi-EP CPU Reference Manual	GFK-2222
PACSystems RX7i, RX3i and RSTi-EP CPU Programmer's Reference Manual	GFK-2950
PACSystems RX7i, RX3i and RSTi-EP TCP/IP Ethernet Communications User Manual	GFK-2224
PACSystems TCP/IP Ethernet Communications Station Manager User Manual	GFK-2225
PACSystems RXi, RX3i, RX7i and RSTi-EP Controller Secure Deployment Guide	GFK-2830

RX3i Manuals

PACSystems RX3i System Manual	GFK-2314
PACSystems RX3i DNP3 Outstation IC695EDS001 Quick Start Guide	GFK-2912

PACSystems RX3i DNP3 Outstation IC695EDS001
Important Product Information GFK-2933

In addition to these manuals, datasheets and product update documents describe individual modules and product revisions. The most recent PACSystems documentation is available on the Emerson support website https://www.emerson.com/Industrial-Automation-Controls/support.

Chapter 2 Installation

This chapter provides instructions for installing the module. The following topics are covered.

- Pre-Installation check
- Module installation and removal
- Port connections
- LED indications
- Firmware updates

For additional information about RX3i system installation, refer to the PACSystems RX3i System Manual, GFK-2314.

You will also need PAC Machine Edition configuration and programming software, version 8.60 or later.

2.1 Pre-Installation Check

Upon receiving your RX3i equipment, carefully inspect all shipping containers for damage. If any part of the system is damaged, notify the carrier immediately. The damaged shipping container should be saved as evidence for inspection by the carrier.

As the consignee, it is your responsibility to register a claim with the carrier for damage incurred during shipment. Emerson will cooperate fully with you, however, should such action be necessary.

After unpacking the RX3i equipment, record all serial numbers. Serial numbers are required if you should need to contact Customer Care during the warranty period. All shipping containers and all packing material should be saved should it be necessary to transport or ship any part of the system.

Verify that all components of the system have been received and that they agree with your order. If the system received does not agree with your order, contact Customer Care.

If you need technical help, contact Technical Support. For phone numbers and email addresses, see the Contact Information page in the front of this manual.

2.2 Installation Location

This product is primarily intended for use with the RX3i system. Its components are considered open equipment (having live electrical parts that may be accessible to users) and must be installed in an ultimate enclosure that is manufactured to provide safety. At a minimum, the enclosure shall provide a degree of protection against solid objects as small as 12mm (fingers, for example). This equates to a NEMA/UL Type 1 enclosure or an IP20 rating (IEC 60529) providing at least a pollution degree 2 environment. For details about installing RX3i rack systems, refer to PACSystems RX3i System Manual, GFK-2314.

2.3 Installation in Hazardous Areas

The following information is for products bearing the UL marking for Hazardous Areas or ATEX marking for explosive atmospheres:

CLASS 1 DIVISION 2 GROUPS ABCD

- This equipment is an open-type device and is meant to be installed in an enclosure suitable for the environment that is only accessible with the use of a tool.
- Suitable for use in Class 1, Division 2, Groups A, B, C and D Hazardous Locations, or nonhazardous locations only.

⚠ WARNING

- Explosion hazard substitution of components may impair suitability for Class 1, Division 2.
- When in hazardous locations, Turn off power before replacing or wiring modules.
- Do not connect or disconnect equipment unless power has been switched off or the area is known to be non-hazardous.

2.3.1 ATEX Zone 2

The module must be mounted in an enclosure certified in accordance with EN60079-15 for use in Zone 2, Group IIC and rated IP54. The enclosure shall only be able to be opened with the use of a tool.

2.3.2 ATEX Marking

Ex II 3 G Ex nA IIC T5 X Ta: 0 - 60C

2.4 Module Installation

2.4.1 Mounting the EDS001

The EDS001 mounts in any suitable main rack I/O slot of the RX3i backplane. Refer to the PACSystems RX3i System Manual, GFK-2314 Chapters 2 & 3 for details on how to mount/dismount RX3i modules, and for instructions with respect to slot choices available.

The EDS001 may be installed while the rack is under power. Refer to the PACSystems RX3i System Manual, GFK-2314 Chapters 2 for hot swap details.

Clearance

At least 75mm (3”) must remain clear above and below the module to allow for convection cooling.

Power Connection

Once the module has been mounted in the RX3i rack, it will receive power from the installed power supply via the RX3i backplane.

Grounding

Note that the EDS001 is fitted with a metal shroud which needs to be secured to the lower rail of the RX3i rack in order to provide a path to ground for noise immunity. Two screws are provided for this purpose. The failure to attach the shroud to the RX3i rack will likely lead to degraded product performance in the presence of electrical noise.

See also grounding instructions for the RX3i Rack and associated hardware in the PACSystems RX3i System Manual, GFK-2314, Chapter 2.

Cable Connection

Attach shielded twisted pair cables via one or both RJ-45 connectors. Optionally, attach the Station Manager via the RS-232 port.

⚠CAUTION

Some Ethernet cables come equipped with RJ-45 connectors that are oversized. Do not exert pressure to insert oversized connectors into the RJ 45 jacks as this may result in damage to the module.

2.4.2 EDS001 Module Removal

The EDS001 may be removed from its RX3i rack while the rack is still under power.

Follow the standard procedure for removing an RX3i module from its slot position, as detailed in the PACSystems RX3i System Manual, GFK-2314 Chapter 2.

Once removed from the rack, the Ethernet connection(s) will become inactive. The RS-232 Station Manager Port will also cease to operate.

2.5 Spare Parts

There are no spare parts specific to IC695EDS001.

Chapter 3 Configuration

The RX3i EDS001 DNP3 Outstation Module receives three different types of configuration:

a. Its rack/slot location is determined via the hardware configuration tool in PACSystems Machine Edition and is downloaded to the RX3i CPU.

b. Its Ethernet parameters are set via PACSystems Machine Edition, as documented in PACSystems RX7i & RX3i TCP/IP Ethernet Communications User Manual, GFK-2224 Chapter 4. Similarly, its Station Manager parameters are set via PACSystems Machine Edition, as documented in PACSystems TCP/IP Ethernet Communications Station Manager User Manual, GFK-2225.

c. Its DNP3 Outstation profile is determined by a COMMREQ instruction which is used to initialize it. The COMMREQ is executed only once following power-up or restart of the RX3i system.

3.1 Configuration Tools

- PACSystems RX3i CPU Firmware 8.00 or later.
- PAC Machine Edition configuration and programming software, version 8.60 or later.
- Serial or Ethernet cable for connecting the PAC Machine Edition programmer computer to the RX3i CPU.

3.2 RX3i Rack/Slot Hardware Configuration

Use PACSystems Machine Edition to configure the EDS001 within the host RX3i System. Select a suitable rack and slot location (Figure 6) and install EDS001 at that location (Figure 7) via the PACSystems Machine Edition hardware configuration tool. PACSystems Machine Edition will check whether the installed power supply can handle the combined load of the EDS001 and all other installed modules. All other configuration details, such as which I/O points and registers to be read or written by the EDS001, are handled as part of the DNP3 Outstation Parametric Configuration discussed in Section 3.5 below. There are no RX3i memory locations explicitly reserved for the use of the EDS001 module.

Figure 6: Adding Module to Rack/Slot location

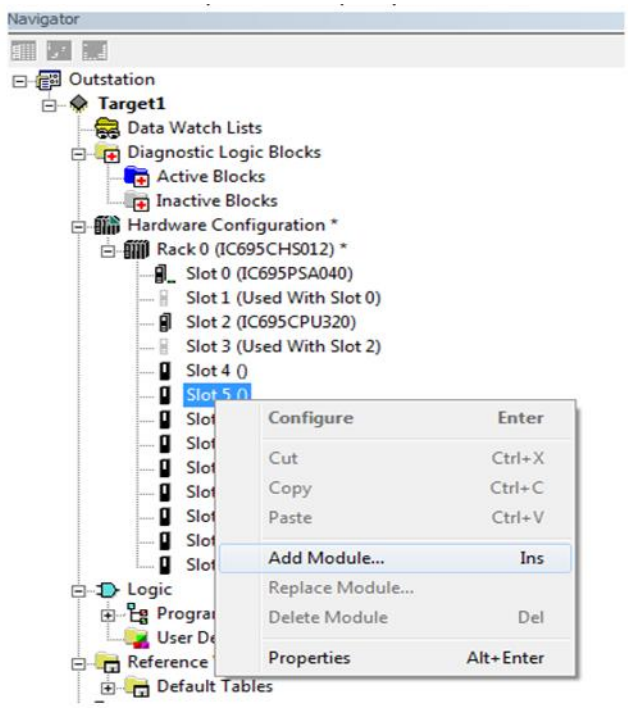
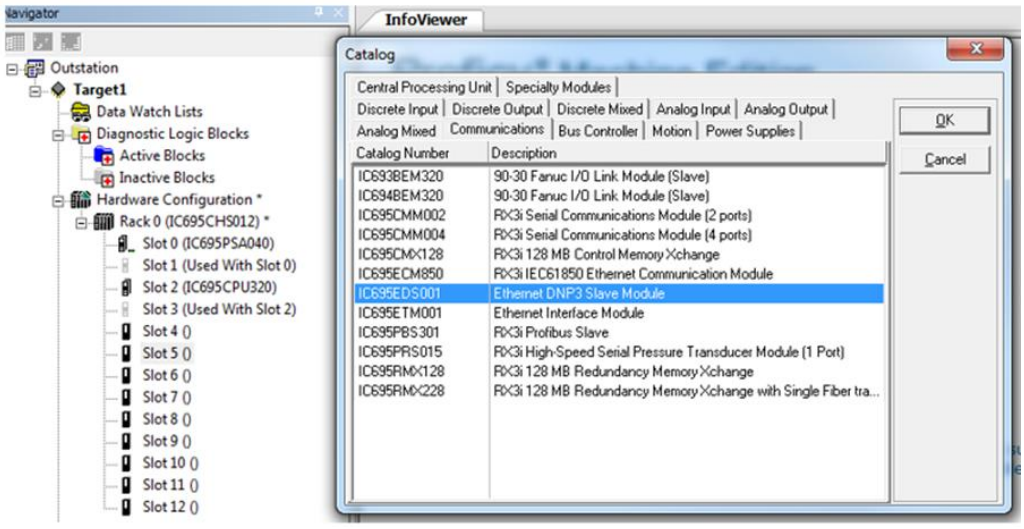


Figure 7: Selection of EDS001 for Installation



Note that any I/O or registers selected for EDS001 write operations should not be assigned to any other modules, as they will be overwritten. PACSystems Machine Edition does not check for such potential conflicts. For example, the %I space allocated to an input module should not be assigned to any DNP3 object configured to an EDS001 module. Similarly, where multiple EDS001 modules are present in the same RX3i system, their configuration ought not to overlap as far as write operations to the CPU is concerned.

The Emerson provided examples use variable mode on the EDS001 module to identify the terminals and prevent un-intended overlap using symbolic variables.

EDS001 modules require some amount of background scan time to efficiently transfer point data to and from the RX3i CPU. The minimum 5ms setting needs to be set in the Background Window Timer parameter in the CPU Scan tab of the hardware configuration screen for the CPU.

Figure 8: CPU Configuration Showing Sample Scan Settings (Scan Tab)

Settings | Scan | Memory | Faults | Port 1 | Port 2 | Scan Sets | Power Consumption | Access Control

Parameters	
Sweep Mode	Normal
Logic Checksum Words	16
Controller Communication Window Mode	Limited
Controller Communications Window Timer (ms)	10
Backplane Communication Window Mode	Limited
Backplane Communications Window Timer (ms)	10
Background Window Timer (ms)	5
Number of Last Scans	0

3.3 LAN Interface Status Bits

There are 80 LAN Status bits; the EDS001 module will typically use 2 of the LSI bits to control parameterization, as follows:

a. the EDS001 will signal that it is ready to accept parameterization by asserting Bit 11, and

b. the CPU should typically not communicate with the EDS001 until such time as Bit 13 has been asserted.

Note: *Should there be a failure of the EDS001 during parameterization, these bits may remain in a 1 or 0 state.*

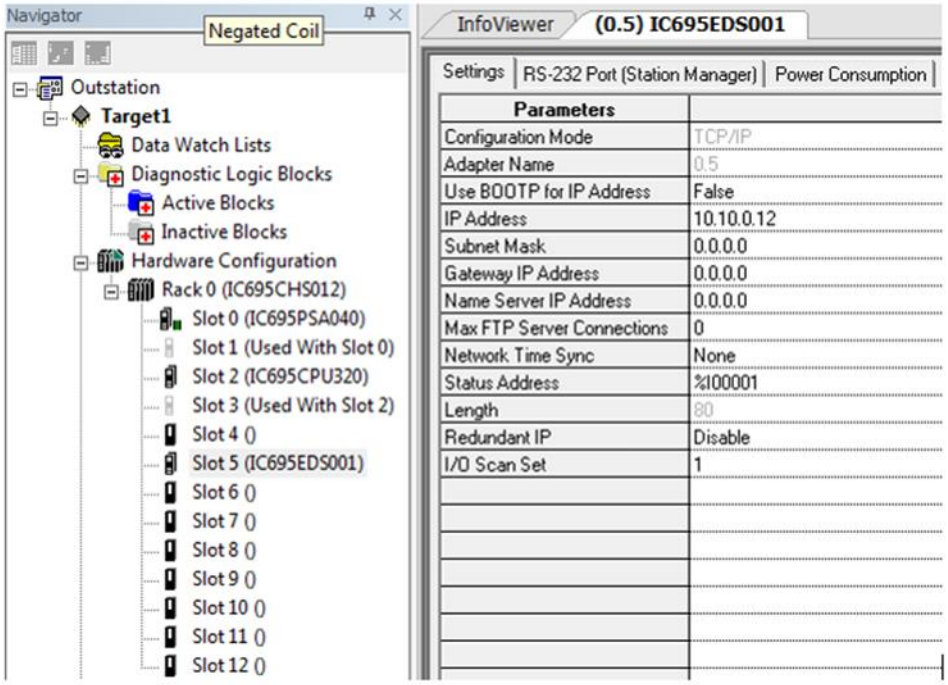
3.4 Ethernet Configuration

Refer to PACSystems RX7i & RX3i TCP/IP Ethernet Communications User Manual, GFK-2224 Chapter 4. There is a section dealing with Ethernet Configuration for rack-based modules.

