# CDOAN-DNP3

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www.cdoancal.com

TPILB

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## Introduction

#### Features

CDOAN-DNP3 is a Windows-based program designed to generate, capture, and test communication with DNP3 protocol devices. Release 2.3.12 on 1-July-2021 supports the following functions:

#### <u>Media</u>

- Serial
- TCP/IP
- UDP/IP (options for broadcast only or all messages)
- Dual-Endpoint

#### **Operational Modes**

- Listen on communication between active master and outstation devices
- Operate as a master in communication to up to ten outstation devices
- Operate as one to ten outstations in communication to a master
- Interpret all data messages, correlating interpreted information with message octets
- Solicited and unsolicited operation

#### Subset Level

- Can constrain outstation operation to subset level 1, 2, 3 specifications
- Can operate as a single-frame response outstation that does not support events
- Or can remove all subset level restrictions

#### Transmission Errors

• Ability in inject selected DNP3 protocol errors into message transmission

#### **Scripting**

• External scripting is supported as of release 3.0.0. Please see documentation on the external script editor for more details

#### **DNP3 Protocol Support**

	DNP3 Protocol Support	
Data Link and Transport Layer Functions	All	
Application	Data	Read, Write, Response, Unsolicited Response
Function Codes	Counters	Freeze, Freeze and Clear, Freeze At Time (broadcast and not)
	Controls	Select, Operate, Direct (normal and no response)
	Time	Non-Lan and LAN time sync
	Unsolicited	Enabled and Disable, Unsolicited Response
	File	Open, Close, Delete, Read, Write, File Info
	Other	Assign Class
Object Groups	Information	Device attributes
	Data	Analog, Binary, Double, Counters, Frozen Counters (static and events), Class Data
	Control	Binary and analog outputs, binary output status, analog output status
	Time	Relative time for events, absolute time for synchronization
	Other	Analog deadbands, File controls
	Secure Authentication	Parsed for display only

#### <u>Views</u>

- DNP3
  - Checkboxes to control default DNP3 features (such as request and response variations)
  - Configuration control over automatic error generation

#### • Master Configuration

- Support communication with up to 10 outstations
- Configure messages for transmission
- o Set properties such as object group, variation, and qualifier
- Ability to combine multiple requests in a single transmission (such a read analog and binary)

#### • Outstation Configuration

- Define point configuration for up to 10 outstations
- Point Modeling: analog and binary value changes, counter "counting"
- Automatic event generation

#### • Communication Messages

- Shows all master and outstation messages
- o Correlates interpreted data to message octet values
- o Complies communication statistics
- Save to/restore from text files
- o Print
- Load files generated by programs from other companies such as PCAP files (and others)
- Point Tabular
  - $\circ$   $\;$  Display of input and output points, showing input data and control actions
  - Ability to add point names, binary point state names, and analog engineering units information
  - Ability to select point for trending
  - o Print
- Change Events list of events objects reported from an outstation
- Trend (graph) of data for up to 4 selected points over a 1-hour period
- Ability to undock windows for personalized screen layout

## Installation

CDOAN-DNP3 is installed from a single setup file called CDOAN-DNP3-setup.exe. it is digitally signed to CDOAN.

#### Licensing

CDOAN-DNP3 is licensed is two ways:

- License code installed on a PC based on hardware in the PC. This licensing form limits operation to the specific PC on which the license is installed. These licenses cannot be transferred to another computer.
- License code installed on a (customer provided) USB flash drive based on characteristics of that drive. Most (but not all) USB flash drives contain enough information to store a license file. A license installed on a USB drive enables operation on any PC in which the USB drive is installed. That is, a USB drive-based license allows operation on any PC, but only one at a time.

The CDOAN-DNP3 startup screen shows active license information and contains a target to request a license from CDOAN.

- If you want a USB flash drive-based license, insert that drive into a USB port before starting this process
- Select the *Request License* target
- The application searches for a USB flash drive that contains enough characteristics to store a license. If one is found, a prompt is issued asking if that drive should be used. If more than one USB drive is inserted, only the first applicable USB flash drive is presented. Trial licenses cannot be installed on a USB drive, only permanent licenses can.
- Enter all requested data including the license type. A trial, available for free, operates for two-weeks
- The resulting license request information is saved to a "txt" file
- Email this file to <u>cdoancal@gmail.com</u>
- A license "txt" file will be sent by return Email
- Restart CDOAN-DNP3 and select the *Load License From File* target. If the license is to be installed on a USB flash drive, remove all other flash drives and insert the target drive before loading the license.

## Menu

The main menu contains five pull-down lists.

#### File

File Open Save Save As New Print Exit	ŀ	31
Messages File	•	Specify Name
Import	•	Load
C:\Temp\x.cdn C:\Temp\status test.cdn C:\Cdoan\Licenses\jv.cdn		Enable Save Current Contents

#### **CDOAN Configuration File**

- Save and Save-As to save a file
- Open to open any configuration file
- Any file name at the bottom to open one of the most recent three saved files

#### Print

• The print option allows printing of the Messages, Change Events, or Point Values view.

Print >	Communication Messages
	Change Events
	Point Tabular

Messages File is used to save messages processed in an active communication session and reload them later

• Specify name

Defines the name of a messages file. Saving can be enabled and disabled from the *Communication Messages* view. When enabled, messages are saved to the file name specified

• Load

Loads messages from a previously saved file

• Enable

Toggle to enable or disable CDOAN-DNP3 to write messages to the messages file. Writing is enabled automatically when a new name is specified. It can be disabled and reenabled here, or from the *Save Messages* check-box at the top of the Messages view.

#### • Save Current Contents

Writes contents of the messages view to a CMSG file, the same as if saving was enabled during communication

#### Import

• Allows the user to select a file written by another program. This file is analyzed and, if any DNP3 messages are found, they are read, converted to CDOAN-DNP3 format, and loaded into the Messages View. It works on many binary and text files including those created by Wireshark

#### Views

The Views pull-down is used to request a view for display or close an already opened view.



CDOAN-DNP3 supports eight views. Each is discussed in the Views section.

Views that are:

Closed: are shown without a checkmark to the left. Selecting a closed view causes that view to be opened Opened: are shown with a checkmark to the left. Selecting an open view causes that view to be closed. An opened view can be selected from a list of open views at the bottom of the CDOAN-DNP3 window



## Communication



The *Communication* pull-down is used to starts active communication in either master or outstation simulation mode, or listening, and to stop an active communication session.

#### Window

The *Window* controls screen layout of open windows.

