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A Sierra Monitor Company

**Driver Manual**  
**(Supplement to the FieldServer Instruction Manual)**

**FS-8700-21 LonWorks**

**APPLICABILITY & EFFECTIVITY**

**Effective for all systems manufactured after April 2009**

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## 1 DESCRIPTION

The LonWorks driver allows the FieldServer to transfer data to and from devices using LonWorks protocol. The FieldServer can emulate either a Server or Client. The FS-B4011 FieldServer is supplied with a LonWorks Card, while the FS-B2011 and FS-B30 Series FieldServers have a built-in LonWorks Interface. A Fieldbus connection is available on the FieldServer. The FS-B30 and FS-B4011 can handle up to 4096 Network Variables and the FS-B2011 up to 1000 which can be of the Standard Network Variable Types (SNVT) and/or User-defined Network Variable Types (UNVT).

## 2 DEFINITIONS

### 2.1 NV Updates/Polls

On LonWorks networks, information is transferred using Network Variable Updates and Network Variable Polls. The Client requests Network Variables from the Server using Network Variable Polls and Network Variable Updates occur when a Client sends Network Variables to a Server.

### 2.2 Network Management

The FieldServer is able to set its own Domain, Subnet and Node ID at start-up using the FieldServer configuration file. Alternatively, the FieldServer is capable of being commissioned and bound by Network Management Tools such as LonMaker® - see Appendix B.1.1 for further information.

#### 2.2.1 LonWorks - Program ID Calculation (SPID)

Network management tools use the Program ID to identify the different applications running on each device. Two devices on a network may have the same Program ID only if they have identical application/configurations

The Program ID for the FieldServer consists of a fixed and a variable field (XX in the Program ID below)..

90:00:95:47:1E:02:04:XX

The fixed part does not change for different configuration files or for different LonWorks driver versions. The variable part XX, which is also defined as the Model or Revision number, does however change.

The variable part is calculated at start-up when the configuration is loaded on the FieldServer. Certain critical fields in the configuration file are used to calculate this variable part of the Program ID. Thus if the configuration file changes significantly (critical fields) the Program ID will change. Also, as we add new features and capabilities to the LonWorks driver, this variable part of the Program ID may be different between LonWorks driver versions (even though the configuration file is the same).

It is possible though very unlikely that through a change in LonWorks driver and/or configuration file, the program IDs calculates out identical to another combination of driver and configuration. If this is the case with two FieldServers on the same network that run different configurations, one of these devices may fail to commission properly.

The following configuration can be used to force the SPID.

Connections		
Adapter	,Protocol	,SPID
Lonworks	,Lonworks	,80:00:95:48:50:02:04:01

## 2.3 Clients/Servers

The FieldServer functions as a Client when polling or sending updates on the LonWorks network and as a Server when being polled or receiving updates. The FieldServer can be bound to a maximum number of 15 LonWorks Nodes. The FieldServer recommended point limit is 1000 points for the FS-B2011 Series and 4096 points for the FS-B30 and FS-B4011.

## 2.4 Explicit/Implicit

Clients can address Servers using explicit or implicit addressing. Clients using explicit addressing obtain their data transfer parameters directly from the FieldServer configuration file. Implicit addressing is used when a Network Management Tool such as LonMaker® is used to connect a FieldServer to other LonWorks Nodes - the FieldServer is assigned its data transfer (binding) parameters by the Network Management Tool.

## 2.5 XIF Files

At start-up the FieldServer creates an external interface file (XIF) called fserver.xif based on the configuration file. The FieldServer differs from most other LonWorks drivers in that it is configurable and therefore its XIF is not fixed for all applications. The list of points available to the network will vary depending on the other networks connected to the FieldServer, and the requirements of the particular application. The recommended procedure for obtaining the XIF file for the FieldServer is to upload it. Refer to Appendix A.4 for details.

## 2.6 Device Resource Files

The STANDARD device resource file covers FieldServer data type support. All Standard Network Variable Types (SNVTs) in this file are available to the user. These SNVTs are listed in Section 5.1.3. Please note that due to the sophisticated nature of LonWorks variables, it may not always be possible to typecast the full information supplied in a LonWorks variable to a simple Data Type contained in another protocol. The FieldServer supports Move and Logic functions which would allow the LonWorks variable to be split up and passed to separate simple data types, thus preventing information loss. The FieldServer supports the sending and receiving of User-defined Network Variable Types (UNVTs) on the LonWorks Network. An UNVT is simply implemented as an array of bytes of user-defined length.