EDS001 is limited to IPv4 addressing and can accept Advanced User Parameters (AUP) file settings for module parameters.

In PAC Machine Edition, click on the EDS001 module; open the parameter configuration window. On the Settings tab, enter the IP Address, subnet mask, and gateway IP Address for the EDS001 Ethernet interface as required by the DNP3 network configuration. Note: there is only one MAC Address and one IP Address for the module. Sample values are shown below:

Figure 9: PAC Machine Edition Tab for entering Ethernet Settings to be used by EDS001



3.5 DNP3 Outstation Profile Configuration

Determine how the EDS001 will be expected to interact with its DNP3 Master(s). Note that the EDS001 may be expected to interact with more than one master and on more than one LAN. The maximum is eight DNP3 Masters per LAN. The cumulative expectations of all the interested DNP3 masters will determine the DNP3 Outstation configuration. The DNP3 Outstation has only one instance of data that it serves.

As a DNP3 Outstation, the EDS001 will have one profile, and it must be configured via the RX3i CPU before it can operate on the DNP3 network. The COMMREQ outlined in Chapter 6 is used for this purpose. It conveys all DNP3 Outstation parameters from the RX3i CPU to the EDS001. The COMMREQ is executed only once to initialize the EDS001. See also Appendix A: for a full definition of all applicable DNP3 Outstation parameters.

Once configured and connected to its DNP3 Master(s), the EDS001 will exchange data automatically per its configuration and that of its masters.

RX3i CPU memory needed for DNP3 Outstation data can optionally be configured into the EDS001 module using a single startup COMMREQ, as documented in Chapter 6. The Outstation configuration is permitted to use %I, %AI, %Q, %AQ, %R, %W, %M, %T and %G memory types, as documented in Chapter 6. Ranges should be selected to accommodate the amount of data involved, but not overflow the end-point of the memory type.

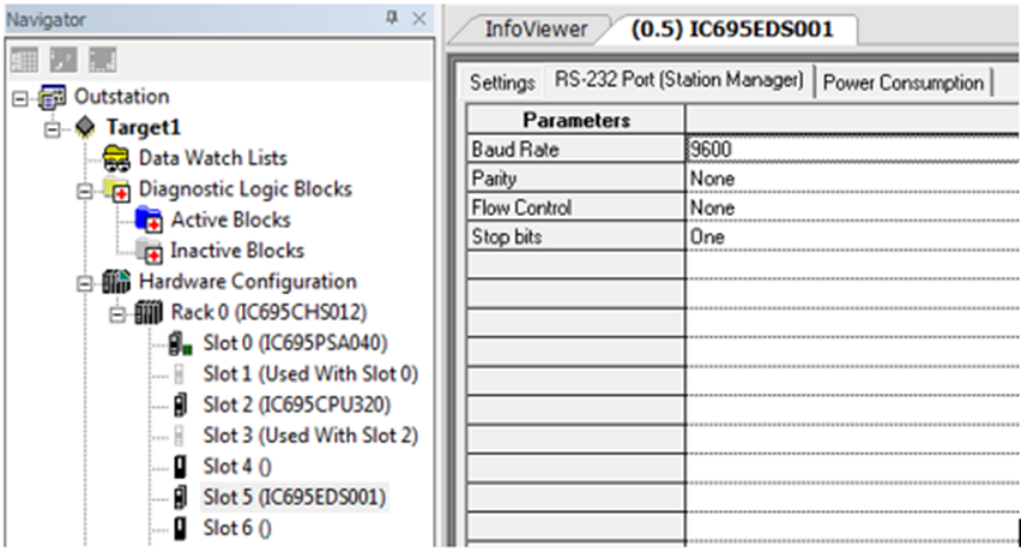
The Outstation configuration file also includes parameters to define an area of PLC memory for master station-Outstation communication status, if required. The format of the Outstation Status Space is defined in Section 6.3.1

As mentioned above, the EDS001 may be connected to separate LANs via its two Ethernet Ports (marked Port 1A and Port 1B). The two ports are independent and should not be connected to the same LAN. Whenever both ports are connected to active LANs, the masters on one LAN will typically impose different real-time demands on the EDS001 than the masters on the alternate LAN. Nonetheless, all traffic is handled per the DNP3 Outstation configuration imposed by the COMMREQ instruction detailed in Chapter 6.

3.6 Station Manager Configuration

Use the RS-232 Port (Station Manager) tab in PAC Machine Edition to set up the Station Manager port on the EDS001 module.

Figure 10: Station Manager Configuration Tab (Showing Defaults)



Refer to the PACSystems TCP/IP Ethernet Communications Station Manager User Manual, GFK-2225.Details on the EDS001 Station manager specifics are found in Appendix B:.

Chapter 4 System Operation

This chapter provides a System Overview and describes:

- Communications
- Redundancy
- I/O Scans
- Alarms
- Station Manager

4.1 System Overview

4.1.1 Communications

The EDS001 is a self-standing communication processor. During normal operation, it handles asynchronous requests from its various DNP3 Masters and exchanges corresponding data with the host RX3i CPU at designated portions of the CPU scan. It performs all these tasks without burdening the CPU beyond the windows designated for data exchange.

On power-up or reset will await the COMMREQ from the user application environment to set its parameters and put it into operation. Once it receives its parameters, the module scans the RX3i for data, based on its configuration. It detects and registers data changes within its host PLC. It also services asynchronous DNP3 Master requests for polling (i.e. reading of PLC data) and writing of data to PLC memory.

Because the module is self-standing, it polls the CPU during the CPU background scan window for data, per its configuration. The module detects and records all corresponding data changes internally. Whenever a master writes to it, the module must wait for the CPU to allow it to write the corresponding information into the PLC memory during the same window.

All Ethernet traffic is asynchronous to the RX3i CPU scanning operation, so the module can service many different requests without burdening the CPU with processing them.

4.1.2 Redundancy

There are no restrictions which apply to an EDS001 when installed in a redundant RX3i CPU. The polling of event and integrity data will occur as if it were in a simplex system.

The EDS001 can take advantage of the Redundant IP feature of a Redundant CPU system, allowing two EDS001 modules in two racks to appear as one module.

Note:

1. It is recommended to add the following TCP Keep Alive parameters in AUP File, for effective changeover of DNP3 communication to Redundant IP:

i. (wkal_idle = 1,wkal_cnt = 1,wkal_intvl = 4)

2. The CROB function and Analog Output Value will be processed by the active controller only.

3. A Master connected to an RX3i CRU system that uses Redundant IP can experience a bump, or loss of communication in the event of a role switch at the DNP3 master station. This is mainly due to the way the Master and its host Operating system processes the change in end station whenever the RX3i switches roles. Your master application, as well as the RX3i PLC application must be developed to withstand a likely bump in the connection during a role switch and not act inappropriately.

Also refer to CRU Local Active OFF below.

4.1.3 I/O Scans

The EDS001 module for DNP3 data exchange does not use a specific I/O Scan Set as defined in the PAC Machine Edition processor Settings tab, and in the Ethernet tab for the EDS001 Module (Figure 9).

STOP Mode

In STOP Mode, the DNP3 Outstation will respond to Class 0, 1, 2, or 3 poll requests. The requests will be serviced with current state data; however, the data will be marked as offline to the Master Station. In STOP Mode, CROB and Analog Output Values will return a failure to the Master Station.

RUN IO Disable

In RUN IO Disable Mode, the DNP3 Outstation will respond as documented for STOP Mode, but the offline flag will not be present on the data.

CRU Local Active OFF

In CRU Local Active OFF Mode, the DNP3 Outstation will respond as documented for STOP Mode, but the offline flag will not be present on the data.

⚠CAUTION

There is no interlock between CROB functions of individual EDS001 modules. They can reference the same memory space and can accept contrary commands from various master stations.

4.1.4 Alarms

The EDS001 generates faults which are logged into the Fault table. A given fault may relate to the Ethernet interface, or may be specific to the DNP3 Outstation functionality. Refer to PACSystems RX7i & RX3i TCP/IP Ethernet Communications User Manual, GFK-2224 for a description of Ethernet-related alarms.

4.1.5 Station Manager

The RS-232 port on the ESD001 module is set up to be used as a Station Manager. Typically, this is used for trouble-shooting and administrative purposes.

In addition to standard Station Manager commands, the EDS001 module responds to specific Stat and Tally Station Manager commands for DNP3 information. The formats are:

- stat a. Response displays various operating status. Note the response for technical support.
- tally a. Response displays various operating counters. Note the response for technical support.

See Appendix B: for examples of these two commands.

For all other commands and responses, refer to the PACSystems TCP/IP Ethernet Communications Station Manager User Manual, GFK-2225.

Each EDS001 will log many conditions to its own Station Manager Log, as well as to the PLC Controller table as part of Fault Group 0x16

Chapter 5 Diagnostics

This chapter describes:

- Status Data
- Module LED Indicators
- Power-up
  - Module Restart
  - Problems During Power-up and Reset
  - Transitioning from Firmware Update Mode to Normal Operating Mode

5.1 Status Data

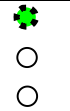
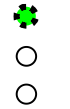
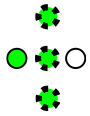
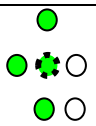
The EDS001 produces a total 100 words to supply status information to the controlling RX3i CPU. As part of the COMMREQ instruction to parameterize the EDS001 module a 100-word region can be specified for real-time diagnostics on the module.

For each bank of 32 status bits, a default beginning reference (the next available %I) for the status bits is automatically assigned by PAC Machine Edition. These assignments may be changed by clicking on the EDS001 and keying in different %I references, or by switching the module to variable mode, and using symbolic addresses.

5.2 Light-Emitting Diode (LED) Indications

The three LEDs in the module header provide a visual indication of the EDS001 module status. Additionally, each RJ-45 port is equipped with a pair of LEDs to indicate the status of the corresponding port.

Table 2:

LED	State		Indicates
ETHERNET OK LAN OK LOG EMPTY		Fast Blink Off Off	Performing Diagnostics
ETHERNET OK LAN OK LOG EMPTY		Slow Blink Off Off	Waiting for Ethernet configuration from CPU
ETHERNET OK LAN OK LOG EMPTY		Slow Blink* On/Traffic/ Off Slow Blink*	(* *EOK and STAT blink in unison*)	Waiting for IP Address
ETHERNET OK LAN OK LOG EMPTY		On On/Traffic/Off On/Off	Operational
ETHERNET OK LAN OK LOG EMPTY		Blink error code Off Off	Hardware failure. Refer to PACSystems RX7i & RX3i TCP/IP Ethernet Communications User Manual, GFK-2224 for blink code definitions.
ETHERNET OK LAN OK LOG EMPTY		Slow Blink* Slow Blink* Slow Blink*	(* *All LEDs blink in unison)*	Firmware Update (pattern is the same for awaiting or performing load)
Port LEDs (one pair for Port 1A, second pair for Port 1B)			
100 Mbps		On Off	100 Mbps Active 100 Mbps Not Achieved
LINK		Rapid Blink Off	Traffic Detected on Port No Traffic Detected on Port

5.3 Power-Up

5.3.1 Problems during Power-up

Certain conditions can prevent the module from powering up and becoming operational or entering firmware update mode:

Table 3:

Problem	Indication	Action
Hardware failure	All Indicator LEDs off. Module unresponsive.	Contact Technical Support to arrange for repair and replacement
Invalid boot image		
Invalid firmware image	Power LED is ON but OK LED is off or Power LED alternates Green & Amber	Perform firmware update

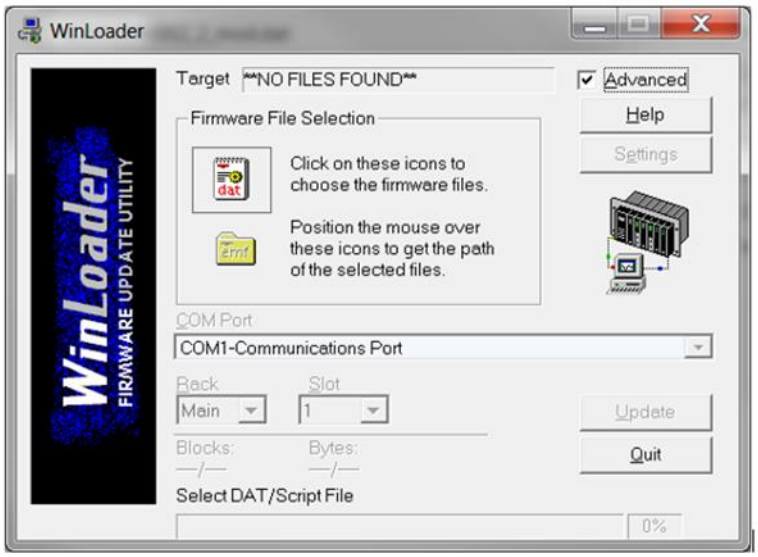
5.3.2 Firmware Update Mode

The EDS001 firmware consists of the ETM001 firmware plus the DNP3-specific firmware, and an Emerson installed license. All these elements are available on the support web-site https://www.emerson.com/Industrial-Automation-Controls/support.

Each firmware upgrade may be obtained from the support web-site as a uniquely-identified ZIP file. The ZIP file must be downloaded to a computer which can be connected to the host RX3i CPU. Each ZIP file includes instructions specific to the target product.

The updated firmware may then be passed to the EDS001 via the host RX3i CPU using the WinLoader utility. The CPU must be in STOP mode in order to deliver the firmware upgrade via the Serial port on the CPU.

