USER MANUAL
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PACSystems™ DNP3 Outstation User Manual

EMERSON

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Warning notices are used in this publication to emphasize that hazardous voltages, currents, temperatures, or other conditions that could cause personal injury 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.

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Section 1 Introduction

This document describes DNP3 Outstation protocol over Ethernet on PACSystems RX3i IC695CPE400/CPL410 and RSTi-EP EPSCPE115 controllers. This feature enables CPE400/CPL410 and CPE115 controllers to act as a DNP3 Outstation on a DNP3 Network, which permits controller data to be exchanged with the DNP3 Masters on a given network.

Introductory material may be found in this Chapter. Chapter 2 provides the mechanism to configure the DNP3 Outstation on this controller. Chapter 3 provides the details of configuration parameters. Chapter 4 describes HSB Redundancy configuration. Chapter 5 describes system operation. Chapter 6 provide performance data for DNP3 Outstation. Appendix provides a profile of the DNP3 Outstation.

1.1 DNP3 Outstation Compatible Controllers

Catalog Number	Description
IC695CPE400	RX3i 1.2GHz 64MB Rackless CPU w/Field Agent
IC695CPL410	RX3i 1.2GHz 64MB Rackless CPU w/Linux
EPSCPE115	RSTi-EP 1.0GHz 1.5MB Rackless CPU

1.2 Revisions in this Manual

Rev	Date	Descriptions
A	Jan 2020	Initial Release

1.3 Glossary

ACTIVE Unit	Primary unit in HSB configuration from which all the communications occur
Analog Output Value Data Object	A means by which the DNP3 Master Station can set an analog value at the Outstation. The CPE400/CPL410 Outstation supports signed 16-bit and 32-bit data, as well as 32-bit PLC Real variables.
BACKUP Unit	Secondary unit in HSB configuration, which is synchronized with Primary unit
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 DNP3 Outstation groups digital data into class 1 and analog data into class 2 by default.
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 Operate (SBO) 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.
HSB	Hot Standby System
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
LLA	The Link Layer Address of a DNP3 node, sometimes called its station address.
Master	DNP3 Master communicating with the Outstation

NASU	Non-synchronized ACTIVE Unit
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.
Outstation	DNP3 Slave communicating with the DNP3 Master
PME	PAC Machine Edition – used to configure, program and monitor RX3i Systems.
Slave	DNP3 Outstation communicating with the Master
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.

1.4 PACSystems Documentation

1.4.1 PACSystems Manuals

PACSystems RX3i and RSTi-EP CPU Reference Manual	GFK-2222
PACSystems TCP/IP Ethernet Communications Station Manager User Manual	GFK-2225
PACSystems RXi, RX3i and RSTi-EP Controller Secure Deployment Guide	GFK-2830
PACSystems Hot Standby CPU Redundancy User Manual	GFK-2308
PACSystems RX3i and RSTi-EP CPU Programmer's Reference Manual	GFK-2950
PACSystems Hot Standby CPU Redundancy User's Guide	GFK-2308
PACSystems RX3i System Manual	GFK-2314
PACSystems RSTi-EP Controllers Performance Evaluation Manual.	GFK-3086

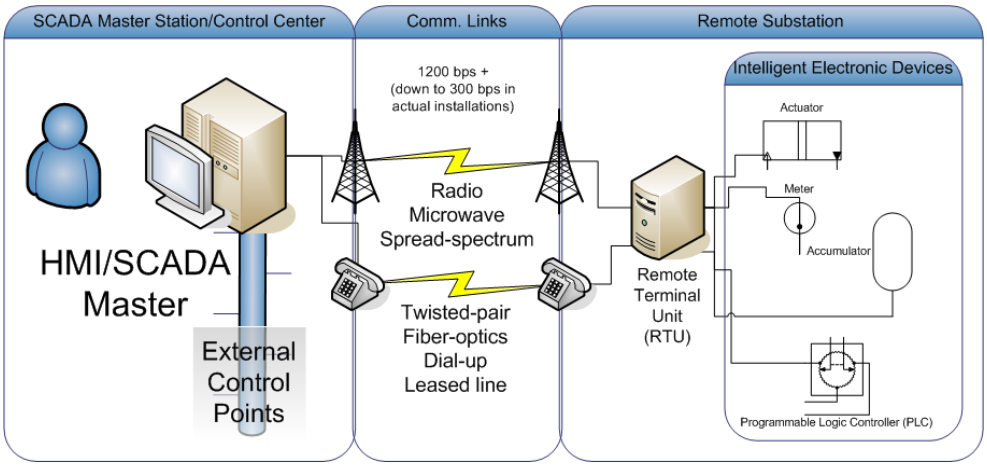
In addition to these manuals, datasheets and product update documents describe individual modules and product revisions. The most recent PACSystems documentation is available on the support website.

1.5 DNP3 Overview

DNP3 is a master/ Outstation 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/waste water, transportation, and oil and gas pipeline sectors. DNP3 is the current specification of Distributed Network Protocol (DNP) 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

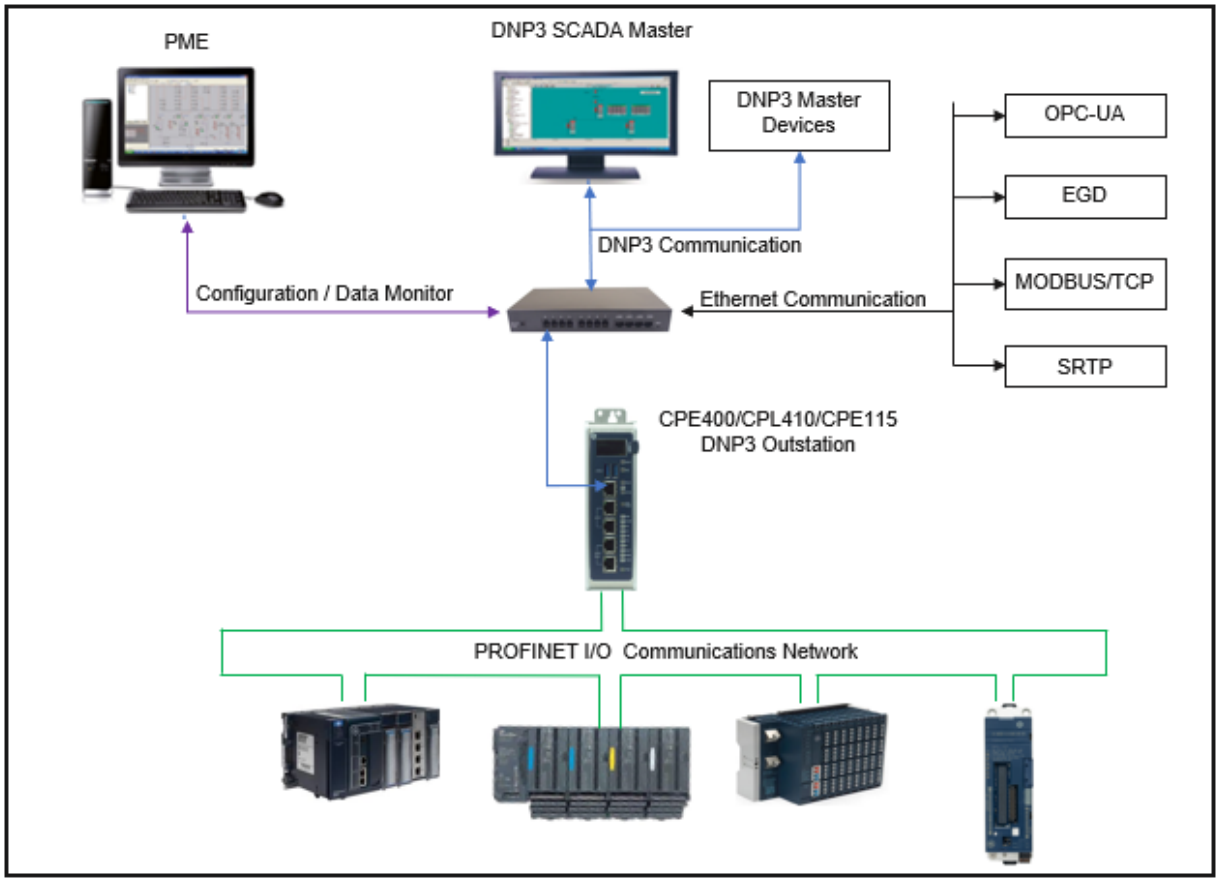
Figure 2: DNP3 Applications from Electrical Distribution Industry



1.6 Simplex System Overview

The PACSystems RX3i CPE400/CPL410 and RSTi-EP CPE115 controller can be used in a simplex system and can be configured to communicate on a DNP3 network as shown in below Figure 3.

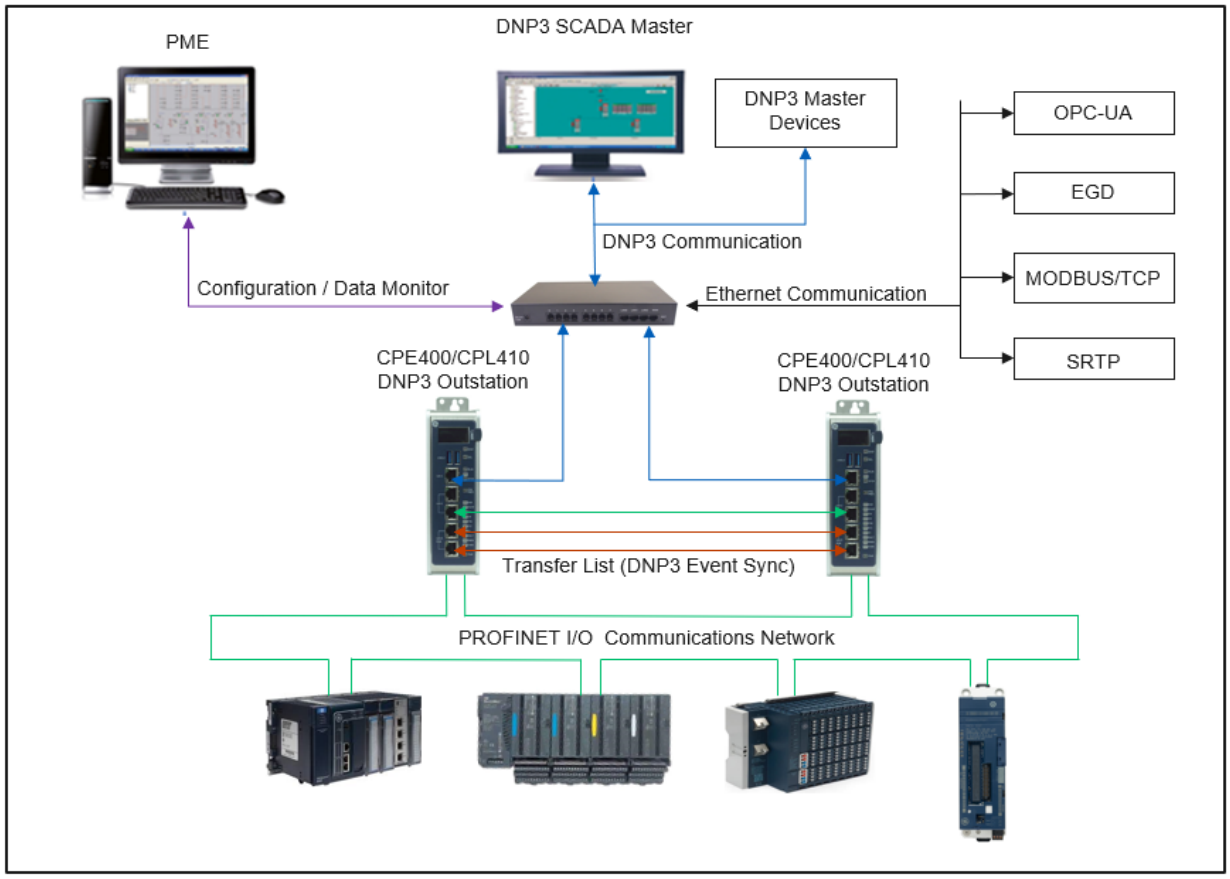
Figure 3: Application Showing CPE400/CPL410/CPE115 with DNP3 Outstation - Simplex System Overview


PME
DNP3 SCADA Master
DNP3 Master Devices
OPC-UA
EGD
MODBUS/TCP
SRTP
DNP3 Communication
Configuration / Data Monitor
Ethernet Communication
CPE400/CPL410/CPE115
DNP3 Outstation
PROFINET I/O Communications Network

1.7 HSB System Overview

The PACSystems RX3i CPE400/CPL410 controller can be used in an HSB system and can be configured to communicate on a DNP3 network as shown below Figure 4. RSTi-EP EPSCPE115 doesn't support Redundancy.

Figure 4: Application showing RX3i CPE400/CPL410 with DNP3 Outstation – HSB System Overview



1.8 DNP3 Outstation Features & Functionality

The following DNP3 Outstation features support on CPE400/CPL410 and CPE115 controller:

Common Features:

1. Static Polling: Data can be assigned to a class and the master can poll by class (Class0, Class1, Class2 and Class3). This allows high priority signals to be polled more frequently than lower priority signals.
2. Sequence of Events: Events between transmissions are captured and stored in the outstation until the next poll. Supports a "sequence of events" history for Binary data (DI, DO and Counters Objects), Analog data (AI, AO and AOV Objects). Supports SOE data transmission on all the 8 Channels for the points that are configured with SOE option.
3. Status flags: Data can be appended with an indicator of the status (Quality) of the data.
4. Report by Exception (RBE): Minimizes network traffic by reporting only data that has changed. (DI, DO, AI, AO, AOV and Counters).
5. Unsolicited Response From the Outstation: Remote devices can report field events without being polled by the master station. A response message can be immediately sent to the master without waiting for the next cyclic poll.
6. Time synchronization and a standard time format.
7. Control Operations: Select Before Operate, Direct Operate, Direct Operate-No Ack.
8. Control Relay Output Block (CROB) Operate command: PULSE_ON, PULSE_OFF, LATCH_ON, LATCH_OFF, TRIP and CLOSE.
9. Analog Output Block (AOV) Operate command.
10. Analog input reporting Deadband.
11. Linear and Circular Event Buffer Configuration for storing the Sequence of events.
12. Configurable Data Link Layer confirmation (Never, Only for multi-frame messages, or Always).
13. Configurable Application Layer confirmation (Only when reporting event data or When reporting event data or multi-fragment messages).
14. Timeout configuration: Data Link Layer Confirmation Response Time Out, Data Link Layer Receive Response Time Out, Application Confirmation Time-Out Occurs.
15. Strict TCP/IP Address matching: Allows the TCP/IP connections from Master Stations that are configured in DNP3 outstation.
16. Strict Lower: Level Address matching: Allows the LLA Address for Master Stations that are configured in DNP3 outstation.
17. Support Point Push functionality which allows users to manually push the Event data into the protocol stack database, or to override default options related to the configuration, or value of points.
18. Supports special variation: “44” in case of Analog Input Objects such as Object 30, 32, 34 and Analog Output Objects 40 & 42.

CPE400/CPL410 Specific Features:

1. HSB Event Synchronization: Events generated in the ACTIVE unit are synchronized to BACKUP Unit.
2. Supports Per-Point and Template Configuration.

1.9 DNP3 Outstation Specifications

1.9.1 DNP3 Outstation Objects and Variance support

The following tables document the DNP3 Outstation capabilities. For CPE400/CPL410 and CPE115 Refer Appendix B DNP3 Outstation Device Profile.

Table 1: DNP3 Outstation Specifications by Object Group

Object Group	Variance	Description	Default Variance in PME
1	1	Binary Input – Packed format	
1	2	Binary Input with Flag	Default
2	1	Binary Input Event - Without time	
2	2	Binary Input with Flag and Time	Default
2	3	Binary Input with Relative Time	
10	1	Binary Output without Flag	
10	2	Binary Output with Flag	Default
11	1	Binary Output without Time	
11	2	Binary Output with Flag and Time	Default
12	1	Control Relay Output Bit (CROB)	
20	1	Counter – 32-bit with flag	Default
20	2	Counter – 16-bit with flag	
20	5	Counter – 32-bit without flag	
20	6	Counter – 16-bit without flag	
21	1	Frozen Counter – 32-bit with flag	Default
21	2	Frozen Counter – 16-bit with flag	
21	5	Frozen Counter – 32-bit with flag and time	
21	6	Frozen Counter – 16-bit with flag and time	
21	9	Frozen Counter – 32-bit without flag	
21	10	Frozen Counter – 16-bit without flag	
22	1	Counter Event – 32-bit with flag	Default
22	2	Counter Event – 16-bit with flag	

Object Group	Variance	Description	Default Variance in PME
22	5	Counter Event – 32-bit with flag and time	
22	6	Counter Event – 16-bit with flag and time	
30	1	Analog Input 32-Bit Signed with Flag	Default
30	2	Analog Input 16-Bit Signed with Flag	
30	3	Analog Input 32 Bit without flag	
30	4	Analog Input 16Bit without flag	
30	5	Analog Input 32-Bit Real with Flag	
30	44	Special Variance, Refer section 5.7	
32	1	Analog Input Event 32Bit without time	
32	2	Analog Input Event 16Bit without time	
32	3	Analog Input 32-Bit Signed with Flag and Time	Default
32	4	Analog Input 16-Bit Signed with Flag and Time	
32	5	Analog Input Event 32Bit Real without time	
32	7	Analog Input 32-Bit Real with Flag and Time	
32	44	Special Variance, Refer section 5.7	
34	1	Analog Input Deadband - 16Bit	
34	2	Analog Input Deadband - 32Bit	Default
34	3	Analog Input Deadband – Single-Precision Floating Point	
34	44	Special Variance, Refer section 5.7	
40	1	Analog Output 32-Bit Signed with Flag	Default
40	2	Analog Output 16-Bit Signed with Flag	
40	3	Analog Output 32-Bit Real with Flag	
40	44	Special Variance, Refer section 5.7	
41	1	Analog Output Value 32-Bit Signed	Default
41	2	Analog Output Value 16-Bit Signed	
41	3	Analog Output Value 32-Bit Real	
42	1	Analog Output Event Status - 32bit without time	
42	2	Analog Output Event Status - 16 bit without time	
42	3	Analog Output 32-Bit Signed with Flag and Time	Default
42	4	Analog Output 16-Bit Signed with Flag and Time	
42	5	Analog Output Event Status - single precision real without time	
42	7	Analog Output 32-Bit Real with Flag and Time	

Object Group	Variance	Description	Default Variance in PME
42	44	Special Variance, Refer section 5.7	
43	1	Analog Output Command Event – 32-bit without time	
43	2	Analog Output Command Event – 16-bit without time	
43	3	Analog Output Command Event – 32-bit with time	Default
43	4	Analog Output Command Event – 16-bit with time	
43	5	Analog Output Command Event – Single-Precision floating point without time	
43	7	Analog Output Command Event – Single-Precision Floating Point with time	
50	1	Set Absolute Time at Outstation	
60	1, 2, 3, 4	Class Poll 0, 1, 2, 3	

1.9.2 DNP3 Outstation Static and Event Poll Support

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, 2, and 3 Event Poll	Yes, returns event data format

1.9.3 Number of Points and Events Support

Table 2: Static Data Objects

Static Object	Group	Maximum Points	
		CPE400/CPL410	CPE115
Binary Input	1	3000	1024
Binary Output Status	10	3000	1024
Binary Counters	20	3000	1024
Frozen Counters	21	3000	1024
Analog Input	30	2000	2000
Analog Output Status	40	2000	2000
Analog Deadband	34	2000	2000
Binary Command – Control Relay	12	1024	1024
Analog Output Value	41	1000	1000

Table 3: Event Data Objects

Event Object	Group	Maximum Events
Binary Input Event	2	8000*
Binary Output Event	11	8000*
Counter Event	22	8000*
Analog Input Event	32	8000*
Analog Output Event	42	8000*
Analog Output Command Event	43	8000*

*DNP3 Outstation supports maximum of 8000 events per Event Object across all the configured DNP3 Masters. Refer Section 5.3 for more information.

Section 2 Configuration of DNP3 Outstation

This section describes creation of a new CPE400/CPL410 DNP3 and CPE115 Outstation project. Use PAC Machine Edition to configure the DNP3 Outstation capabilities on a CPE400/CPL410 and CPE115.

2.1 Required Configuration Tools

CPE400/CPL410:

- PACSystems RX3i CPU CPE400/CPL410 Firmware, version 9.95 or later.
- PAC Machine Edition configuration and programming software, version 9.70 or later.

CPE115:

- PACSystems RSTi-EP CPE115 Firmware, version 9.97 or later.
- PAC Machine Edition configuration and programming software, version 9.70 or later.

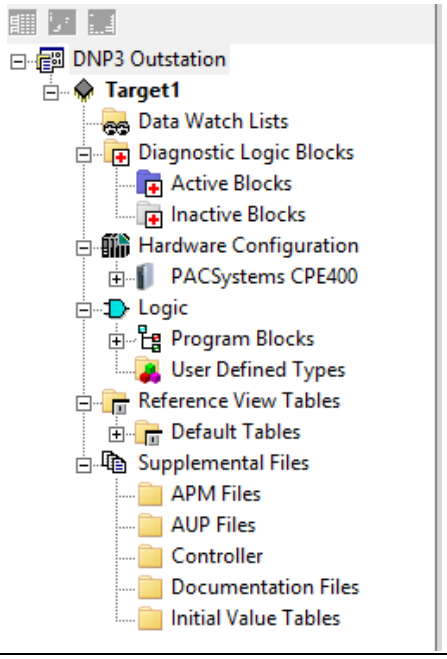
2.2 Configuration

2.2.1 Project Creation and Configuration

CPE400/CPL410:

1. Open PAC Machine Edition.
2. From the Navigator pane create a New Project of RX3i Rackless type for CPE400/CPL410. The Navigator pane appears as shown in Figure 5.