## 2.7 NV Aliases

The FieldServer currently supports a default of 63 network variable aliases to avoid network variable connection constraints. This number may be increased to a maximum of 4096.

## 2.8 Configuration Properties

Configuration Properties (CP's) characterize the behavior of a device in the system. Network installation tools realize this attribute and provide database storage to support maintenance operations. If a device fails and needs to be replaced, the configuration property data stored in the database is downloaded into the replacement device to restore the behavior of the replaced device in the system. Configuration properties are implemented on the FieldServer through configuration network variables. User-defined configuration property types are not supported. Appendix A.5 provides a list of standard configuration property types that are supported.

The information that follows describes how to expand upon the factory defaults provided in the configuration files included with the FieldServer.

### 3 DRIVER SCOPE OF SUPPLY

#### 3.1 Supplied by FieldServer Technologies for this driver

FieldServer Technologies Part #	Description
FS-8700-21	Driver Manual.

#### 3.2 Provided by the Supplier of 3<sup>rd</sup> Party Equipment

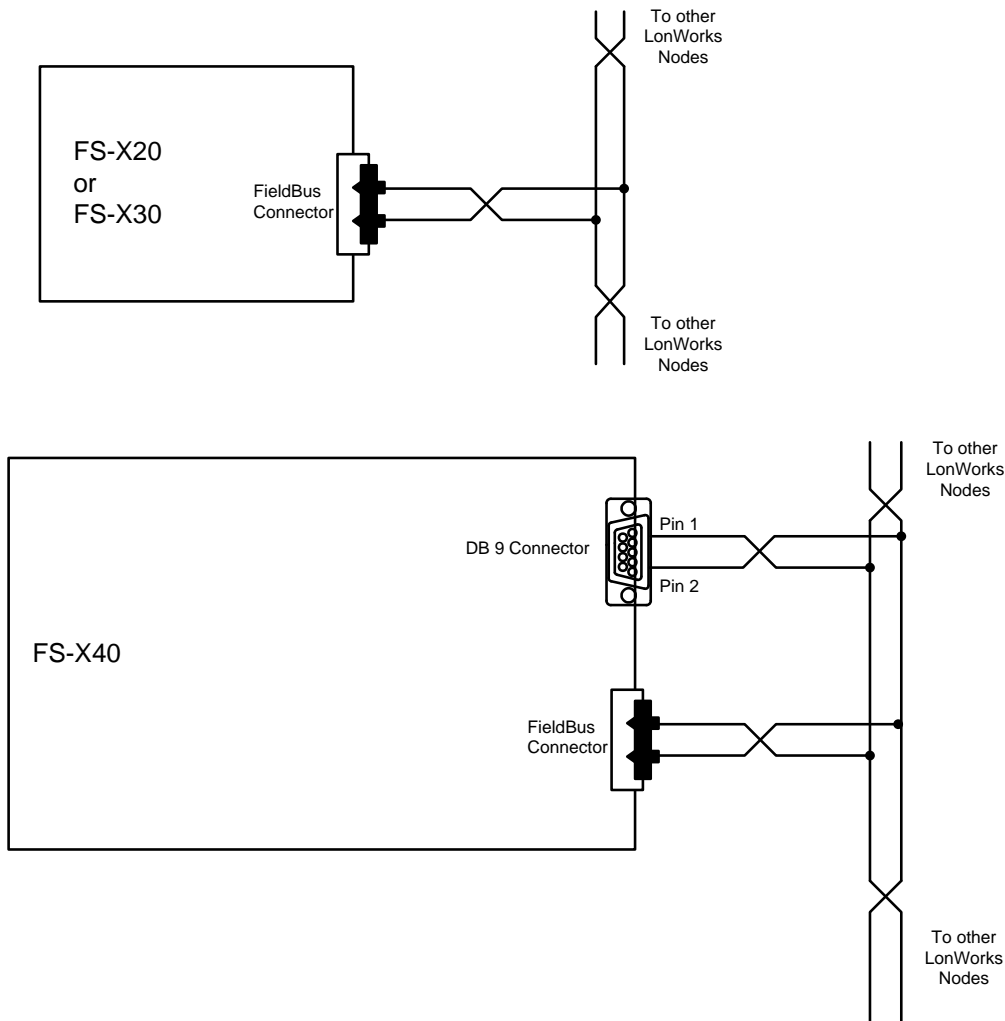
Part #	Description
N/A	LonMaker® Integration Tool from Echelon Corporation (Optional Network Management Software)
N/A	LonWatcher from Distech Controls Inc. (Optional Network Management Software)
N/A	Circon System Integrator from Circon Systems Corporation (Optional Network Management Software)
PCC10	PCCard LonWorks Adapter (Optional)