Figure 11: WinLoa03der Utility Screen-Shot



After new firmware has been successfully downloaded to the EDS001 module, and the CPU has been switched to RUN mode, the EDS001 module will reboot using the new firmware. In order to initialize and resume DNP3 Outstation operation, it will be necessary to activate

the COMMREQ instruction in Chapter 6 in order to provide the module with its DNP3 Outstation profile.

See the EDS001 firmware update LED pattern above. This pattern will be displayed between the time the firmware download is initiated by the CPU and until such time as the module is able to return to normal operation.

5.4 Module Faults in the RX3i I/O Fault Tables

Powering up or down, pressing the Ethernet Restart push-button, or connecting/disconnecting the EDS001 from its Ethernet LANs will have effects on both the CPU and on the affected LANs.

If the EDS001 module fails, the RX3i CPU will record a *Loss of Device* fault particular to the EDS001 module at the corresponding rack/slot location. If the rack in which the EDS001 is located loses Power, and is not the same rack as the CPU, the RX3i CPU will record a *Loss of Device* for all devices in that rack, including for the EDS001 module(s) located there.

Adding an EDS001 to an RX3i rack causes the RX3i CPU to register an *Addition of Device* fault for the corresponding EDS001 and indicate the rack/slot location involved. Powering up a rack containing an EDS001 will cause the RX3i CPU to register an *Addition of Device* fault for all devices in the rack, including the EDS001.

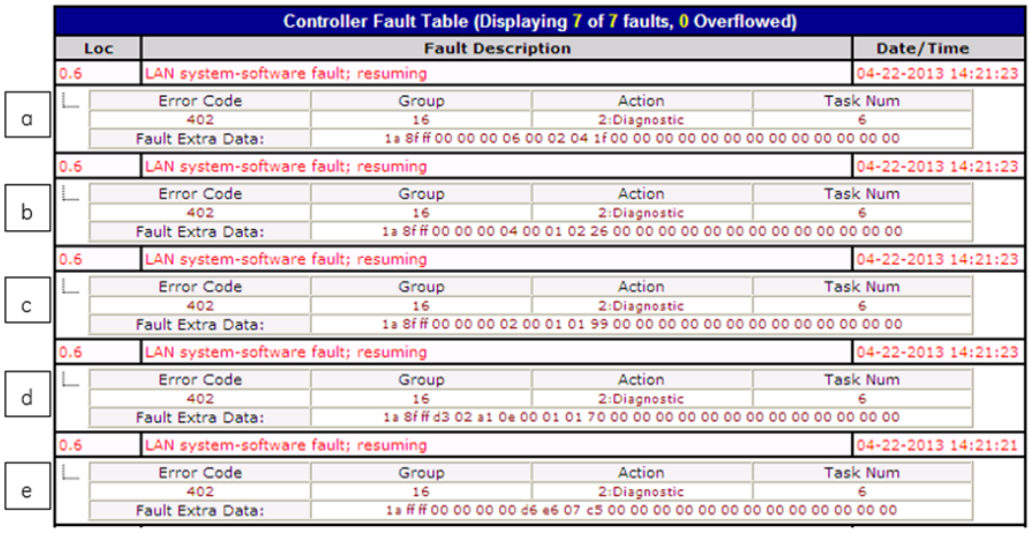
Pressing the Ethernet Restart push-button has no effect on the Fault Table in the RX3i CPU. However, all traffic on both LANs will cease to be processed by the EDS001 until such time as the Ethernet service has been re-established internal to the module. During this time, the EDS001 module will continue to read data from the RX3i CPU memory, per its DNP3 Outstation configuration. Since no new data will be available to be written to the CPU during the Ethernet reset period, the EDS001 will present no new data to the RX3i CPU.

Disconnecting an RJ-45 connector from Port 1A or Port 1B will disrupt Ethernet traffic on the corresponding port. The EDS001 will continue to attempt transmission and will read data from the RX3i memory per its DNP3 Outstation configuration in order to have fresh data available for transmission. Since no new DNP3 data will be received during this period, the EDS001 will present no new data to the RX3i CPU. Once the RJ-45 connector is re-connected, data exchanges per DNP3 Outstation configuration will resume automatically.

5.4.1 Typical Fault Messages during Power-Up

The following messages may appear in the RX3i CPU Fault Table during a typical power-on sequence:

Figure 12: Typical Power-Up PLC Fault Table Entries Originated by EDS001



Controller Fault Table (Displaying 7 of 7 faults, 0 Overflowed)

	Loc	Fault Description	Date/Time
	0.6	LAN system-software fault; resuming	04-22-2013 14:21:23
a		Error Code: 402 | Group: 16 | Action: 2:Diagnostic | Task Num: 6	
		Fault Extra Data: 1a 8f ff 00 00 00 06 00 02 04 1f 00 00 00 00 00 00 00 00 00 00 00 00	
	0.6	LAN system-software fault; resuming	04-22-2013 14:21:23
b		Error Code: 402 | Group: 16 | Action: 2:Diagnostic | Task Num: 6	
		Fault Extra Data: 1a 8f ff 00 00 00 04 00 01 02 26 00 00 00 00 00 00 00 00 00 00 00 00	
	0.6	LAN system-software fault; resuming	04-22-2013 14:21:23
c		Error Code: 402 | Group: 16 | Action: 2:Diagnostic | Task Num: 6	
		Fault Extra Data: 1a 8f ff 00 00 00 02 00 01 01 99 00 00 00 00 00 00 00 00 00 00 00 00	
	0.6	LAN system-software fault; resuming	04-22-2013 14:21:23
d		Error Code: 402 | Group: 16 | Action: 2:Diagnostic | Task Num: 6	
		Fault Extra Data: 1a 8f ff d3 02 a1 0e 00 01 01 70 00 00 00 00 00 00 00 00 00 00 00 00	
	0.6	LAN system-software fault; resuming	04-22-2013 14:21:21
e		Error Code: 402 | Group: 16 | Action: 2:Diagnostic | Task Num: 6	
		Fault Extra Data: 1a ff ff 00 00 00 00 d6 e6 07 c5 00 00 00 00 00 00 00 00 00 00 00 00	

The messages above detail the normal start-up sequence of the EDS001 module. Each line has been keyed *a* thru *e* for each of explanation, as follows:

a. The EDS001 is operating.

b. The EDS001 is configured.

c. The EDS001 is executing and waiting for the COMMREQ configuration command.

d. The firmware revision of the EDS001 module is displayed – in the example it is D302, a10e.

e. The license revision of the EDS001 is displayed in hex values 4,5,6,7 (here displaying 000000d6).

Refer to Appendix C: for more details, or other log messages.

5.4.2 Using Status Data for Troubleshooting

There are three main types of status data available to the RX3i application program:

1. FT Output of the COMMREQ Function Block: This output is set if there is a programming error in the COMMREQ Function Block itself, if the rack and slot specified in the COMMREQ SYSID parameter is not configured to contain an Ethernet interface, or if the data block length specified in the Command Block is out of range. This output also may indicate that no more COMMREQ functions can be initiated in the ladder program until the Ethernet interface has time to process some of the pending COMMREQ functions.

If the FT Output is set, the CPU does not transfer the Command Block to the Ethernet interface. Under these circumstances, the other status indicators are not updated for this COMMREQ.

2. Status Bits: The status bits are updated in the RX3i CPU once each PLC scan by the Ethernet interface. These bits are generally used to prevent initiation of a COMMREQ function when certain errors occur or to signal a problem on an established channel. The status bits include the LAN Interface Status bits and the Channel Status bits. The starting location of these bits is set up when the module is configured.
    - The LAN Interface Status (LIS) Bits monitor the health of the Ethernet interface itself, such as the LAN Interface OK bit.
3. Communications Status Word: The COMMREQ Status word (CRS word) provides detailed information on the status of the COMMREQ request. The communications status word is not updated in the CPU each scan as are the status bits. They are generally used to determine the cause of a communication error after the COMMREQ function has been initiated. The cause is reported in the form of an error code. The COMMREQ Status word (CRS word) is returned from the Ethernet interface to the RX3i CPU immediately if the Command Block contains a syntax error or if the command is local. The location of the CRS word is defined in the Command Block for the COMMREQ function. See Table 37

5.4.3 Clearing the RX3i Fault Tables

Clearing the RX3i CPU's I/O fault tables has no effect on the EDS001. This action merely clears the I/O Fault Table temporarily; nor does it clear the EDS001 log information.

Chapter 6 Configuration of DNP3 Outstation Parameters Using COMMREQ

This chapter describes the configuration parameters used to set up the DNP3 Outstation aspects of the EDS001 module. The COMMREQ used to convey the parameters from the user's application program to the EDS001 is typically found in a structured text (ST) programming block in ladder logic. This chapter contains segments of ladder logic to illustrate how various parameters are passed to the EDS001 module, and what the user's options are. The values supplied throughout the chapter are examples and may not relate to the way you wish your DNP3 Outstation to be configured. Ladder logic examples may be found on the support web-site https://www.emerson.com/Industrial-Automation-Controls/support.

Look for developer document DD301 and DD316 for original ETM001 related collateral and EDS001 related collateral respectively.

mComreq_Setup[xx] appears throughout this chapter.

mComreq_Setup[] is an array containing the parameter data the user wishes to move to the DNP3 Outstation module via the COMMREQ instruction.

[xx] is the index into that array.

6.1 Overview

The EDS001 module is set up as a DNP3 Outstation using an ST block which is executed once in a standard ladder logic program. The purpose of the ST block is to configure the EDS001 module with the parameters required for the user's application.

A typical user application might be trying to set up the DNP3 Outstation as follows:

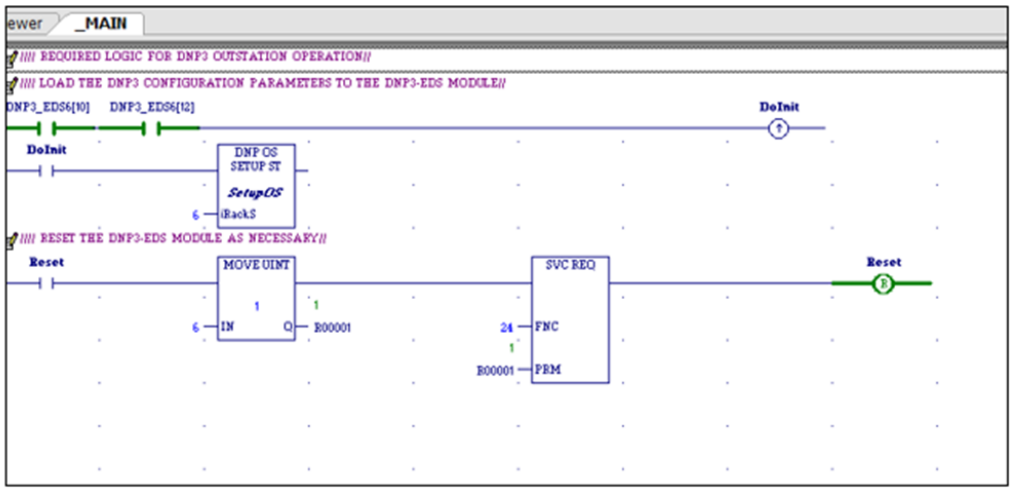
Table 4: Sample DNP3 Outstation Requirement

Sample User Requirement	RX3i CPU Memory Assignment	Range
COMMREQ Status Word	%R00001	%R00001
Outstation Status Space	%W00001	%W00001-%W00100
DI (16 objects)	%I00001	%I00001-%I00016
DO (16 objects)	%Q00001	%Q00001-%Q00016
AI (4 objects)	%AI00001	%AI00001-%AI00004
AO (4 objects)	%AQ00001	%AQ00001-%AQ00004
CROB bit (8 objects)	%M00001	%M00001-%M00008
Analog output value (4 objects)	%R00011	%R00011-%R00014

An ST block simplifies the mechanics of the COMMREQ instruction which, when used to initialize the DNP3 Outstation, conveys 114 configuration parameters from the user's application program to the EDS001 Module. It contains both required and optional parameters for DNP3 Outstation functionality. Note that any change to the values must be re-sent via COMMREQ to a freshly booted EDS001 module. Resetting the EDS001 can be accomplished by using Service Request 24 (refer to PACSystems RX7i and RX3i CPU Programmer's Reference Manual, GFK-2950).

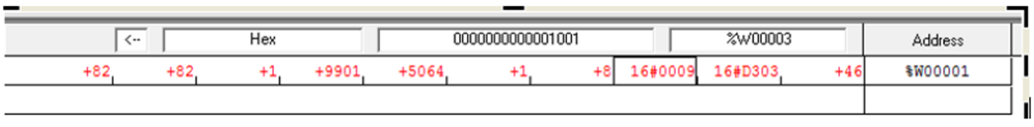
In the ladder example a one-shot is employed to ensure the ST block is executed only once following power-up or following a restart of the CPU. Before downloading the parameters, the logic waits until the EDS001 module signals that it is ready to accept its DNP3 Outstation parameters.

Figure 13: Ladder Logic used to Configure DNP3 Outstation Parameters



The DNP3 Firmware version can be checked as defined in the COMMREQ configuration for Outstation status space described in Section 6.3.1 For details, refer to Appendix A:, Definition of the Status Area. The Major and Minor version for DNP3 Firmware is available in the offset 1 (Ver_1word) and 2 (Ver_2word) respectively. The screen capture (Figure 14) displays the DNP3 Firmware version.

Figure 14: Reading the Firmware Version



Alternatively, the DNP3 firmware version can also be checked via Station Manager Command – stat a, as shown in Appendix B:.

The ETM001 firmware version can be found using the Ethernet online command as:

Target---> Online Commands --->Show Status...----->Details

6.2 Required Configuration Parameters

The ten parameters outlined in 6.2.1and 6.2.2are required for all RX3i DNP3 Outstation configuration files. These parameters set a basic configuration in the DNP3 Outstation module that allows connection to a DNP3 master station. All configuration parameter values should be entered in decimal format. Refer to the parameter description to determine valid input values for application-based, or user-defined, parameter settings. Set values for these parameters as required by the application.