🔜 СВ	OAN						
File	Edit	Views	Communication	Wi	ndow		
				1	Tile		
				·	Cascade		
					Undock	×.	Master Config
					Dock		Outstation Config
							Communication
							Change Events
							Point Data
							Trend

## TileTiles all active "Docked" views. As many as four views can be tiled. When more than four views<br/>are open and docked, the *Tile* commands reverts to *Cascade*CascadeCascades all active "Docked" views

Undock and Dock

Views are initially shown docked within the larger encompassing CDOAN program window. They can be moved and resized within that window only. Most views can be undocked. An undocked view is allowed to float and move anywhere in the computer monitor (or monitors) area. Undocked views can be re-docked.

## Stop

A sixth *Stop* tollbar target appears when, and only when communication is active.



Selecting this *Stop* menu target causes communication to stop. It is identical to selecting *Stop* from the *Communication* pull-down menu.

## Views

This section discusses each of CDOAN-DNP3's seven views.

## Config

The Config view supports entry of general operational parameters and license information.

🖳 Config				
Communication Media Serial O TCP (UDP broadcast) O TCP Only O Dual Endpoint O UDP Only O TCP and UDP	Master Outstation	COM Port COM5 COM4	Baud Rate 9600 Serial: Use RTS, Serial: Require D	Font Point Size 10 /CTS Control For Transmission /CD For Reception
Most Recently Loaded Configuration File Most Recently Loaded Comm Messages File				Configure Sample Master Configure Sample Outstation
Date/Time Range when Loading a Messages File	e Start Time End Time	17-Jan -2025 13:22:21 17-Jan -2025 13:22:21	Apply Start Time	Filter Filter
		Revision History		
License valid until Wednesda	y, January 1, 2070. E	nabled: D: DNP3 Scripting	Lined Fact lineares Sav	ve Manually Entered License
License Codes 8FB9C20B 8FDB609 Release 3.0.5, 17 - Jan - 20	6 8FABDFED	74D78AE2 70-DE-F3	Used for License	Load License From File Request License

#### **Communication Mode**

Serial Uses serial communication

TCP Only Uses TCP only

UDP Only Uses UDP only

#### TCP (UDP Broadcast)

- Master: Sends broadcast requests with UDP; non-broadcast with TCP
- Outstation: Shows all messages received. Responds to TCP messages only

**Dual Endpoint** Uses TCP, plus

- Master: Listens for a connection; auto configures to the DNP address extracted from the unsolicited null startup message
- Outstation: Must be enabled for unsolicited mode; issues a connection request on startup

TCP and UDP

- Master: Sends all messages over TCP
- Outstation: Sends replies consistent with the request (UDP to UDP, TCP to TCP).

Master	
IP Address	Optional master IP address, used only in network listening mode. If provided, only message from
	the master or outstation IP addresses will be shown
COM Port	The "IP address" column changes to a "COM Port" column for serial protocols. This is the COM
	port used to receive messages from, or send messages to, the master
Outstation	
IP address	Outstation IP address, required for master operation, optional for listening operation
CONTPOR	ne in address column changes to a COM Port column for serial protocols. This is the COM
	port used to receive messages from, or send messages to, the outstations
Network Port	IP port used for network communication
Baud Pate	The "Network Port" field changes to a "Baud Pate" field for serial communication
Badd Nate RTS/CTS Control	Serial mode only
	<ul> <li>If checked, RTS is set before each message is queued for transmission. The message is not</li> </ul>
	sent until CTS is detected. RTS is turned off when message transmission is finished.
	If unchecked, RTS is set permanently when communication is started. CTS is not required
Require DCD	Serial mode only
	<ul> <li>If checked, input data is discarded if DCD is not true when the data is received</li> </ul>
	If unchecked, the DCD state is not relevant
Font Doint Sizo	Changes the point size for the Mactor Config. Outstation Config. Change Events. Trend, and Deint
FUIL FUIL SIZE	Data views Point sizes between 8 and 12 are allowed. The default is 9
Configure Sample	e Master Creates a sample master station to obtain data from a single outstation. To start running
	as a master, select this option and Communication/Master. [Defaults will be set to communicate
	to a network outstation on the same processor, such as another copy of CDOAN-DNP3. To
	communicate to another device, modify the communicate type and IP address or COM port.]
<b>C</b>	
Configure Sample	binary and analog output points. To start running as an outstation solost this option and
	Communication /Quitetation
Date/Time Range	e Communication messages can be saved to a text file and reloaded at a later date. Start and/or
_	stop time ranges, if enabled, are used to limit the load process to only a section of a large saved
	file. These fields are applied when File/Messages File/Load is selected.
License Code Are	a The UDUAN-UNP3 license consists of four 8-digit hex values, shown in the screen. A new license
	a license file delivered from CDOAN can be loaded by selecting Load license from file
	a needse me denvered nom eboAn can be loaded by selecting <b>Load needse from file.</b>
	To request a new license, select the <b>Request License</b> and send the resulting text file created to
	<u>cdoancal@gmail.com</u>

Revision History Displays CDOAN-DNP3 release dates and revision history

## Note

To get a feeling for CDOAN-DNP3 operations:

- Start one copy of CDOAN-DNP3, select *Configure Sample Outstation* and *Communication/Outstation*
- Start a second copy of CDOAN-DNP3 on the same computer, select *Configure Sample Master* and *Communication/Master*
- You should be up and running

## **DNP3** Parameters

DNP3 Parameters													
General			Outs	tation Se	ttings				Trans	missio	n Errors		
		<b>C U</b>	- Outs	nput Object	s	<b>-</b> .					-		
Local      UTC     Local Uncellected		Static	Sand In		With	Events	With		_	Neve	r Once	Always	Occasionally
Use Serial Time Sync For LAN and WAN		Flags	Class 0	Format	Time	Enabled	Time	Class	No Appl Co		0	0	0
Keep Alive Timer (0 to disable) 0	Binary		$\checkmark$				$\checkmark$	1	No Appi Co		0	0	0
	Counter			16-bit				3	CRC	۲	$\bigcirc$	$\bigcirc$	0
Master Settings	Frozen			32-bit				3	No Inc SEO		0	0	0
Request Variation/General									NO INC SEQ	۲	0	0	0
Any O Hags O No Hags	Analog			16-bit	) Float			2	Add IIN flag	s 💿	$\bigcirc$	$\bigcirc$	0
O Time O Relative Time				32-bit	J Hour				Buffer (	verflow	Config	Corrupt	Device Restart
Paguat Variation (Numaria Objects	Output	Analo	og Status In	Group 0					Device	Trouble	Local (	Control	Need Time
Any      16-bit      32-bit      Enat	Status	Binar	y Status In (	Group 0									
			C	Jutput Objec	cts				Ignore IINs	۲	0	$\bigcirc$	0
Source/Destination Addresses	Binary	Allow SE	80 Allo	w Direct	Select/	Operate Ti	neout		Device	Restart	Need	Time	
Of Master 0	Analog	$\checkmark$			5								
Of Outstation 0													
	Send Reset Link At Startup Counter Deadband 0												
Delay between Select and Operate	Cold Restart Time (secs) 5 Analog Deadband 1												
Broadcast Address													
• FFFF () FFFE () FFFD	Subset Level compliance Hie Head/Write Location												
	No	Restrictions	O Leve	Lev Lev	ei 2 🔾 Le	vel 3 () Sin	gle Fram	e	C:\Users\jackv_	)00\Docu	ments		

This view is used to set DNP3 protocol options. It is divided into four sections:

- Settings applicable when running in master simulation mode
- Settings applicable when running in outstation simulation mode
- Settings applicable in both modes
- Settings to generate transmission errors

#### **General Settings**

#### Time Base

Can either be UTC or local time. The time base is used in all event generation, and to format the clock shown in the upper right corner of the program window.