Figure 5: New Project Instance



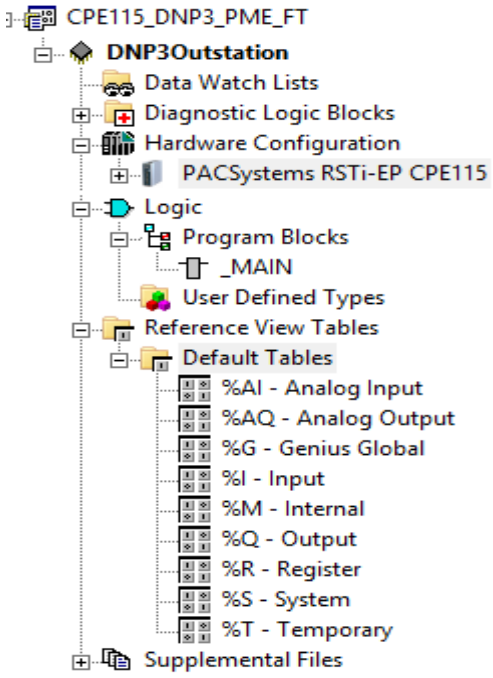
CPE115:

1. Open PAC Machine Edition.
2. From the Navigator pane create a New Project of RX3i Rackless type for PACSystems RSTi-EP Standalone type for CPE115.The Navigator pane appears as shown in Figure 6.

Note:

For CPE115, when the DNP3 Outstation protocol is used in combination of other Ethernet Protocols it is recommended to set “Watchdog Timer (msec)” Parameter value to 500mSec under Hardware configuration Settings tab in PME. Refer performance evaluation manual (GFK-3086) for more specific details.

Figure 6: CPE115 New Project Instance

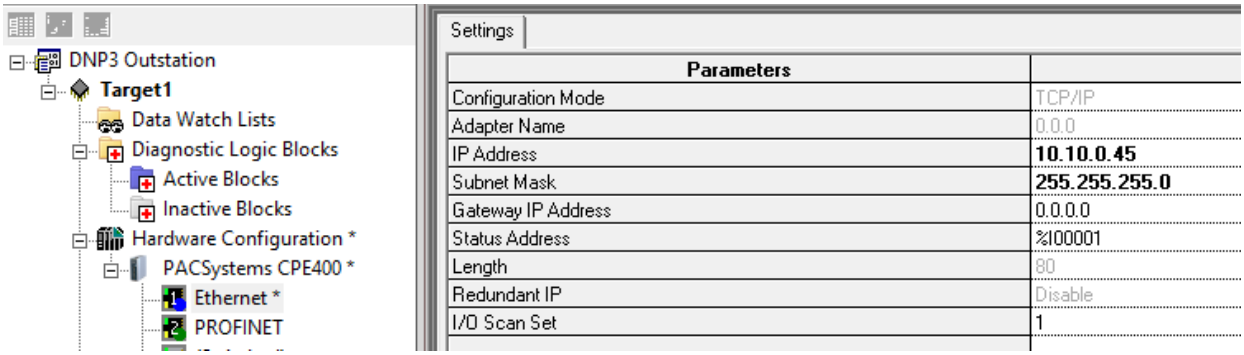


2.2.2 Ethernet IP Address Configuration

CPE400/CPL410

1. Expand PACSystems CPE400 and Click on Ethernet for configuration.
2. Enter the required IP address, Subnet Mask and Gateway parameters as shown in Figure 7.

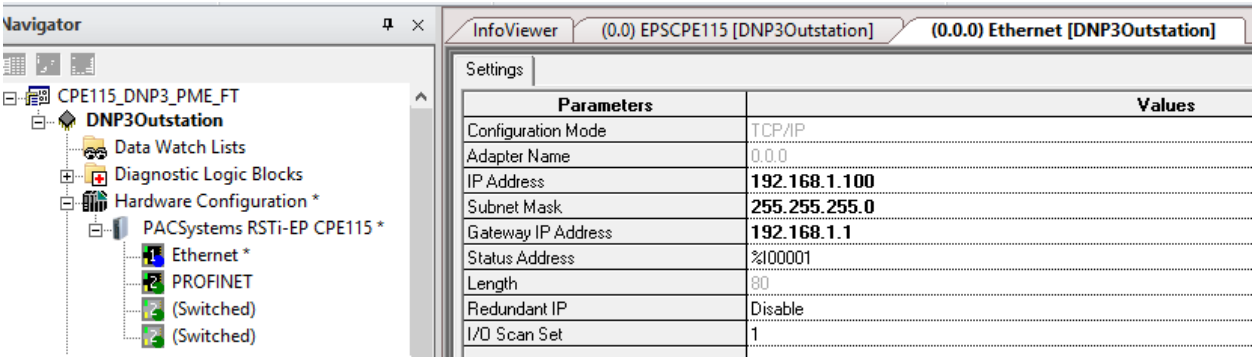
Figure 7: Configuring the Ethernet IP Address



CPE400/CPL410:

3. Expand PACSystems RSTi-EP CPE115 and Click on Ethernet for configuration.
4. Enter the required IP address, Subnet Mask and Gateway parameters as shown in Figure 8.

Figure 8: Configuring the Ethernet IP Address CPE115

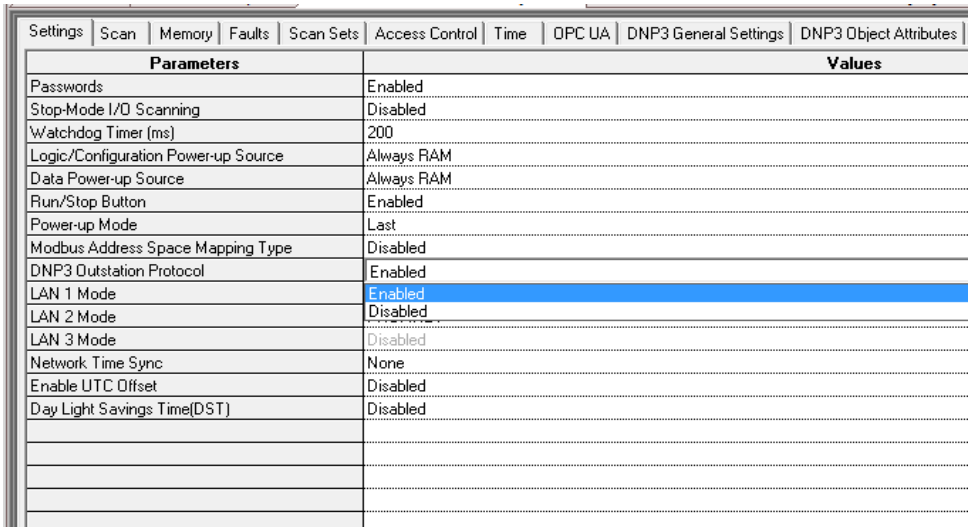


2.2.3 Enable DNP3 Outstation

CPE400/CPL410:

Enable DNP3 Outstation by going to the target CPU's settings page and set parameter DNP3 Outstation Protocol to Enabled, as shown in Figure 9. Tabs DNP3 General Settings and DNP3 Object Attributes will appear.

Figure 9: Enable DNP3 Configuration



CPE115:

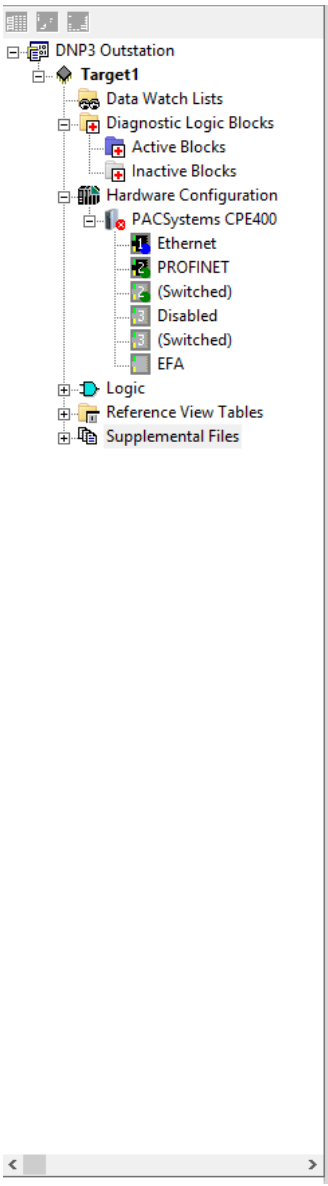
For CPE115 DNP3 Outstation configuration is done using Service request. Refer Section 5.14.2

2.2.4 DNP3 General Settings and Object Attributes configuration

CPE400/CPL410:

Use **DNP3 General Settings** and **DNP3 Object Attributes** tabs to configure DNP3 Outstation. For a detailed description of each parameter, see Section 3.

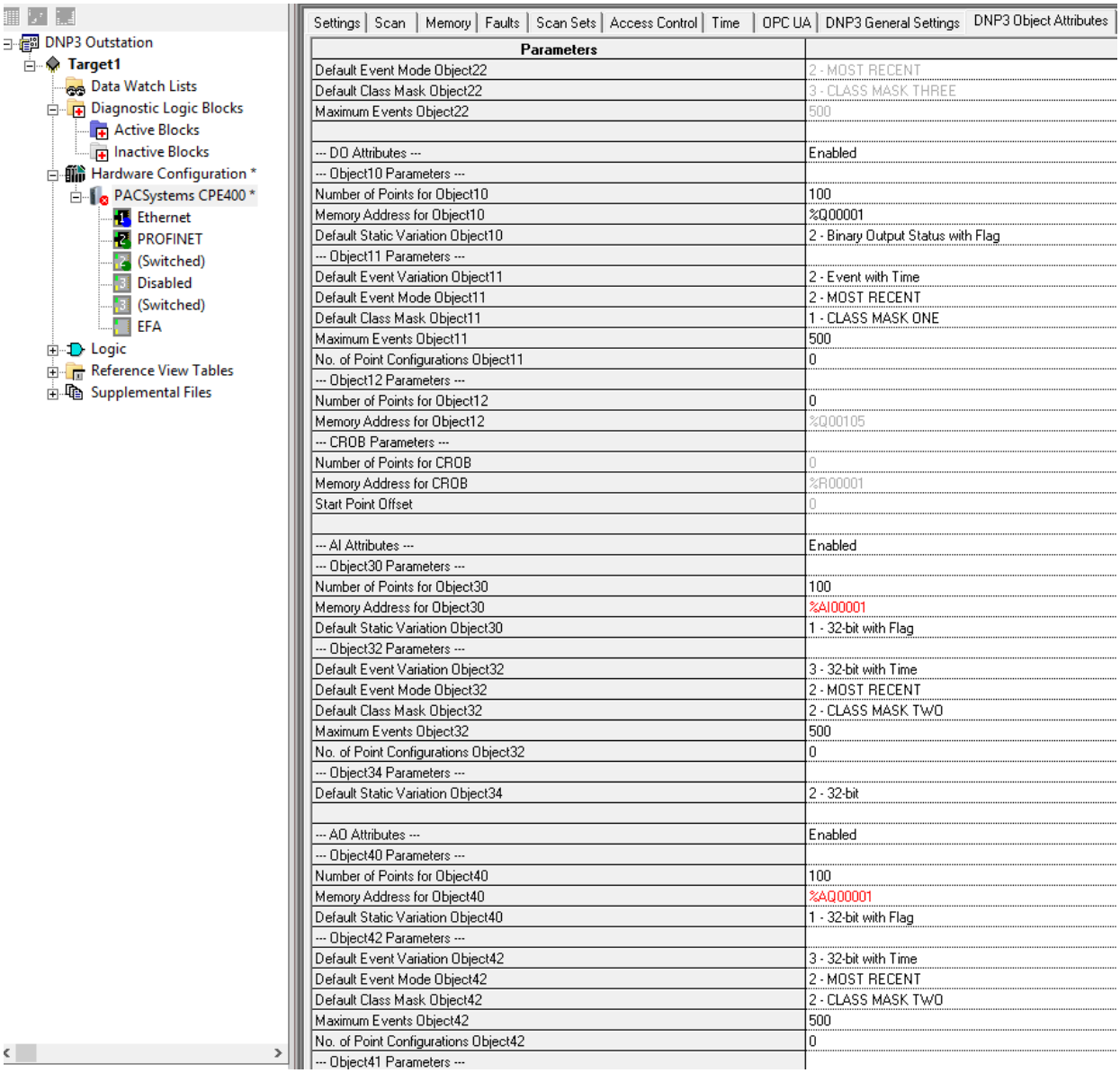
Figure 10: DNP3 General Settings Parameters



Settings | Scan | Memory | Faults | Scan Sets | Access Control | Time | OPC UA | DNP3 General Settings | DNP3 Object Attributes

Parameters	
--- Physical Layer Parameters ---	
Number of Channels	1
DNP3 Port	20000
Validate Source IP	Disabled
IP Address 1	0.0.0.0
--- Application Layer Parameters ---	
Validate Source Address	Disabled
Source Address 1	0
Transmit Fragment Size (bytes)	2048
Multi Fragment Response	True
Multi Fragment Confirm	True
Application Confirm Timeout (mSec)	30
Unsolicited Confirm Timeout (Sec)	10
Select Timeout (Sec)	5
Clock Valid Period (Min)	30
DNP3-TCP Keep Alive	30
Link Timeout Disconnect	False
Max Control Requests	10
DNP3 Time-Sync Required	False
Outstation Restart Bit	False
Set Default Class Mask None	False
Enable Point Push Events Y2K adder	False
Force DI Points to Point Push	False
Force DO Points to Point Push	False
Force AI Points to Point Push	False
Force AO Points to Point Push	False
Enable Point Push Events Local Forced Flag	False
Enable Quality Force	False
--- Link Layer Parameters ---	
Slave Address	4
Destination Address	3
Maximum Retries	3
Confirm Mode	0x00 - Never
Confirm Timeout (Sec)	2
Frame Timeout (Sec)	15
--- Unsolicited Event Parameters ---	
Enable Messages	True
Maximum Retries	3
Retry Delay (Sec)	5
Offline Retry Delay (Sec)	60
Class1 Event Delay (Sec)	5
Class2 Event Delay (Sec)	5
Class3 Event Delay (Sec)	5
Number Class1 Events	5
Number Class2 Events	5
Number Class3 Events	5

Figure 11: DNP3 Object Attributes Parameters



Parameters	
Default Event Mode Object22	2 - MOST RECENT
Default Class Mask Object22	3 - CLASS MASK THREE
Maximum Events Object22	500
--- DO Attributes ---	Enabled
--- Object10 Parameters ---	
Number of Points for Object10	100
Memory Address for Object10	%Q00001
Default Static Variation Object10	2 - Binary Output Status with Flag
--- Object11 Parameters ---	
Default Event Variation Object11	2 - Event with Time
Default Event Mode Object11	2 - MOST RECENT
Default Class Mask Object11	1 - CLASS MASK ONE
Maximum Events Object11	500
No. of Point Configurations Object11	0
--- Object12 Parameters ---	
Number of Points for Object12	0
Memory Address for Object12	%Q00105
--- CROB Parameters ---	
Number of Points for CROB	0
Memory Address for CROB	%R00001
Start Point Offset	0
--- AI Attributes ---	Enabled
--- Object30 Parameters ---	
Number of Points for Object30	100
Memory Address for Object30	%AI00001
Default Static Variation Object30	1 - 32-bit with Flag
--- Object32 Parameters ---	
Default Event Variation Object32	3 - 32-bit with Time
Default Event Mode Object32	2 - MOST RECENT
Default Class Mask Object32	2 - CLASS MASK TWO
Maximum Events Object32	500
No. of Point Configurations Object32	0
--- Object34 Parameters ---	
Default Static Variation Object34	2 - 32-bit
--- AO Attributes ---	Enabled
--- Object40 Parameters ---	
Number of Points for Object40	100
Memory Address for Object40	%AQ00001
Default Static Variation Object40	1 - 32-bit with Flag
--- Object42 Parameters ---	
Default Event Variation Object42	3 - 32-bit with Time
Default Event Mode Object42	2 - MOST RECENT
Default Class Mask Object42	2 - CLASS MASK TWO
Maximum Events Object42	500
No. of Point Configurations Object42	0
--- Object41 Parameters ---	

2.2.5 CPE115:

For CPE115, to configure Physical Layer, Link Layer, Application Layer, Unsolicited, Event scan, and DNP3 Object attribute parameters, the following ST Block parameters are used. For detailed description of each parameter, see Section 3.

Table 4: Configuration Parameters

Parameter	Description
mDNP3_Setup [07]	Number of Channels
mDNP3_Setup [08]	DNP3 Port
mDNP3_Setup [09]	Slave Address
mDNP3_Setup [10]	Enable Unsolicited Messages
mDNP3_Setup [11]	Class1, Class2 and Class3 Event Delay
mDNP3_Setup [12]	Number of Class1, Class2 and Class3 Events
mDNP3_Setup [13]	Destination Address
mDNP3_Setup [14]	Data Change Scan Period
mDNP3_Setup [15].1	Outstation Restart bit
mDNP3_Setup [15].2	DNP3 Time-Sync required
mDNP3_Setup [15].3	Link layer Confirm Mode
mDNP3_Setup [15].4	
mDNP3_Setup [15].5	Multi-Fragment Response
mDNP3_Setup [15].6	Multi-Fragment Confirm
mDNP3_Setup [15].7	Class Mask None
mDNP3_Setup [15].8	Unused bit
mDNP3_Setup [15].9	Link Timeout Disconnect
mDNP3_Setup [15].10	Delete Oldest Events
mDNP3_Setup [15].11	Enable Point push Events Local Forced Flag
mDNP3_Setup [15].12	Enable Point push Event Y2k Ladder
mDNP3_Setup [15].13	Force DI Points to Point Push
mDNP3_Setup [15].14	Force DO Points to Point Push
mDNP3_Setup [15].15	Force AI Points to Point Push
mDNP3_Setup [15].16	Force AO Points to Point Push
mDNP3_Setup [16]	Reserved
mDNP3_Setup [17]	Memory Type for Quality Force
mDNP3_Setup [18]	Memory Address for Quality Force
mDNP3_Setup [19]	Tx Fragment Size
mDNP3_Setup [20]	Application Confirm Timeout
mDNP3_Setup [21]	Unsolicited Confirm Timeout
mDNP3_Setup [22]	Clock Valid Period
mDNP3_Setup [23]	DNP3 TCP Keepalive Time
mDNP3_Setup [24]	Maximum Retries
mDNP3_Setup [25]	Confirm Timeout
mDNP3_Setup [26]	Frame Timeout
mDNP3_Setup [27]	Max Control Requests
mDNP3_Setup [28]	Select Timeout
mDNP3_Setup [29]	Multi master SOE Mode Enable/Disable bit

Parameter	Description
mDNP3_Setup [30]	Number of Points for Object01
mDNP3_Setup [31]	Memory Type for Object01
mDNP3_Setup [32]	Memory Address for Object01
mDNP3_Setup [33]	Default Static Variation for Object01
mDNP3_Setup [34]	Default Event Variation Object02
mDNP3_Setup [35]	Default Event Mode Object02
mDNP3_Setup [36]	Default Class Mask Object02
mDNP3_Setup [37]	Maximum Events Object02
mDNP3_Setup [38]	Enable Binary Counter: Object 20,21,22
mDNP3_Setup [39]	Default Static Variation Object20
mDNP3_Setup [40]	Default Static Variation Object21
mDNP3_Setup [41]	Default Event Variation Object22
mDNP3_Setup [42]	Default Event Mode Object22
mDNP3_Setup [43]	Default Class Mask Object22
mDNP3_Setup [44]	Maximum Events Object22
mDNP3_Setup [45]	Number of Points for Object10
mDNP3_Setup [46]	Memory Type for Object10
mDNP3_Setup [47]	Memory Address for Object10
mDNP3_Setup [48]	Default Static Variation for Object10
mDNP3_Setup [49]	Default Event Variation Object11
mDNP3_Setup [50]	Default Event Mode Object11
mDNP3_Setup [51]	Default Class Mask Object11
mDNP3_Setup [52]	Maximum Events Object11
mDNP3_Setup [53]	Number of Points for Object 12
mDNP3_Setup [54]	Memory Type for Object 12
mDNP3_Setup [55]	Memory Address for Object 12
mDNP3_Setup [56]	Command Variation for Object 12
mDNP3_Setup [57]	Number of Points for CROB
mDNP3_Setup [58]	Memory Type for CROB
mDNP3_Setup [59]	Memory Address for CROB
mDNP3_Setup [60]	Start Point Offset
mDNP3_Setup [61]	Number of Points for Object30
mDNP3_Setup [62]	Memory Type for Object30
mDNP3_Setup [63]	Memory Address for Object30
mDNP3_Setup [64]	Default Static Variation for Object30
mDNP3_Setup [65]	Default Event Variation Object32

Parameter	Description
mDNP3_Setup [66]	Default Event Mode Object32
mDNP3_Setup [67]	Default Class Mask Object32
mDNP3_Setup [68]	Maximum Events Object32
mDNP3_Setup [69]	Reserved
mDNP3_Setup [70]	Default Static Variation for Object34
mDNP3_Setup [71]	Number of Points for Object40
mDNP3_Setup [72]	Memory Type for Object40
mDNP3_Setup [73]	Memory Address for Object40
mDNP3_Setup [74]	Default Static Variation for Object40
mDNP3_Setup [75]	Default Event Variation Object42
mDNP3_Setup [76]	Default Event Mode Object42
mDNP3_Setup [77]	Default Class Mask Object42
mDNP3_Setup [78]	Maximum Events Object42
mDNP3_Setup [79]	Number of Points for Object41
mDNP3_Setup [80]	Memory Type for Object41
mDNP3_Setup [81]	Memory Address for Object41
mDNP3_Setup [82]	Command Variation for Object41
mDNP3_Setup [83]	Number of Points for Object43
mDNP3_Setup [84]	Start Point Offset
mDNP3_Setup [85]	Default Event Variation Object43
mDNP3_Setup [86]	Default Event Mode Object43
mDNP3_Setup [87]	Default Class Mask Object43
mDNP3_Setup [88]	Maximum Events Object43
mDNP3_Setup [89]	Validate Source IP
mDNP3_Setup [90]	IP Address 1
mDNP3_Setup [91]	
mDNP3_Setup [92]	
mDNP3_Setup [93]	
mDNP3_Setup [94]	IP Address 2
mDNP3_Setup [95]	
mDNP3_Setup [96]	
mDNP3_Setup [97]	
mDNP3_Setup [98]	IP Address 3
mDNP3_Setup [99]	
mDNP3_Setup [100]	

Parameter	Description
mDNP3_Setup [101]	
mDNP3_Setup [102]	IP Address 4
mDNP3_Setup [103]	
mDNP3_Setup [104]	
mDNP3_Setup [105]	
mDNP3_Setup [106]	IP Address 5
mDNP3_Setup [107]	
mDNP3_Setup [108]	
mDNP3_Setup [109]	
mDNP3_Setup [110]	IP Address 6
mDNP3_Setup [111]	
mDNP3_Setup [112]	
mDNP3_Setup [113]	
mDNP3_Setup [114]	IP Address 7
mDNP3_Setup [115]	
mDNP3_Setup [116]	
mDNP3_Setup [117]	
mDNP3_Setup [118]	IP Address 8
mDNP3_Setup [119]	
mDNP3_Setup [120]	
mDNP3_Setup [121]	
mDNP3_Setup [122]	Validate Source Address
mDNP3_Setup [123]	Source Address 1
mDNP3_Setup [124]	Source Address 2
mDNP3_Setup [125]	Source Address 3
mDNP3_Setup [126]	Source Address 4
mDNP3_Setup [127]	Source Address 5
mDNP3_Setup [128]	Source Address 6
mDNP3_Setup [129]	Source Address 7
mDNP3_Setup [130]	Source Address 8
mDNP3_Setup [131]	Reserved
mDNP3_Setup [132]	Reserved

Refer Appendix C for ST Block example to configure DNP3 Outstation in CPE115 controller.