Note: *Reserved parameters always have a value of zero (0).*

6.2.1 Standard COMMREQ Command Block Parameters

Table 5:

Parameter	Value	Description
mComreq_Setup[00]	114	COMMREQ Data Length, always 114 (decimal)
mComreq_Setup[01]	0	WAIT/NOWAIT Flag, always 0
mComreq_Setup[02]	m-type value	Memory Type for COMMREQ Status Word. Value (decimal) : 8-%R, 10-%AI, 12-%AQ, 196-%W
mComreq_Setup[03]	offset value	Memory Address Offset for COMMREQ Status Word. Zero-based offset into memory: value = address – 1 (for example, %R1 requires offset 0, %R100 requires offset 99)
mComreq_Setup[04]	0	Reserved
mComreq_Setup[05]	0	Reserved

6.2.2 Parameters for Master Station-Outstation Connection

Table 6:

Parameter	Value	Description
mComreq_Setup[06]	1234	Outstation Command Number Always 1234
mComreq_Setup[07]	conn value	Number of Master Station Connections to support Value: 1 to 8: default is 1
mComreq_Setup[08]	20000	TCP/IP Port Number for DNP3 Data Connection, By convention it should be 20000, however this can be overridden by the SOE setting
mComreq_Setup[09]	LLA value	LLA Address for DNP3 Outstation Module Value: 1 to 255: typically 4 ***Note:*** *The LLA address for the Outstation must be unique among connected masters.* See Note: Unsolicited responses to DNP3 Master in the section -DNP3 Polled Object Parameters –Push-Back Messages (Section b)

6.3 Optional Configuration Parameters

The parameters listed in the sub-sections documented in this section are optional for RX3i DNP3 Outstation configuration files. The optional parameters are application-based, or user-defined, configuration parameters that determine the Outstation functionality and the responses to master station requests. All configuration parameter values should be entered in decimal format. Refer to the parameter description to determine valid input values for application-based, or user-defined, parameter settings.

Note: *Reserved parameters always have a value of zero (0).*

6.3.1 Parameters for Outstation Status Space (Section a)

The Outstation Status Space is a 100-word data table that contains the current operational status of the master station-Outstation connection. Set appropriate values for the constituent parameters as required by the application. The PLC memory location assigned to contain the Outstation Status Space is defined by the user, as follows:

Note: *by setting the Memory type to 0, the feature is disabled.*

For more information on Status Space 100-word data table refer to Definition of the Status Area in Appendix A:.

Table 7:

Parameter	Value	Description
mComreq_Setup[10]	m-type value	Memory Type for Outstation Status Space Value (decimal): 8-%R, 10-%AI, 12-%AQ, 196-%W, 0-unused
mComreq_Setup[11]	0	Reserved
mComreq_Setup[12]	address value	Memory Address for Outstation Status Space Value: 1 to maximum (based on memory type)
mComreq_Setup[13]	0	Reserved

6.3.2 DNP3 Polled Object Parameters – Digital Inputs & Outputs (Section b)

A digital input is defined as a DNP3 Object (Inputs) 01 Var 2 poll response. Corresponding PLC memory type, memory address, and number of objects are required to be entered. Set values for these parameters as required by the application.

Note: *by setting the Memory type to 0, the Object is disabled*

Table 8:

Parameter	Value	Description
mComreq_Setup[26]	m-type value	Memory Type for DI Polled Objects Value (decimal): 70-%I, 72-%Q, 76-%M, 74-%T, 86-%G, 0-unused
mComreq_Setup[27]	0	Reserved
mComreq_Setup[28]	address value	Memory Address for DI Polled Objects Value: 1 to maximum (based on memory type)
mComreq_Setup[29]	0	Reserved
mComreq_Setup[30]	number value	Number of DI Polled Objects Value: 1 to 3000
mComreq_Setup[31]	0	Reserved

A digital output is defined as a DNP3 Object (Outputs) 10 Var 2 poll response. PLC memory type, memory address, and number of objects are required to be entered. Set values for these parameters as required by the application.

Note: *by setting the Memory type to 0, the Object is disabled.*

Table 9:

Parameter	Value	Description
mComreq_Setup[32]	m-type value	Memory Type for DO Polled Objects Value (decimal): 70-%I, 72-%Q, 76-%M, 74-%T, 86-%G, 0-unused
mComreq_Setup[33]	0	Reserved
mComreq_Setup[34]	address value	Memory Address for DO Polled Objects. Value: 1 to maximum (based on memory type)
mComreq_Setup[35]	0	Reserved
mComreq_Setup[36]	number value	Number of DO Polled Objects Value: 1 to 3000
mComreq_Setup[37]	0	Reserved

The Definition of the Address Value for Digital memory is word (16-bit) bounded. When presented with a non-word bounded address, the EDS001 module rounds the presented address down to the nearest word boundary. No alarm is created when such an adjustment is made.

The number of DI objects is byte-bounded. The EDS001 module rounds up to the nearest byte. For example, trying to define 22 DI objects will result in 24 being assigned.

The actual address and number of items being queried for Digital inputs and/or outputs can be seen in the response to the STAT A command in the Station Manager interface.

6.3.3 DNP3 Polled Object Parameters – Analog Inputs & Outputs (Section b)

An analog input is defined as a DNP3 Object (Analog Inputs) 30 Var 2 poll response. Corresponding PLC memory type, memory address, and number of objects are required to be entered. Set values for these parameters as required by the application.

Note: *by setting the Memory type to 0, the Object is disabled.*

Table 10:

Parameter	Value	Description
mComreq_Setup[38]	m-type value	Memory Type for AI Polled Objects Value (decimal): 8-%R, 10-%AI, 12-%AQ, 196-%W, 0-unused
mComreq_Setup[39]	0	Reserved
mComreq_Setup[40]	address value	Memory Address for AI Polled Objects Value: 1 to maximum (based on memory type)
mComreq_Setup[41]	0	Reserved
mComreq_Setup[42]	number value	Number of AI Polled Objects Value: 1 to 1024
mComreq_Setup[43]	0	Reserved

An analog output is defined as a DNP3 Object (Analog Outputs) 40 Var 2 poll response. PLC memory type, memory address, and number of objects are required to be entered. Set values for these parameters as required by the application.

Note: *by setting the Memory type to 0, the Object is disabled.*

Table 11:

Parameter	Value	Description
mComreq_Setup[44]	m-type value	Memory Type for AO Polled Objects. Value (decimal): 8-%R, 10-%AI, 12-%AQ, 196-%W, 0-unused
mComreq_Setup[45]	0	Reserved
mComreq_Setup[46]	address value	Memory Address for AO Polled Objects. Value: 1 to maximum (based on memory type)
mComreq_Setup[47]	0	Reserved
mComreq_Setup[48]	number value	Number of AO Polled Objects. Value: 1 to 1024
mComreq_Setup[49]	0	Reserved

Analog polled objects require configuration of a corresponding data format parameter. One parameter sets the data format for all AI polled objects; another parameter sets the data format for all AO polled objects. Set values for these parameters as required by the application.

Data Format Options for Analog Polled Objects

- 0 – 16-bit signed value (default format)
- 1 – 16-bit signed value
- 2 – 32-bit signed value
- 3 – 32-bit floating point value
- 44 – Special code

Use one data format option to set each of the following parameters:

Table 12:

Parameter	Value	Description
mComreq_Setup[109]	format value	Data Format for all AI Polled Objects (Object 30, 32) Value: 0, 1, 2, or 3 or 44 per list above
mComreq_Setup[110]	format value	Data Format for all AO Polled Objects (Object 40, 42). Value: 0, 1, 2, or 3 or 44 per list above

The examples which follow (for special def_code 44) are provided for ease of configuration:

Configuration example for Analog Inputs polled object:

- mComreq_Setup[38] = 10;
- mComreq_Setup[39] = 0;
- mComreq_Setup[40] = 1;
- mComreq_Setup[41] = 0;
- mComreq_Setup[42] = 1024; // This length will be overridden as shown in the following table.
- mComreq_Setup[43] = 0;
- mComreq_Setup[109] = 44.

Table 13:

(DEF Code = 44) Data Type	Register Memory Fixed	Range	Object Index	Master Request Options	
16 Bit INT	%AI0001-%AI002	600	0	Obj 30, Var2/Var 4	Obj 32, Var2/Var 4
			1	Obj 30, Var2/Var 4	Obj 32, Var2/Var 4
			2	Obj 30, Var2/Var 4	Obj 32, Var2/Var 4
			3	Obj 30, Var2/Var 4	Obj 32, Var2/Var 4
			4	Obj 30, Var2/Var 4	Obj 32, Var2/Var 4
			5	Obj 30, Var2/Var 4	Obj 32, Var2/Var 4
			6	Obj 30, Var2/Var 4	Obj 32, Var2/Var 4
			7	Obj 30, Var2/Var 4	Obj 32, Var2/Var 4
			..	Obj 30, Var2/Var 4	Obj 32, Var2/Var 4
	%AI1199-%AI1200		599	Obj 30, Var2/Var 4	Obj 32, Var2/Var 4
32 Bit INT	%AI1201-%AI1202	600	600	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
			601	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
			602	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
			603	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
			604	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
			605	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
			606	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
			607	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
			..	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
	%AI2399-%AI2400		1199	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
32 Bit REAL	%AI2401-%AI2402	1200	1200	Obj 30, Var5	Obj 32, Var5/Var7
			1201	Obj 30, Var5	Obj 32, Var5/Var7
			1202	Obj 30, Var5	Obj 32, Var5/Var7
			1203	Obj 30, Var5	Obj 32, Var5/Var7
			1204	Obj 30, Var5	Obj 32, Var5/Var7
			1205	Obj 30, Var5	Obj 32, Var5/Var7
			1206	Obj 30, Var5	Obj 32, Var5/Var7
			1207	Obj 30, Var5	Obj 32, Var5/Var7
			..	Obj 30, Var5	Obj 32, Var5/Var7
	%AI4799-%AI4800		2399	Obj 30, Var5	Obj 32, Var5/Var7

Configuration example for Analog Output status polled object:

- mComreq_Setup[44] = 12;
- mComreq_Setup[45] = 0;
- mComreq_Setup[46] = 1;
- mComreq_Setup[47] = 0;
- mComreq_Setup[48] = 1024; // This length will be overridden as shown in the following table.

- mComreq_Setup[49] = 0;
- mComreq_Setup[110] = 44.

Table 14:

(DEF Code = 44) Data Type	Register Memory Fixed	Range	Object Index	Master Request Options	
16 Bit INT	%AQ0001-%AQ002	600	0	Obj 40, Var2	Obj 42, Var2/Var 4
			1	Obj 40, Var2	Obj 42, Var2/Var 4
			2	Obj 40, Var2	Obj 42, Var2/Var 4
			3	Obj 40, Var2	Obj 42, Var2/Var 4
			4	Obj 40, Var2	Obj 42, Var2/Var 4
			5	Obj 40, Var2	Obj 42, Var2/Var 4
			6	Obj 40, Var2	Obj 42, Var2/Var 4
			7	Obj 40, Var2	Obj 42, Var2/Var 4
			..	Obj 40, Var2	Obj 42, Var2/Var 4
	%AQ1199-%AQ1200		599	Obj 40, Var2	Obj 42, Var2/Var 4
32 Bit INT	%AQ1201-%AQ1202	600	600	Obj 40, Var1	Obj 42, Var1/Var 3
			601	Obj 40, Var1	Obj 42, Var1/Var 3
			602	Obj 40, Var1	Obj 42, Var1/Var 3
			603	Obj 40, Var1	Obj 42, Var1/Var 3
			604	Obj 40, Var1	Obj 42, Var1/Var 3
			605	Obj 40, Var1	Obj 42, Var1/Var 3
			606	Obj 40, Var1	Obj 42, Var1/Var 3
			607	Obj 40, Var1	Obj 42, Var1/Var 3
			..	Obj 40, Var1	Obj 42, Var1/Var 3
	%AQ2399-%AQ2400		1199	Obj 40, Var1	Obj 42, Var1/Var 3
32 Bit REAL	%AQ2401-%AQ2402	1200	1200	Obj 40, Var3	Obj 42, Var5
			1201	Obj 40, Var3	Obj 42, Var5
			1202	Obj 40, Var3	Obj 42, Var5
			1203	Obj 40, Var3	Obj 42, Var5
			1204	Obj 40, Var3	Obj 42, Var5
			1205	Obj 40, Var3	Obj 42, Var5
			1206	Obj 40, Var3	Obj 42, Var5
			1207	Obj 40, Var3	Obj 42, Var5
			..	Obj 40, Var3	Obj 42, Var5
	%AQ4799-%AQ4800		2399	Obj 40, Var3	Obj 42, Var5

6.3.4 DNP3 Polled Object Parameters –Push-Back Messages (Section b)

Set values for these parameters as required by the application.

Table 15:

Parameter	Value	Description
mComreq_Setup[23]	filter value	Time Interval for Shutter-Type Data Filter (milliseconds). Value: 10 to 32000; default is 250. The internal database screens fast-changing events with a shutter type of filter. This parameter sets the shutter interval for all polled data.
mComreq_Setup[15]	time value	Time Delay for Data Push Back (seconds). Value: 1 to 32000; if 0, it defaults to 5 seconds. The amount of time to wait after a new value is detected, but not polled, before doing an unsolicited information push (if the master station has enabled this setting). See Note: Unsolicited responses to DNP3 Master below.
mComreq_Setup[16]	event value	Number of Events Delay for Data Push Back. Value: 1 to 255; if 0, it defaults to 5 events. The number of events to wait after a new value is detected, but not polled, before doing an unsolicited information push (if the master station has enabled this setting). See Note: Unsolicited responses to DNP3 Master below.