#### **Confirm User Data**

If checked, all user data messages are transmitted using *confirmed user data* If not checked, all user data messages are transmitted using *unconfirmed user data* 

#### Use Serial Time Sync For LAN and WAN

Time synchronization commands sent over a network normally use the LAN model starting with "Record Current Time". If this option is checked, network time synchronization commands use the serial model starting with "Delay Measurement". The serial model is always used for serial communication.

#### **Keep Alive Timer**

Time, in seconds, to transmit a keep alive message, defined as a *Request Link Status*. If 0, a *Request Link Status* is not sent unless otherwise configured. If non-zero, it defines a time, in seconds:

#### Outstation Mode

A **Request Link Status** message is sent whenever no message is received from the master in the specified time. The **Request Link Status** message is sent to the master DNP address entered under the Master Settings area on this view. For network operations, the **Request Link Status** message is not sent unless there is an active TCP connection.

#### Master Mode

A *Request Link Status* message is sent to any configured outstation whenever no message is received from it in the specified time. A user configured *Request Link Status* message (in the normal set of messages to be sent) overrides this keep alive message. That is, if the user has configured logic for transmission of a *Request Link Status* message, the program will not override that logic.

#### Connect Mode

Keep alive logic is not activated if master mode was started by selection Communication/Connect.

#### Master Settings

Selecting any option here propagates the selection as the default for all messages in the *Master Config* view.

									· ·			
Romioct /\	/ariation	Gonoral	Dotinos a	nrotoron	r n ۱	variations	to he	hagure	tor oh	iort (	groun	roade
nequest/ v	anation	General	Dennes	i preieren		70110113		useu	101 00	Ject	Bioup	reaus.

Any	No preference (use variation 0, Any)
Flags	Use a specific variation that includes reporting of flags
No Flags	Use a specific variation that excludes reporting of flags
Time	Use a variation that requests time, when applicable
<b>Relative Time</b>	Use a variation that requests relative time for binary events, and normal time for other
	applicable events

Request/Variation Numeric Objects Defines a preference in variations to be used when reading object groups

	used to report numeric values
Any	No preference (use variation 0, Any)
16-bit	Request 16-bit values
32-bit	Request 32-bit values
Float	Request floating point values, when applicable

#### Source/Destination Addresses

Of MasterAddress of master. Source address in messages sent in master simulation modeOf OutstationAddress of outstation. Default destination address in messages sent in master simulation mode

#### **Delay Between Select and Operate**

Imposes a delay of 0 to 9 seconds between issuing the select and operate portions of a binary or analog command

#### Broadcast Addresses

Defines what address is used when a broadcast message is sent.

## **Outstation Settings**

#### Input Objects

#### Static

#### Always with Flags

- If checked, a point's data value is always sent using a variation with flags
- If not checked, a data value is sent using a variation without flags if the point is in a normal state (online and no other flags set). The point value is sent using a variation with flags under any other condition.

#### Send in Class 0

• Includes points in the object group in class 0 responses

#### Format

• Numeric format variation for reporting analog and counters

#### With Time

• Use a variation with time for reporting static values (application for frozen counters only)

#### **Output Status**

• Options to include analog and binary output status points in a response to a class 0 poll

#### **Events**

#### Enabled

• Generate events for the associated object type

#### With Time

• Use a variation with time for reporting events

#### Class

• Class used for reporting events of this type

#### **Output Objects**

#### Allow SBO

• Allow SBO commands

#### Allow SBO

• Allow Direct Operate commands

#### Select/Operate Timeout

• The operate portion of an SBO sequence is rejected if the difference between reception of the select and the output command exceeds the time specified

#### Other

#### Send Reset Link at Startup

• If checked, a *reset link* command is sent (by each configured outstation) as soon as possible after startup. This may be useful using confirmed user data services. If unchecked, CDOAN-DNP3 still sends a reset link, if the link has not been previously reset, on reception of a message using confirmed user data services

#### Cold Restart Time (secs)

• Defines time, in seconds, required to process a Cold Restart command. The outstation will not respond to requests during this time

#### **Counter Deadband**

• Deadband for reporting [non-frozen] counter events. A value of 0 disables events based on value change

#### Analog Deadband

• Deadband for reporting analog change events

#### Subset Level Compliance

#### No Restrictions

Introduces no communication restrictions to meet requirements of any subset level

#### Level 1

Responds only to requests included in subset level 1, specifically, a level 1 outstation does not:

- Respond to polls for specific object groups
- Support frozen counters nor freeze operations
- Generate analog events with time
- Support assign class commands

#### Level 2

Removes restrictions imposed for subset level 1. A subset level 2 outstation will:

- Respond to polls for specific object groups specifying variation 0 and qualifier 6 (all)
- Respond to polls for binary input events specifying any valid variation 0 and qualifier 6 (all)
- Support frozen counters but not frozen counter events

#### Level 3

Removes restrictions imposed for subset level 2. A subset level 3 outstation will:

- Respond to polls for specific object groups specifying any valid variation
- Respond to polls for specific object groups specifying the all qualifier (6) or a start/stop qualifier (0 or 1)
- Support frozen counter events
- Support assign class

#### Single Frame

A single frame response outstation is a very small subset level 1 outstation. It conforms to subset level 1 standards, but, additionally, does not generate events.

#### Error Generation

Each error class can be configured to generate the corresponding error condition:

- Never
- Once The error is generated on the next applicable response. Afterwards, the option is automat6ically changed to *Never*
- Always
- Occasionally The error to generated at random time, less than 50%

Error types are:

- CRC generates a CRC error
- No Appl Con Do not send an application confirm when requested
- No Inc SEQ Do not increment the application sequence number for new requests

 Add IIN Flags – In outstation simulation mode, sets additional internal indication flags. This option cannot be used to "unset" flags that would normally be set based on the state of communication and the outstation. Select the additional flags you want to set first, and then select "Always", Once", or "Occasionally".

## File Read/Write Location

File operations supported include:

- Open
- Delete
- Read
- Write
- Get status

Files are read from and written to the specified folder. Please note that, for outstation operations, file operations are only supported if the *No Restrictions* box is checked under Subset Compliance. File operations are not part of subset levels 1, 2, or 3.