2.3 Start DNP3 Outstation in CPU

CPE400/CPL410:

Once the required configuration for DNP3 Outstation is done, connect PME to Controller, go ONLINE, and download the configuration to CPU. The DNP3 Outstation protocol starts in the CPU and will be ready to start accepting the DNP3 Master connections.

CPE115:

Once the required ST Block configuration parameters are set for DNP3 Outstation, connect PME to Controller, go ONLINE, and download the configuration to CPU. Use Service Request Command to start DNP3 Outstation protocol to start accepting the DNP3 Master connections. Refer section 5.14.2.

2.4 DNP3 Master Communication

To establish the communication between Outstation and Master, set Master IP address, TCP/IP Port Number, and Source LLA as per the DNP3 Outstation Configuration.

Use Station Manager tool and ‘stat a’ command to view the DNP3 Outstation Configuration Parameters. For ‘stat a’ command output refer section Appendix A.

Section 3 DNP3 Configuration Parameters

This chapter provides a description for the DNP3 configuration parameters available for the CPE400/CPL410 and CPE115 in PAC Machine Edition. The configuration parameters are divided into two major sections. DNP3 Outstation will have one profile and it must be configured via the PME before it can operate on the DNP3 network.

The PME configuration outlined in this chapter is used for this purpose. See Appendix B DNP3 Outstation Device Profile for full support of applicable DNP3 Outstation parameters.

a. DNP3 General Settings
b. DNP3 Object Attributes

This section will also help users determine how the Outstation Module will be expected to interact with its DNP3 Master(s). The Outstation Module may be expected to interact with more than one DNP3 master. (Only a maximum of eight DNP3 masters are supported.) The cumulative configurations of all DNP3 masters on a network will determine the DNP3 Outstation configuration. The DNP3 Outstation has only one instance of data that it serves.

3.1 DNP3 General Settings

3.1.1 Physical Layer Parameters

Table 5: Physical Layer Parameters

Parameters	Description	Valid Values
Number of Channels	Number of Master connections to be made with the Outstation. For e.g., if configured as 2, then Maximum of 2 Masters can connect to Outstation.	Value: 1 to 8 Default: 1
DNP3 Port	TCP/IP Port Number for DNP3 Data Connection	Value: Valid Port Number Default: 20000
Validate Source IP	Specifies if DNP3 Master connection IP validation is enabled / disabled. If enabled, masters can establish the connections with outstation using the configured IPs. If disabled, Master IPs are not validated and can establish the connections with Outstation. In HSB Configuration, this value is always Enabled. Refer Section 5.2.1	Value: Enabled/Disabled Default: Disabled for Simplex, always Enabled for HSB Note: HSB configuration is applicable only for CPE400/CPL410
IP Addresses 1 to 8	Master IP Addresses that a given Master can establish a connection with Outstation.	Value: Valid IP addresses

Note:

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For CPE400/410 HSB System, when number of channels is configured to 1, TCP/IP whitelisting is disabled, and configured IP Address will be ignored. DNP3 Outstation can connect to any Master irrespective of whitelisted IP address configured in PME. This is done to handle the scenario where a Redundant Pair of master connections with different IP addresses are required to be connected to 1 configured session in Outstation. However, if more than 1 master session is configured then based on configuration, IP white listing is applicable and masters with the designated IP can connect to the Outstation.

3.1.2 Application Layer Parameters

Table 6: Application Layer Parameters

Parameters	Description	Valid Values
Validate Source Address	Application layer validates source address in received frames. If enabled, masters can establish the connections with outstation using the configured LLA Addresses. If disabled, Master's LLA addresses is not validated and can establish the connections with Outstation. Note: If Validate Source Address is enabled then Validate Source IP gets enabled by default, user needs to configure the Source IP Addresses. In HSB Configuration, this value is always Enabled. Refer Section 5.2.2	Value: Enabled/Disabled Default: Disabled for Simplex, Enabled for HSB Note: HSB configuration is applicable only for CPE400/CPL410
Source Address 1 to 8	List of Master LLA Addresses that a given Master can establish a connection with DNP3 Outstation on Channel[x].	Value: Valid LLA (In Range of 1 to 65519) Default: 3, 5, 6 to 11, for respective number of Masters

Parameters	Description	Valid Values
Transmit Fragment Size (bytes)	Maximum value of Transmit Fragment Size. For e.g., if configured as 1024, then Outstation will transmit messages with Fragment size of 1024 bytes.	Value: 1 to 2048 Bytes (Modulus of 128) Default: 2048 Bytes
Multi-Fragment Response	If set to True, DNP3 Application layer is allowed to send Multi-Fragment responses from Outstation to Master. If set to False, DNP3 Outstation sends the response data in Single Fragment of configured "Transmit Fragment Size".	Value: True/False Default: True For CPE115: Value: 1 / 0.
Multi- Fragment Confirm	If set to True, Application layer confirmations will be requested for non-final fragments of a multi fragment response.	Value: True/False Default: True For CPE115: Value: 1 / 0.
Application Confirm Timeout (mSec)	Specifies how long the Outstation will wait for an Application layer confirmation from the DNP3 Master for a Solicited Event response.	Value: 1 to 65535 mSec Default: 30 mSec
Unsolicited Confirm Timeout (Sec)	Specifies how long the DNP3 Outstation will wait for an Application layer confirmation from the DNP3 Master for an Unsolicited Event response.	Value: 1 to 300 Sec Default: 10 Sec
Select Timeout (Sec)	Maximum amount of time that a Select will remain valid before the corresponding Operate	Value: 1 to 300 Sec, Default: 5 Sec

Parameters	Description	Valid Values
	command is received from the Master.	
Clock Valid Period (Min)	Specifies how long the local clock will remain valid after receiving a time synchronization. Refer Section 5.9	Value: 0 to 1440 Min, Default: 30 Min
DNP3-TCP Keep Alive	Specifies how often to send link status requests if no DNP3 frames have been received. Refer Section 5.10	Value: 0 to 300 Sec Default: 30 Sec
Link Timeout Disconnect	Specifies to disconnect/reconnect a connection when link status request times out. Refer Section 5.10	Value: True/False, Default: False For CPE115: Value: 1 / 0.
Max Control Requests	Determines the maximum number of controls (CROB/AOV) allowed in a single write request.	Value: 1 to 10 Default: 10
DNP3 Time – Sync Required	Specifies whether the DNP3 Outstation will set the Need Time IIN bit at startup and after the clock valid period has elapsed. Note: When SNTP is configured in the CPU this parameter should be set to False. Refer Section 5.9	Value: True/False Default: False For CPE115: Value: 1 / 0.
Outstation Restart Bit	Specifies if required to set Restart Bit in IIN when DNP3 Outstation starts.	Value: True/False Default: False For CPE115: Value: 1 / 0.

Parameters	Description	Valid Values
Set Default Class Mask None	When set to True, On DNP3 Outstation startup (or) when CPU transition from RUN-to-STOP/STOP-to-RUN, all the DNP3 points Class Mask is set to None, so that no Event Reports are generated for change in Online/Offline status in the point Flags.	Value: True/False Default: False For CPE115: Value: 1 / 0.
Enable Point Push Events Y2K adder	Specifies whether Point Push Data Needs a Year 2000 Adder. If set to True, Point Push Event time stamp year requires Year 2000 Adder; Event time stamp year assumes 2-digit year with an epoch of 1970. If set to True, Point Push Event time stamp doesn't require Year 2000 adder; Event time stamp year assumes 4-digit year.	Value: True/False Default: False For CPE115: Value: 1 / 0.
Force DI Points to Point Push	All the points of the DI Object by default are set in Point Push mode, disabling automatic detection of data. Refer Section 5.6.2	Value: True/False Default: False For CPE115: Value: 1 / 0.
Force DO Points to Point Push	All the points of the DO Object by default is set in Point Push mode, disabling automatic detection of data. Refer Section 5.6.2	Value: True/False Default: False For CPE115: Value: 1 / 0.
Force AI Points to Point Push	All the points of the AI Object by default is set in Point Push mode,	Value: True/False Default: False

Parameters	Description	Valid Values
	disabling automatic detection of data. Refer Section 5.6.2	For CPE115: Value: 1 / 0.
Force AO Points to Point Push	All the points of the AO Object by default is set in Point Push mode, disabling automatic detection of data. Refer Section 5.6.2	Value: True/False Default: False For CPE115: Value: 1 / 0.
Enable Point Push Events Local Forced Flag	Specifies whether the DNP3 Outstation will force Point Push Events to Set/ Re-Set the LOCAL FORCED bit in Point Flags.	Value: True/False Default: False For CPE115: Value: 1 / 0.
Enable Quality Force	Specifies whether the DNP3 Outstation will Enable / Disable the forcing of the ONLINE bit to Set/Re-Set in Point Flags. Refer Section 5.11.	Value: True/False Default: False This parameter is applicable only for CPE400/CPL410.
QF Memory Address	CPU Reference Memory Type & Address	Memory Type: %R, %AI, %AQ, %W Allocates available reference Memory ranges Default: %R00001 For CPE115: Memory Type: 8 - %R, 10 - %AI, 12 - %AQ, 196 - %W If Memory Type and Memory Address set to 0 Quality Force is disabled.

3.1.3 Link Layer Parameters

Table 7: Link Layer Parameters

Parameters	Description	Valid Values
Slave Address	Data Link Layer Address for DNP3 Outstation.	Value: Range 1 to 65519 Default Value: 4
Destination Address	This Master LLA Address is used to send Unsolicited NULL responses to Masters to establish DNP3 Communication. When Validate Source Address is Disabled the DNP3 Outstation will send the Unsolicited NULL responses to this configured destination LLA. If Enabled, Unsolicited NULL response is sent to configured Source LLA Address.	Value: Valid LLA (In Range of 1 to 65519) Default: 3
Maximum Retries	Specifies maximum number of link layer retries if link layer confirm times out.	Value: 0 to 255 Default: 3
Confirm Mode	Specifies when DNP3 Outstation shall ask for link layer confirmations.	Value: Never, Always, and Sometimes Default: Never For CPE115: Value:00,10,10 mDNP3_Setup[15].3 and mDNP3_Setup[15].4 bits should set with values

Parameters	Description	Valid Values
Confirm Timeout (Sec)	Specifies how long the DNP3 Outstation will wait for Link Layer Confirmation.	Value: 1 to 300 Sec Default: 2 Sec
Frame Timeout (Sec)	Specifies maximum amount of time to wait for a complete frame after receiving valid frame sync characters.	Value: 5 to 300 Sec Default: 15 Sec

3.1.4 Unsolicited Parameters

Table 8: Unsolicited Parameters

Parameters	Description	Valid Values
Enabled Messages	Specifies whether the DNP3 Outstation unsolicited responses are allowed. If set to True, Outstation unsolicited responses are allowed, when Master request Outstation to enable unsolicited response. If set to False, Outstation unsolicited responses are not allowed, even when Master request Outstation to enable unsolicited response.	Value: True/False Default: True For CPE115: Value: 1 / 0.
Maximum Retries	Specify the maximum number of unsolicited retries before changing to the 'OFFLINE'.	Value: 1 to 255 Default: 3
Retry Delay (Sec)	Specifies the time to delay after an unsolicited confirm timeout before retrying the unsolicited response.	Value: 5 to 32000 Sec Default: 5 Sec
Offline Retry Delay (Sec)	Specifies the time to delay after an unsolicited timeout before retrying the unsolicited response after Maximum Retries have been attempted (Set to 0 for disabling).	Value: 0 to 32000 Sec Default: 60 Sec
Class 1, 2, and 3 Event Delay (Sec)	Specifies the maximum amount of time in seconds after an event in the corresponding class is received before an unsolicited response will be generated.	Value: 1 to 32000 Sec Default value is 5 Sec

Number of Class 1, 2, and 3 Events	Specifies the maximum number of events in the corresponding class to be allowed before an unsolicited response will be generated.	Value: 1 to 255 Default value is 5

3.1.5 Event Scan Parameters

Table 9: Event Scan Parameters

Parameters	Description	Valid Values
Delete Oldest Event for Session 1 to 8	Specifies if event with the earliest Time Stamp will be deleted in Session [x] when a new event is added to an event queue that is full. If set to True, event with the earliest timestamp will be deleted in Session[x] when a new event is added to an event queue that is full. If set to False, event with the latest timestamp will be discarded in Session[x] when a new event is added to an event queue that is full.	Value: True/False Default: False Note: For CPE115, there is only single parameter for this feature, and it is applicable for all the configured sessions.
Data Change Scan Period	Specifies Time interval for all Polled DNP3 Objects to identify the change in data to generate Events. The internal database screens fast-changing events with data change Scan period.	Value: 10 to 32000 mSec Default: 250 mSec

3.2 DNP3 Object Attributes

This section provides details to configure DNP3 Object Attributes:

- General Parameters
- Point Template Configuration
- DI Attributes
- DO Attributes
- AI Attributes
- AO Attributes

3.2.1 General Parameters

This section describes DNP3 Outstation general parameters:

Table 10: General Parameters

Parameters	Description
Digital Input	Digital Input is defined as a DNP3 Object Binary Inputs – Obj01. Corresponding PLC memory type, memory address, and number of Points are required to be configured. Set the configuration parameter values as required by the DNP3 application.
Analog Input	Analog Input is defined as a DNP3 Object Analog Inputs – Obj30. Corresponding PLC memory type, memory address, and number of Points are required to be configured. Set the configuration parameter values as required by the DNP3 application.
Counters	Counters is defined as a DNP3 Objects such as Binary Counters - Obj20 and Frozen Counters – Obj21. The number of points is same as configured for Binary Inputs – Obj01. Set the configuration parameter values as required by the DNP3 application.
Digital Output Status	Digital Output Status is defined as a DNP3 Object Binary Output Status – Obj10. Corresponding PLC memory type, memory address, and number of Points are required to be configured. Set the configuration parameter values as required by the DNP3 application.
Digital Output / CROB	Digital Output is defined as a DNP3 Object Control Relay Output Block (CROB) - Obj12 . Corresponding PLC memory type, memory address, and number of Points are required to be configured. Set the configuration parameter values as required by the DNP3 application.

Parameters	Description
Analog Output Status	Analog Output Status is defined as a DNP3 Object Analog Output Status – Obj40. Corresponding PLC memory type, memory address, and number of Points are required to be configured. Set the configuration parameter values as required by the DNP3 application.
Analog Output / AOV	Analog Output is defined as a DNP3 Object Analog Output Value (AOV) - Obj41. Corresponding PLC memory type, memory address, and number of Points are required to be configured. Set the configuration parameter values as required by the DNP3 application.
Event Modes	DNP3 Outstation Objects support following Event Modes: 1. Most Recent – When this event mode is configured, only the latest event (i.e. static data value) is stored and reported to DNP3 master. 2. SOE (Sequence of Events) – With this event mode configuration, sequence of events will be stored and reported to DNP3 master as historical data. 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. All the configured DNP3 Points can generate Events. The Events can be either be instances of a single point change, or multiple changes of the same point.
Class Masks	DNP3 Outstation supports following Class Masks: 1. CLASS MASK NONE – No Event data will be generated; all the Point values can be polled through general Interrogation/Integrity Poll. 2. CLASS MASK ONE – Events generated are categorized as Class-1 Events. 3. CLASS MASK TWO - Events generated are categorized as Class-2 Events. 4. CLASS MASK THREE - Events generated are categorized as Class-3 Events. All the Events can be classified under Class 0 or Class 1, 2 or 3. Events from individual Classes can be polled different intervals as needed by DNP3 Master.
Number of Point Configurations	DNP3 Outstation supports Per-Point Configuration where selected points can have non-default Event Mode and Class Mask Type. This parameter allows us to specify the number of points that requires non-default Event Mode and Class Mask Type. 1. If this parameter is configured as 0, No points in the DNP3 object will participate in Per-Point Configuration and have

Parameters	Description
	default configured values of Event Mode and Class Mask type. 2. If it is configured as non-zero, then user will be provided with Per-Point Object XX Tab where Users can choose Point Index for which the Event Mode and Class Mask Type can be configured with other than default value. Note: Each DNP3 Object support a maximum of 512 Per-Point Configurations. For CPE115, this parameter is not applicable.

3.2.2 Point Template Configuration

Table 11: Point Template Configuration

Parameters	Description	Valid Values
Point Template Configuration	DNP3 Outstation supports Point Template Configuration where a range of points can have non-default Event Mode and Class Mask Type. This parameter allows us to specify the number of point template configuration that requires non-default Event Mode and Class Mask Type. 1. If this parameter is configured as 0, No points in the DNP3 object will participate in Point Template Configuration and have default configured values of Event Mode and Class Mask type. 2. If it is configured as non-zero, then user will be provided with Point Template Configuration Tab with configured value rows where users can choose DNP3 Object type and range of Points with Start and End Indexes for which the Event Mode and Class Mask Type can	Value: 0 to 100 Default: 0

	be configured with other than default values. Note: A maximum of 100 Point Template Configurations is supported. Refer Section 5.8.2 For CPE115, this parameter is not applicable. *Error! Reference source not found.*	

3.2.3 DI Attributes

This section allows user to configure DI Polled and Events Objects configuration parameters – such as Binary Input Object 01, 02, and Binary Counter Objects - 20, 21, and 22.

Table 12: DI Attributes

Parameters	Description	Valid Values
DI Attributes	If Enabled, the DI parameters gets enabled for configuration. If Disabled, the DI parameters are not allowed to be configured. This parameter is applicable only for CPE400/CPL410.	Value: Enabled/Disabled Default: Enabled
Object01 Parameters		
Number of Points Object01	Number of Points.	Value: 1 to 3000 Default: 100 For CPE115: Value: 0 to 1024 If set to 0 DI Attributes is not available.
Memory Address for Object01	CPU Reference Memory Type & Address	Memory Type: %I, %Q, %M, %T, %G Allocates available reference Memory ranges Default: %I00001 For CPE115: Memory Type: 70 - %I, 72 - %Q, 76 - %M, 74 - %T, 86 - %G

Parameters	Description	Valid Values
		If set to 0 DI Attributes is not available.
Default Static Variation Object01	Binary Input Object01 default Static Variation	Value: 1 - "Binary Input Packed Format" 2 – "Binary Input with Flag" Default: 2 – "Binary Input with Flag"
Object02 Parameters		
Default Event Variation Object02	Binary Input Event Object02 default Event Variation	Value: 1 – "Event without Time" 2 – "Event with Time" 3 – "Event with Relative Time" Default: 2 "Event with Time"
Default Event Mode Object02	Object02 Default Event Mode	Value: 1 - SOE 2 - MOST RECENT Default: 2 - MOST RECENT
Default Class Mask Object02	Object02 Default Event Class Mask	Value: 0 – CLASS MASK NONE 1 – CLASS MASK ONE 2 – CLASS MASK TWO 3 – CLASS MASK THREE Default: 1 – CLASS MASK ONE
Maximum Events Object02	Maximum Number of Events for Event Object02	Value: 0 to 8000 Default: 500
Number of Point Configurations Object02	Number of Points that require other than default Event Mode & Class Mask.	Value: 0 to 512 Default: 0

Parameters	Description	Valid Values
	This parameter is only applicable for CPE400/CPL410	
Enable Counter Objects20, 21, 22	Enable / Disable Binary Counter Objects 20, 21 & 22	Value: True/False Default: False For CPE115: Value: 1 / 0. If set to 0 Counter Objects will be disabled.
Default Static Variation Object20	Binary Counter Object20 default Static Variation	Value: 1 – "32-bit with Flag" 2 – "16-bit with Flag" 5 – "32-bit without Flag" 6 – "16-bit without Flag" Default: 1 – "32-bit with Flag"
Default Static Variation Object21	Binary Frozen Counter Object21 default Static Variation	Value: 1 – "32-bit with Flag" 2 – "16-bit with Flag" 5 – "32-bit with Flag & Time" 6 – "16-bit with Flag & Time" 9 – "32-bit without Flag" 10 – "16-bit without Flag" Default: 1 – "32-bit with Flag"
Default Event Variation Object22	Binary Counter Event Object22 default Event Variation	Value: 1 – "32-bit with Flag" 2 – "16-bit with Flag" 5 – "32-bit with Flag & Time" 6 – "16-bit with Flag & Time" 9 – "32-bit without Flag"

Parameters	Description	Valid Values
		10 – "16-bit without Flag" Default: 1 – "32-bit with Flag"
Default Event Mode Object22	Object22 Default Event Mode	Value: 1 - SOE 2 - MOST RECENT Default: 2 - MOST RECENT
Default Class Mask Object22	Object22 Event Class Mask	Value: 0 – CLASS MASK NONE 1 – CLASS MASK ONE 2 – CLASS MASK TWO 3 – CLASS MASK THREE Default: 3 – CLASS MASK THREE
Maximum Events Object22	Maximum Number of Events for Event Object22	Value: 0 to 8000 Default: 500

3.2.4 DO Attributes

This section allows user to configure DO Polled and Events Objects configuration parameters – such as Binary Output Status Object10, Event Object12, and Binary Output CROB.