Note:

1. *Unsolicited responses to DNP3 Master:*
2. *This change is introduced in EDS Firmware version-D303/150 and above. The firmware version D303/150 removes the constraint of EDS sending unsolicited responses only to a fixed DNP3 Master LLA address which is hardcoded to [EDS LLA Address -1].*
3. *Thus, if the DNP3 Master with a different LLA address (other than 'EDS LLA Address -1' is connected to EDS, it rejects these frames periodically.*
4. *For e.g. if the EDS LLA Address is configured as 4 [mComreq_Setup[09] : 4], then EDS sends unsolicited responses only to the Master with LLA address as 3 [mComreq_Setup[09] -1 : 3]. Thus, if the DNP3 Master with a different LLA address (other than '3' is connected to EDS, it rejects these frames periodically. This constraint is removed in this version and the EDS now sends unsolicited responses only to the connected DNP3 Master LLA address, irrespective of its own configured LLA address.*

6.3.5 DNP3 Output Block Parameters – CROBs (Section c)

A CROB (Control Relay Output Block) is defined as a DNP3 Object 12 Var 1. Corresponding PLC memory type, memory address, and number of objects are required to be entered. Set values for these parameters as required by the application.

Note: *by setting the Memory type to 0, the Object is disabled.*

Table 16:

Parameter	Value	Description
mComreq_Setup[50]	m-type value	Memory Type for CROB Objects Value (decimal): 70-%I, 72-%Q, 76-%M, 74-%T, 86-%G, 0-unused
mComreq_Setup[51]	0	Memory type for CROB Control Dword Value (decimal): 8-%R, 10-%AI, 12-%AQ, 196-%W For details refer to CROB Control Feature Configuration.
mComreq_Setup[52]	address value	Memory Address for CROB Objects. Value: 1 to maximum (based on memory type)
mComreq_Setup[53]	0	Reserved
mComreq_Setup[54]	number value	Number of CROB Objects. Value: 1 to 3000
mComreq_Setup[55]	0	Reserved

The Definition of the Address Value for Digital memory is word (16-bit) bounded. When presented with a non-word bounded address, the EDS001 module rounds the presented address down to the nearest word boundary. No alarm is created when such an adjustment is made.

The number of DI objects is byte-bounded. The EDS001 module rounds up to the nearest byte. For example, trying to define 22 DI objects will result in 24 being assigned.

The actual address and number of items being queried for Digital inputs and/or outputs can be seen in the response to the STAT A command in the Station Manager interface.

6.3.6 DNP3 Output Block Parameters–Analog Output Values (Section c)

An AOV (Analog Output Value) is defined as a DNP3 Object 41 Var 1. PLC memory type, memory address, and number of objects are required to be entered. Set values for these parameters as required by the application.

Note: *by setting the Memory type to 0, the Object is disabled.*

Table 17:

Parameter	Value	Description
mComreq_Setup[56]	m-type value	Memory Type for AOV Objects Value (decimal): 8-%R, 10-%AI, 12-%AQ, 196-%W, 0-unused
mComreq_Setup[57]	0	Reserved
mComreq_Setup[58]	address value	Memory Address for AOV Objects Value: 1 to maximum (based on memory type)
mComreq_Setup[59]	0	Reserved
mComreq_Setup[60]	number value	Number of AOV Objects. Value: 1 to 1024
mComreq_Setup[61]	0	Reserved

Analog output value objects require configuration of a data format parameter. This parameter sets the data format for all AOV objects. The EDS001 will decode the format sent by the master station. Note that if configured for AOV format 2 or 3, any sent analog format will be accepted. This is referred to as flexible setting.

Data Format Options for AOV Objects:

- 0 – 16-bit signed value (default format)
- 1 – 16-bit signed value (Int)
- 2 – 32-bit signed value (Dint), data format determined by master station
- 3 – 32-bit floating point value (Real), data format determined by master station

Note: *The AOV format value (2 or 3) for parameter mComreq_Setup[111] will set the size of memory to be twice the number of AOV Objects. For example, if the user selects mComreq_Setup[58] =8, mComreq_Setup[60] = 1024, and sets the mComreq_Setup[111] to 2 or 3, then the memory consumed will be twice of the range. In this specific example, [%R0001-%R2048] memory will be consumed, since two registers will be used to store each of the 32-bit values.*

Use one data format option to set the following parameter:

Table 18:

Parameter	Value	Description
mComreq_Setup[111]	format value	Data Format for all AOV Objects (Object 41) Value: 0, 1, 2, or 3 per list above.

6.3.7 Sequence of Events Collection Parameter (Section d)

Set the value for the Sequence of Events (SOE) collection parameter as required by the application.

Table 19:

Parameter	Value	Description
mComreq_Setup[66]	0 or 1	0 = Disable SOE Collection of DNP3 Data; 1 = Enable SOE Collection of DNP3 Data ***Note:*** *UTC time is used to time-stamp events during SOE collection.*

SOE is a technique whereby the DNP3 module will store events even if a master is not connected. SOE collection will continue until such time as either the maximum storage space for SOE storage has been exhausted, or the master connects.

This is a flag that indicates to the module to do following two things:

- Store point data historically to the limits specified.
- Create a [TCP/IP port +1] from the port specified in [008] for a master to connect to and get this information in addition to the connections with port specified in [008].

Note that this port [TCP/IP port +1] is in addition to the existing port as specified in [008] and is used by EDS001 module to transfer the historical/buffered event data to the Master. This connection with Master using the new port (TCP/IP Port +1) is treated as an additional Master connection. Hence the user needs to explicitly set the number of Master connections accordingly in [007], so that DNP3 Master can get the buffered event data on this additional connection with [TCP/IP Port + 1].

For example, if the SOE is enabled [66] =1, and [008] =20000, then the number of Master connections in parameter [007] should be set to 2. In this case the EDS001 will have two connections to the Master:

with Port 20000: Master will receive current event data via this connection

with Port 20001: Master will receive historical or buffered event data via this connection.

Note: *The SOE functionality for historical /buffered events will only be available for one Master for a given EDS001 module. In case of multiple masters connecting to EDS001 module, the EDS001 module will send the SOE data only to the first master connection on the port [TCP/IP port +1].*

SOE mode can store more than one event for a point, so a sequence of events history may be stored in the module whenever this parameter has been enabled.

The number of data points for which events can be stored is 8000 AI and 8000 AO points, and 2000 DI and 2000 DO Points. Events can either be instances of a single point change, or multiple changes of the same point.

The length of the SOE storage buffer is fixed by default, and the stored contents are historical. Once the buffer fills up, no more events data will be captured in the buffer. In reporting out the buffer contents, the module transmits them in reverse chronological order: the first-recorded event will be the last event transmitted.

However, bit 12 in Option Parameter Word 17 can be used to make the buffer circular. The Circular buffer, in contrast, will start discarding the oldest event when the buffer for an object becomes full. When reporting out, the first-reported event will be the oldest event captured, with the others following in reverse chronological order.

6.3.8 Strict Connection Control Parameters (Section e)

The DNP3 Outstation application code can enforce strict acceptance of connections to the EDS001 by DNP3 master stations. There are two general parameters which govern this feature and corresponding parameters for setting the incoming connection masks. This functionality is also referred to as white listing.

The EDS001 module allows the establishment of a white list of allowed connections, both TCP/IP and LLA Master Station addresses. The parameters for this feature are such that they can be enabled independently. This firmware allows LLA whitelisting to be enabled without IP whitelisting, with constraints. However, LLA white listing is to be used with TCP/IP white listing, not by itself. The constraint being that module only makes an SOE connection (Port+1).

Note: *When SOE, Strict IP address and LLA matching are enabled, the 1st configured IP address and LLA are dedicated to SOE port (Port+1) and 2nd to 8th IP address dedicated to Non-SOE port (port).*

General Parameters

Parameters mComreq_Setup[67] and mComreq_Setup[68] configure the DNP3 Outstation to operate in a restrictive connection mode. Whenever parameters mComreq_Setup[67] and mComreq_Setup[68] are set to zero (0), the DNP3 Outstation will accept connections from any master station without regard to source address.

To configure the ability of the DNP3 Outstation to restrict those masters permitted to connect to it, the above two parameters are being used to enable checking of the source TCP/IP (IPV4) address via mComreq_Setup[67] or

the source Lower-Level Address (LLA) address via mComreq_Setup[68], as described in the following tables.

Strict TCP/IP Address Matching

Use parameter mComreq_Setup[67] to enable restrictive TCP/IP addressing features. Parameters mComreq_Setup[69] through mComreq_Setup[100] are then used in groups of four (4) to set the IPV4 addresses of the master stations that are allowed to connect to the Outstation. Reference the table below for address assignments. Default values are listed; set values for these parameters as required by the application.

Parameter	Value	Description
mComreq_Setup[67]	0 / non- zero	Strict TCP/IP Address Matching for Master Stations: Value: 0 – disable, non-zero – enable
mComreq_Setup[69]	10	IP address octet 1 – Master Station 1
mComreq_Setup[70]	0	IP address octet 2

Parameter	Value	Description
mComreq_Setup[71]	0	IP address octet 3
mComreq_Setup[72]	1	IP address octet 4
mComreq_Setup[73]	10	IP address octet 1 – Master Station 2
mComreq_Setup[74]	0	IP address octet 2
mComreq_Setup[75]	0	IP address octet 3
mComreq_Setup[76]	2	IP address octet 4
mComreq_Setup[77]	10	IP address octet 1 – Master Station 3
mComreq_Setup[78]	0	IP address octet 2
mComreq_Setup[79]	0	IP address octet 3
mComreq_Setup[80]	3	IP address octet 4
mComreq_Setup[81]	10	IP address octet 1 – Master Station 4
mComreq_Setup[82]	0	IP address octet 2
mComreq_Setup[83]	0	IP address octet 3
mComreq_Setup[84]	4	IP address octet 4
mComreq_Setup[85]	10	IP address octet 1 – Master Station 5
mComreq_Setup[86]	0	IP address octet 2
mComreq_Setup[87]	0	IP address octet 3
mComreq_Setup[88]	5	IP address octet 4
mComreq_Setup[89]	10	IP address octet 1 – Master Station 6
mComreq_Setup[90]	0	IP address octet 2
mComreq_Setup[91]	0	IP address octet 3
mComreq_Setup[92]	6	IP address octet 4
mComreq_Setup[93]	10	IP address octet 1 – Master Station 7
mComreq_Setup[94]	0	IP address octet 2
mComreq_Setup[95]	0	IP address octet 3
mComreq_Setup[96]	7	IP address octet 4
mComreq_Setup[97]	10	IP address octet 1 – Master Station 8
mComreq_Setup[98]	0	IP address octet 2
mComreq_Setup[99]	0	IP address octet 3
mComreq_Setup[100]	8	IP address octet 4

Strict Lower-Level Address Matching

Use parameter mComreq_Setup[68] to enable restrictive Lower-Level Address (LLA) addressing features. Parameters mComreq_Setup[101] through mComreq_Setup[108] are then used to set the LLA addresses of the master stations that are allowed to connect to the Outstation. Reference the table below for address assignments. Default values are listed; set values for these parameters as required by the application.

See Note: Unsolicited responses to DNP3 Master in the section -DNP3 Polled Object Parameters –Push-Back Messages (Section b)

Parameter	Value	Description
mComreq_Setup[68]	0 / non- zero	Strict LLA Address Matching for Master Stations: Value: 0 – disable, non-zero – enable
mComreq_Setup[101]	4	LLA address – Master Station 1
mComreq_Setup[102]	5	LLA address – Master Station 2
mComreq_Setup[103]	6	LLA address – Master Station 3
mComreq_Setup[104]	7	LLA address – Master Station 4
mComreq_Setup[105]	8	LLA address – Master Station 5
mComreq_Setup[106]	9	LLA address – Master Station 6
mComreq_Setup[107]	10	LLA address – Master Station 7
mComreq_Setup[108]	11	LLA address – Master Station 8

6.3.9 Configuring Event Buffer Size (Section f)

Use parameter mComreq_Setup[114] to configure the Event Buffer size for Digital Inputs (BI – Binary Inputs and BO – Binary Output status) and Analog Inputs (AI – Analog Inputs and AOS – Analog Output status). The user can configure the Analog & Digital Event Buffer Size as per the Bit pattern below.

Parameter	Value	Description								
mComreq_Setup[114]	0 / non-zero	< DIGITAL BUF SIZE (BO)>					< DIGITAL BUF SIZE (BI)>			
		Bit7	Bit6	Bit5	Bit4		Bit3	Bit2	Bit1	Bit0	
		0	0	0	0	= 2K [Default]	0	0	0	0	= 2K [Default]
		0	0	0	1	= 1K	0	0	0	1	= 1K
		0	0	1	0	= 2K	0	0	1	0	= 2K
		0	0	1	1	= 4K	0	0	1	1	= 4K
		0	1	0	0	= 6K	0	1	0	0	= 6K
		0	1	0	1	= 8K	0	1	0	1	= 8K
		< ANALOG BUF SIZE (AOS)>					< ANALOG BUF SIZE (AI)>				
		Bit15	Bit14	Bit13	Bit12		Bit11	Bit10	Bit9	Bit8	
		0	0	0	0	= 8K [Default]	0	0	0	0	= 8K [Default]
		0	0	0	1	=1K	0	0	0	1	= 1K
		0	0	1	0	= 2K	0	0	1	0	= 2K
		0	0	1	1	= 4K	0	0	1	1	= 4K
		0	1	0	0	= 6K	0	1	0	0	= 6K
		0	1	0	1	= 8K	0	1	0	1	= 8K

Note:

1. *Any other value in the [114] which does not fall in above patterns then all the Event Buffer sizes are set to 2K.*
2. *Max number of points configured is limited to 24K, if configuration exceeds the limit, then all the Event Buffer sizes are set to 2K.*

6.3.10 Optional Parameter for PLC Access Wait Time

Table 20:

Parameter	Value	Description
mComreq_Setup[19]	500	PLC Access Wait Time in ms for adjustments to response of EDS on increased backplane loading. This related to BPD events [8H] in logs. Valid range is 50ms to 2000ms *Note: When not configured or set to any other value outside of the range, internally defaults to 500ms;* *Note: It is available in EDS Firmware version-D303/150 and above*

6.4 Point Push Interface Definition

Point Push is a DNP3 Outstation feature used to manually enter DNP3 point data, date and time, and/or flags information into the internal database of the EDS001 module. This feature is available in either SOE mode, or NON SOE Mode. It can be used to interface a PLC

to an SOE or record-based system (local or remote) so that records containing information from the source can be transferred to the EDS001.