## Master Station Configuration

This view supports configuration of messages to transmit in master simulation mode. CDAON-DNP3 supports independent communication to up to ten outstations.

	🖶 CDOAN												
Г	File Edit	Views Communication	Window										
🔜 Master Station Configuration													
	Туре	Request	Var	Dest	Peri	Frequency	Qualifier	Range	Range	Index	CROB	V	al Agair 🛆
	CLASS	1/2/3/0	2341-Class 1230	0	2	Periodic 🗸	All					$\sim$	Send
	CONTROL	Binary SBO	1-Command	0	2	Periodic 🗸	Point Index	1		0		$\sim$	Send

## Fields

Each row defines one message to send. Multiple messages of the same request type are allowed.

Туре	General type of Release 3.0.0 a in documentati to determine w commands, is s	<sup>1</sup> message to send, such a <b>Read</b> , <b>Class</b> , and <b>Control</b> dded external scripting, with the type "Script". Scripting capabilities are described on for the associated script editor. Script entries should be coded as periodic, used hen top send the next script message. The external script file, containing a list of pecified in the Var (Variation) field.								
Request	Clarification of	request within <b>Type</b> , such as <b>Binary SBO</b> or <b>Analog SBO</b> within <b>Control</b>								
Var	DNP3 variation									
Dest	Destination (ou	tstation) address								
<b>Period</b> Transmission time, in seconds. The first transmission occurs at this time after comstarts and, if enabled for periodic transmission, at each interval thereafter.										
Frequency	How often the	message is sent								
	Disabled Periodic	Never sent Sent initially at the time after startup specified in the "period" column, and periodically thereafter at the same frequency								
	Once On Demand	Sent once at the time after startup specified in the "period" column Send only on request by the user (See "Again" column description)								
Qualifier	DNP3 qualifier code									
Range1	DNP3 range1 va	alue, as consistent with the qualifier code								
Range2	DNP3 range2 value, as consistent with the qualifier code									
Index	Point index, val	id for binary and analog output commands only								
CROB	Control relay o	utput block type, valid for binary output commands only								
ValValue for analog output commands, orPulse-on time for binary output commands, orFile name for file read and write commands										

AgainAny message (except those identified as disabled) is sent when specified by the *Frequency* field,<br/>and also whenever the *Again* button is selected. This is useful for (for example) sending control<br/>actions only when requested by the user

## Editing Entries

Entries are created and edited from the *Edit* pull-down list, or by right-clicking on a row in the grid.

🖳 Master St	ation Configuration											• 🛛
Туре	Request	Var	Dest	Per	Frequency	Qualifier	Rang	Rang	Index	CROB	Val	Agai ^
READ	Analog Static	0-Any	1	0	Once ~	All				\ \	1	Send
READ	Binary Static	0-Any	1	0	Once ~	All				\ \	1	Send
READ	Counter Static	0-Any	1	0	Once ~	All				\ \	1	Send
READ	Binary Events	0-Any	1	2	Perio ~	All				\ \	1	Send
READ	Analog Events	0-Any	1	10	Perio Y	All				\ \	1	Bend
READ	Analog Static	0-Anv	1	60	Perio ~	All				\ \	/	Send
READ	Binary Static	Change Request	•	60	Perio Y	All				\ \	1	Bend
READ	Counter Static	Change Variation	1	60	Perio ~	All				\ \	1	Send
READ	Frozen Counter Static	Change Qualifie	r	0	Once ~	All				\ \	1	Send
READ	Frozen Counter Static	Cut		60	Perio ~	All				\ \	1	Send
CONTR	Binary SBO	Сору		0	On D 🗠	Point Index	1			\ \	1	Send
CONTR	Analog SBO	Paste		0	On D 🗠	Point Index	1			`	1	Send
		Insert After										
		Insert Before										
		Link to Prior										
												×

Fields of the edit pull-down menu are:

## Change Request

Change Request 🔹 🕨	Data Link	- +	
Change Variation	Class	- +	
Change Qualifier	Read	•	READ Analog Static
Cut	Control	•	READ Binary Static
Сору	Freeze	•	READ Double Binary Static
Paste	Time	•	READ Counter Static
Insert After	File	•	READ Frozen Counter Static
Insert Before	Other	•	READ Binary Output Status
Link to Prior			READ Analog Output Status
			READ Analog Events
			READ Binary Events
			READ Double Binary Events
			READ Counter Events
			READ Frozen Counter Events
			READ Analog Deadbands
			READ Device Attributes

Allows for selection of a new request and request type. Selecting a message causes the *Type* and *Request* columns to be filled in appropriately.

#### Change Variation

Presents options to enter a variation consistent with the *Type* and *Request*. For example, the following choices are presented for a *Read Analog Status* request.

READ Analog Static		×
0; Any		
1; Flag_32_bit		
2; Flag_16_bit		
3; NoFlag_32_bit		
◯ 4; NoFlag_16_bit		
◯ 5; Flag_float		
ОК	Cancel	

## Change Qualifier

Presents options to enter a qualifier code consistent with the *Type* and *Request*. For example, the following choices are presented for a *Read Analog Status* request.

READ Analog Static $ imes$								
All								
O Start/Stop								
OK Cancel								

#### Cut, Copy, Paste

Has standard meanings and apply to a single operation on the entire row.

- Cut removes the row and moves it to a clipboard
- Copy moves a copy of the current row to the clipboard
- Paste inserts the item in the clipboard at the current row location, overwriting the row's current contents

#### Insert After and Insert Before

Inserts an [Unassigned] entry after or before the current row.

#### Link To Prior

If the message selected and the message above the selected message are the same type, they can be merged into a single request. For example, if both messages are "READ" or both are "CONTROL SBO" requests, then they can be as a single message by linking them. The *Link To Prior* option appears only if linkage is possible.

For example, consider the following:

📑 Maste	r Station Configuration												• X	3
Туре	Request	Var	Dest	Perio	Frequency		Qualifier	Range	Range:	Index	CROB	Val	Again	^
READ	Analog Static	0-Any	1	0	Once	$\sim$	All				~		Send	
READ	Binary Static	Charge Barnet	1	0	Once	$\sim$	All				~		Send	
READ	Counter Static	Change Request	1	60	Periodic	$\sim$	All				~		Send	
		Change Variation Change Qualifier Cut Copy Paste Insert After Insert Before Link to Prior												

#### Selecting *Link To Prior* results in:

ſ	🖳 Master Sta	Master Station Configuration														
	Туре	Request	Var	Dest	Perio	Frequency		Qualifier	Range	Range:	Index	CROB	Val	Again	^	
	READ	Analog Static	0-Any	1	0	Once	$\sim$	All				~		Send		
	+	Binary Static	0-Any	1	0	Once	$\sim$	All				~		Send		
	READ	Counter Static	0-Any	1	60	Periodic	$\sim$	All				~		Send		

Note that the two messages are now joined. Sending this will issue a single message to read two objects: Analog Static and Binary Static. Also, the pull-down list (if requested) now shows as:

Change Request
Change Variation
Change Qualifier
Cut
Сору
Paste
Insert After
Insert Before
Unlink from Prior

## Outstation Configuration

Shows and allows editing of the point data base for outstation simulation mode.