Table 13: DO Attributes

Parameters	Description	Valid Values
DO Attributes	If Enabled, the DO parameters get enabled for configuration. If Disabled, the DO parameters are not allowed to be configured. This parameter is applicable only for CPE400/CPL410.	Value: Enabled/Disabled Default: Enabled
Object10 Parameters		
Number of Points for Object10	Number of Points	Value: 1 to 3000 Default: 100 For CPE115: Value: 0 to 1024 If set to 0 DO Attributes is not available.
Memory Address for Object10	CPU Reference Memory Type & Address	Value: Memory Type: %I, %Q, %M, %T, %G Allocates available reference Memory ranges Default: %Q00001 For CPE115: Memory Type: 70 - %I, 72 - %Q, 76 - %M, 74 - %T, 86 - %G If set to 0 DO Attributes is not available.
Default Static Variation for Object10	Binary Output Object10 default Static Variation	Value:

Parameters	Description	Valid Values
		1 – “Binary Output Packed Format” 2 – “Binary Output Status with Flag” Default: 2 – “Binary Output Status with Flag”
Object11 Parameters		
Default Event Variation for Object11	Binary Output Event Object11 default Event Variation	Value: 1 – “Event without Time” 2 – “Event with Time” Default: 2 – “Event with Time”
Default Event Mode for Object11	Object11 default Event Mode	Value: 1 - SOE 2 - MOST RECENT Default: 2 – “Event with Time”
Default Class Mask for Object11	Object11 default Event Class Mask	Value: 0 – CLASS MASK NONE 1 – CLASS MASK ONE 2 – CLASS MASK TWO 3 – CLASS MASK THREE Default: 1 – CLASS MASK ONE
Maximum Events for Object11	Maximum Number of Events for Event Object11	Value: 0 to 8000 Default: 500
Number of Point Configurations Object11	Number of Points that require other than default Event Mode & Class Mask This parameter is only applicable for CPE400/CPL410	Value: 0 to 512 Default: 0
Object12 Parameters		

Parameters	Description	Valid Values
Number of Points for Object12	Number of Points	Value: 0 to1024 Default: 0
Memory Address for Object12	CPU Reference Memory Type & Address	Value: Memory Type: %I, %Q, %M, %T, %G Allocates available reference Memory ranges Default: Q%00105 For CPE115: Memory Type: 70 - %I, 72 - %Q, 76 - %M, 74 - %T, 86 - %G
CROB Parameters		
Number of Points for CROB	Number of CROB Points	Value: 0 to 1024 (Should be <= No. of Obj12 Points) Default: 0
Memory Address for CROB	CPU Reference Memory Type & Address	Value: Memory Type: %R, %AI, %AQ, %W Allocates available reference Memory ranges Default: %R00001 For CPE115: Memory Type: 8 - %R, 10 - %AI, 12 - %AQ, 196 - %W
Start Point Offset	Start Point offset of Object12 to be associated with CROB Control Word	Value: 1 to No. of Obj12 Points Default: 0

3.2.5 AI Attributes

This section allows user to configure AI Polled and Events Objects configuration parameters – such as Analog Input Object 30, 32, and Analog Dead Band Objects - 34.

Table 14: AI Attributes

Parameters	Description	Valid Values
AI Attributes	If Enabled, the AI parameters get enabled for configuration. If Disabled, the AI parameters are not allowed to be configured. This parameter is applicable only for CPE400/CPL410.	Value: Enabled/Disabled Default: Enabled
Object30 Parameters		
Number of Points for Object30	Number of Points	Value: 1 to 2000 Default: 100 For CPE115: Value: 0 to 2000 If set to 0 AI Attributes is not available.
Memory Address for Object30	CPU Reference Memory Type & Address	Value: Memory Type: %R, %AI, %AQ, %W Allocates available reference Memory ranges Default: %AI00001 For CPE115: Memory Type: 8 - %R, 10 - %AI, 12 - %AQ, 196 - %W, If set to 0 AI Attributes is not available.
Default Static Variation for Object30	Analog Input Object30 Default Static Variation	Value: 1 – “32-bit with Flag” 2 – “16-bit with Flag” 3 – “32-bit without Flag” 4 – “16-bit without Flag”

Parameters	Description	Valid Values
		5 – “Single-precision, Floating point with Flag” 44 – “Special Code” (Static & Event shall go together) Default: 1 – “32-bit with Flag”
Object32 Parameters		
Default Event Variation for Object32	Analog Input Event Object32 Default Event Variation	Value: 1 – “32-bit without Time” 2 – “16-bit without Time” 3 – “32-bit with Time” 4 – “16-bit with Time” 5 – “Single-precision, Floating point without Time” 7 – “Single-precision, Floating point with Time” 44 – “Special Code” (Static & Event shall go together) Default: 3 – “32-bit with Time”
Default Event Mode for Object32	Object32 Default Event Mode	Value: 1 - SOE 2 - MOST RECENT Default: 2 - MOST RECENT
Default Class Mask for Object32	Object32 Default Event Class Mask	Value: 0 – CLASS MASK NONE 1 – CLASS MASK ONE 2 – CLASS MASK TWO 3 – CLASS MASK THREE Default: 2 – CLASS MASK TWO
Maximum Events for Object32	Maximum Number of Events for Event Object32	Value: 0 to 8000 Default: 500
Number of Point Configurations Object32	Number of Points that require other than default Event Mode & Class Mask	Value: 0 to Max. Point Configured Default: 0

Parameters	Description	Valid Values
	This parameter is only applicable for CPE400/CPL410	
Object34 Parameters		
Default Static Variation for Object34	Analog Input Object 34 Default Static Variation	Value: 1 – "16-bit" 2 – "32-bit" 3 – "Single-precision, Floating point" 44 – "Special Code" Default: 2 – "32-bit"

3.2.6 AO Attributes

This section allows user to configure AO Polled and Events Objects configuration parameters – such as Analog Output Status Object 40, 42, and Analog Outputs Objects – 41,43.

Table 15: AO Attributes

Parameters	Description	Valid Values
AO Attributes	If Enabled, the AO parameters gets enabled for configuration. If Disabled, the AO parameters are not allowed to be configured. This parameter is applicable only for CPE400/CPL410.	Value: Enabled/Disabled Default: Enabled
Object40 Parameters		
Number of Points for Object40	Maximum Number of Points	Value: 1 to 2000 Default: 100 For CPE115: Value: 0 to 2000 If set to 0 AO Attributes is not available
Memory Address for Object40	Memory Type & Address	Value: Memory Type: %R, %AI, %AQ, %W Allocates available reference Memory ranges Default: %AQ00001 For CPE115: Memory Type: 8 - %R, 10 - %AI, 12 - %AQ, 196 - %W If set to 0 AO Attributes is not available.

Parameters	Description	Valid Values
Default Static Variation for Object40	Analog Output Status Object40 Default Static Variation	Value: 1 – "32-bit with Flag" 2 – "16-bit with Flag" 3 – "Single-precision, Floating point with Flag" 44 – "Special Code" (Static & Event shall go together) Default: 1 – "32-bit with Flag"
Object42 Parameters		
Default Event Variation for Object42	Analog Output Status Event Object42 Default Event Variation	Value: 1 – "32-bit without Time" 2 – "16-bit without Time" 3 – "32-bit with Time" 4 – "16-bit with Time" 5 – "Single-precision, Floating point without Time" 7 – "Single-precision, Floating point with Time" 44 – "Special Code" (Static & Event shall go together) Default: 3 – "32-bit with Time"
Default Event Mode for Object42	Object42 Default Event Mode	Value: 1 - SOE 2 - MOST RECENT Default: 2 - MOST RECENT
Default Class Mask for Object42	Object42 Default Event Class Mask	Value:

Parameters	Description	Valid Values
		0 – CLASS MASK NONE 1 – CLASS MASK ONE 2 – CLASS MASK TWO 3 – CLASS MASK THREE Default: 2 – CLASS MASK TWO
Maximum Events for Object42	Maximum Number of Events for this Event object	Value: 0 to 8000 Default: 500
Number of Point Configurations Object42	Number of Points configured with other than default Event Mode & Class Mask that is set. This parameter is only applicable for CPE400/CPL410	Value: 0 to Max. Point configured Default: 0
Object41 Parameters		
Number of Points for Object41	Maximum Number of Points	Value: 0 to 1000 Default: 0
Memory Address for Object41	Memory Type & Address	Value: Memory Type: %R, %AI, %AQ, %W Allocates available reference Memory ranges Default: %AQ00201 For CPE115: Memory Type: 8 - %R, 10 - %AI, 12 - %AQ, 196 - %W
Command Variation for Object41	Analog Output Object41 Command Variation	Value: 1 – “32-bit” 2 – “16-bit”

Parameters	Description	Valid Values
		3 – “Single-precision, Floating point” Default: 1 – “32-bit”
Object43 Parameters		
Number of Points for Object43	Maximum Number of Points	Value: 0 to (Should be <= No. of Object 41 Points) Default: 0
Start Point Offset	Start Point offset of Object41 to be associated with Analog Output Command Event Object43	Value: 1 to No. of Obj41 Points Default: 0
Default Event Variation for Object43	Analog Output Command Event Object43 Default Event Variation	Value: 1 – “32-bit without Time” 2 – “16-bit without Time” 3 – “32-bit with Time” 4 – “16-bit with Time” 5 – “Single-precision, Floating point without Time” 7 – “Single-precision, Floating point with Time” Default: 3 – “32-bit with Time”
Default Event Mode for Object43	Object43 Default Event Mode	Value: 1 – SOE 2 - MOST RECENT Default: 2 - MOST RECENT

Parameters	Description	Valid Values
Default Class Mask for Object43	Object43 Default Event Class Mask	Value: 0 – CLASS MASK NONE 1 – CLASS MASK ONE 2 – CLASS MASK TWO 3 – CLASS MASK THREE Default: 3 – CLASS MASK THREE
Maximum Events for Object43	Maximum Number of Events for this Event Object	Value: 0 to 8000 Default: 500

Section 4 HSB Redundancy Configuration

This section describes how to configure a CPE400/CPL410 DNP3 Outstation in HSB Redundancy System.
Note: CPE115 does not support Redundancy.

4.1 CPE400/CPL410 DNP3 Outstation HSB Redundancy Configuration

Configure CPE400/CPL410 DNP3 Outstation in HSB Redundancy system as mentioned in section 5.1.1 of *PACSystems Hot Standby CPU Redundancy User Manual, GFK–2308*. In the Primary Controller under general setting property page, enable DNP3 Outstation Protocol, do the required parameter setting under 'DNP3 General Settings' and 'DNP3 Object Attributes' tabs. Now mirror the configuration to secondary controller.

NOTE: Validate Source IP and Validate Source Address are both enabled by default and users cannot disable these parameters in HSB configuration. It is mandatory to provide unique source LLA addresses and Source IPs.

Configure the Transfer List with a reference memory address ranges provided as part of DNP3 object settings tab under individual DI, DO, AI and AO attributes, Refer section 5.4.1.4 of *PACSystems Hot Standby CPU Redundancy User Manual, GFK–2308*.It is recommended to configure the Transfer List in Redundancy System, if transfer list is not configured with DNP3 references, the static data will not be synchronized in the very first sweep cycle after the Role Switch.

For additional information on HSB Redundancy Configuration and Download, please refer to *PACSystems Hot Standby CPU Redundancy User Manual, GFK–2308*.

Section 5 System Operation

This chapter provides a system overview and describes the following systems parameters:

- Controller and DNP3 Outstation Communication
- Strict Connection Control Parameters
- Event Buffer Configuration
- Sequence of Events (SOE)
- CROB Control Feature
- User Event Point Push Interface
- Special Code Variation - 44
- Per-Point Configuration
- Clock Valid Period and Time Sync
- DNP3 Keep Alive
- DNP3 Flags - Quality Force
- DNP3 Redundancy Feature
- Analog Deadband
- DNP3 Status using SVC_REQ #130
- I/O Scans
- Alarms
- Station Manager
- Enable/Disable SOE Mode at Runtime

5.1 Controller and DNP3 Outstation Communication

The CPE400/CPL410 and CPE115 during normal operation, handles asynchronous requests from its various DNP3 masters 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 the DNP3 application in controller will wait for the PME configuration. Once PME receives its configuration parameters, the DNP3 application scans the data, based on the information provided. The DNP3 application detects and registers data changes within the controller. It also services asynchronous DNP3 master requests for polling and writing of data to PLC reference memory.

The DNP3 application polls the CPU during the CPU background scan window for data, per its configuration. The application detects and records all corresponding data changes internally. Whenever master sends a write request, the application must wait for the corresponding scan window to allow it to write the information into the PLC Reference memory during the same window.

5.2 Strict Connection Control Parameters

The DNP3 Outstation application code is capable of enforcing strict acceptance of connections to the Outstation 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 Outstation allows the establishment of a white list of allowed connections, both TCP/IP and LLA Master Station addresses. The TCP/IP white listing can be enabled independently where as LLA white listing by default enables TCP/IP white listing.

Parameters used to configure the DNP3 Outstation to operate in a restrictive connection mode are:

CPE400/CPL410:

a) Validate Source IP
b) Validate Source Address

CPE115:

Table 16: Whitelisting Parameters

Parameter	Description
mDNP3_Setup [89]	Validate Source IP
mDNP3_Setup [122]	Validate Source Address

Whenever parameters **Validate Source IP** and **Validate Source Address** are Disabled, the DNP3 Outstation will accept connections from any master station without regard to it source IP or address.

For HSB System, Validate Source IP and Validate Source Address are enabled by default and are required to maintain integrity of events generated between the ACTIVE and BACKUP units. In case of failure in current ACTIVE unit, the BACKUP unit will take over and all the masters connected to the new ACTIVE unit will get their respective events.

5.2.1 Strict TCP/IP Address Matching

Use parameter Validate Source IP to enable restrictive TCP/IP addressing features. Parameters IP Address 1 through IP Address 8 are then used to set the IPV4 addresses of the master stations that are allowed to connect to the Outstation. Reference the table below for address assignments. Set values for these parameters as required by the application.

Table 17: Strict TCP/IP Address Matching

Parameter	Description
Validate Source IP	Strict TCP/IP Address Matching for Master Stations: Value: Enabled / Disabled For CPE115 Value:1/0
IP Address 1	Valid IP address - Master Station 1
IP Address 2	Valid IP address - Master Station 2
IP Address 3	Valid IP address - Master Station 3
IP Address 4	Valid IP address - Master Station 4
IP Address 5	Valid IP address - Master Station 5
IP Address 6	Valid IP address - Master Station 6
IP Address 7	Valid IP address - Master Station 7
IP Address 8	Valid IP address - Master Station 8

5.2.2 Strict Lower-Level Address Matching

Use parameter Validate Source Address to enable restrictive Lower-Level Address (LLA) addressing features. Parameters Source Address 1 through Source Address 8 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. Set values for these parameters as required by the application.

Table 18: Strict Lower-Level Address Matching

Parameter	Description
Validate Source Address	Strict LLA Address Matching for Master Stations: Value: Enabled / Disabled For CPE115
Source Address 1	Valid LLA address – Master Station 1
Source Address 2	Valid LLA address – Master Station 2
Source Address 3	Valid LLA address – Master Station 3
Source Address 4	Valid LLA address – Master Station 4
Source Address 5	Valid LLA address – Master Station 5
Source Address 6	Valid LLA address – Master Station 6
Source Address 7	Valid LLA address – Master Station 7
Source Address 8	Valid LLA address – Master Station 8

5.3 Event Buffer Configuration

Event Buffers can be configured for individual event Objects and Buffer length is configurable to a maximum of 8000 Events. DNP3 Outstation supports 6 Event Objects types (Obj 2, 11, 22, 32, 42, 43), total maximum events available are 48000. In case of CPE115 maximum supported events are 24000 .

The number of events or size of Event Buffer configured for a given Event object is utilized across all the configured DNP3 master sessions, even a single DNP3 master session can result in using up all the event buffer space. For e.g. If the number of configured masters is one, then all the 8000 events per object will be available for that master, if eight Masters are configured, then any of the masters or all the masters together can accommodate 8000 events for that given Object.

When there is any change in the data, events are generated at Outstation and stored in the Event Buffer Queue for all the configured number of master sessions, irrespective of the connection status. If any of the masters is not connected or if the events are not being polled by any of the masters, then the events are not removed from Event Buffer Queue, this results in consuming all the configured Event Buffer space without leaving room for the newly generated events to be stored in the buffer. When new events are generated but not able to store in the event buffer queue will result in setting up the IIN2.3 ‘Event buffer Overflow’ bit. To avoid this situation, it is recommended to only configure the required number of masters and perform regular data polls such as General Interrogation or RBE.

5.4 Sequence of Events (SOE)

Sequence of Events (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. SOE collection can be enabled by configuring the Event Mode as SOE in PME. For detailed description of supported Event Modes, refer Section 3.2.1. The SOE functionality for historical/buffered events will be available for all 8 masters on the configured DNP3 port.

SOE mode can store more than one event for a point, so a sequence of events history may be stored in the DNP3 Outstation whenever Event Mode is set as SOE. Events can either be instances of a single point change, or multiple changes of the same point.

The length of the Event Buffer for each individual event object is configurable and maximum buffer size can go up to 8000 events. If buffer size is set to 0 then SOE will be disabled and the event object will store only most recent events.

Once the Event buffer fills up, no more events data will be captured in the buffer and this will be indicated using IIN Over Flow bit. In reporting out the buffer contents, the Outstation transmits them in reverse chronological order: the first-recorded event will be

the last event transmitted. However, “Delete Oldest Event for Session[x]” parameters 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.

For CPE400/410 though the objects are configured with Event Mode as SOE for the channels, in Run mode using Service Request users can disable the SOE Event Mode for the selected channel through the channel Mask. When SOE channel mask value is set to 1 the configured Event mode as per the configuration (SOE or MOST_RECENT) is applicable, If the mask value is set to 0, then the configured Event Mode is set to MOST_RECENT.

For E.g. In CPE400 PME Configuration, if number of channels configured is 4, and If **mask value is set to16#0003**, the Master 1 & Master 2 will use the configured Event Mode (SOE or MOST_RECENT), and Master 3 & Master 4 will set the Event Mode to MOST_RECENT. For Service Request refer section 5.14.9.

For CPE115 though the objects are configured with Event Mode as SOE for the channels, using parameter **“mDNP3_Setup [29].x”** users can disable the SOE Event Mode for the selected channel through the channel Mask. When SOE channel mask value is set to 1 the configured Event mode as per the configuration (SOE or MOST_RECENT) is applicable, If the mask value is set to 0, then the configured Event Mode is set to MOST_RECENT. The mask ‘x’ indicates the channel number, the bit value [0 through 7] indicates channels numbers [1 through 8] if white listing of IP Address is enabled, else the bit value [0 through 7] indicate random channel numbers among [1 to 8].

For E.g. In CPE115 DNP3 parameters, if number of channels configured is 4, and If **mDNP3_Setup [29].x = 2#0000000000000011**, and with White listing enabled, the Master 1 & Master 2 will use the configured Event Mode (SOE or MOST_RECENT), and Master 3 & Master 4 will set the Event Mode to MOST_RECENT. If White listing is disabled, then any of the 2 Masters will have the configured Event mode and the other 2 Masters will have Event mode set to MOST_RECENT.

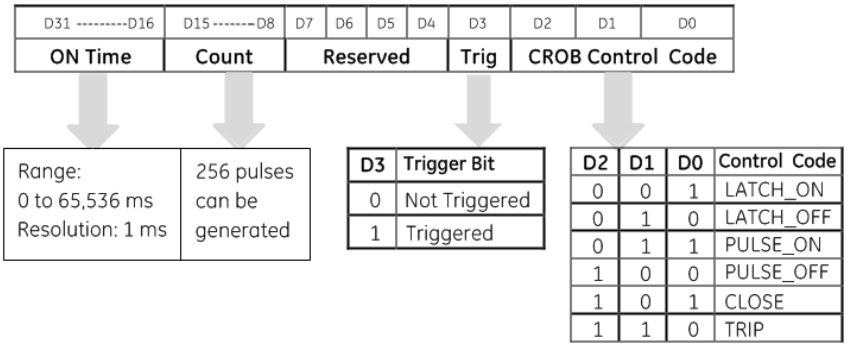
5.5 CROB Control Feature

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 CROB configuration. These configurations provide a mechanism for passing on the CROB control information like Control code and Control information coming from the DNP3 Master to the Controller Application logic, which can be used for generating desired commands.

5.5.1 CROB Control 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) are updated in the appropriate CROB Control DWord (32-bit) and Trigger bit is set, refer to Figure 12. 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 12: 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 12**Error! Reference source not found.**.

2. Trigger Bit

This is a read/write bit and is set by the Outstation Module 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 Module shall execute the operation. Counts greater than one 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 65,536 ms.

5.5.2 Parameters for CROB Control Block

The Parameters for configuring the CROB Control Block are:

Table 19: Parameters for CROB Control Block

CROB Parameters		
Number of Points for CROB	Number of CROB Points	Value: 0 to 1024 (Should be <= No. of Obj12 Points) Default: 0
Memory Address for CROB	CPU Reference Memory Type & Address	Value: Memory Type: %R, %AI, %AQ, %W Allocates available reference Memory ranges Default: %R00001 For CPE115: Memory Type: 8 - %R, 10 - %AI, 196 - %W
Start Point Offset	Start Point offset of Object12 to be associated with CROB Control Word	Value: 1 to No. of Obj12 Points Default: 0

If the “Number of Points for Obj12” parameter is set to 0, then no CROB words are configured. “Start Point Offset” parameter is offset/Point Number of Obj12 that needs to be associated with CROB Control DWord.

5.5.3 Example Configuration for CROB Control

The example presented here in Figure 13and Figure 14, shows the configuration required and the corresponding effect on memory usage for the CROB Control DWord:

For CPE400/410:

Figure 13: CROB Control DWord Layout

--- Object12 Parameters ---	
Number of Points for Object12	16
Memory Address for Object12	%M06001
--- CROB Parameters ---	
Number of Points for CROB	4
Memory Address for CROB	%R00200
Start Point Offset	5

For CPE115:

Figure 14: CROB Control DWord Layout for CPE115

```
// Object 12 Parameters
// Memory Type for Object 12: Value: 70-%I, 72-%Q, 76-%M, 74-%T, 86-%G, Default: 72
mDNP3_Setup[53] := 16;   // Number of Points for Object 12
mDNP3_Setup[54] := 76;   // Memory Type for Object 12
mDNP3_Setup[55] := 6001; // Memory Address for Object 12
mDNP3_Setup[56] := 1;    // Command Variation

// CROB Parameters
// Memory Type for CROB. Value: 8-%R, 10-%AI, 12-%AQ, 196-%W.
mDNP3_Setup[57] := 4;    // Number of Points for CROB
mDNP3_Setup[58] := 8;    // Memory Type for CROB
mDNP3_Setup[59] := 200;  // Memory Address for CROB
mDNP3_Setup[60] := 5;    // Start Point Offset
```

The mapping below is created per the above given configuration. The reference %M6005-%M6008 will be PLC Controlled CROB objects with associated CROB Control DWord in reference %R200-%R206.