Point Push works by specifying a CPU memory interface region for the EDS001 to monitor. The memory space specified is formatted with a custom record format that will be used by the EDS001 to accept point push records.

6.4.1 Interface Specification

A 107-word interface is specified with the following parameters.

Table 21:

Parameter	Value	Description
mComreq_Setup[62]	m-type value	Memory Type for Point Push Words Value (decimal): 8-%R, 10-%AI, 12-%AQ, 196-%W, 0-unused
mComreq_Setup[63]	0	Reserved
mComreq_Setup[64]	address value	Memory Address for Point Push Words Value: 1 to maximum (based on memory type)
mComreq_Setup[65]	0	Reserved

6.4.2 Record Format

The Point Push Record Format consists first of a 3-word Header Section and a 13-word Record Section. The Record Section may be repeated up to eight times. Each iteration is concatenated to the preceding Record Section.

Header Section of the Record Format

Table 22:

index	Value	Description
[000]	1235	Specific value the EDS001 will look for to start the record
[001]	1 ,,, 65534	A counter or changed variable that will signal the EDS001 that there is new data to be processed.
[002]	1 .. 8	Number of Record Sections to process

Note: *While the Point Push interface is operating, it will continue to modify the header section. Note that it takes multiple scans to accomplish a Point Push.*

Record Section of the Record Format

The record section may be repeated up to 8 times, and consists of:

Table 23:

index	Field	Description and values
[003][4]	Object	01 – for DI, 10 – for DO 30 – for AIV, 40 – for AOV
[004]	Variance	Typically, 0, inheriting the variance of the point setup
[005]	Point	Point Number, 0 to the maximum possible point number by Object
[006]	Data [0]	Low Word of Data[5]
[007]	Data [1]	High Word of Data[6]
[008]	Unused	Unused
[009]	Unused	Unused
[010]	Hour	Hours
[011]	Minute	Minutes
[012]	Second 1k[7]	Seconds
[013]	Month	Month
[014]	Day	Day
[015]	Year	Year

[4] [3], [16], [29], [42], [55], [68], [81], and [94] are the starting indices for each repeated record section, which may be repeated up to eight times. Each record consists of thirteen words.

[5] In the case of DI or DO objects, when Data[0] is non-zero, Point Push interprets the value as TRUE.

[6] In the case of DI or DO objects in 32-bit mode, both Data[0] & Data[1] are used.

[7] Seconds1k indicates the number of seconds denominated in milliseconds. Thus, 1 second has a value of 1000.

6.4.3 Interface Collection Mechanism

Based on the Record Format in Section 6.4.2, the following is the process for pushing points into the EDS001:

- IF words [000] and [002] are non-zero, a point push is in operation is processing, or has ended in an error.
- IF words [000] and [002] are both 0 a point push can start.
  - Fill the DNP3 records into the table
  - In word [002] place the number of records to be pushed (1 to 8)
  - In word [000] place the Number 1235
  - In word [001] place a non-zero number, that is not the same as the contents of status word 92. This is the trigger for the Point Push operation. NOTE: this word is an unsigned integer, so you can simply ADD_UINT 1 to the value in the status word, and if 0 add again.
- If words [000], [001], [002] are all -1 (65535) then a Point Push has been detected by the EDS001 and is in process. Note: Point Push works over many PLC scans, so the ladder logic can take up to three scans to complete.
- If words [000] and [002] are both 0, the push is complete. Word [001] will revert to the same sequence number pushed. A new Point Push record can now be initiated.
- The Point Push interface will HOLD if no event space is available and will not accept any point push records, the step where the three records are set to -1 will not occur, and the header information will remain the same as that entered by the user's application code.

You can retry a Point Push but be aware that some of the Point Push records may have transferred successfully to the EDS001 database, since the EDS001 Point Push interface checks the Point Push data as it processes. An invalid point number, or object, will cause the Point Push to terminate, once discovered.

6.4.4 Point Push for Digital Data

When using point push for Digital data, COMMREQ parameter 17, bits 13 and 14 allow the entire range of points for an object to start in Point Push mode, taking a single snap-shot of the point values at start, and not marking the points as having changed. This is used when the Point Push interface is being used with the Soft SOE block application, so as not to detect change of data repeatedly for the same point, same value at startup.

6.4.5 Point Push for Analog Data

When using point push for Analog data, the following rules need to be observed for the data to be interpreted correctly by the EDS001 module code, as the variance specified, and the default variance have a correlation to the data interpretation.

The Variance for the point must be set using the following table.

Table 24:

Setting	Data Size	Data Words being used.
2	16-bit Int	Use data word 0, Data[0]
1	32-bit Int	Use data word 0 and 1, Data[0],[1] where the low word of data is in [1]
5	32-bit Float	Similar to 32-bit Int, where the lower portion of the data is in [1]

The Variance of the data is affected by the default setting for the word data type, COMMREQ parameters [109] and [110].

Effect on the variances of the data by the default setting:

Table 25:

Setting of [109 or 110]	Result
1	Data is converted to 16-bit Int data, variance 2 works properly; variance 1, when the value is > 32768, will show an overflow; and variance 5 typically shows overflow.
2	Data is converted to 32-bit Int data; variance 1 and 2 work properly; variance 5 shows data only in integer format. However, the format of the AI and AO data polled in general is converted into 32-bit format.
3	Data can be in any of the three formats, and can be mixed, showing proper value and format. However, the format of the AI and AO data polled in general is converted into 32-bit Real format.

6.5 Option Parameter Word 17

Table 26:

Parameter	Value	Description
mComreq_Setup[17]		Option Parameters bits as shown in the following table

6.5.1 Bit Table for the Word

Table 27:

Bit	Field	Description and values
1	IIN Related	When 1, do not signal master with a restart when the EDS001 starts
2	IIN Related	Do not signal master with time is needed bit, and do not accept time set from master
3	Point Push	When 1, assume year is 2yk+. When 0 assume a 4-digit year with an epoch of 1970
4	Protocol	Data Link Layer can send multiple frames without asking for confirmation.
5	Protocol	Data Link Layer for any message does not need confirmation
6	Protocol	Application Layer does not need confirmation
7	Point Push	Point Push points are not marked as Local Forced in flags field of point on poll

Bit	Field	Description and values
8	Point Push	On startup default all points to a NULL grouping, so no event data is generated.
9	Keep Alive	When '1', EDS will wait for 60 seconds before sending Link status requests and if no DNP3 frames are received on the given session or there is no response from DNP3 Master, then the EDS will automatically disconnect the connection with the Master. ***Note:*** *It is available in EDS Firmware version-D303/150 and above.*
10	unused	unused
11	unused	unused
12	SOE	When 1, do not enforce fixed buffers; instead place the data in a circular buffer.
13	Point Push	DI Object by default is set in Point Push mode, disabling automatic detection of data. However, initial state at power-up is captured for points.
14	Point Push	DO Object by default is set in Point Push mode, disabling automatic detection of data. However, initial state at power-up is captured for points.
15	future	
16	future	

ST Text Example

*This example is from a Point Push SOE system.

```
//              fedcba0987654321
mComreq_Setup[17] := 2#0001000001000110;
//
// Word 17 Option Bits
// Bit 1 == 1 Do not signal the master with a restart when starting.
// Bit 2 == 1 Do Not ask Master for time Set on startup
// Bit 3 == 1 if using Manual Point Feed with Year 2000+ dates, remove the 2k
// Bit 4 == 1 Data Link Layer can send multiple frames without confirmation
// Bit 5 == 1 Data Link Layer does not need confirmation
// Bit 6 == 1 Application Layer does not need confirmation
// Bit 7 == 1 Point Push points are NOT marked as forced when under PP control
// Bit 8 == 1 On Startup do no default objects to default class grouping.
// Bit 9 .unused
// Bit a .unused
// Bit b .unused
```

// Bit c == 1 Circular Buffer Data will be kept in SOE mode.

// Bit d == 1 Object 01 Points, all part of Point Push at startup

// Bit e == 1 Object 10 Points, all part of Point Push at startup

// Bit f == 1 Object 30 Points, all part of Point Push at startup

// Bit g == 1 Object 40 Points, all part of Point Push at startup

6.6 Tuning Parameters

The EDS001 has an option area that can specify tuning parameters to the DNP3 application for timing of DNP3 application and protocol layer specifications. The interface specifies a 20-word area that contains 32-bit values based on Table 29:

6.6.1 Interface Specification

These two words define a 20-word memory reference.

Note: the memory address is limited to 65535.

Table 28:

Parameter	Value	Description
mComreq_Setup[112]	m-type value	Memory Type for Option Setting Words Value (decimal): 8-%R, 10-%AI, 12-%AQ, 196-%W, 0-unused
mComreq_Setup[113]	0	Memory address for option parameter settings

6.6.2 Interface Definition

The Tuning data area has the following memory descriptions, in 32-bit Unsigned Integer values

Table 29:

index	Unit	Description
[000]	ms	Amount of time in milliseconds that the clock is valid for. Default is 10 minutes.
[001]	ms	Data Link Layer Confirmation Response Time Out.
[002]	ms	Data Link Layer Receive Response Time Out.
[003]	ms	Application Confirmation Time-Out Occurs. Default is 10 minutes (which has a value of 600,000).
[004]	N/A	unused
[005]	N/A	unused
[006]	N/A	unused
[007]	N/A	unused
[008]	N/A	unused
[009]	N/A	unused

6.7 Control Word

Table 30:

Parameter	Value	Description
mComreq_Setup[24]	0	Memory Type for Control word (16-bit) Value: 8-%R, 10-%AI, 12-%AQ, 196-%W, 0-unused
mComreq_Setup[25]	0	Memory Address for Control word (16-bit) Control word Parameters bits as shown in the below table

6.7.1 Bit Table for the Control Word

Table 31:

<table>
<tr><th>Bit</th><th>Field</th><th>Description and values</th></tr>
<tr><td>1</td><td>Quality Force</td><td>When this bit is set to ‘0’, the quality of the protocol objects for EDS001 module is set as Offline irrespective of CPU state. The state table follows:
<table>
<tr><th>CPU state</th><th>Quality Force Bit</th><th>Quality State</th></tr>
<tr><td>STOP</td><td>0</td><td>Offline</td></tr>
<tr><td>STOP</td><td>1</td><td>Offline</td></tr>
<tr><td>RUN</td><td>0</td><td>Offline</td></tr>
<tr><td>RUN</td><td>1</td><td>Online</td></tr>
</table>
Note: You can use this bit in runtime logic to interlock quality state with other interlocks. If you set the mComreq_Setup[24] = 0, then Quality Force will not be applicable and Quality will be driven by the CPU state.
Effective with firmware version 1.10, events are generated even when the Quality flag is offline, and the appropriate quality status is then updated to the Master. Prior to firmware version 1.10, the offline state of the Quality flag prevented this.</td></tr>
<tr><td>2-16</td><td>Unused</td><td>Unused</td></tr>
</table>

6.8 Time Source Selection for Event Time Stamping

Table 32:

Parameter	Value	Description
mComreq_Setup[18]	0	User selection of Time Source for time stamping of events. 1 – Selects CPU Time Source 0 – Selects local EDS001 Time Source. Default value is set to 0. The time synch command from the DNP3 master will set the local time for both the EDS001 module and the CPU. However, the timestamp for events will be based on the selection above.

6.9 CROB Control Feature Configuration

6.9.1 Overview

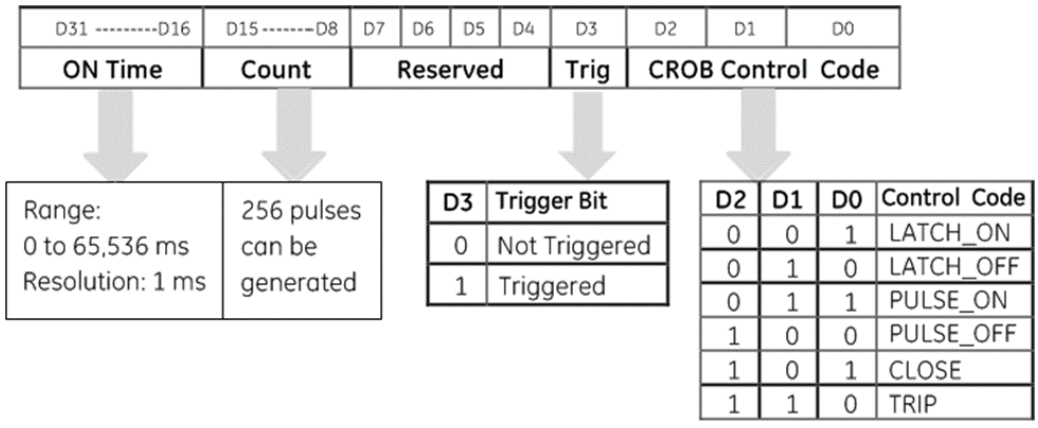
This feature is provided to support different control codes like PULSE ON/OFF, CLOSE, TRIP and LATCH ON/OFF for the CROB Control objects. This is implemented using additional COMMREQ control words. These CROB control words provide a mechanism for passing on the CROB control information like Control code, Control information etc. coming from the DNP3 Master to the Controller Application logic, which can be used for generating desired commands.

6.9.2 CROB Control Dword Definition

When the Outstation receives a CROB operate command from a Master station, the associated Command parameters like Point number, Pulse duration time, Count and Control type (PULSE_ON, PULSE_OFF, LATCH_ON, LATCH_OFF, TRIP and CLOSE) etc. are updated in the appropriate CROB Control Dword (32-bit) (refer to Figure 15) and Trigger bit is set. The Controller logic can then check the trigger bit and generate the required command as per the Control Code.