🔛 CDOAN														-	
File View	s Communication	Window	r i i i i i i i i i i i i i i i i i i i									No	t Runni	ng 23:4	2:39 UTC
🖳 Outstati	on Configuration														
Adrs	Туре		Index	Value	Alt. Value	Time	OnL	Rst	Lost	RFrc	LFrc	Chat	Dcon	Ref	Over ^
1	Binary	~	0	0	0	0									
1	Binary	~	1	0	0	0									
1	Binary	<	2	0	0	0	$\checkmark$								
1	Binary	~	3	0	0	0									
1	Binary	<	4	0	0	0	$\checkmark$								
1	Binary	<	5	0	0	0	$\checkmark$								
1	Binary	~	6	0	0	0	$\checkmark$								
1	Binary	~	7	0	0	0	$\checkmark$								
1	Counter	~	0	0	0	0									
1	Counter	~	1	0	0	0	$\checkmark$								
1	Counter	~	2	0	0	0									
1	Counter	~	3	0	0	0	$\checkmark$								
1	Counter	~	4	0	0	0									
1	Counter	~	5	0	0	0	$\checkmark$								
1	Counter	~	6	0	0	0	$\checkmark$								
1	Counter	~	7	0	0	0									
1	Analog	~	0	0	0	0	$\checkmark$								
1	Analog	~	1	0	0	0									
1	Analog	~	2	0	0	0	$\checkmark$								
1	Analog	~	3	0	0	0									
1	Analog	~	4	0	0	0	$\checkmark$								
1	Analog	~	5	0	0	0	$\checkmark$								
1	Analog	~	6	0	0	0									
1	Analog	~	7	0	0	0	$\checkmark$								
1	Binary Output	$\sim$	0	0	0	0									
<															>
Config	DNP3 Master Ou	utstation													

## Adding and Deleting Points

Points are added to or deleted from the table by selecting the edit pull-down list or right-clicking a row in the table.

<u>e</u> l	E CDOAN																	
F	File Edit Views Communication Window																	
	Ad Conv					Index	Value	Alt. Value	Time	OnL	Rst	Lost	RFrc	LFrc	Chat	Dcon	Ref	Over
	1	Paste			$\sim$	0	0	0	0	$\checkmark$								
	1		Binary	1	×	1	0	0	0	$\checkmark$								
	1 Binary			~	2	0	0	0	$\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{\mathbf{$									
	1		Binary		~	3	0	0	0	N								

Selecting:

- Add generates the following dialog
- **Delete** deletes points in all selected rows
- **Copy** remembers contents of the current row for **Paste** operations
- **Paste** copies contents of the "Copied" row to all selected cells (excluding Adrs, Type, and Index). The target row and the source row must be of the same point type.

Add points		×
Outstation		
Point Type	Binary	~
	Binary 2-Bit Binary Counter Analog	cel
	Binary Output Analog Output Unassigned	

Enter the outstation address, the number of points to add, and the point type.

- Points are generated starting at index 0 within each point type at each outstation. Additional points are assigned incrementally increasing indices. There is no way to start point indices at any value other than 0, and there is no way to generate "gaps" in the address space. When a point is deleted from the middle (e.g., deleting point index 5 after creating indices 0 to 10), point indices are re-sequenced before an outstation simulation session is started.
- Both input and output points must be defined. A control action received for an undefined point results in an "undefined" control status response.
- Each counter point configures both an active running counter and a frozen counter consistent with the subset level being simulated. A frozen counter value represents the value of the same running counter that existed when the freeze operation was processed.

#### Point Properties

Properties define values and flags to report to the master when the point is polled. Any property may be changed while communication is active. The new value will be reported and events are generated when applicable.

Value	Value initially associated with the point
Alt. Value	Alternate point value
Time	The alternate value is processed at a frequency specified in the time column, in seconds. "Processing" depends on the point type.
Analog Inputs	Alternates between alternate and initial values at every time interval. An event is generated if the difference between the values meets or exceeds the analog reporting deadband (specified in the DNP3 Protocol Settings View). Only one event per analog input is saved. Each new event overwrites any prior, non-reported event
Binary Inputs	Alternates between and alternate and initial values at every time interval. A binary event is generated if the values differ. Multiple events per point are saved.
Counter	Current value is incremented by the alternate values every period. An event is generated when the accumulated unreported change exceeds the counter deadband value in the DNP3 parameters page. No events based on a value change are reported if the counter event deadband value is 0.
Flags	The state of each point flag. Any change while communication is active generates an event. Changing an inconsistent flag, such as reference error for a binary input point, has no effect.
	The meaning of each flag is shown by mouseover in the flag title line.

## Communication

## Starting Communication

Active communication is started when by selecting either Master, Outstation, Listen, or Connect under the Communication pull-down list.

🔛 CD	OAN		
File	Edit	Views	Communication Window
			Master
			Outstation
			Listen
			Connect

MasterStarts communication as a master. Messages are transmitted as defined in the Master Config<br/>View.OutstationStarts communication as a set of 1 to 10 outstations, using point data defined in the Outstation<br/>Config view.ListenListens to communication between active masters and outstations. Network listening can be<br/>filtered to specific masters or outstations by entering their IP addresses in the Config view.ConnectAn alternative way to start communication as a master. In this mode, CDOAN-DNP3 connects,<br/>but no messages are transmitted initially. Messages are transmitted manually, once for every<br/>time a message's Again box is checked in the Master Config view.

Aster Station Configuration									
Request	Period	Send	Qualifier	Range1	Range2	Index	CROB	Val	Again
Class 1/2/3/0	0	Once ~	All				~		Again
								' 	Û

Other messages may be automatically sent to satisfy requirements for Data Link ACK, Application confirm, or on detecting the *Restart* or *Need Time* internal indication bits.

## Showing Communication Messages

The **Communication Messages** view displays communication data collected from an active network or serial communication session, or loaded from a saved messages file. Options at the top of windows control how data is presented.