Table 20: Example Configuration for CROB Control

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	

5.6 User Event Point Push Interface

Point Push Interface is a feature where users will have a mechanism to manually create and push an Event through user logic into DNP3 Outstation Event Buffer. It allows us to set the Event parameters such as DNP3 object type, Variance type, Point Number, Value, Date and Time, and/or flags information. 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 Outstation Module.

To use this feature, a special SVC_REQ #130, with protocol code 0x0002 can be used, for more information, please see Section 5.14.7. The SVC_REQ is configured with a custom record format as shown below, that will be used to push an Event into DNP3 Outstation Event Buffer.

Note: A DNP3 point that has been used in the Point Push will not get updated automatically when there is change in the actual reference memory data, it can only receive updates using Point Push Interface. So, care must be taken to use this feature only on the points to have such an intended behavior.

5.6.1 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. Refer Section 5.14.7 for point push service request, and Section 5.14.8 for Record Sample.

Table 21: Header Section of the Record Format

Index	Value	Description
[000]	1235	Specific value the Outstation will look for to start the
[001]	1 ... 65534	A counter or changed variable that will signal the Outstation 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.

Table 22: Record Section (may repeated up to 8 times)

Index	Field	Description and values
[003][1]	Object	01 – for DI, 10 – for DO 30 – for AI, 40 – for AO
[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[2]
[007]	Data[1]	High Word of Data[3]
[008]	Unused	Unused
[009]	Unused	Unused
[010]	Hour	Hours
[011]	Minute	Minutes
[012]	Seconds1k[4]	Seconds
[013]	Month	Month
[014]	Day	Day
[015]	Year	Year

5.6.2 Force Point Push for Digital/Analog Data

All the points in a DNP3 Object can be forced to update their data only through Point Push feature. When **"Force DI Points to Point Push"** parameter in DNP3 General Setting Tab is set to **True**, all the Points in Obj01 will start in Point Push mode. However, it takes a single snap-shot of all the point values at start up and will not mark the points with changed bit set in the flag. This feature can be used when the Point Push interface is being used with the Soft SOE block application, to not to detect change of data repeatedly for the same point.

Similarly, use **Force DO Points to Point Push**, **Force AI Points to Point Push** and **Force AO Points to Point Push** for the respective DNP3 Objects.

[1] *[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.*

[2] *In the case of DI or DO objects, when Data[0] is non-zero, Point Push interprets the value as True*

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

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

5.7 Special Code Variation - 44

The DNP3 Outstation provides a non-standard variation '44-Special Code' for analog objects such as Obj30, 32, 34, 40 and 42. This variation can be used in cases where an analog object points require with combination of three different data formats (16 bit, 32 bit and Single precision Floating Point Types) for a given DNP3 Analog Object.

When an analog object type configured to use this variation, it supports a maximum of 1200 Points with default data format set as shown below.

Point Count	44 – Special Code Variation	
	Default Static Variation	Default Event Variation
300	Analog Input 16-Bit Signed with Flag	Analog Input 16-Bit Signed with Flag and Time
300	Analog Input 32-Bit Signed with Flag	Analog Input 32-Bit Signed with Flag and Time
600	Analog Input 32-Bit Real with Flag	Analog Input 32-Bit Real with Flag and Time

CPE400/CPL410:

For example, see below Figure 15, Table 23:

Figure 15: Configuration example for Analog Inputs polled object:

--- AI Attributes ---	Enabled
--- Object30 Parameters ---	
Number of Points for Object30	1200
Memory Address for Object30	%AI00001
Default Static Variation Object30	44 - Special Code

CPE115:

For example, see below Figure 16, Table 23:

Figure 16: CPE115 Configuration example for Analog Inputs polled object:

```
//  Memory Type. Value: 8-%R, 10-%AI, 12-%AQ, 196-%W, Default
mDNP3_Setup[61] := 2000;  // Number of Points for Object30
mDNP3_Setup[62] := 10;    // Memory Type for Object30
mDNP3_Setup[63] := 1;     // Memory Address for Object30
mDNP3_Setup[64] := 44;    // Default Static Variation for Object30
```

Table 23: Example of Memory Layout when Obj30 variation set to '44 - Special Code'

Data Type	Register Memory Fixed	Range	Object Index	Master Request Options	
16 Bit INT	%AI0001-%AI002	300	*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
	%AI599-%AI600		*299*	Obj 30, Var2/Var 4	Obj 32, Var2/Var 4
32 Bit INT	%AI601-%AI602	300	*300*	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
			301	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
			302	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
			303	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
			304	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
			305	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
			306	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
			307	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
			..	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
	%AI1199-%AI1200		599	Obj 30, Var1/Var 3	Obj 32, Var1/Var 3
32 Bit REAL	%AI1201-%AI1202	600	*600*	Obj 30, Var5	Obj 32, Var5/Var7
			601	Obj 30, Var5	Obj 32, Var5/Var7
			602	Obj 30, Var5	Obj 32, Var5/Var7
			603	Obj 30, Var5	Obj 32, Var5/Var7
			604	Obj 30, Var5	Obj 32, Var5/Var7
			605	Obj 30, Var5	Obj 32, Var5/Var7
			606	Obj 30, Var5	Obj 32, Var5/Var7
			607	Obj 30, Var5	Obj 32, Var5/Var7
			..	Obj 30, Var5	Obj 32, Var5/Var7
	%AI2399-%AI2400		1199	Obj 30, Var5	Obj 32, Var5/Var7

5.8 Per-Point Configuration

For CPE400/CPL410, DNP3 Outstation supports point-level configuration, which allows users to configure different Event Class Mask Type and Event Mode for individual points that overrides the default values set at the Object level. Users can choose to configure per-point configuration either point basis or a range of points.

1. Object[xx] Per Point Configuration
2. Point Template configuration

For CPE115, this feature is not supported.

5.8.1 Object[xx] Per Point Configuration

User can use "**Number of Point Configurations Object[xx]"** parameter to set per point configuration, when this parameter is set to non-zero value it populates a new properties page tab which will allow us to do per-point configuration. A maximum of 512 points is allowed for a given event Object.

Users can configure the following parameters on Per Point basis:

Point Index:

Index of the Point for which the non-default configuration is required. This can be configured with values in **Range of 0 to Number of Points for Object[xx] - 1**. Index values need to be unique and cannot be duplicated.

Event Mode:

Event Mode can be configured with below modes:

a) MOST RECENT

b) SOE (Sequence to Events)

Class Mask:

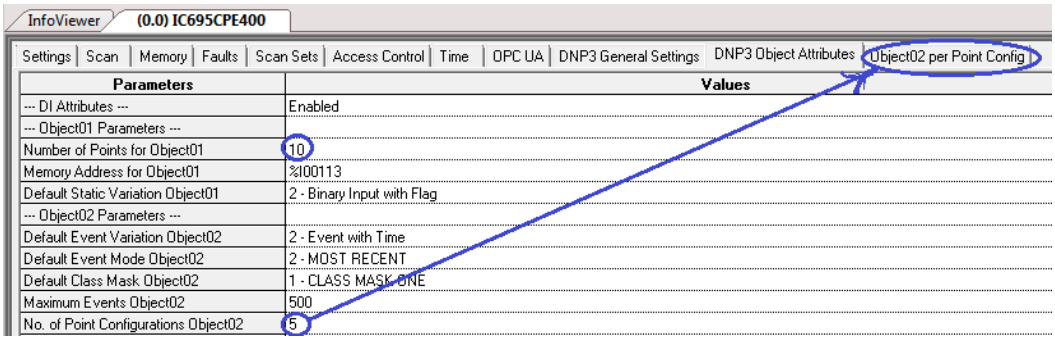
Event Class Mask Type can be configured with below types:

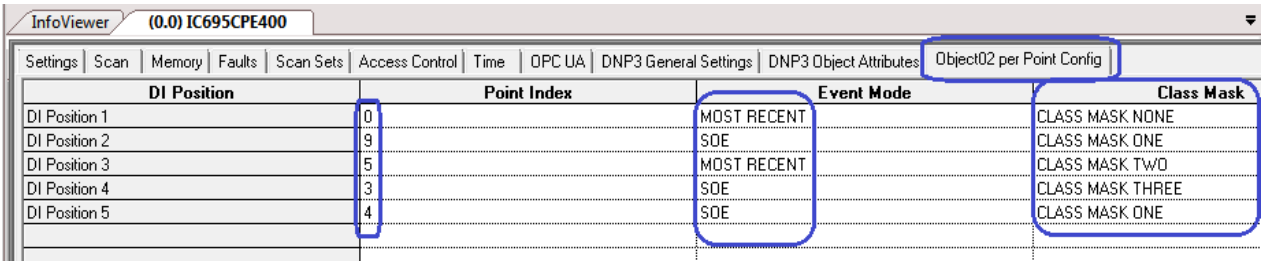
a) CLASS MASK NONE
b) CLASS MASK ONE
c) CLASS MASK TWO
d) CLASS MASK THREE

For e.g. - Per point Configuration - DI Attributes

In this example **Number of Points for Object01** are configured to 10 with default Event Mode as **MOST RECENT** and default Event Class Mask Type as **CLASS MASK ONE**. If user desire to configure 5 points with different Event Class Mask Type and Event Mode, then the 'No. of Point Configurations Object02' parameter needs to be set to 5 as shown below.

Figure 17: DI Attributes - Per-Point Configuration Parameters


InfoViewer
(0.0) IC695CPE400
Settings
Scan
Memory
Faults
Scan Sets
Access Control
Time
OPC UA
DNP3 General Settings
DNP3 Object Attributes
Object02 per Point Config
Parameters
Values
--- DI Attributes ---
Enabled
--- Object01 Parameters ---
Number of Points for Object01
10
Memory Address for Object01
%I00113
Default Static Variation Object01
2 - Binary Input with Flag
--- Object02 Parameters ---
Default Event Variation Object02
2 - Event with Time
Default Event Mode Object02
2 - MOST RECENT
Default Class Mask Object02
1 - CLASS MASK ONE
Maximum Events Object02
500
No. of Point Configurations Object02
5


InfoViewer
(0.0) IC695CPE400
Settings
Scan
Memory
Faults
Scan Sets
Access Control
Time
OPC UA
DNP3 General Settings
DNP3 Object Attributes
Object02 per Point Config
DI Position
Point Index
Event Mode
Class Mask
DI Position 1
0
MOST RECENT
CLASS MASK NONE
DI Position 2
9
SOE
CLASS MASK ONE
DI Position 3
5
MOST RECENT
CLASS MASK TWO
DI Position 4
3
SOE
CLASS MASK THREE
DI Position 5
4
SOE
CLASS MASK ONE

With the above configuration, all the object01 Points will have the following Class Mask Type and Event Mode as shown below:

Table 24: Point Index and its assignments

Point Index	Event Mode	Class Mask
0	MOST RECENT	CLASS MASK NONE
1 and 2	MOST RECENT	CLASS MASK ONE
3	SOE	CLASS MASK THREE
4	SOE	CLASS MASK ONE
5	MOST RECENT	CLASS MASK TWO
6 to 8	MOST RECENT	CLASS MASK ONE
9	SOE	CLASS MASK ONE

5.8.2 Point Template Configuration

User can use '**Point Template Configuration**' parameter to set required number of template configurations, when this parameter is set to non-zero value it populates a new properties page tab which will allow us to do Template configuration. A maximum of 100 templates is allowed in DNP3 Outstation Configuration. In Template Configuration a range of points for selected object can be configured to have different Event Class Mask Type and Event Mode other than the defaults configured at object level.

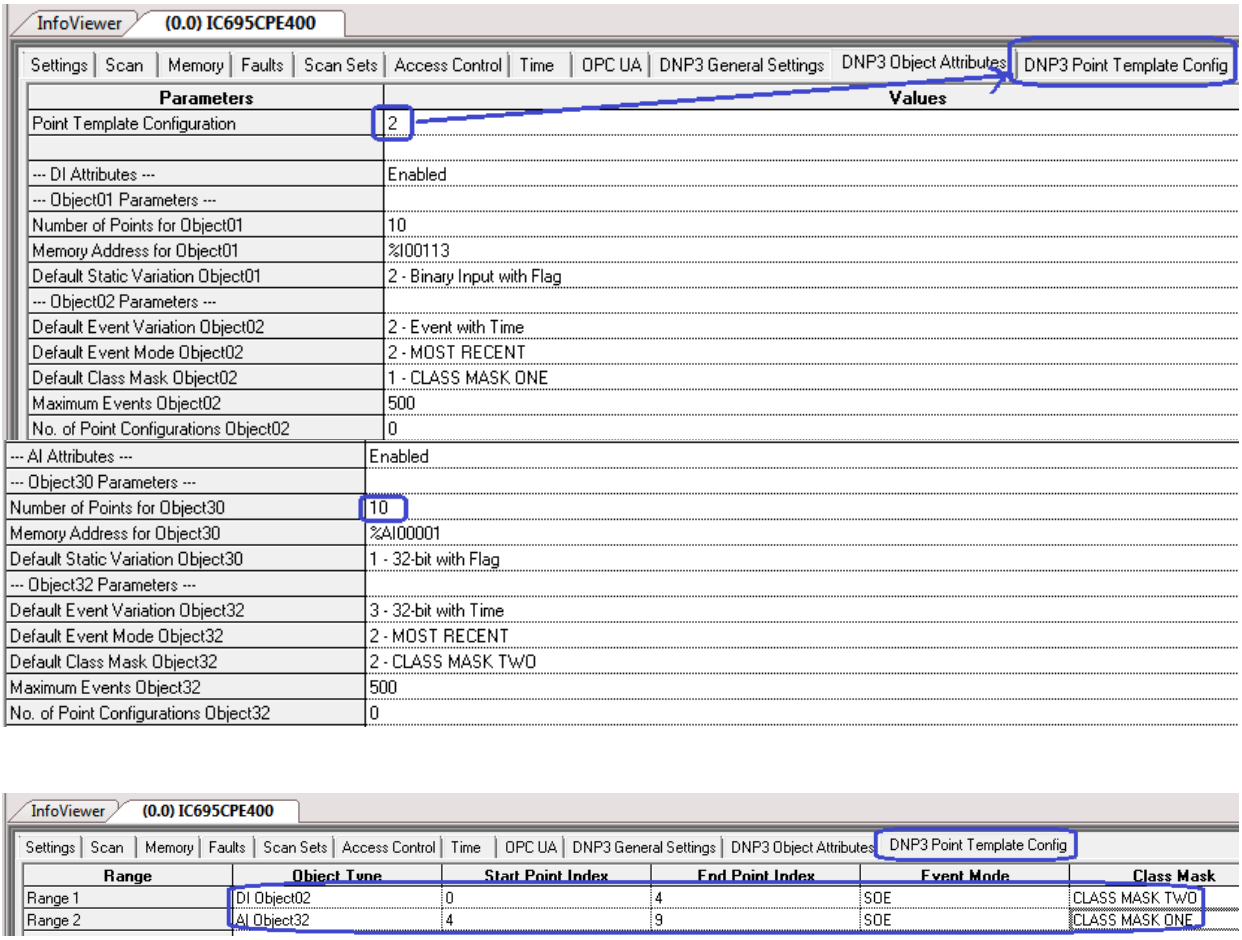
Users can configure the following parameters on template basis:

1. Object Type (Obj2, 12, 32, 42)
2. Range of Points (Start Point Index, End Point Index)
3. Event Mode
4. Event Class Mask Type

For e.g. - Point Template Configuration

In this example **Point Template Configuration** is configured to 1 and **Number of Points for Object01** are configured to 10 with default Event Mode as **MOST RECENT** and default Event Class Mask Type as **CLASS MASK ONE**.

Figure 18: Template Configuration - DI Attributes



With the above configuration, all the Object02 and Object32 Points will have Class Mask Type and Event Mode as shown below Table 25:

Table 25: Point Index Assignments

Point Index and its assignments for DI Object02

Point Index	Event Mode	Class Mask
0 to 4	SOE	CLASS MASK TWO
5 to 9	MOST RECENT	CLASS MASK ONE

Point Index and its assignments for AI Object32

Point Index	Event Mode	Class Mask
0 to 4	MOST RECENT	CLASS MASK TWO
4 to 9	SOE	CLASS MASK ONE

Note: When user selects both Per-Point Configuration and Point Template Configuration, below is the priority order for which point Class Mask Type and Event Mode gets over ridden.

1. Per Point Configuration
2. Point Template Configuration
3. Default Configuration

5.9 Clock Valid Period and Time Sync

Clock Valid Period: This parameter specifies how long the local clock will remain valid after receiving a time synchronization message from DNP3 Master. This value is applicable when '**DNP3 Time-Sync Required'** parameter is Enabled.

DNP3 Time-Sync Required: This parameter specifies whether the DNP3 Outstation will set the 'Need Time IIN' bit at Startup and after every clock valid period has elapsed. When DNP3 Master sees this bit, it responds with a time synchronization message. Upon receiving this time synchronization message DNP3 Outstation sets the CPU time. This time is used to Time stamp the Events while reporting the Events.

Note: When SNTP is enabled in the CPU, it is recommended to set the '**DNP3 Time-Sync Required**' to **False** to avoid conflict in setting up the CPU time.

5.10 DNP3 Keep Alive

DNP3-TCP Keep Alive: This parameter specifies how often to send link status requests if no DNP3 frames have been received on a given session. In DNP3 IP Networking specification, this is called keep-alive interval. A value of zero will turn off DNP3 Keep alive feature.

Link timeout Disconnect: This parameter specifies to disconnect/reconnect a connection when DNP3-TCP Keep Alive link status request times out. When this parameter is set to **True,** it disconnects the session when Link status request times out.

5.11 DNP3 Flags - Quality Force

Users can use '**Enable Quality Force'** parameter in the DNP3 Outstation to Enable / Disable the forcing of the ONLINE bit to Set/Re-Set in DNP3 Objects Flags.

When this parameter is **Enabled**, parameter **QF Memory Address** is populated with CPU Reference address in the PME, this reference address can be used to control the Quality State of DNP3 objects to set **Online / Offline** when there is a change in the point data. If

parameter is set to **Disable**, then Quality Force will not be applicable, and Quality will be driven by the CPU RUN/STOP state.

Below is the state table:

Table 26: Quality Force State Table

CPU RUN State	Data in QF Memory Address	Quality State in Flags
STOP	0	Offline
STOP	1	Offline
RUN	0	Offline
RUN	1	Online

Note: Users can use this reference address and set its value in runtime logic to interlock quality state with other interlocks.

5.12 DNP3 Redundancy Feature

The CPE400/CPL410 DNP3 utilizes Redundant IP feature allowing two HSB CPE400/CPL410 controllers to appear as one DNP3 Outstation module.

DNP3 Redundancy has two CPE400/CPL410 Units in a Hot-Standby setup – Primary unit and Secondary unit. Primary or Secondary status of a unit is decided by the PME configuration. The unit which goes into Run mode first in a Redundancy setup will act as an ACTIVE unit and the other unit will automatically take up the BACKUP unit role. DNP3 Master establishes communication with DNP3 Outstation ACTIVE unit using Redundant IP. Events are always generated and reported to DNP3 Master by ACTIVE Unit only.

Events generated in the ACTIVE unit are always synchronized to the BACKUP unit in every CPU sweep cycle. This allows users to not lose any events when there is a single point failure in the current ACTIVE CPU.

For detailed Operation of HSB Redundancy system refer the *PACSystems Hot Standby CPU Redundancy User Manual, GFK-2308*.

Note:

1. The CROB function, Analog Output Value and Point Push Data will be processed by the ACTIVE Unit only.
2. A master connected to an RX3i HSB system that uses Redundant IP can experience a bump, or loss of communication with DNP3 master in the event of a role switch. 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. The DNP3 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.
3. DNP3 redundancy is not available in HSB System when LAN2 is configured with PROFINET since Redundant IP is not supported.

For CPE115, DNP3 Redundancy feature is not supported.

5.13 Analog Deadband

Users can use the DNP3 Object34 – Analog Deadband to control the rate of Events generated for the Analog Input Object30 points. An analog input point may use Deadbands to determine when there is a change of input value sufficient to be of interest and report an Event for the change. DNP3 Master can set and report the Analog Deadband value for a given Analog Input point.

When a non-zero Analog Deadband value is set for a given Analog Input point and the absolute value of the difference between the present value of that point and the value that was most recently queued as an event for that point, exceeds the Deadband value, then an event is generated.

A Deadband of zero permits any change in the Analog Input value to generate an event, and a Deadband of the full range of the variable prevents generation of an event.

Example:

Consider an Analog Input point is set with a Deadband value of 100 and current value of that point is 50, and now if the point value changes to 70, then the change in value is not reported as an event to the master since the absolute difference is not greater than the Deadband value, but the static value of the point is updated to 70. However, if the point value changes from 70 to 180, then this change in value is reported to the master, since the difference is greater than the Deadband value set.

5.14 DNP3 SVC_REQ #130 commands

The CPU provides Service Request SVC_REQ#130 to configure the DNP3 Outstation, and to know the DNP3 Outstation status.

5.14.1 DNP3 Outstation Service Request

The service request #130, with Protocol code 0x0002 (dedicated for DNP3 Outstation) can be used to get the status of the DNP3 Outstation. It contains sub-functions to accomplish different tasks as shown in sections below.

Table 27: SERVICE_REQUEST 130 Protocols

Protocol	Code
OPC UA SERVER	16#0001
DNP3 OUTSTATION	16#0002

Note: All other protocol codes other than shown above are reserved, and if used, the SVC_REQ function will not pass power.

The DNP3 specific sub-functions are shown in below table.

Table 28: SERVICE_REQUEST 130, Protocol 2, Sub-Functions:

Sub-function	Code	Sub-function command Supported by CPU
START	16#00	CPE115
STOP	16#01	CPE115
CLEAR	16#02	CPE115
SLAVE_STATUS	16#03	CPE400/CPL410 and CPE115
CONFIG_STATUS	16#04	CPE400/CPL410 and CPE115
SEND_POINT_PUSH_DATA	16#05	CPE400/CPL410 and CPE115
SOE_ENABLE_DISABLE_MASK	16#06	CPE400/CPL410

Note: All other sub-functions that are reserved; if used, the SVC_REQ function does not pass power.

5.14.2 Service Request Sub-function – START(0x00)

This function starts the DNP3 Outstation with the provided configuration parameters for CPE115.

Note: This request can only be successfully performed when the DNP3 Outstation is in a READY TO START state after power-on / has been stopped using a service request STOP. The controller will set the corresponding status bit (RUNNING) in the DNP3 Outstation status if the command has been handled successfully.