For example, when the Pulse CROB command is issued by the Master station, then the Outstation receives the command and updates CROB Control Dword with all command parameters. The User logic can generate a Pulse command as per the trigger bit and pulse duration parameters. The user logic needs to clear the trigger bit for any subsequent operation.

Figure 15: CROB Control Dword Layout



The following are the parameters for the CROB Control Dword:

1. CROB Control Code

   This defines the control code for the CROB Control command as received by the Outstation. The three bits are used to indicate the control code as shown in Figure 15.

2. Trig Bit

   This is a read/write bit and is set by the Outstation in response to the CROB command from the Master station. This can be reset by the user application to indicate the consumption.

3. UINT8: Count

   This is the number of times the Outstation shall execute the operation. Counts greater than 1 generate a series of pulses or repeated operations for the point.

4. UINT16: Pulse Time

   This is the duration for the pulse ON time /OFF time expressed as the number of milliseconds, that the output remains active. The pulse time can be set in 1 ms increments up to 65 secs.

6.9.3 Parameters for CROB Control Block

The Parameters for configuring the CROB Control Block are:

Table 33:

Parameter	Value	Description
mComreq_Setup[20]	0	Starting Memory Address of CROB Control Dword
mComreq_Setup[21]	0	No of PLC Controlled CROBs (This should be Less than what is configured in mComreq_Setup [54])
mComreq_Setup[22]	0	Offset of CROB to be associated with CROB Control Dword (starting from 1). This should be within the range provided for CROB objects. The offset should start with 0.

Refer to Section 6.3.5, DNP3 Output Block Parameters – CROBs (Section c) for CROB configuration and mComreq_Setup[51] for defining the CROB Control word memory type.

Example COMMREQ Configuration for CROB Control

The example presented here shows the configuring COMMREQ required and the corresponding effect on memory usage for the CROB Control Dword:

```
// == == == == == == == == == == == == == == == == == ==
// Section c.  -- DNP3 Output Block Definition Parameters
// == == == == == == == == == == == == == == == == == ==
mComreq_Setup[50] := 76;       // Memory type for CROB objects (76=%M)
mComreq_Setup[51] := 8;        // Memory type for CROB Control Dword (8=%R)
mComreq_Setup[52] := 6001;    // Memory address for CROB objects
mComreq_Setup[53] := 0;        // Reserved
mComreq_Setup[54] := 16;       // Number of CROB objects
mComreq_Setup[55] := 0;        // Reserved
// == == == == == == == == == == == == == == == == == ==========
// DNP3 CROB Control Block Definition Parameters
// == == == == == == == == == == == == == == == == == ==========
mComreq_Setup[20] := 200;  // Starting Memory Address of CROB Control Dword
```

mComreq_Setup[21] := 4; // No of PLC Controlled CROBs (should be less than the value in [54])

mComreq_Setup[22] := 5; // Offset of CROB to be associated with CROB Control Dword (starting

from 1). This should be within the range provided for CROB objects. The offset starts with 0.

SN	CROB Objects	Associated CROB Control Dword
0	%M6001	
1	%M6002	
2	%M6003	
3	%M6004	
4	%M6005	%R200
5	%M6006	%R202
6	%M6007	%R204
7	%M6008	%R206
8	%M6009	
9	%M6010	
10	%M6011	
11	%M6012	
12	%M6013	
13	%M6014	
14	%M6015	
15	%M6016	

The mapping below is created per the configuration above. %M6005-%M6008 become the PLC Controlled CROB objects with associated CROB Control Dword in %R200-%R206.

6.10 Unassigned Parameters

The following COMMREQ parameters are unused.

Note: Unused parameters always have a value of zero (0).

Table 34:

Parameter	Value	Description
mComreq_Setup[14]	0	Unused

6.11 Required COMMREQ Function Block Parameters

The callout in the ST block defines and executes the standard COMMREQ function block as required for the configuration of the EDS001 module(s). Whenever more than one EDS001 module is installed, care must be exercised when defining parameters in the COMMREQ

callout to ensure correct assignment and configuration of the Outstation parameters to the intended EDS001 modules.

// Execute the COMMREQ on the RX3i EDS001 module

//comm_req(IN := mComreq_Setup, SYSID := iRackSlot, Task := 0, FT => mComreq_CallSta,

ENO => mComreq_ENO);

The COMMREQ function block parameters are described in the table below. Set values for these parameters as required by the application.

Table 35:

Parameter	Value	Description
IN	mComreq_Setup	Location of the COMMREQ Command Block Parameters, always mComreq_Setup
SYSID	iRackSlot	Slot Location of the DNP3-ETM001 Module in RX3i Rack, always iRackSlot
TASK	0	Task Value, always 0
FT	mComreq_CallSta	Fault Output, always mComreq_CallSta
ENO	mComreq_ENO	Enable Output, always mComreq_ENO

6.12 Program Download

After parameters in the ST block have been set up as required by the application, the project can be downloaded to the RX3i controller for verification and operation.

6.13 DNP3 Communications Start-up

The EDS001 module will power up and signal the user program through LIS bit 11 that it is ready to receive the configuration parameters as defined in the ST block. LIS bit 11 and LIS bit 13 (LAN OK) are used together in the user program to execute the one-shot signal to configure the module with its parameters.

LAN Interface Status (LIS) bits 10, 11, and 12 are reserved for use with Ethernet applications. Only LIS bit 11 is used with the DNP3 Outstation; reference the status information below for operational details.

Table 36:

LIS bit 11	Description
0	DNP3 Outstation is not executing.
1	DNP3 Outstation is executing and is ready for configuration.

6.14 COMMREQ Status Word Codes

After power-up of the RX3i controller, the status of the DNP3 Outstation can be checked in the COMMREQ Status Word. Refer to the table below for status code values and descriptions.

Table 37:

Status Code	Description
1	Successful configuration of the DNP3 Outstation.
40592	Warning: The DNP3 Outstation is already configured and operating.
16#C090	Error: An attempt was made to configure a DNP3 Outstation in an inactive (backup) CRU-type CPU in a redundancy application.

6.15 Security

The DNP3 protocol implemented in the EDS001 module is not explicitly secure; nor is the access to Controller memory explicitly secure. Steps must be taken to secure the network from unauthorized control, interception, or access to the DNP3 communications. Steps must also be taken to secure the Controller from unauthorized access or control using the security features found in the latest released versions of PAC Machine Edition 7.0 and PACSystems RX3i CPU firmware.

Emerson strongly recommends that the DNP3 CROB control memory NOT be permitted to be directly connected to control devices. Such devices should also be protected from direct access using the security features found in the latest released versions of PAC Machine Edition and PACSystems RX3i CPU firmware. Consult Emerson technical support for more information.

Emerson also strongly recommends that the EDS001 modules, in all instances, be updated with the latest released version of EDS001 firmware to ensure all available security enhancements are present. Firmware updates may be obtained at https://www.emerson.com/Industrial-Automation-Controls/support.

Appendix A: Definition of the Status Area

A-1 General Table View

A-1.1 General Picture

Table 38:

	9	8	7	6	5	4	3	2	1	0
0x	Collect 10 Task Run Indicator	Collect 01 Task Run Indicator	PLC Data Task Run Indicator	9901	Main Task Counter	Set Session Count	Compiled Session Count	Ver_2 Word	Ver_1 Word	CTR
10x	01 PLC Point Changed Task Run Indicator	9902	0	40 PLC Read Was Skipped	30 PLC Read Was Skipped	10 PLC Read Was Skipped	01 PLC Read Was Skipped	Time to Process Read of All PLC Points	Collect 40 Task Run Indicator	Collect 40 Task Run Indicator
20x	10 Change Indication Counter	01 Change Indication Counter	40 Change Indication Flag	30 Change Indication Flag	10 Change Indication Flag	01 Change Indication Flag	9903	40 PLC Point Changed Task Run Indicator	30 PLC Point Changed Task Run Indicator	10 PLC Point Changed Task Run Indicator
30x	Connection 7 State	Connection 6 State	Connection 5 State	Connection 4 State	Connection 3 State	Connection 2 State	Connection 1 State	9904	40 Change Indication Counter	30 Change Indication Counter
40x	Count of Class 1 Events Queued for SOE Session	9906	%S36	%S35	%S34	%S33	CPU State Value from library Call	This PLC is the Active One	9905	Connection 8 State
50x	32 Event Was Polled Count (*1)	12 Event Was Polled Count (*1)	02 Event Was Polled Count (*1)	42 An Event was found Counter	32 An Event was found Counter	12 An Event was found Counter	02 An Event was found Counter	9907	Count of Class 3 Events Queued for SOE Session	Count of Class 2 Events Queued for SOE Session
60x	Object 30 Byte width	AOV User Specification	Object 40 User specification	Object 30 User specification	9908	42 Event Queue Count	32 Event Queue Count	12 Event Queue Count	02 Event Queue Count	42 Event Was Polled Count (*1)
70x	DI SOE History Full when non 0	Sum of Points Quied	Main task Process Counter	9909	Static Variation for Object 40	Static Variation for Object 30	Type of Data Object 40	Type of Data Object 30	AOV Byte width	Object 40 Byte width
80x	DO Point Push Counter	DI Point Push Counter	9910	Counter indicating a NOT accepted AO Object	Counter indicating a NOT accepted AI Object	Counter indicating a NOT accepted DO Object	Counter indicating a NOT accepted DI Object	AO SOE History Full when non 0	AI SOE History Full when non 0	DO SOE History Full when non 0
90x	CTR	9999	Echo of Options Address	Echo Of Options Type	0	0	0	Last Sequence Number Processed	AO Point Push Counter	AI Point Push Counter

A-2 Specific Areas of Status

A-2.1 Status of a Master Connection

Connected Masters will be indicated at indices 33,34,35,36,37,38,39 & 40. A value of 3 indicates a Master is present. If you need to monitor a specific master, you must first use LLA matching in the security parameters to determine the position of that Master among the indices. The positions will match the as specified.

A-2.2 Point Push

Indices 81, 82, 83 & 84 are used to indicate a successful Point Push to a specific DNP3 Object.

Index 92 is an echo of the last Point Push sequence (record [001]) processed.

A-2.3 Events being stored

Indices 81, 82, 83 & 84 are used to indicate a successful point push to a specific DNP3 Object.

Appendix B: Station Manager Status

The EDS001 Station Manager interface supports an additional command switch *A* that can be used with the stat and tally commands to gather statistics and configuration settings from the module. Typically, these are for tech support to use, but they can be used to debug a system prior to engaging Emerson support. Below are examples of its usage in the STAT and Tally Commands

STAT A

The Stat A command is designed to be self-documenting in its output, it represents many of the configuration and operational parameters, settings, or status of the EDS001.

```
COM3> stat A

------------------------------------------------------------------------------

Status of the RX3i EDS001 DNP3 Outstation 0xD302

Core Code Licensed from Triangle MicroWorks, Inc.

Application by Intelligent Platforms LLC

Development by the Intelligent Platforms LLC

Revision Major [D303] Minor [100]

Compilation Date and Time: May 5, 2014 16:32:19

------------------------------------------------------------------------------

Basic Configuration

Maximum compiled sessions is 8. Number of specified sessions 2

The Database shutter is 250 (ms)

Accept incoming connections on 19999 (tcp ip port)

Use TCP/IP Source Station Matching 0 (when not 0)

Use DNP3 LLA Source Station Matching 0 (when not 0)

Specified LLA This Station Address 4

.....

SOE Options

Internal buffering of SOE data, storage of multiple events per point number

MAX storage size DI=2010 AI=8010 DO=2010 AO=8010

Connections on port 19999 (tcp ip port) will not accept unsolicited enable requests

Connections on port 20000 (tcp ip port) will accept unsolicited enable requests

If Unsolicited Push Back to the Master is enabled (from the master)

After 5 Seconds, or 5 buffered events Send unsolicited on port 20000

.....

How I See the PLC

stateOfPLCIsActive 1

cpu_state 0
```

Sbitdata.sBits.b1 0

Sbitdata.sBits.b2 0

Sbitdata.sBits.b3 0

Sbitdata.sBits.b4 0

.....

Information about each connection

DNP Connection Information Connection: 1

Validation of LLA Disabled

This station / Session Low Level Address

DST LLA = [4]

SRC LLA (not here) = [*] *any

Supported Objects and Variations

[01] 2 [10] 2 [30] 2 [32] 4 [40] 2 [42] 4

Session State: Active 1 Online 2

Last Session Sequence Num: tx 11 rx 4

DNP Connection Information Connection: 2

Validation of LLA Disabled

This station / Session Low Level Address

DST LLA = [4]

SRC LLA (not here) = [*] *any

Supported Objects and Variations

[01] 2 [10] 2 [30] 2 [32] 4 [40] 2 [42] 4

Session State: Active 1 Online 0

Last Session Sequence Num: tx 0 rx 0

.....

Data Width Specifications

Parameter [109]=1 [110]=1 [111]=3

.....

Object 01 Memory Type %I (bit) Starting Address 1 Number of points 256

Object 10 Memory Type %Q (bit) Starting Address 1 Number of points 16

Object 30 Memory Type %AI (register) Starting Address 1 Number of points 4

Width of an Object 30 point 2 (bytes)

Object 30 DNP Data Type signed 16-bit word

Object 40 Memory Type %AQ (register) Starting Address 1 Number of points 4

Width of an Object 40 point 2 (bytes)

Object 40 DNP Data Type signed 16-bit word

.....

Object 12 (CROB) Memory Type %M (bit) Starting Address 1 Number of points 8

Object 41 (A Set) Memory Type %R (register) Starting Address 11 Number of points 4

Width of an Object 41 point 4 (bytes)

.....

Point Push Memory Type %R (register) Starting Address 501 Number of Words Being Used 107

.....

Last Point Push Response Sequence 0

internal Point Push stored last sequence 0

.....