## Scroll Options (radio buttons)

Scroll - Normal scrolling

Do No Scroll - New messages are still added at the bottom of the window, but lines do not scroll. The window remains focused at the current position. The view can be scrolled manually

## Display Options (check boxes)

Show D.L.	Shows hex octets (bytes) in each data link frame. CRC security bytes are enclosed in braces "{ }" and are shown in red when in error.
Show Appl	Shows hex octets (bytes) in each application fragment, shown only when a complete fragment is received, which may require multiple data link frames. Application data omits CRC bytes
Octet Details	Data bytes for each interpreted application data item are shown in the margin to the right of the corresponding description
Black/White	Information in the "Active Comm" view can be shown in color, with different colors used for master and for outstation communication, or in black and white
Save Messages	When checked, data written to the "Active Comm" view is also written to a communication message file. File writing stops when the box is unchecked or when communication stops.
Show Headers O	nly - When checked, only summary information about each message is shown. This reduces processor utilization. Most processor time is used updating the screen.
	All data processing still occurs and point values are updated on the <i>Point Data</i> view. The only change with this option set is that data presentation on the <i>Communication</i> view is compressed.
	If enabled, the user is given an option (when communication is stopped) to regenerate the communication view with all messages shown in expanded format.

#### Sample Excerpt from Active Comm Data Presentation

	Data Lin	k Frame Bytes	(71)																
Data Link Layer Octets	05 64 3 22 D0 8 32 FB 0	A 44 02 00 01 D 70 01 02 81 1 32 FB{E1 BF;	00{53 79}C F9 22 D0 8	A CO 81 D 70{8D	00 00 F8}01	02 02 1 1E 02	17 0 00 0	3 00 0 0 04 0	1 F9 2 1 32 1	22 D0 FB 01	8D 70 32 FB	{A5 } 01 ;	AB}01 32 FE	01 (	01 F9 2F A3}	CRC Sho	Octet wn in	s in bra r <mark>ed</mark> if in	ces. error
	Function		Length	Contro	1				Sourc	ce D	estina	tion							
Data Link Layer	Unconfirm	med User Data	58	DIR:0	PRM:1	FCV:0			1	2									
-	Transpor	t Layer																	
Transport Layer	FIN:1 FI	R:1 SEQ:10																	
	Applicat:	ion Layer Byte	es (52) - C	RCs Rem	oved												A		
Application	CO 81 00	00 02 02 17 0	)3 00 01 F9	22 D0	8D 70	01 01	01 F9	22 D0	8D 7(	0 01	02 81	F9 23	2 D0	8D 7(	0 01		Арри	cation (	octets
Layer Octets	1E 02 00	00 04 01 32 F	FB 01 32 FE	01 32	FB 01	32 FB	01 32	FB									Corre	spondi	ig to
	Function	Cor	ntrol		Inter	rnal In	dicat	ions									Infor	nation	
Application Header	Response	FIF	R:1 FIN:1 C	ON:0													at the	e leπ	
		UNS	5:0 SEQ:0					_								C0 81	00 00	)	
	Object	· · · · · · · · · · · · · · · · · · ·	Var	lation				Qua	lifiei	r	o								
1st Object Header	2:Binary	input event	2:0	ith tim	e	<b>m</b> /	-	0X1	/:List	C OI	3 poin	ts				02 02	17 03	3	
	Index	varue	Flags			11m	e Feb 0												
1at Object Date	> 0	0	Online			20-	Feb-2	020 09	.59:54	2.020						00 01	F9 22	D0 8D	70 01
ist Object Data	> 1	1	Online			20-	Feb-2	020 09	.59:52	2.020						01 01	F9 22	2 D0 8D	70 01
	Object		Var	istion		20-	rep-2	0113	lifia	s.023						02 81	F9 22	. D0 8D	70 01
2 1012 111	30:3nalo	a input	2.1	6 bit w	ith fl	larr		0.20	0.Stai	rt 0	Stop	4				12.00			
Znd Object Header	Index	Value	Flags	O DIC W	1011 11	Lag	Index	Value	0.504		Flags	-				1E 02	00 00	04	
	> 0	64306	Online			>	1	64306			Online					01 22	ED 0.	22 55	
2nd Object Data	> 2	64306	Online			Ś	3	64306			Online					01 32	. D U.	. 34 fB 22 FB	
,	5.4	64306	Online				Č									01 52	- FB 0.	. 32 FD	

## Sample when "Show Headers Only" checked

🔛 Communication Messages						
Scroll Options						
Scroll O Do Not Scroll	Show D.L. Show Appl	ictet Details 🔄 Black/White	Save Messages	Show Headers Unly		
MASTER [18-May-2021 1	9:01:50.9251 : Read: Class dat	a				Master Data Link
> Transport header:F	IN:1 FIR:1 SEQ:0					C
60:Class data	2:Class 1	0x06:A11				0
60:Class data	3:Class 2	0x06:All				Master Application
60:Class data	4:Class 3	0x06:A11				6
60:Class data	1:Class 0	0x06:A11				<u> </u>
						Master Error
OUTSTATION [18-May-20]	21 19:01:51.030] : Response: A	nalog_input				0
> Internal Indication	ne: Need Time Destart					
30:Analog input	4:16 bit. No flag	0x00:Start 0.	Stop 7			Outstation Data Link
	1110 D10, 10 1149		stop .			0
MASTER [18-May-2021 1	9:01:52.034] : Write: Internal	indications				0
> Transport header:F	IN:1 FIR:1 SEQ:0					Outstation Application
80:Internal Indication	ns 1:Packed	0x00:Start 7,	Stop 7			6
						·
OUTSTATION [18-May-20]	21 19:01:52.111] : Response					Outstation Error
> Transport header:r	IN:I FIR:I SEU:U					0
> Internal Indication	ns. Need_lime					
MASTER [18-May-2021 1]	9:01:53.0591 : Record Current	Time				
> Transport header:F	IN:1 FIR:1 SEQ:0					
OUTSTATION [18-May-20]	21 19:01:53.136] : Response					
> Transport header:F	IN:1 FIR:1 SEQ:0				<b>*</b>	

ľ

#### Communication Statistics

Shown at the right edge of this view.

Master Data Link	•	Messages received from a master Data Link
Master Application	0	Application
Master Error	0	With errors
Outstation Data Link	•	Messages received from an outstation
	0	Data Link
Outstation Application	0	Application
Outstation Error	0	With errors

## Edit Menu

The edit menu for the Communication View allows for:

- Deleting all messages
- Clearing message totals shown at the right potion of the view

When communication is inaction, the edit view contains extra entries

Edit	
	Delete All
	Clear message totals
:	Search
	Next
:	Save Current Messages

- Search allows entry of a search string for messages shown. Text is case insensitive
- Next finds the next entry
- Save Current Messages Writes contents of the messages view to a CMSG file, the same as if saving was enabled during communication

## Point Data

#### Display

The points view shows values for all points from all devices detected during communication. Time stamps for input points are shown only if reported by the outstation.

In addition to input points, an entry is made for every analog and binary output control action detected. A time stamp is generated for these output actions indicating the time the control was detected.