When resuming from STOPPED to READY_TO_START state using a service request the dynamic (or run-time) changes made to the configuration parameters will not be effective. To enforce modified configuration data, it is mandatory to follow the sequence of STOP → CLEAR → START commands using service request.

Table 29: Parameters for START sub-function service request

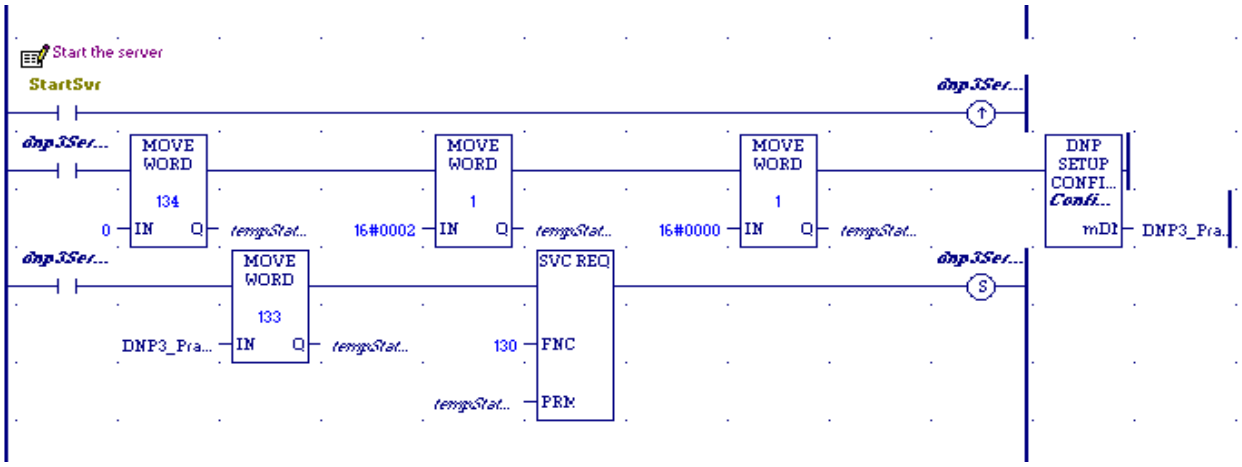
Parameter	Summary	Data Direction (LD perspective)
16#0002	DNP3 Outstation Protocol	IN
16#0000	START Request	IN
133 Words of Configuration Data	DNP3 Configuration Data	IN

The use of the START sub-function code in a ladder diagram is illustrated in the following example. If the SVC_REQ does not pass power, it indicates a failure.

Note: In this example, an ST block is used to copy the configuration parameters to the memory area (%R) used by the Service Request.

Example:

Figure 19: START Service Request



Service Request Sub-function – STOP(0x01)

This function puts the DNP3 Outstation in STOPPED state for CPE115. In this state, 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.

Note:

a. This request can only be successfully performed when the DNP3 Outstation is in RUNNING state. It does not remove or clear the configuration files. The controller will set the corresponding status bit (STOPPED) in the DNP3 Outstation status if the command has been handled successfully.

b. When resuming from STOPPED to READY_TO_START state using a service request the changes made to the configuration parameters will not be effective. For changes to be effective a CLEAR request must be issued after sending the STOP request.

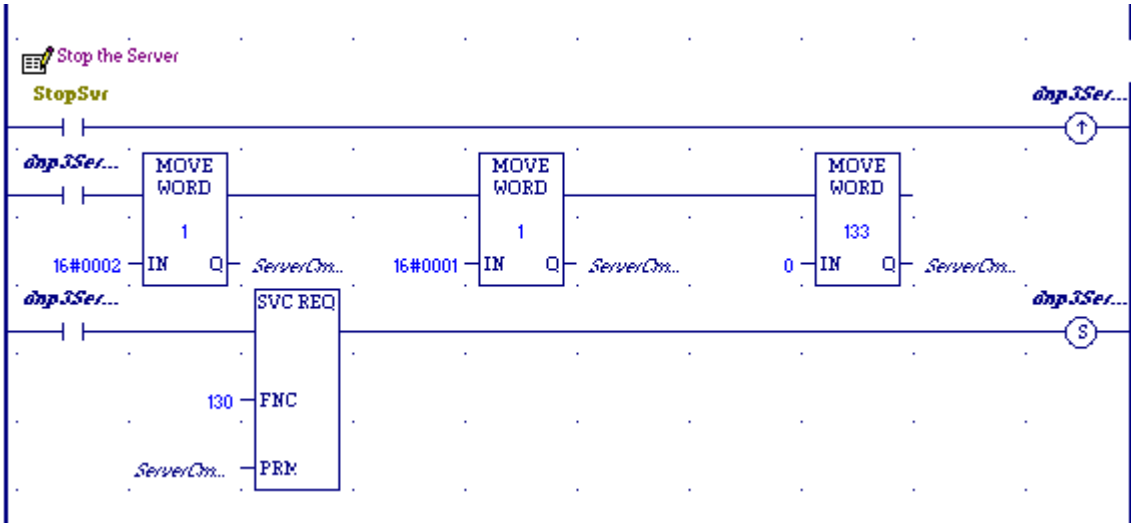
Table 30: Parameters for STOP sub-function service request

Parameter	Summary	Data Direction (LD perspective)
16#0002	DNP3 Outstation Protocol	IN
16#0001	STOP request	IN

The use of the STOP sub-function code in a ladder diagram is illustrated in the following example. If the SVC_REQ does not pass power, it indicates a failure.

Example:

Figure 20: STOP Service Request



5.14.3 Service Request Sub-function – CLEAR(0x02)

This function clears the DNP3 configuration parameters stored by the DNP3 Outstation for CPE115.

Note: This request can only be successfully performed when the DNP3 Outstation has been stopped. The controller will set the corresponding status bit (CONFIG_STAT_WAITING) in the DNP3 Config status if the command has been handled successfully.

Table 31: Parameters for CLEAR sub-function service request

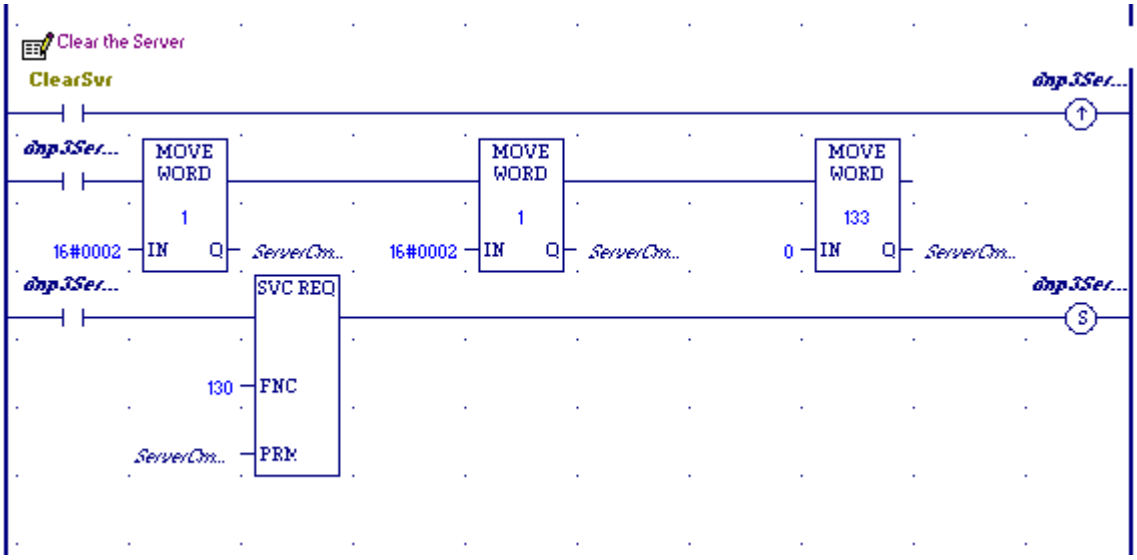
Parameter	Summary	Data Direction (LD perspective)
16#0002	DNP3 Outstation Protocol	IN
16#0002	CLEAR request	IN

If the SVC_REQ does not pass power, it indicates a failure.

The use of the CLEAR sub-function code in a ladder diagram is illustrated in the following example.

Example:

Figure 21: CLEAR Service Request



5.14.4 DNP3 Outstation re-configuration using Service Request

For CPE115, DNP3 Outstation configuration can be changed during run time without stopping and clearing the Hardware configuration using Service Request. Follow below steps to re-configure the DNP3 outstation.

1. Stop DNP3 Outstation using Service Request Sub-function command – STOP(0x01).
2. Clear DNP3 Outstation configuration using Service Request Sub-function command – CLEAR(0x02).
3. Modify DNP3 Configuration ST Block parameters as per requirement.
4. Do Run Mode Store of the modified DNP3 configuration ST Block.
5. Start DNP3 Outstation using Service Request Sub-function command – START(0x00).

For CPE400/410, this feature is not applicable.

5.14.5 Service Request Sub-function – SLAVE_STATUS(0x03)

The SLAVE_STATUS sub-function code can be used to obtain 16-bit info about the current state of the DNP3 Outstation. The sub-function response uses the following bitmasks:

INIT_IN_PROGRESS	0x0001
READY_TO_START	0x0002
RUNNING	0x0004
STOPPED	0x0008

POINT_PUSH_IN_PROGRESS	0x0100
ACTIVE_UNIT	0x0200
BACKUP_UNIT	0x0400

Table 32: Parameters for the SLAVE_STATUS sub-function service request

Parameter	Summary	Data Direction (LD perspective)
16#0002	DNP3 Outstation Protocol	IN
16#0003	SLAVE_STATUS request	IN
0000 0000 0000 0000	Slave Status Response – bitmask (see below)	OUT

The use of the SLAVE_STATUS sub-function code in a ladder diagram is illustrated in the following example. If the SVC_REQ does not pass Power, it indicates a failure.

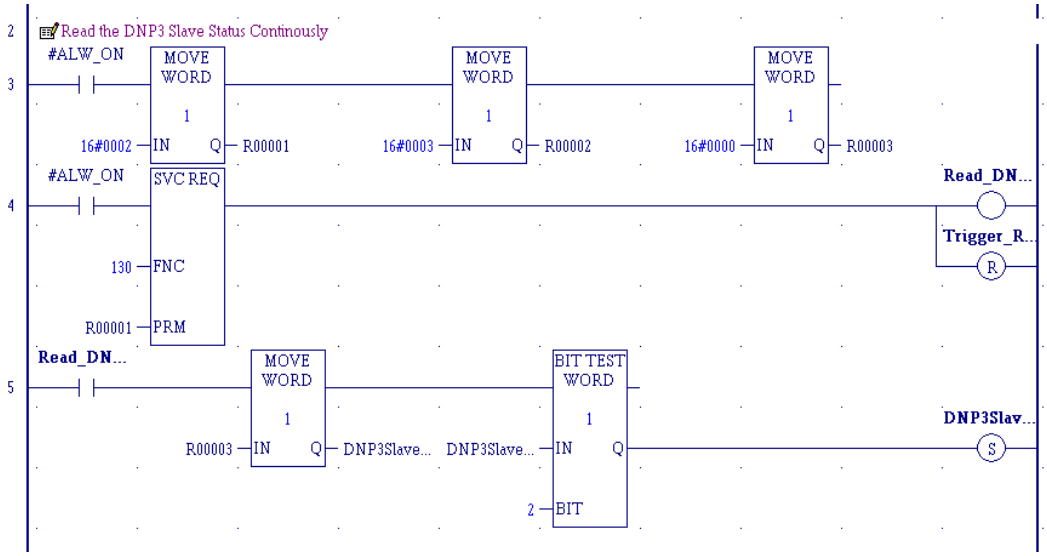
The SERVER_STATUS word bit definitions are displayed below.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	-	-	-	-	BACKUP	ACTIVE	POINT PUSH IN PROGRESS	-	-	-	-	STOPPED	RUNNING	READY TO START	INIT IN PROGRESS

Note: While the DNP3 Outstation is starting, the *SLAVE_STATUS* service request returns 0001h *DNP3 Outstation Initialization in Progress.*

Example:

Figure 22: SLAVE_STATUS Service Request



5.14.6 Service Request Sub-function – CONFIG_STATUS(0x04)

The CONFIG_STATUS sub-function code can be used to obtain info about the configuration status of the DNP3 Outstation. The sub-function response uses the following bitmask:

WAITING	0x0001
IN_PROGRESS	0x0002
CONFIGURED	0x0004
INVALID	0x0008

Table 33: Parameters for the CONFIG_STATUS sub-function service requests

Parameter	Summary	Data Direction (LD perspective)
16#0002	DNP3 Outstation Protocol	IN
16#0004	CONFIG_STATUS request	IN
0000 0000 0000 0000	Config Status Response - bitmask	OUT

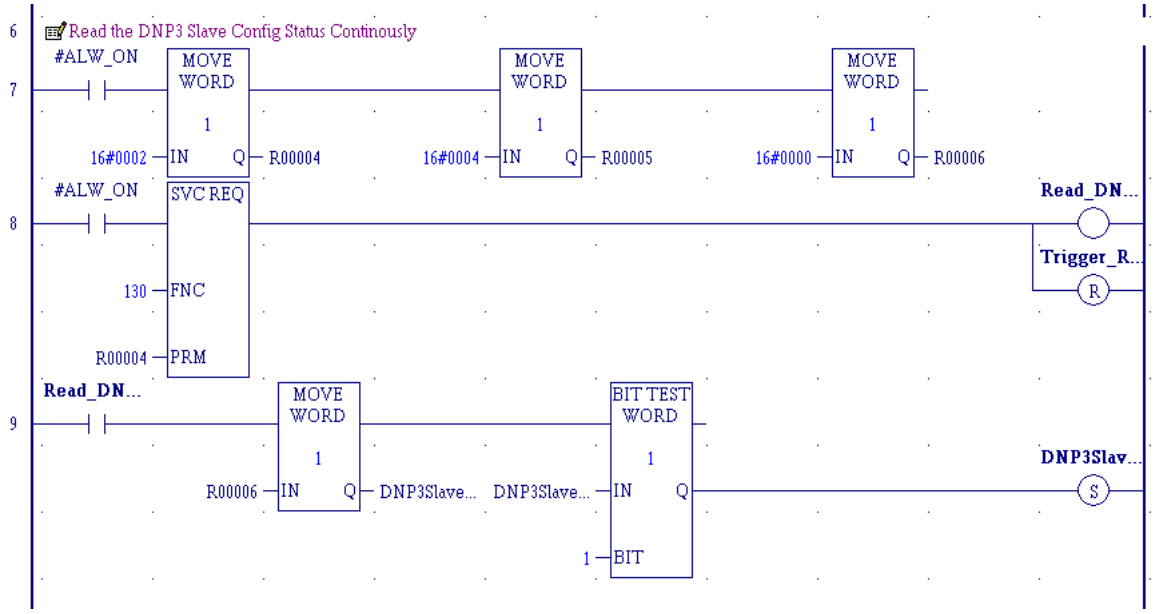
The use of the CONFIG_STATUS sub-function code in a ladder diagram is illustrated in the following example. If the SVC_REQ does not pass Power, it indicates a failure.

The CONFIG_STATUS word bit definitions are displayed below.

15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	0
-	-	-	-	-	-	-	-	-	-	-	-	INVALID CONFIG	CONFIGURED	CONFIG IN PROGRESS	WAITING FOR CONFIG

Example:

Figure 23: CONFIG_STATUS Service Request



5.14.7 Service Request Sub-function – SEND_POINT_PUSH_DATA(0x05)

Point Push Interface is a feature where users will have a mechanism to manually create and push an Event through user logic into DNP3 Outstation Event Buffer. Refer Section 5.6.

Note: This request can only be successfully performed when the DNP3 Outstation is in CONFIGURED & RUNNING state, otherwise it may fail. The controller will set the corresponding bit in the DNP3 Outstation status if the command is in progress.

POINT_PUSH_IN_PROGRESS 0x0100

Table 34: Parameters for the SEND_POINT_PUSH_DATA sub-function service request

Parameter	Summary	Data Direction (LD perspective)
16#0002	DNP3 Outstation Protocol	IN
16#0005	Send Point Push Data Request	IN
107 Words[5] of Point Push Data for 8 Records.	DNP3 Configuration Data	IN

Note: The length of Point Push Data may vary based on the number of Point Push Records. The maximum number of point push records supported are limited to 8.

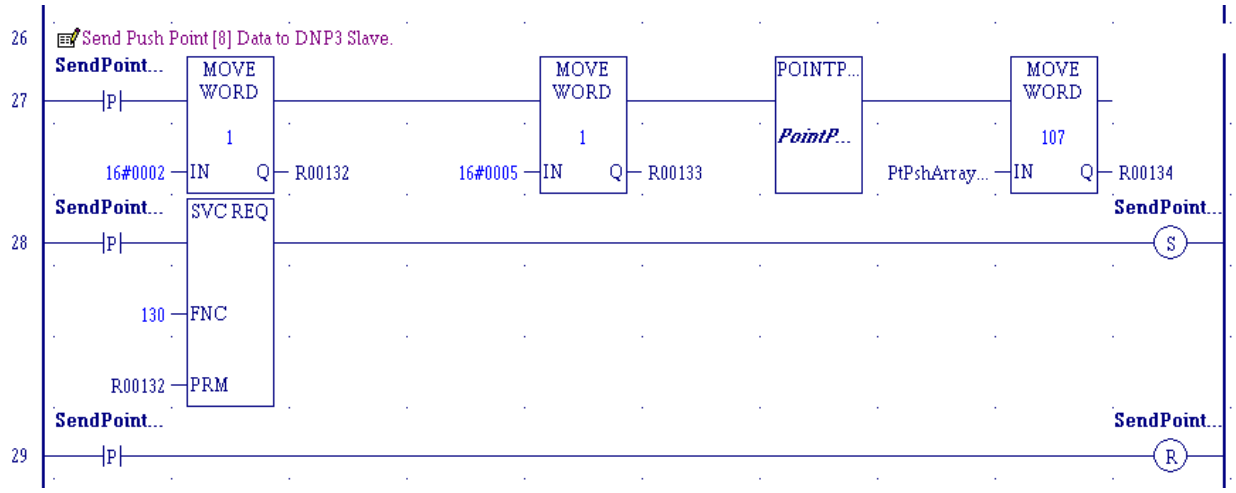
The use of the SEND_POINT_PUSH_DATA sub-function code in a ladder diagram is illustrated in the following example. If the SVC_REQ does not pass Power, it indicates a failure.

[5] *For more information on configuration data, refer to Section 5.14.8.*

Example:

Note: In this example, an ST block is used to copy the point push data to the memory area (%R) used by the Service Request.