Options in [17]

Send Restart Bit on Power Up 1

Send Need Time Synch Bit 0

Point Push Data Needs a Y2k Adder 1

Data Link Layer Parameter Value 0

Application Link Layer Parameter Value 0

When 1, do not set the Point forced for Point Push points 0

When 1, do not assign default groups 0

When 1, do not assign object 01 to all be Push Points 0

When 1, do not assign object 10 to all be Push Points 0

When 1, do not assign object 30 to all be Push Points 0

When 1, do not assign object 40 to all be Push Points 0

When 1, Circular Buffer Enabled; when 0 Circular Buffer disabled; Current Value =0

.....

Time to Process all points input read 36 (ms)

.....

Interface Status and Debug Memory Type %w (register) Starting Address 1

.....----------

>

TALLY A

The Tally A command is used for engineering diagnostics. It shows the status of the PLC interface, and many internal counters, in a numeric fashion. The explanation of this data is not documented here, but is required for support.

COM3> tally A

Task Counters

mtc= 44015

mtr= 23610

mts= 0

RT01= 1983 RT10= 1987 RT30= 2844 RT40= 3558

DT01= 8983 DT10= 9861 DT30= 10709 DT40= 11430

EF02= 62 EF12= 0 EF32= 0 EF42= 8

SQ02= 0 SQ12= 0 SQ32= 0 SQ42= 0

SK02= 2739 SK12= 2735 SK32= 1878 SK42= 1164

EC02= 17 EC12= 0 EC32= 0 EC42= 2

ETK_Read [0]=C005000B ETK_Read [1]=C005000B ETK_Read [2]=C005000B ETK_Read [3]=C005000B

Read Ok [0]= 3560 Read Ok [1]= 2845 Read Ok [2]= 1988 Read Ok [3]= 1984

Read Fail [0]= 1164 Read Fail [1]= 1878 Read Fail [2]= 2735 Read Fail [3]= 2739

ETK_Write [0]=C005000B ETK_Write [1]= 0 ETK_Write [2]= 0 ETK_Write [3]= 0 ETK_Write [4]= 0 ETK_Write [5]= 0

Write Ok [0]= 2994 Write Ok [1]= 0 Write Ok [2]= 0 Write Ok [3]= 0 Write Ok [4]= 0 Write Ok [5]= 0

Write Fail[0]= 259 Write Fail[1]= 0 Write Fail[2]= 0 Write Fail[3]= 0 Write Fail[4]= 0 Write Fail[5]= 0

Appendix C: Log Messages Table

The EDS001 logs messages internally and passes them to the CPU log. Most of these faults are not fatal, and the basic ones are described here. Fatal and other recurrent faults should be reported to technical support. The hardware has a larger list of possible faults; consult the PACSystems RX7i & RX3i TCP/IP Ethernet Communications User Manual, GFK-2224 for other fault categories.

C-1 EDS001 Fault Example

Figure 16:

All DNP3 module faults start with an Extra Data code of 1a.

The next 2 bytes define the fault category.

LOG_FILE_MEMORY	0x6FFF
LOG_FILE_NETSTACK	0x7FFF
LOG_FILE_DNPSlave	0x8FFF
LOG_FILE_CFG	0x9FFF
LOG_FILE_POINT	0xBFFF
LOG_FILE_CREQ	0xCFFF
LOG_FILE_DNP3PLCTASK	0xDFFF
LOG_FILE_DEMO	0xEFFF
LOG_FILE_MAIN	0xFFFF

The following table is typical messages from the DNP3 Module

Table 39:

Extra Data Byte 1	Extra Byte 2 and 3	Extra Bytes 4,5,6,7	Extra Bytes 8,9	Description
1a	8F FF	## ## ## ##	00 01	The bytes 4 to 7 indicate the Major and Minor revision code for the DNP3 Module.
1a	8F FF	00 00 00 02	00 01	Module is started, awaiting COMMREQ call.
1a	8F FF	00 00 00 03	00 01	Module is operating in Demo Mode, with Point count restrictions.
1a	8F FF	00 00 00 04	00 01	Module is operating in production mode

Extra Data Byte 1	Extra Byte 2 and 3	Extra Bytes 4,5,6,7	Extra Bytes 8,9	Description
1a	8F FF	00 01 00 01	00 10	Module FAILED, request to create internal session returned a failure for SOE interface.
1a	8F FF	00 01 00 02	00 10	Module FAILED, request to create internal session returned a failure for non SOE interface.
1a	8F FF	00 01 00 03	00 10	Module FAILED, request to create internal session returned a failure.
1a	8F FF	00 00 00 06	00 20	Module going into Operate Mode
1a	EF FF	FF FF FF FF	FF FF	Module is operating in a demo mode; this indicates registration of a task to kill the module in 4 hours.
1a	FF FF	## ## ## ##	D6 E6	License module using D6 E6 License Any number in bytes 4-7 indicates a failure in decoding this license code
1a	FF FF	00 00 00 00	FF F1	Licensed module using Internal development license
1a	FF FF	FF FF FF FF	FF FF	Module has terminated operations
1a	7F FF	00 01 00 00	00 05	Internal Error - Unable to Initialize TCP Channel
1a	7F FF	00 01 00 00	00 02	Internal Error - Unable to setup UDP Socket
1a	7F FF	00 02 00 00	00 02	Internal Error - Unable to create UDP Socket
1a	7F FF	00 03 00 00	00 02	Internal Error - Unable to bind UDP Socket
1a	7F FF	00 01 00 00	00 03	Internal Error - Unable to create TCP Socket
1a	7F FF	00 02 00 00	00 03	Internal Error - TCP Socket Reuse Address Failed
1a	7F FF	00 03 00 00	00 03	Internal Error - TCP Socket bind failed
1a	7F FF	00 04 00 00	00 03	Internal Error - TCP Socket set Attribute Failed (non-blocking)
1a	7F FF	00 05 00 00	00 03	Internal Error - TCP Socket set Attribute Failed (No-Delay)
1a	7F FF	00 06 00 00	00 03	Internal Error - TCP Socket set Attribute Failed (Keepalive)
1a	7F FF	00 07 00 00	00 03	Internal Error - TCP Socket Connect bad return code
1a	7F FF	00 08 00 00	00 03	Internal Error - TCP select failed waiting for connection
1a	7F FF	00 09 00 00	00 03	Internal Error - TCP connect failed, closing socket
1a	7F FF	00 0A 00 00	00 03	Internal Error - TCP connect failed for getting socket Options
1a	7F FF	00 01 00 00	00 04	Internal Error - Unable to create Listen TCP Socket
1a	7F FF	00 02 00 00	00 04	Internal Error – Listen TCP Reuse Address Failed
1a	7F FF	00 04 00 00	00 04	Internal Error - TCP Listen socket bind Failed
1a	7F FF	00 05 00 00	00 04	Internal Error - TCP Listen Socket Listen failed
1a	7F FF	00 06 00 00	00 04	Internal Error - TCP Listen Socket set Attribute Failed (non-blocking)
1a	7F FF	00 07 00 00	00 04	Internal Error - TCP Socket memory allocation failed
1a	7F FF	00 01 00 00	00 05	Internal Error - TCP Socket Accept failed
1a	7F FF	00 02 00 00	00 05	Internal Error - TCP Accept Socket non-blocking failed
1a	7F FF	00 03 00 00	00 05	Internal Error - TCP Accept Socket No-Delay Failed

Extra Data Byte 1	Extra Byte 2 and 3	Extra Bytes 4,5,6,7	Extra Bytes 8,9	Description
1a	7F FF	00 04 00 00	00 05 (03 23)	Internal Error - TCP Accept Socket set Attribute Failed (Keepalive)
1a	7F FF	00 04 00 00	00 05 (03 8F)	Internal Error -No channel to use so close the Accept socket
1a	7F FF	00 01 00 00	00 06	Internal Error - UDP Socket read failed
1a	7F FF	00 01 00 00	00 07	Internal Error - TCP Select failed
1a	7F FF	00 01 00 00	00 08	Internal Error - TCP Send error
1a	7F FF	00 01 00 00	00 09	Internal Error - UDP Send error
1a	6F FF	00 01 00 00	00 01	Internal Error - Internal Memory Allocation failed
1a	9F FF	00 01 00 00	## ##	Internal Notification– PLC Available
1a	9F FF	00 02 00 00	## ##	Internal Notification – PLC Fail
1a	9F FF	00 03 00 00	## ##	Internal Notification – NET Available
1a	9F FF	00 04 00 00	## ##	Internal Notification – NET Fail
1a	9F FF	00 05 00 00	## ##	Internal Notification – Config Available
1a	9F FF	00 06 00 00	## ##	Internal Notification – Config Clear
1a	9F FF	00 08 00 00	00 F0	Internal Notification – Unit detected ‘Active’ Mode
1a	9F FF	00 07 00 00	00 E4	Internal Notification– Unit detected ‘Backup’ Mode

Appendix D: Device Profile

D-1 DNP V3.0 Device Profile

DNP V3.0 DEVICE PROFILE DOCUMENT				
Vendor Name:	Intelligent Platforms LLC.			
Device Name:	*RX3i EDS001 Outstation*, using the Triangle MicroWorks, Inc. DNP3 Outstation Source Code Library, Version 3.16			
Highest DNP Level Supported:			Device Function:	
For Requests:	Level 3		☐	Master
For Responses:	Level 3		☒	Outstation
Notable objects, functions, and/or qualifiers supported in addition to the Highest DNP Levels Supported (the complete list is described in the attached table): For static (non-change-event) object requests, request qualifier codes 07 and 08 (limited quantity), and 17 and 28 (index) are supported. Static object requests sent with qualifiers 07, or 08, will be responded with qualifiers 00 or 01. 16-bit, 32-bit and Floating-Point Analog Change Events with Time may be requested. Floating Point Analog Output Status and Output Block Objects 40 and 41 are supported. Output Event Objects 11, 13, 42 and 43 are supported.				
Maximum Data Link Frame Size (octets):			Maximum Application Fragment Size (octets):	
Transmitted:	292		Transmitted:	2048
Received	292		Received	2048
Maximum Data Link Re-tries:			Maximum Application Layer Re-tries:	
☐	None		☒	None
☒	Fixed 65535		☐	Configurable
Requires Data Link Layer Confirmation: ☐ Never ☐ Always ☐ Sometimes ☒ Configurable as: *Never*, *Only for multi-frame messages*, or *Always*				

DNP V3.0
DEVICE PROFILE DOCUMENT

Requires Application Layer Confirmation:

- ☐ Never
- ☐ Always
- ☐ When reporting Event Data (Outstation devices only)
- ☐ When sending multi-fragment responses (Outstation devices only)
- ☐ Sometimes
- ☒ Configurable as: Only when reporting event data or

When reporting event data or multi-fragment messages.

Timeouts while waiting for:

Data Link Confirm:	■ None	☐ Fixed at ____	☐ Variable	☐ Configurable.
Complete Appl. Fragment:	☒ None	☐ Fixed at ____	☐ Variable	☐ Configurable
Application Confirm:	■ None	☐ Fixed at ____	☐ Variable	☐ Configurable.
Complete Appl. Response:	☒ None	☐ Fixed at ____	☐ Variable	☐ Configurable

Others:
Unsolicited Notification Delay, configurable
Unsolicited Offline Interval, configurable
Binary Change Event Scan Period, configurable
Analog Change Event Scan Period, configurable

Sends/Executes Control Operations:

WRITE Binary Outputs	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
SELECT/OPERATE	☐ Never	☒ Always	☐ Sometimes	☐ Configurable
DIRECT OPERATE	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
DIRECT OPERATE – NO ACK	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
Count > 1	☐ Never	☒ Always	☐ Sometimes	☐ Configurable
Pulse On	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
Pulse Off	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
Latch On	☐ Never	☒ Always	☐ Sometimes	☐ Configurable
Latch Off	☐ Never	☒ Always	☐ Sometimes	☐ Configurable
Queue	☒ Never	☐ Always	☐ Sometimes	☐ Configurable
Clear Queue	☒ Never	☐ Always	☐ Sometimes	☐ Configurable

Attach explanation if 'Sometimes' or 'Configurable' was checked for any operation.

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Reports Binary Input Change Events when no specific variation requested: ☐ Never ☒ Only time-tagged ☒ Only non-time-tagged☐ Configurable to send one or the other	Reports time-tagged Binary Input Change Events when no specific variation requested: ☐ Never ☒ Binary Input Change with Time ☒ Binary Input Change with Relative Time ☐ Configurable
Sends Unsolicited Responses: ☐ Never ☒ Configurable ☐ Only certain objects ☐ Sometimes (attach explanation) ☒ ENABLE/DISABLE UNSOLICITED Function codes supported	Sends Static Data in Unsolicited Responses: ☒ Never ☐ When Device Restarts When Status Flags Change No other options are permitted.
Default Counter Object/Variation: ☒ No Counters Reported ☐ Configurable ☐ Default Object Default Variation: ☐ Point-by-point list attached	Counters Roll Over at: ☒ No Counters Reported ☐ Configurable (attach explanation) ☐ 16 Bits ☐ 32 Bits ☐ Other Value: _____ ☐ Point-by-point list attached

Sends Multi-Fragment Responses:
☒ Yes
☐ No
☐ Configurable

Sequential File Transfer Support:

Append File Mode	☐ Yes	☒ No	
Custom Status Code Strings	☐ Yes	☒ No	
Permissions Field	☐ Yes	☒ No	
File Events Assigned to Class		☐ Yes	☒ No
File Events Send Immediately		☐ Yes	☒ No
Multiple Blocks in a Fragment		☐ Yes	☒ No
Max Number of Files Open	N/A		

USER MANUAL
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Technical Support & Contact Information

Home link: http://www.Emerson.com/Industrial-Automation-Controls

Knowledge Base: https://www.emerson.com/Industrial-Automation-Controls/support

Note: If the product is purchased through an Authorized Channel Partner, please contact the seller directly for any support.

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