	🔒 CDC	DAN					
Г	File	Edit Views Commun	ication Window	_			Communicat
		Edit Point Names and	d Value/State Descriptions				
		Trend		Namo	Value	Time	Elaca A
	Aun	siyhe	index	Name	value	Time	riags
	1	Binary Input	0		0		No flag (Online implied)
	1	Binary Input	1		0		No flag (Online implied)
	1	Binary Input	2		0		No flag (Online implied)

Points are sorted by DNP3 address (address of the outstation), then by point type, and point index.

## Edit Menu

The edit menu supports:

#### Edit Point Names and Value/State Descriptions

Addition of point name, binary state name, and analog engineering unit information (described in next section)

#### Trend

Adding an analog, binary, or double binary points point to the trend view. Counters cannot be trended.

#### Trend

Selecting the *Trend* target automatically starts trending on the selected point. The point will be shown in the color of the trend slot to which is was assigned. No further entry is needed.

## Adding Point Names, Binary State Descriptions, and Analog Engineering Units Information

The product supports entry of:

- Point names for all input point types, and
- State names for binary and double binary input points, and
- Engineering unit descriptions and conversion information for analog input points

The entry process is started by selecting <u>Edit Point Names and Value/State Descriptions</u> in the edit pull-down list from the **Point Values** view. The selection generates the menu shown on the next page.

drs		Туре	Index	Name	Value		Time	Flags	5
Show	◯ Hide	● Show ○ Hide	Show	/ ○ Hide	e	v O Hide	● Show ○ H	ide 🔍 S	how O Hide
	Outstation	Point Type	Index	Name	Eng Min	Eng Max	EU	Name Off	Name On
hished	1	Binary	0	Binary 1				Trip	Close
	1	Binary	1	Binary 4				Trip	Close
dit	1	Counter	0	Name For Counter 0					
	1	Counter	1	Name For Counter 1					
id	1	Analog	0	Analog 0	100	200	Mvar		
	1	Analog	1	Analog 1	100	200	Mvar		
ete									
e All									
	<								

#### Which Point Tabular Columns To Show

#### Show/Hide

The top targets in the view, identified with Show and Hide options, provide control over which columns to display in the main *Point Values* view. Once points names are included, the *Point Values* windows may be too small to show data for all columns. To make more space for applicable columns, other columns may be removed from that view by selecting "Hide". The may be reenabled by selecting "Show". As a default, all columns are shown.

#### Point Field Descriptions

Each entry defines one point and contains up to nine information fields.

#### Point Identification and Name

Four fields tell the program how to identify a point and the name of that point, and these four are the only required fields.

- Outstation is the DNP 2-octet address of the outstation device
- Point type is the DNP point type and is either Analog, Binary, Counter, and Double (Binary)
- Index is the DNP point index
- Name is the point name

#### Analog Specific Information

The next three fields are valid for analog inputs only.

- EngMin defines a floating-point number specifying the engineering-units value corresponding to a DNP3 value of -32768
- EngMax defines a floating-point number specifying the engineering-units value corresponding to a DNP3 value of 32767
- EU is the engineering units name, such as MVar

An entry made into any of these three fields for a non-analog point will eventually be erased.

#### Binary and Double Binary Specific Information

The final two fields are used only for binary, 1-bit and 2-bit, points.

- Name Off defines the state name for a binary state of '0' or a double binary state of '1' (i.e., 0-1)
- Name On defines the state name for a binary state of '1' or a double binary state of '2' (i.e., 1-0).

An entry made into any of these two fields for any non-binary type point will eventually be erased.

#### Buttons

Changes are made to the table through one or more of the buttons shown at the left of the menu

#### Finished

Select when done. The exit process may scan for and remove duplicates, and will remove invalid entries, such as engineering unit information for non-analog points.

#### Delete

Deletes all selected entries

Delete All Deletes all entries

#### Adding and Editing Points

There are two ways to enter new point information:

- Add and Edit can be used to add or modify a single point
- Import can be used to import a list of points from a CSV (comma separated values) file

Any point information entered is used for display in the *Point Data* view. Point name information is not shown in the communication scrolling window.

#### Edit

#### Add

Used to add a new point, or edit an existing point. Selecting either target generates the following menu.

🛃 Point Name	and State/Value Desc	riptions	—	×
Outstation Index Point Type Analog Binary	0 Counter Double	For Analogs - Eng Units: Units for -32768: Units for 32767: For Binaries - name when Off Name when on	Mvar 100 200	
Name OK	Analog 0 Cancel			

The name can be any ASCII string. However, '<', '>', and ':' are reserved characters and, if entered, will be removed.

#### Import

Importing point information from a set of comma delimited values is more involved. Selecting Import shows:

📙 Import CSV File	e of Point Names and State	/Value Information							-
If the outstation	on address is not in the	e CSV file, use this	value	0					
Order of fields	s in CSV File								
Field 1	Field 2	Field 3	Field 4	Field 5	Field 6	Field 7	Field 8	Field 9	
Outstation	<ul> <li>✓ PointType</li> </ul>	~ Index	<ul> <li>✓ Name</li> </ul>	~	~	~	~	~	~
Import	FIELD MEANINGS								^
Cancel	Outstation is the DNP3	3 2-octet outstation a	ddress						
	Point Type is the DNF Analog is assumed for Binary is assumed for	23 point type or any word beginnin or any word beginning	ng with 'a', or the numb	ers 30 or 32 (DNP3 o	object groups)				
	Counter is assumed to - One entry is used for Double-bit binary is a	for any word beginning or both current and fro	ng with 'c', or the numb izen counter values	ers 20 through 23 (D	NP3 object groups)				
	Index is the point index	x	a boginning mar a ; o						
	Name is the point nam	ne							
	EngMax is valid for an	alog points and defi	nes the engineering v	alue correspodning	to an input value of 327	67			- 11
	EngMin is valid for an	alog points and defir	nes the engineering va	lue correspodning t	o an input value of -327	68			
	EU is valid for analog	s and defined the en	gineering units name,	such as MW					
	NameOn is valid for b For binarv. it defines	inary and double bin the state name cores	ary inputs sponding to a state va	lue of 1					~

The CSV file to be imported can have 3 to 9 fields separated by commas. After import, the program must be able to assign an outstation address, point type, point index, and point name to each entry. Of these, the last three, point type, point index, and point name, must be in the CSV file. The first, outstation address, may also be in the file. If not, the outstation address contained in the entry field at the top of this menu is used.

There are five other fields that are not required, but will be processed if present. The meanings of all are described in a prior section.

- EngMin, EngMax, and EU are used for analog inputs, and
- NameOff and NameOn are used for binary inputs (1-bit and 2-bit)

Using the pull-down lists for each of the nine fields, enter the field contained in the corresponding position in the CSV file. If the CSV file has a field that is not used for this application, that field is skipped by selecting the "---" in the pull-down list for that field position.