Figure 24: SEND_PUSH_POINT Service Request



5.14.8 Point Push Data Example

This section provides the sample of individual parameters of the 8 Point Push Data records used in ST block in above figure.

```
'-------------------------------------
' Created: Tuesday, November 11, 2019
'
' Description:
'
'-------------------------------------
mCountSeq := mCountSeq + 1;

if mCountSeq = 0 then
  mCountSeq := 1;
end_if;

if mCountSeq > 59999 then
  mCountSeq := 1;
end_IF;

// Array length is 107 [0 to 106] Words
PtPshArrayLL4[0  ] := 1235;   // This needs to be a key value
of 1237
PtPshArrayLL4[1  ] := mCountSeq;  // This number has to
different than the last time
PtPshArrayLL4[2  ] := 8;      // This is the number of Records,
1 to 8

//  #1
PtPshArrayLL4[3  ] := 1;   //Object type: 01-DI, 10-DO, 30-AIV,
40-AOV
PtPshArrayLL4[4  ] := 0;   //Variance Typically 0
PtPshArrayLL4[5  ] := 17;   //Point number
PtPshArrayLL4[6  ] := Input_Pt;   //Data [0]
PtPshArrayLL4[7  ] := 0;   //Data [1]
PtPshArrayLL4[8  ] := 0;   //unused
PtPshArrayLL4[9  ] := 0;   //unused
PtPshArrayLL4[10 ] := 2;   //hour
PtPshArrayLL4[11 ] := 1;   //minute
PtPshArrayLL4[12 ] := mCountSeq;//second
PtPshArrayLL4[13 ] := 4;     //month
PtPshArrayLL4[14 ] := 18;     //day
PtPshArrayLL4[15 ] := 17;     //year 2k based
// #2
PtPshArrayLL4[16 ] := 10;   //Object type: 01-DI, 10-DO, 30-
AIV, 40-AOV
PtPshArrayLL4[17 ] := 0;   //Variance Typically 0
PtPshArrayLL4[18 ] := 17;   //Point number
PtPshArrayLL4[19 ] := Output_Pt;   //Data [0]
PtPshArrayLL4[20 ] := 0;   //Data [1]
PtPshArrayLL4[21 ] := 0;   //unused
PtPshArrayLL4[22 ] := 0;   //unused
PtPshArrayLL4[23 ] := 2;   //hour
PtPshArrayLL4[24 ] := 1;   //minute
PtPshArrayLL4[25 ] := mCountSeq;//second
PtPshArrayLL4[26 ] := 4;     //month
```

```
PtPshArrayLL4[27 ] := 18;     //day
PtPshArrayLL4[28 ] := 17;     //year 2k based
// #3
PtPshArrayLL4[29 ] := 30;   //Object type: 01-DI, 10-DO, 30-AIV, 40-
AOV
PtPshArrayLL4[30 ] := 0;   //Variance Typically 0
PtPshArrayLL4[31 ] := 5;   //Point number
PtPshArrayLL4[32 ] := AIV_Var2;   //Data [0]
PtPshArrayLL4[33 ] := 0;   //Data [1]
PtPshArrayLL4[34 ] := 0;   //unused
PtPshArrayLL4[35 ] := 0;   //unused
PtPshArrayLL4[36 ] := 2;   //hour
PtPshArrayLL4[37 ] := 1;   //minute
PtPshArrayLL4[38 ] := mCountSeq;//second
PtPshArrayLL4[39 ] := 4;     //month
PtPshArrayLL4[40 ] := 18;     //day
PtPshArrayLL4[41 ] := 17;     //year 2k based
// #4
PtPshArrayLL4[42 ] := 30;   //Object type: 01-DI, 10-DO, 30-AIV, 40-
AOV
PtPshArrayLL4[43 ] := 0;   //Variance Typically 0
PtPshArrayLL4[44 ] := 6;   //Point number
PtPshArrayLL4[45 ] := AIV_Var1_1;   //Data [0]
PtPshArrayLL4[46 ] := AIV_Var1_2;   //Data [1]
PtPshArrayLL4[47 ] := 0;   //unused
PtPshArrayLL4[48 ] := 0;   //unused
PtPshArrayLL4[49 ] := 2;   //hour
PtPshArrayLL4[50 ] := 1;   //minute
PtPshArrayLL4[51 ] := mCountSeq;//second
PtPshArrayLL4[52 ] := 4;     //month
PtPshArrayLL4[53 ] := 18;     //day
PtPshArrayLL4[54 ] := 17;     //year 2k based
// #5
PtPshArrayLL4[55 ] := 30;   //Object type: 01-DI, 10-DO, 30-AIV, 40-
AOV
PtPshArrayLL4[56 ] := 0;   //Variance Typically 0
PtPshArrayLL4[57 ] := 7;   //Point number
PtPshArrayLL4[58 ] := AIV_Var3_1;   //Data [0]
PtPshArrayLL4[59 ] := AIV_Var3_2;   //Data [1]
PtPshArrayLL4[60 ] := 0;   //unused
PtPshArrayLL4[61 ] := 0;   //unused
PtPshArrayLL4[62 ] := 2;   //hour
PtPshArrayLL4[63 ] := 1;   //minute
PtPshArrayLL4[64 ] := mCountSeq;//second
PtPshArrayLL4[65 ] := 4;     //month
PtPshArrayLL4[66 ] := 18;     //day
PtPshArrayLL4[67 ] := 17;     //year 2k based
// #6
PtPshArrayLL4[68 ] := 40;   //Object type: 01-DI, 10-DO, 30-AIV, 40-
AOV
PtPshArrayLL4[69 ] := 0;   //Variance Typically 0
PtPshArrayLL4[70 ] := 5;   //Point number
PtPshArrayLL4[71 ] := AOV_Var2;   //Data [0]
PtPshArrayLL4[72 ] := 0;   //Data [1]
PtPshArrayLL4[73 ] := 0;   //unused
PtPshArrayLL4[74 ] := 0;   //unused
PtPshArrayLL4[75 ] := 2;   //hour
PtPshArrayLL4[76 ] := 1;   //minute
PtPshArrayLL4[77 ] := mCountSeq;//second
PtPshArrayLL4[78 ] := 4;     //month
PtPshArrayLL4[79 ] := 18;     //day
PtPshArrayLL4[80 ] := 17;     //year 2k based
// #7
```

```
PtPshArrayLL4[81 ] := 40;   //Object type: 01-DI, 10-DO, 30-AIV, 40-
AOV
PtPshArrayLL4[82 ] := 0;   //Variance Typically 0
PtPshArrayLL4[83 ] := 6;   //Point number
PtPshArrayLL4[84 ] := AOV_Var1_1;   //Data [0]
PtPshArrayLL4[85 ] := AOV_Var1_2;   //Data [1]
PtPshArrayLL4[86 ] := 0;   //unused
PtPshArrayLL4[87 ] := 0;   //unused
PtPshArrayLL4[88 ] := 2;   //hour
PtPshArrayLL4[89 ] := 1;   //minute
PtPshArrayLL4[90 ] := mCountSeq;//second
PtPshArrayLL4[91 ] := 4;     //month
PtPshArrayLL4[92 ] := 18;     //day
PtPshArrayLL4[93 ] := 17;     //year 2k based
// #8
PtPshArrayLL4[94 ] := 40;   //Object type: 01-DI, 10-DO, 30-AIV, 40-
AOV
PtPshArrayLL4[95 ] := 0;   //Variance Typically 0
PtPshArrayLL4[96 ] := 7;   //Point number
PtPshArrayLL4[97 ] := AOV_Var3_1;   //Data [0]
PtPshArrayLL4[98 ] := AOV_Var3_2;   //Data [1]
PtPshArrayLL4[99 ] := 0;   //unused
PtPshArrayLL4[100] := 0;   //unused
PtPshArrayLL4[101] := 2;   //hour
PtPshArrayLL4[102] := 1;   //minute
PtPshArrayLL4[103] := mCountSeq;//second
PtPshArrayLL4[104] := 4;     //month
PtPshArrayLL4[105] := 18;     //day
PtPshArrayLL4[106] := 17;     //year 2k based
//
```

5.14.9 Service Request Sub-function – SOE_ENABLE_DISABLE_MASK(0x06)

For CPE400/410 though the objects are configured with Event Mode as SOE for the channels, in Run mode using Service Request users can disable the SOE Event Mode for the selected channel through the channel Mask. When SOE channel mask value is set to 1 the configured Event mode as per the configuration (SOE or MOST_RECENT) is applicable, If the mask value is set to 0, then the configured Event Mode is set to MOST_RECENT.

The use of the Enable/Disable SOE Mode at Runtime sub-function code in a ladder diagram is illustrated in the following example. If the SVC_REQ does not pass Power, it indicates a failure.

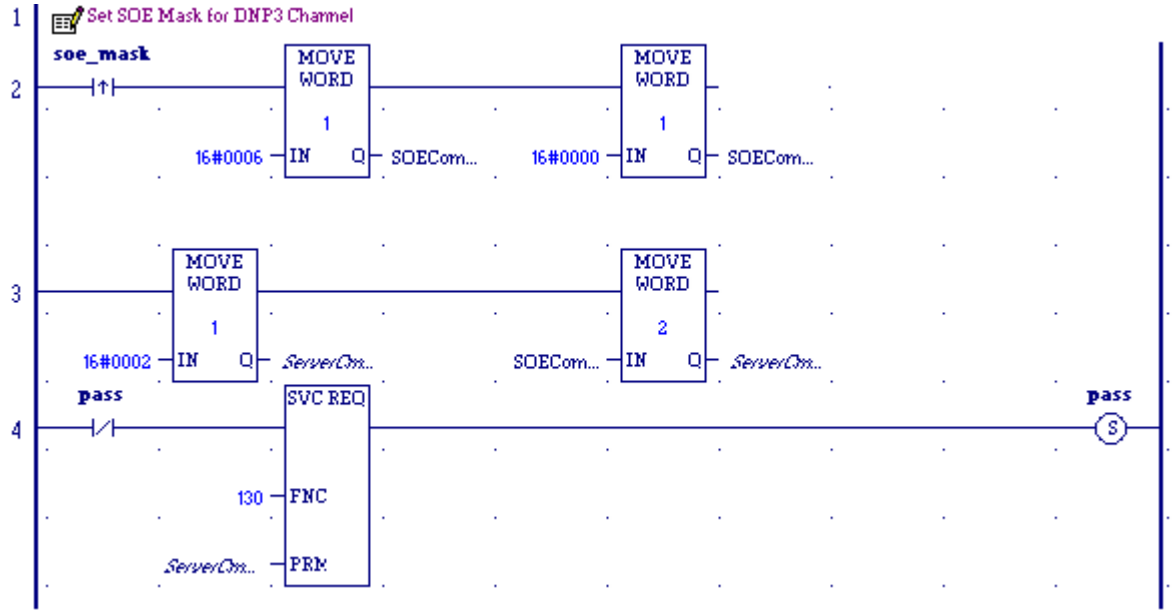
Table 35: Parameters for Enable/Disable SOE Mode at Runtime sub-function service request

Parameter	Summary	Data Direction (LD perspective)
$X_8X_7X_6X_5X_4X_3X_2X_1$	SOE Channel – bitmask for each of 8 channels respectively X = 1, For Channel Events, Event Mode is set to PME configuration X = 0, For Channel Events, Event Mode is forced to MOST_RECENT	IN

Note: This request can be successfully performed when the DNP3 Outstation is CONFIGURED for TCP/IP and/or LLA whitelisting enabled and in RUNNING state, otherwise service request will not pass the power.

Example:

Figure 25: SOE_ENABLE_DISABLE_MASK Service Request



5.15 I/O Scans

The CPE400/CPL410 and CPE115 module for DNP3 data exchange does not use a specific I/O Scan Set as defined in the PME processor **Settings** tab, and in the **Ethernet** tab for the CPE400/CPL410 and CPE115 Module.

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 DNP3 Master. In STOP Mode, CROB and Analog Output Values will return a failure to the Master Station.

RUN IO Disable

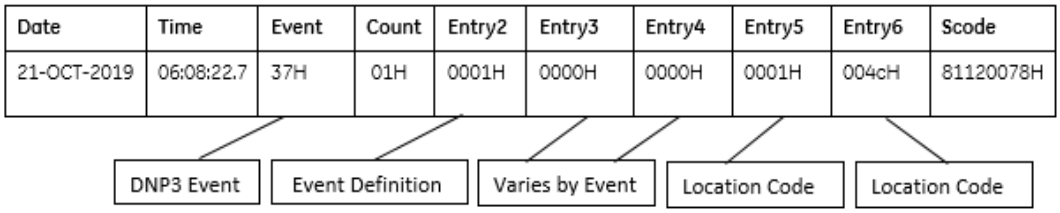
In RUN IO Disable Mode, the DNP3 Outstation will respond as documented for STOP Mode.

5.16 Alarms

DNP3 Outstation will internally log messages to the CPU log, most of these faults are not fatal, a given fault may relate to the Ethernet interface, or may be specific to the DNP3 Outstation functionality. Fatal and recurrent other faults should be reported to technical support.

For more information on Log Messages captured by the Station Manager, Refer to GFK-2225, *PACSystems TCP/IP Ethernet Communications Station Manager User Manual*.

Figure 26: LOG Command Display for Event Type 37



5.17 Station Manager

The Ethernet port on the CPU 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 CPU responds to DNP3 Outstation 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.

Table 36: DNP3 Outstation Station Manager command 'tally a' counters

Counters	Description
Psh_Ev02	Displays the number of Point Push Events generated for Digital Inputs
Psh_Ev11	Displays the number of Point Push Events generated for Digital Output Status
Psh_Ev32	Displays the number of Point Push Events generated for Analog Inputs
Psh_Ev42	Displays the number of Point Push Events generated for Analog Output Status
Soe_Ev02	Displays the number of SOE Events generated for Digital Inputs
Soe_Ev11	Displays the number of SOE Events generated for Digital Output Status
Soe_Ev22	Displays the number of SOE Events generated for Binary Counters
Soe_Ev32	Displays the number of SOE Events generated for Analog Inputs

Soe_Ev42	Displays the number of SOE Events generated for Analog Output Status
Events02	Displays the number of Events generated for Digital Inputs
Events11	Displays the number of Events generated for Digital Output Status
Events22	Displays the number of Events generated for Binary Counters
Events32	Displays the number of Events generated for Analog Inputs
Events42	Displays the number of Events generated for Analog Output Status
Events43	Displays the number of Events generated Analog Output Values
Cla1_RBE	Displays the number of Events generated for Class1
Cla2_RBE	Displays the number of Events generated for Class2
Cla3_RBE	Displays the number of Events generated for Class3
IIN[x]_Bit	Displays the Internal Indication bits (IIN bits) that are set for the respective Channel 'x'. x -> Channel 1 to Channel 8.
Ob01RdOK	Displays the count of Successful Reads from PLC for Digital Inputs
Ob01RdEr	Displays the count of Failed Reads from PLC for Digital Inputs
Ob10RdOK	Displays the count of Successful Reads from PLC for Digital Output Status
Ob10RdEr	Displays the count of Failed Reads from PLC for Digital Output Status
Ob30RdOK	Displays the count of Successful Reads from PLC for Analog Inputs
Ob30RdEr	Displays the count of Failed Reads from PLC for Analog Inputs
Ob34RdOK	Displays the count of Successful Reads from PLC for Analog Input Deadband
Ob34RdEr	Displays the count of Failed Reads from PLC for Analog Input Deadband
Ob40RdOK	Displays the count of Successful Reads from PLC for Analog Output Status
Ob40RdEr	Displays the count of Failed Reads from PLC for Analog Output Status
CROBWrOK	Displays the count of Successful Writes to PLC for CROB Object
CROBWrEr	Displays the count of Failed Writes to PLC for CROB Object

AOv1WrOK	Displays the count of Successful Writes to PLC for AOV Object with Variation 1
AOv1WrEr	Displays the count of Failed Writes to PLC for AOV Object with Variation 1
AOv2WrOK	Displays the count of Successful Writes to PLC for AOV Object with Variation 2
AOv2WrEr	Displays the count of Failed Writes to PLC for AOV Object with Variation 2
AOv3WrOK	Displays the count of Successful Writes to PLC for AOV Object with Variation 3
AOv3WrEr	Displays the count of Failed Writes to PLC for AOV Object with Variation 3
Ob34WrOK	Displays the count of Successful Writes to PLC for Analog Input Deadband
Ob34WrEr	Displays the count of Failed Writes to PLC for Analog Input Deadband

Note: A value of 0 in the Counters indicates no events have been generated or events have been reported to Masters.

See Appendix A for examples of these two commands.

For all other commands and responses, refer to GFK_2225, *PACSystems TCP/IP Ethernet Communications Station Manager User Manual.*

Each CPE400/CPL410 and CPE115 will log conditions to its own Station Manager Log, as well as to the PLC Controller table as part of Fault Group 0x37.

Section 6 CPU Performance Calculations

For CPE400/CPL410, this section summarizes on how to estimate CPU sweep time due to Event synchronization between the ACTIVE & BACKUP Units in the HSB Redundancy System for the CPE400/CPL410 DNP3 Outstation controllers.

6.1 Impact on CPU Sweep Time due to Event Synchronization

DNP3 Event Synchronization between ACTIVE and BACKUP units in a HSB Redundancy System requires the transfer of event data in addition to the user transfer list data, which impacts the sweep time of the CPUs.

In normal operating conditions, the impact on sweep time due to DNP3 Event Synchronization is minimal (approximately a few milliseconds). However, if either of the two units is powered down and one unit accumulates DNP3 events, then the sweep time of the units will experience an increase in time when the unit powers up. This increase in sweep time is due in part by all the accumulated events that are to be transferred from ACTIVE unit to BACKUP unit in one sweep cycle. This one-time increase in sweep time depends on the actual accumulated number of events in the ACTIVE unit. Therefore, the maximum impact on sweep time can be observed if the accumulated events are equal to the total number of configured events (maximum possible accumulation).

6.2 Maximum Impact on Sweep Time

The following equation gives this maximum impact on sweep time in relation to the total number of configured events:

Maximum Impact on Sweep Time (mSec) = (0.00837244375 x N) + (T2 – T1)

Where:

N = Total Number of Configured Events

T1 = Base Sweep Time of system without DNP3 Outstation enabled (mSec)

T2 = Base Sweep Time of system with DNP3 Outstation enabled and no Events are available in the unit (mSec)

Total Number of Configured Events (N) =

No. of Configured Binary Input (DI) Events +

No. of Configured Counter Object Events +

No. of Configured Binary Output (DO) Events +

No. of Configured Analog Input (AI) Events +

No. of Configured Analog Output (AO) Events +

No. of Configured Analog Output Value (AOV) Events

This equation only gives an approximate max impact on sweep time and the actual max impact on sweep time may vary slightly from the calculated value.

Note: The increase in sweep time calculated with the above equation denotes the maximum impact on sweep time, not the normal running sweep time, and it is likely to occur only in power-up scenarios. In normal running condition, impact on sweep time due to DNP3 Event Synchronization is minimal and is **NOT** calculated using the above equation.

Appendix A Station Manager Status

The 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 DNP3 Outstation.

```
  > stat a
REM> ------------------------------------------------------------------------------
REM> Status of the DNP3 Outstation Protocol
REM> Core Code Licensed from Triangle MicroWorks, Inc.
REM> TMW DNP3 Stack Version: 3.22.0000, Build: 618, Date and Time: Mon Nov 06
09:33:24 2017
REM> Application By Emerson Automation Solutions
REM> All RIGHTS RESERVED
REM> ------------------------------------------------------------------------------

REM> 0x001 = INIT_IN_PROGRESS
0x002 = READY_TO_START
0x004 = RUNNING
0x008 = STOPPED
0x100 = POINT_PUSH_IN_PROG
REM> 0x200 = ACTIVE UNIT
0x400 = BACKUP UNIT
REM> DNP3Os Application Status     : 0x204

REM>
0x01 = WAITING_FOR_CONFIG
0x02 = CONFIG_IN_PROGRESS
0x04 = CONFIGURED
0x08 = INVALID_CONFIG
REM> DNP3Os Configuration Status   : 0x04

REM> DNP3Os Application State      : 0x09
REM> ------------------------------------------------------------------------------
REM> ....................................
REM> Basic Configuration
REM> Maximum Channels supported      : 8
REM> Number of configured Channels   : 8
REM> DNP3 connections TCP/IP port    : 20000
REM> DNP3 Slave LLA Address          : 4
REM> DNP3 Destination LLA Address    : 3

REM> Matching TCP/IP Master address with Station is Disabled
REM> Matching LLA Master with Station is Disabled

REM> PLC CPU Scan Time Interval      : 251 ms
....................................

REM> If Unsolicited Events to the Master is enabled (from the master)
REM> After 5 Seconds, or 5 buffered Class 1 events Slave sends unsolicited
response.
```

```
REM> After 5 Seconds, or 5 buffered Class 2 events Slave sends unsolicited
response.
REM> After 5 Seconds, or 5 buffered Class 3 events Slave sends unsolicited
response.

REM>
.....................................
REM> PLC CPU Status
REM> PLC CPU IO Enabled   : TRUE
REM> PLC CPU Online State : TRUE

REM> User Control Word not configured.
REM>
.....................................
REM> Information about each connection
REM>
DNP Connection information for Connection : 1
REM> This Outstation / Session LLA = [4]
REM> Master LLA = [3]
REM> Validation of Master LLA Disabled
REM> Validation of Master IP Disabled
REM> Master IP = [*] *any
REM> Is session currently active : Active
REM> Session IIN : 0x600
REM>
DNP Connection information for Connection : 2
REM> This Outstation / Session LLA = [4]
REM> Master LLA = [3]
REM> Validation of Master LLA Disabled
REM> Validation of Master IP Disabled
REM> Master IP = [*] *any
REM> Is session currently active : Active
REM> Session IIN : 0x600
REM>
DNP Connection information for Connection : 3
REM> This Outstation / Session LLA = [4]
REM> Master LLA = [3]
REM> Validation of Master LLA Disabled
REM> Validation of Master IP Disabled
REM> Master IP = [*] *any
REM> Is session currently active : Active
REM> Session IIN : 0x600
REM>
DNP Connection information for Connection : 4
REM> This Outstation / Session LLA = [4]
REM> Master LLA = [3]
REM> Validation of Master LLA Disabled
REM> Validation of Master IP Disabled
REM> Master IP = [*] *any
REM> Is session currently active : Active
REM> Session IIN : 0x600
REM>
DNP Connection information for Connection : 5
REM> This Outstation / Session LLA = [4]
REM> Master LLA = [3]
REM> Validation of Master LLA Disabled
REM> Validation of Master IP Disabled
REM> Master IP = [*] *any
REM> Is session currently active : Active
REM> Session IIN : 0x600
REM>
DNP Connection information for Connection : 6
REM> This Outstation / Session LLA = [4]
REM> Master LLA = [3]
REM> Validation of Master LLA Disabled
```

```
REM> Validation of Master IP Disabled
REM> Master IP = [*] *any
REM> Is session currently active : Active
REM> Session IIN : 0x600
REM>
DNP Connection information for Connection : 7
REM> This Outstation / Session LLA = [4]
REM> Master LLA = [3]
REM> Validation of Master LLA Disabled
REM> Validation of Master IP Disabled
REM> Master IP = [*] *any
REM> Is session currently active : Active
REM> Session IIN : 0x600
REM>
DNP Connection information for Connection : 8
REM> This Outstation / Session LLA = [4]
REM> Master LLA = [3]
REM> Validation of Master LLA Disabled
REM> Validation of Master IP Disabled
REM> Master IP = [*] *any
REM> Is session currently active : Active
REM> Session IIN : 0x608
REM>
.....................................
REM>
.....................................
REM> Object Types & format Specifications
REM> Object 01:
REM>  Memory Type           : %I (Bit)
REM>  Starting Address      : 1
REM>  Number of points      : 128
REM>  Def Static Variation  : 1

REM> Object 02:
REM>  Def Event Variation   : 2
REM>  Def Event Mode        : 0
REM>  Def Class Mask        : 1
REM>  Max Event Storage Size: 6000
REM>  Max Point Configs     : 0

REM> Object 20,21,22 not configured.

REM> Object 10:
REM>  Memory Type           : %Q (Bit)
REM>  Starting Address      : 1
REM>  Number of points      : 128
REM>  Def Static Variation  : 1

REM> Object 11:
REM>  Def Event Variation   : 2
REM>  Def Event Mode        : 0
REM>  Def Class Mask        : 1
REM>  Max Event Storage Size: 4000
REM>  Max Point Configs     : 0

REM> Object 12:
REM>  Memory Type           : %M (Bit)
REM>  Starting Address      : 1
REM>  Number of points      : 50
REM>  Def Static Variation  : 1

REM> Object 12 (CROB):
REM>  CROB Ctrl Block Memory Type : %w (Register)
REM>  Starting Address            : 1
REM>  Starting Offset             : 48
```

```
REM>  Number of points            : 2

REM> Object 30:
REM>  Memory Type           : %AI (Register)
REM>  Starting Address      : 1
REM>  Number of points      : 128
REM>  Def Static Variation  : 1

REM> Object 32:
REM>  Def Event Variation   : 3
REM>  Def Event Mode        : 0
REM>  Def Class Mask        : 2
REM>  Max Event Storage Size: 2000
REM>  Max Point Configs     : 0

REM> Obj34 Static Variation : 2

REM> Object 40:
REM>  Memory Type           : %AQ (Register)
REM>  Starting Address      : 1
REM>  Number of points      : 128
REM>  Def Static Variation  : 1

REM> Object 42:
REM>  Def Event Variation   : 3
REM>  Def Event Mode        : 0
REM>  Def Class Mask        : 2
REM>  Max Event Storage Size: 1000
REM>  Max Point Configs     : 0

REM> Object 41 (AOV):
REM>  Memory Type           : %w (Register)
REM>  Starting Address      : 501
REM>  Number of points      : 128
REM>  Def Static Variation  : 1

REM> Object 43:
REM>  Event Obj43 Count             : 4
REM>  Point Offset of AOV Object 41 : 30
REM>  Def Cmd Event Variation       : 3
REM>  Def Event Mode                : 1
REM>  Def Class Mask                : 3
REM>  Max Event Storage Size        : 8000

REM>
.....................................
REM>
.....................................
REM> DNP3S Outstation Option Parameters
REM> Multiple Data link layer Confirm Mode    : 0
REM> App layer confirmations will be requested
REM> for non-final fragments of a multi fragment response  : TRUE
REM>
.....................................
REM> DNP3S Outstation Tuning Parameters:
REM> Maximum Transmit Fragment Size               : 2048
REM> Application Confirmation Time-Out            : 30 Sec
REM> Unsolicited Event response Time-Out          : 10 Sec
REM> Local clock valid period after Time sync     : 30 Min
REM> Max number of LL retries if Confirm Time-out : 3
REM> Link Layer Confirmation Response Time Out    : 2 Sec
REM> Link Layer Receive Response Time Out         : 15 Sec
REM> Maximum controls allowed in a single request : 10
REM> Time 'select' will remain valid              : 5 Sec
REM> .....................................
```

```
REM> ------------------------------------------------------------------------------
REM>
```