Field syntax:

- Blanks are removed before and after all names. Blanks within a name are allowed.
- '<', '>', and ':' are reserved characters in all names and will be removed
- EngMin and EngMax are floating point numbers
- The point type is converted to "Analog", "Binary", "Counter", or "Double" according to the following rules
  - Analog is any name beginning with A or a, or DNP3 object group numbers 30 or 32
  - Binary is any name beginning with B or b, or DNP3 object group numbers 1 or 2
  - Counter is any name beginning with C or c, or DNP3 object group numbers from 20 to 23
  - Double binary is any name beginning with D or d, or DNP3 object group numbers 3 or 4

Once all columns have been configured, select the Import target to select the CSV file for import.

When the import process completes, the list of points imported is shown along with any errors detected during import of the CSV file. Any name found in the CSV file with the same outstation address, point type, and point index as one already existing in the point name list overwrites the previous entry. No error is logged for this.

Show	◯ Hide	Type ● Show ◯ Hide	Index Show	Name O Hide Show O Hide	Value Show	◯ Hide	Time ● Show O H	fide St	now O Hide
	Outstation	Point Type	Index	Name	Eng Min	Eng Max	FU	Name Off	Name On
inished	1	Binary	1	Binary 1					
	1	Binary	4	Binary 4					
dit	1	Binary	7	Binary 7					
	1	Binary	10	Binary 10					
Add	1	Binary	13	Binary 13					
	1	Binary	16	Binary 16					
nport	1	Binary	19	Binary 19					
	1	Binary	22	Binary 22					
1.1	1	Binary	25	Binary 25					
elete	1	Binary	28	Binary 28					
	1	Binary	31	Binary 31					
ete All	1	Binary	34	Binary 34					
	1	Binary	37	Binary 37					
	1	Binary	40	Binary 40					
	1	Binary	43	Binary 43					
	1	Binary	46	Binary 46					~
	<			1					>

All errors detected in any given CSV file line are shown at the bottom of the menu followed by the line from the CSV file where the error was detected. A line with any error is discarded. Lines without errors are processed.



The Trend view plots values for up to four points. Each sample plotted represents the average value detected over a five-second period. Although value changes are processed as detected, the trend graph is only updated once every 15 seconds.

Each point is identified by name, outstation address, point index, and point type.

The name is entered by the user for informational purposes only

The Trend supports plotting of analog, binary (single and double inputs), and frozen counter points:

- Each analog value plotted represents the average over a 5-second period
- Each binary value is a weighted average, giving extra weight to brief momentary changes so that fast trip/close changes can be viewed. This is shown by a bump in the plot that may not show a complete transition from '0' to '1'. For an example, see the top of the red graph.
- Frozen counter values represent accumulations. The value plotted is the difference between successive readings. A new value is calculated when the reported value changes, or on the poll after a freeze is detected. An initial frozen counter value is not plotted until the second change (or freeze) occurs.

## Trend

There are two ways to activate a point in one of the four columns:

1. Enter outstation, point index, and point type on the trend display. Then right-click one of the enterable fields. An inactive point is shown with at least one of the fields displayed with a gray background. Once active, all fields are shown with a white background

🖳 Trend			
Name	4th St MVar	Name	
Outstation	1	Outstati	
Point Index 1	1	Point In	
Point Type	Analog 🗸	Point T	
4th St	MVar × Activate		

2. Right-click on a point in the point values view (as shown previously)

A point's background in the point view is shown in the color used to plot that point in the trend view. The background is white for all other (non-trending) points.

## Change Events

## Display

This view shows a list of all reported binary, analog, counter, and frozen counter events. Additionally, an "implied" binary event change is reported when a new state is detected for a 1-bit or 2-bit binary input point within a static object. That is, a change is detected in a static poll response that was not previously reported as an event.

	CD	OAN																					
F	ile	Edit	Vie	NS	Comn	nunica	tion	Wi	ndow	Stop													
	<b></b> (		Delete	All																		- 0	8
	[20-	Nov-	-2020	04:4	8:22.	822]	Adrs	1,	Binary	input	event	With	relative	time,	Index	1,	Value 1 ,	Flags	Online,	Time	0.000	secs	
	[20-	-Nov-	-2020	04:4	8:22.	822]	Adrs	1,	Binary	input	event	With	relative	time,	Index	4,	Value 1 ,	Flags	Online,	Time	5.189	secs	
	[20-	Nov-	-2020	04:4	8:22.	822]	Adrs	1,	Binary	input	event	With	relative	time,	Index	1,	Value 0 ,	Flags	Online,	Time	6.037	secs	
	[20-	Nov-	-2020	04:4	8:22.	822]	Adrs	1,	Binary	input	event	With	relative	time,	Index	1,	Value 1 ,	Flags	Online,	Time	9.033	secs	
	[20-	Nov-	-2020	04:4	8:22.	822]	Adrs	1,	Binary	input	event	With	relative	time,	Index	1,	Value 0 ,	Flags	Online,	Time	12.037	secs	
	[20-	Nov-	-2020	04:4	8:22.	822]	Adrs	1,	Binary	input	event	With	relative	time,	Index	1,	Value 1 ,	Flags	Online,	Time	15.038	secs	
	[20-	Nov-	-2020	04:4	8:22.	822]	Adrs	1,	Binary	input	event	With	relative	time,	Index	1,	Value 0 ,	Flags	Online,	Time	18.031	secs	

Edit Menu

Edit	
Delete All	
Save to File	
Save to CSV File 🔶	Include Time-Stamp Milliseconds
	Remove Time-Stamp Milliseconds

Delete All deletes all events.

Save To File writes change events contents to a text file

Save to CSV File writes change events to a comma delimited string file with the following columns:

- Time event was written to change events view
- Outstation address
- Object name (e.g., Analog)
- Object Index
- Object Value
- Object flags
- Event time stamp reported from the outstation (if present). The time stamp for events reported with relative time format is calculated by adding the most recent common time of occurrence

Options exists for including or excluding the millisecond portion of both time fields. The default Excel time format may not process milliseconds correctly. If you include milliseconds in the CSV file, then the cell format for the time columns should be set to "Custom" with a type string of "hh:mm:ss.000". (The final characters are numeric 0's).

Format Cel	ls					?	×
Number	Alignment	Font	Border	Fill	Protection		
<u>C</u> ategory:							
General Number Currency	^	-Sample Event	TimeStamp	)			
Accountin Date	ng	<u>T</u> ype: hh:mm:	ss.000 <				
Percentag Fraction Scientific Text Special Custom	ge	General 0 0,00 #,##0 #,##0_) #,##0_) #,##0_0 \$#,##0 \$#,##0 \$#,##0 \$#,##0	0 ;(#,##0) ;[Red](#,##0, 0_);(#,##0, 0_);[Red](#, );[S#,##0) );[Red](\$#,; 00_);(\$#,##	0) 00) ##0.00) ##0) :0.00)			~
	~					<u>D</u> elet	e
Type the r	number forma	t code, usi	ng one of i	the existin	g codes as a starting poi	nt.	
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