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.

```
> tally a

REM> ------------------------------------------------------------------------------
-
REM> <<< DNP3 Outstations Tallies >>>   06-JUN-2019 22:10:14.0 (+0:00)
REM> Psh_Ev02=00000000H  Psh_Ev11=00000000H  Psh_Ev32=00000000H  Psh_Ev42=00000000H
REM> Soe_Ev02=00000060H  Soe_Ev11=00000060H  Soe_Ev22=00000000H  Soe_Ev32=000001f4H
REM> Soe_Ev42=000001f4H  Events02=00000000H  Events11=00000000H  Events22=00000000H
REM> Events32=00000000H  Events42=00000000H  Events43=00000000H  Cla1_RBE=00000000H
REM> Cla2_RBE=00000000H  Cla3_RBE=00000000H  IIN1_Bit=00000000H  IIN2_Bit=00000000H
REM> IIN3_Bit=00000000H  IIN4_Bit=00000000H  IIN5_Bit=00000000H  IIN6_Bit=00000000H
REM> IIN7_Bit=00000000H  IIN8_Bit=00000000H  Ob01RdOK=00025b1aH  Ob01RdEr=00000000H
REM> Ob10RdOK=00025b1aH  Ob10RdEr=00000000H  Ob30RdOK=00025b1aH  Ob30RdEr=00000000H
REM> Ob34RdOK=00000000H  Ob34RdEr=00000000H  Ob40RdOK=00025b19H  Ob40RdEr=00000000H
REM> CROBWrOK=00000000H  CROBWrEr=00000000H  AOv1WrOK=00000000H  AOv1WrEr=00000000H
REM> AOv2WrOK=00000000H  AOv2WrEr=00000000H  AOv3WrOK=00000000H  AOv3WrEr=00000000H
REM> Ob34WrOK=00000000H  Ob34WrEr=00000000H
REM>
REM> ------------------------------------------------------------------------------
-
REM>
```

Appendix B PACSystems RX3i CPE400/CPL410 and RSTi-EP EPSCPE115 DNP3 Protocol Outstation Device Profile

DNP V3.0 **DEVICE PROFILE DOCUMENT**			
Vendor Name:	**Emerson Automation Solutions**		
Device Name:	***CPE400/CPL410, CPE115 Outstation*, using the Triangle Micro Works, Inc. DNP3 Outstation Source Code Library, Version 3.22**		
Highest DNP Level Supported: For Requests: **Level 3** For Responses: **Level 3**		Device Function: ☐ Master ☒ **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, 42 and 43 are supported.**			
Maximum Data Link Frame Size (octets): Transmitted: **292** Received **292**		Maximum Application Fragment Size (octets): Transmitted: **2048** Received **2048**	
Maximum Data Link Re-tries: ☒ **Configurable, range 0 to 255** ☐ Fixed 65535		Maximum Application Layer Re-tries: ☒ **None** ☐ Configurable	

DNP V3.0
DEVICE PROFILE DOCUMENT

Requires Data Link Layer Confirmation:

- ☐ Never
- ☐ Always
- ☐ Sometimes
- ☒ **Configurable as: *Never*, *Only for multi-frame messages*, or *Always***

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

DNP V3.0
DEVICE PROFILE DOCUMENT

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.

Default Counter Object/Variation:	Counters Roll Over at:
☐ No Counters Reported	☐ No Counters Reported
☒ **Configurable**	☐ Configurable (attach explanation)
☒ **Default Object**	☒ **16 Bits**
Default Variation:	☒ **32 Bits**
☐ Point-by-point list attached	☐ Other Value: _____
	☐ Point-by-point list attached

Sends Multi-Fragment Responses:

☐ Yes
☐ No
☒ **Configurable**

DNP V3.0
DEVICE PROFILE DOCUMENT

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	

TCP Keep Alive

☐Timer disabled
☐Fixed at _____ms
☒**Configurable, range 0 to 30000 ms**
☐ Configurable, selectable from _____,_____,_____ms
☐ Configurable, other, describe_____

Data Link Address

☐ Fixed at_____
☒ **Configurable, range 0 to 65519**
☐ Configurable, selectable from _____,_____,_____
☐ Configurable, other, describe_____

DNP3 Source Address Validation

☐Never
☐Always, one address allowed
☐ Always, any one of multiple addresses allowed
☒**Sometimes, explain -Configurable Enable/Disable**

DNP3 Source Address(es) expected when Validation is Enabled

☐Configurable to any 16 bit DNP Data Link Address value
☒ **Configurable, range Configurable, range 0 to 65519**
☐Configurable, selectable from _____,_____,_____
☐ Configurable, other, describe_____

Event Buffer Overflow Behavior

☐Discard the oldest event
☐ Discard the newest event
☒ **Other, explain: Configurable**

DNP V3.0
DEVICE PROFILE DOCUMENT

Supports Unsolicited Reporting

☐ Yes
☐ No
☒ **Configurable, selectable from On and Off**

Unsolicited Response Confirmation Timeout

☐ Fixed at_____ ms
☒ **Configurable, range 1000 to 300000 ms**
☐ Configurable, selectable from ___,___,___ms
☐ Configurable, other, describe_____
☐ Variable, explain _____

Number of Unsolicited Retries

☐ None
☐ Fixed at _____
☒ **Configurable, range 1 to 255**
☐ Configurable, selectable from ____,____,____
☐ Configurable, other, describe_____
☐ Unlimited

Number of class 1 events-Unsolicited Response Trigger Condition

☐ Class 1 not used to trigger Unsolicited Responses
☐ Fixed at _____
☒ **Configurable, range 1 to 255**
☐ Configurable, selectable from ____,____,____
☐ Configurable, other, describe_____

Number of class 2 events-Unsolicited Response Trigger Condition

☐ Class 1 not used to trigger Unsolicited Responses
☐ Fixed at _____
☒ **Configurable, range 1 to 255**
☐ Configurable, selectable from ____,____,____
☐ Configurable, other, describe_____

Number of class 3 events-Unsolicited Response Trigger Condition

☐ Class 1 not used to trigger Unsolicited Responses
☐ Fixed at _____
☒ **Configurable, range 1 to 255**
☐ Configurable, selectable from ____,____,____
☐ Configurable, other, describe_____

DNP V3.0 DEVICE PROFILE DOCUMENT
Hold time after class 1 event-Unsolicited Response Trigger Condition ☐ Class 1 not used to trigger Unsolicited Responses ☐ Fixed at _____ ms ☒ **Configurable, range 1000 to 32000000 ms** ☐ Configurable, selectable from _____,_____,_____ ms ☐ Configurable, other, describe_____
Hold time after class 2 event-Unsolicited Response Trigger Condition ☐ Class 1 not used to trigger Unsolicited Responses ☐ Fixed at _____ ms ☒ **Configurable, range 1000 to 32000000 ms** ☐ Configurable, selectable from _____,_____,_____ ms ☐ Configurable, other, describe_____
Hold time after class 3 event-Unsolicited Response Trigger Condition ☐ Class 1 not used to trigger Unsolicited Responses ☐ Fixed at _____ ms ☒ **Configurable, range 1000 to 32000000 ms** ☐ Configurable, selectable from _____,_____,_____ ms ☐ Configurable, other, describe_____

Appendix C RSTi-EP EPSCPE115 Configuration example

```
// == == == == == == == == == == == == == == == == == == == == == == == ==
// CPE115 DNP3 configuration
// == == == == == == == == == == == == == == == == == == == == == == == ==
// Setup Block for DNP3 Outstation on EPSCPE115
// == == == == == == == == == == == == == == == == == == == == == == == ==
// Standard Command Block Parameters
// ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ```
mDNP3_Setup[00] := 132;  // SvcReq data length, always 132
mDNP3_Setup[01] := 0;   // Reserved, always 0
mDNP3_Setup[02] := 0;   // Reserved, always 0
mDNP3_Setup[03] := 0;   // Reserved, always 0
mDNP3_Setup[04] := 0;   // Reserved, always 0
mDNP3_Setup[05] := 0;   // Reserved, always 0
// == == == == == == == == == == == == == == == == == == == == == == == ==
// Outstation Connection Parameters
//
mDNP3_Setup[06] := 1234;    // Outstation command number, always 1234 ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ```
mDNP3_Setup[07] := 1;        // Number of Channels
mDNP3_Setup[08] := 20000;  // DNP3 Port
mDNP3_Setup[09] := 4;        // Slave Address
// Unsolicited Parameters
mDNP3_Setup[10] := 1;       // Enable Messages
mDNP3_Setup[11] := 5;       // Class1,Class2 and Class3 Event Delay
mDNP3_Setup[12] := 5;       // Number of Class1,Class2 and Class3 Events
mDNP3_Setup[13] := 3;       // Destination Address
//Event Scan Parameters
mDNP3_Setup[14] := 250;   // Data Change Scan Period
//
mDNP3_Setup[15] := 2#0000001000000000;
// [x].1 Send Outstation Restart bit If set, Send Outstation Restart bit
// [x].2 DNP3 Time-Sync required If set, Send DNP3 Time-Sync required bit
// [x].3,4 Link layer Confirmation Mode Specifies when DNP3 Outstation shall ask
//   Value: 0x00 - Never, 0x01 - Always, 0x10 - Sometimes Default: 0x00 - Never
// [x].5 Multi-Fragment responses If set, Application layer is not allowed to send Multi-Fragment responses
// [x].6 Multifragment Confirm If set, Application layer not allow confirmations for Multi fragment response
// [x].7 Class Mask None If set, Assign Class Mask None to all points during RUN/STOP transition
// [x].8 Unused
// [x].9 Link TimeOut Disconnect If set, disconnect a connection when linklayer times out
// [x].10 Delete Oldest Events If set, Uses Circular Event Buffer by deleting oldest Events
// [x].11 Enable Pointpush Events Local Forced If set, Mark Local Forced Flag for Point Push Events
// [x].12 Enable Pointpush Event Y2k Ladder If set, Point Push Data Needs a Y2K ladder
// [x].13 Force DI Points to Point Push If set, assign object 01 Points all part of Point Push at startup
// [x].14 Force DI Points to Point Push If set, assign object 10 Points all part of Point Push at startup
// [x].15 Force DI Points to Point Push If set, assign object 30 Points all part of Point Push at startup
// [x].16 Force DI Points to Point Push If set, assign object 40 Points all part of Point Push at startup
//
mDNP3_Setup[16] := 0;   // Reserved
```

```
mDNP3_Setup[17] := 0;   //Memory Type for Quality Force
mDNP3_Setup[18] := 0;     //Memory Address for Quality Force
mDNP3_Setup[19] := 2048; // Transmit Fragment Size
mDNP3_Setup[20] := 30;    // Application  Confirm Timeout
mDNP3_Setup[21] := 10;   // Unsolicited Confirm Timeout
mDNP3_Setup[22] := 30;  // Clock Valid Period
mDNP3_Setup[23] := 30;  // DNP3 TCP KeepAlive Time
mDNP3_Setup[24] := 3;    // Maximum Retries
mDNP3_Setup[25] := 2;    // Confirm Timeout
mDNP3_Setup[26] := 15;  // Frame Timeout
mDNP3_Setup[27] := 10;  // Max Control Requests
mDNP3_Setup[28] := 5;   // Select Timeout
// Sequence of Events Collection Parameter
// Note: If set to disable for a given channel, the Default Event Mode setting in the object params will be
forced to MOST_RECENT
mDNP3_Setup[29] := 2#000000000000001; // Per Channel Disable (0) or Enable (1) SOE collection of DNP3
data
//  ----------DI Attributes----------
//  Object01 Parameters
// == == == == == == == == == == == == == == == == == ==
//  Memory Type: Value: 70-%I, 72-%Q, 76-%M, 74-%T, 86-%G
mDNP3_Setup[30] := 100; // Number of Points for Object01
mDNP3_Setup[31] := 70;  // Memory Type for Object01
mDNP3_Setup[32] := 1;   // Memory Address for Object01
mDNP3_Setup[33] := 2;   // Default Static Variation for Object01
// Object02 Parameters
// == == == == == == == == == == == == == == == == == ==
//  Default Event Mode Value: 1 - SOE, 2 - MOST RECENT
//  Default Class Mask Value: 0 - Class 0, 1 - Class 1, 2 - Class 2, 3 - Class 3
//  Maximum Events. Value: 0 to 8000
mDNP3_Setup[34] := 2;   // Default Event Variation Object02
mDNP3_Setup[35] := 1;   // Default Event Mode Object02
mDNP3_Setup[36] := 1;   // Default Class Mask Object02
mDNP3_Setup[37] := 500; // Maximum Events Object02
// Enable Binary Counter value 1-Enable 0-Disable
mDNP3_Setup[38] := 0;   // Enable Binary Counter: Object 20,21,22
// Object20 Parameters
// == == == == == == == == == == == == == == == == == ==
mDNP3_Setup[39] := 1;   // Default Static Variation Object20
// Object21 Parameters
// == == == == == == == == == == == == == == == == == ==
mDNP3_Setup[40] := 1;   // Default Static Variation Object21
// Object22 Parameters
// == == == == == == == == == == == == == == == == == ==
//  Default Event Mode Value: 1 - SOE, 2 - MOST RECENT
//  Default Class Mask Value: 0 - Class 0, 1 - Class 1, 2 - Class 2, 3 - Class 3
//  Maximum Events. Value: 0 to 8000.
mDNP3_Setup[41] := 1;   // Default Event Variation Object22
mDNP3_Setup[42] := 2;   // Default Event Mode Object22
mDNP3_Setup[43] := 1;   // Default Class Mask Object22
mDNP3_Setup[44] := 500;  // Maximum Events Object22
//  ----------DO Attributes----------
//  Object10 Parameters
```

```
// == == == == == == == == == == == == == == == == == == == == == == == ==
//  Memory Type: Value: 70-%I, 72-%Q, 76-%M, 74-%T, 86-%G
mDNP3_Setup[45] := 100;  // Number of Points for Object10
mDNP3_Setup[46] := 72;   // Memory Type for Object10
mDNP3_Setup[47] := 1;    // Memory Address for Object10
mDNP3_Setup[48] := 2;    // Default Static Variation for Object10
// Object11 Parameters
// == == == == == == == == == == == == == == == == == == == == == == == ==
//  Default Event Mode Value: 1 - SOE, 2 - MOST RECENT
//  Default Class Mask Value: 0 - Class 0, 1 - Class 1, 2 - Class 2, 3 - Class 3
//  Maximum Events. Value: 0 to 8000.
mDNP3_Setup[49] := 2;   // Default Event Variation Object11
mDNP3_Setup[50] := 1;   // Default Event Mode Object11
mDNP3_Setup[51] := 1;   // Default Class Mask Object11
mDNP3_Setup[52] := 500; // Maximum Events Object11
// Object 12 Parameters
// Memory Type for Object 12: Value: 70-%I, 72-%Q, 76-%M, 74-%T, 86-%G, Default: 72
mDNP3_Setup[53] := 0;    // Number of Points for Object 12
mDNP3_Setup[54] := 72;   // Memory Type for Object 12
mDNP3_Setup[55] := 1;    // Memory Address for Object 12
mDNP3_Setup[56] := 1;    // Command Variation for Object 12
// CROB Parameters
// Memory Type for CROB. Value: 8-%R, 10-%AI, 12-%AQ, 196-%W.
mDNP3_Setup[57] := 0;    // Number of Points for CROB
mDNP3_Setup[58] := 8;    // Memory Type for CROB
mDNP3_Setup[59] := 1;   // Memory Address for CROB
mDNP3_Setup[60] := 0;    // Start Point Offset
//  --------------------AI Attributes----------------------
//  Object30 Parameters
// == == == == == == == == == == == == == == == == == == == == == == == ==
//  Memory Type. Value: 8-%R, 10-%AI, 12-%AQ, 196-%W, Default
mDNP3_Setup[61] := 100; // Number of Points for Object30
mDNP3_Setup[62] := 10;   // Memory Type for Object30
mDNP3_Setup[63] := 1;    // Memory Address for Object30
mDNP3_Setup[64] := 2;    // Default Static Variation for Object30
// Object32 Parameters
// == == == == == == == == == == == == == == == == == == == == == == == ==
//  Default Event Mode Value: 1 - SOE, 2 - MOST RECENT
//  Default Class Mask Value: 0 - Class 0, 1 - Class 1, 2 - Class 2, 3 - Class 3
//  Maximum Events. Value: 0 to 8000.
mDNP3_Setup[65] := 4;   // Default Event Variation Object32
mDNP3_Setup[66] := 1;   // Default Event Mode Object32
mDNP3_Setup[67] := 2;   // Default Class Mask Object32
mDNP3_Setup[68] := 500;  // Maximum Events Object32
//
mDNP3_Setup[69] := 0;   //Reserved
// Object34 Parameters
// == == == == == == == == == == == == == == == == == == == == == == == ==
mDNP3_Setup[70] := 2;   // Default Static Variation for Object34
//  --------------------AO Attributes----------------------
//  Object40 Parameters
// == == == == == == == == == == == == == == == == == == == == == == == ==
//  Memory Type. Value: 8-%R, 10-%AI, 12-%AQ, 196-%W
```

```
//  Memory Address. Value: 1 to Maximum (based on Memory Type)
//  Default Static Variation
mDNP3_Setup[71] := 100;  // Number of Points for Object40
mDNP3_Setup[72] := 12;   // Memory Type for Object40
mDNP3_Setup[73] := 1;    // Memory Address for Object40
mDNP3_Setup[74] := 2;    // Default Static Variation for Object40
//  Object42 Parameters
// == == == == == == == == == == == == == == == == == == == ==
//  Default Event Mode Value: 1 - SOE, 2 - MOST RECENT
//  Default Class Mask Value: 0 - Class 0, 1 - Class 1, 2 - Class 2, 3 - Class 3
//  Maximum Events. Value: 0 to 8000.
mDNP3_Setup[75] := 4;    // Default Event Variation Object42
mDNP3_Setup[76] := 1;    // Default Event Mode Object42
mDNP3_Setup[77] := 2;    // Default Class Mask Object42
mDNP3_Setup[78] := 500;  // Maximum Events Object42
//  Object41 Parameters
// == == == == == == == == == == == == == == == == == == == ==
//  Memory Type. Value: 8-%R, 10-%AI, 12-%AQ, 196-%W
mDNP3_Setup[79] := 0;  // Number of Points for Object41
mDNP3_Setup[80] := 12;   // Memory Type for Object41
mDNP3_Setup[81] := 1;    // Memory Address for Object41
mDNP3_Setup[82] := 2;    // Command Variation for Object41

//  Object43 Parameters
// == == == == == == == == == == == == == == == == == == == ==
//  Default Event Mode Value: 1 - SOE, 2 - MOST RECENT
//  Default Class Mask Value: 0 - Class 0, 1 - Class 1, 2 - Class 2, 3 - Class 3
//  Maximum Events. Value: 0 to 8000.
mDNP3_Setup[83] := 0;  // Number of Points for Object43
mDNP3_Setup[84] := 0;    // Start Point Offset
mDNP3_Setup[85] := 4;    // Default Event Variation Object43
mDNP3_Setup[86] := 1;    // Default Event Mode Object43
mDNP3_Setup[87] := 3;    // Default Class Mask Object43
mDNP3_Setup[88] := 500;  // Maximum Events Object43
//
mDNP3_Setup[89] := 0;      // Validate Source IP
mDNP3_Setup[90] := 0;      // IP address 1
mDNP3_Setup[91] := 0;
mDNP3_Setup[92] := 0;
mDNP3_Setup[93] := 0;
//
mDNP3_Setup[94] := 0;      // IP address 2
mDNP3_Setup[95] := 0;
mDNP3_Setup[96] := 0;
mDNP3_Setup[97] := 0;
//
mDNP3_Setup[98] := 0;      // IP address 3
mDNP3_Setup[99] := 0;
mDNP3_Setup[100] := 0;
mDNP3_Setup[101] := 0;
//
mDNP3_Setup[102] := 0;     // IP address 4
mDNP3_Setup[103] := 0;
```

```
mDNP3_Setup[104] := 0;
mDNP3_Setup[105] := 0;
//
mDNP3_Setup[106] := 0;    // IP address 5
mDNP3_Setup[107] := 0;
mDNP3_Setup[108] := 0;
mDNP3_Setup[109] := 0;
//
mDNP3_Setup[110] := 0;    // IP address 6
mDNP3_Setup[111] := 0;
mDNP3_Setup[112] := 0;
mDNP3_Setup[113] := 0;
//
mDNP3_Setup[114] := 0;    // IP address 7
mDNP3_Setup[115] := 0;
mDNP3_Setup[116] := 0;
mDNP3_Setup[117] := 0;
//
mDNP3_Setup[118] := 0;    // IP address 8
mDNP3_Setup[119] := 0;
mDNP3_Setup[120] := 0;
mDNP3_Setup[121] := 0;
//
mDNP3_Setup[122] := 0;   // Validate Source Address
mDNP3_Setup[123] := 11;  // Source Address 1
mDNP3_Setup[124] := 12;  // Source Address 2
mDNP3_Setup[125] := 53;  // Source Address 3
mDNP3_Setup[126] := 54;  // Source Address 4
mDNP3_Setup[127] := 55;  // Source Address 5
mDNP3_Setup[128] := 56;  // Source Address 6
mDNP3_Setup[129] := 57;  // Source Address 7
mDNP3_Setup[130] := 58;  // Source Address 8
// == == == == == == == == == == == == == == == ==
// DNP3 - Reserved
// ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ``` ```
mDNP3_Setup[131] := 0;   // Reserved
mDNP3_Setup[132] := 0;   // Reserved
```

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