#### 3.3 Additional files required for the Driver

Filename	Auto-Created by driver	"Always Loaded By FieldServer Technologies	Conditionally loaded	Comments
Config.csv		X		Template loaded if no custom configuration ordered, otherwise Custom configuration loaded.
fserver.xif	X			Generated at power up. Changes if profile in configuration changes.
lon.ini			X	Used for providing defaulted DSN. Refer to Section 6.1.4
lonvars.cfg	X			Maintains commissioning settings. If corrupted, delete it, and reboot FieldServer to create new one.

## 4 HARDWARE CONNECTIONS

LonWorks devices are available with several different physical interfaces. The screw plug supplied with the FieldServer LonWorks interface will connect the FieldServer to the FTT-10 network. The 9 pin D-connector can also be used to connect to the network (FS-B4011 only). The 2-wire twisted-pair connection to the network is polarity insensitive. The FTT-10 network is a free topology network which supports star, loop and/or bus wiring connections. Please refer to the FTT-10A Free Topology Transceiver User's Guide from Echelon Corporation for recommended wiring practices if necessary. The connection diagram below shows how the FieldServer FS-B2011, FS-B30 and FS-B4011 are connected to a LonWorks network:



Configure the remote LonWorks devices according to manufacturer's instructions.

### 4.1 Service Pin

The service pin is used to commission the FieldServer onto the network using a LonWorks Network Management tool. On FS-B2011 and FS-B4011 FieldServers the node's unique Neuron ID will be displayed on the Error Screen of the Ruinet utility with every service pin press.

### 4.2 Neuron ID

The driver prints the Neuron ID on the Driver Message Screen as its starts. On FS-B2011 and FS-B4011 FieldServers it is possible to print the Neuron ID on the Error Screen at any time by pushing the Service Button on the side of the FieldServer. On all platforms, the driver can store the Neuron ID in a Data Array so that it can be read by a Client node – Refer also to Appendix C.3.

### 4.3 Lon LED's

The location of the Lon LED varies between FieldServer's. Please consult the Start-up guide for the FieldServer in question. Lon LED is consistent with the table below for all FieldServers.

Explicit	Implicit – Not Commissioned	Implicit – Commissioned
Off	Flashing	Off

### 4.4 The LonWorks Adapter Card (FS-X40 only)



#### 4.4.1 Port Address Switch

The LonWorks driver has been configured to access the LonWorks card at ISA port address 340 hex. This is the default setting for the card, and the DIP switches must not be modified. The DIP switch setting on the card is as follows:

Switch	Setting
1	ON
2	ON
3	OFF
4	ON
5	OFF
6	OFF
7	OFF
8	OFF



## 5 IMPLICIT CONFIGURATIONS

### 5.1 Special considerations

Implicit addressing is used when a Network Management Tool such as LonMaker® is used to connect a FieldServer to other LonWorks nodes - the FieldServer is assigned its data transfer (binding) parameters by the Network Management Tool.

#### 5.1.1 Map Descriptor Names (Network Variable Names)

When using Implicit configuration, the LonWorks driver provides a table of Network Variables for other Nodes to read. These Nodes access the variables according to Index numbers which are automatically assigned by the driver according to the Map Descriptor definition order in the configuration file. The driver also creates an identification table for configuration nodes to read the name and types of variables available on the FieldServer. Within the LonWorks protocol, this table size is limited to 64K bytes. If the application requires a large number of Server mappings (up to 4096), it will be necessary to limit the variable name length. Each Server mapping requires 4 bytes plus the length of the name from this 64K block.

#### 5.1.2 Implicit Lon functions

Implicit Map Descriptors are distinguished from Explicit Map Descriptors by the function used in the Lon\_Function field of the Map Descriptor. Depending on the nature and direction of Data Transfer needed, different implicit functions are available as follows (NOTE: function field MUST pair up with the Lon\_Function field as shown in the table):

Lon_Function	Description	Function Field
NVUI	Network Variable Update Input	PASSIVE
NVPO	Network Variable Polled Output	
NVPIIMC	Network Variable Polled Input Implicitly addressed Continuously sent	RDBC
NVUOIMC	Network Variable Update Output Implicitly addressed Continuously sent	WRBC
NVUOIMX	Network Variable Update Output Implicitly addressed and sent on Change	WRBX
NVUOIMT	Network Variable Update Output Implicitly addressed sent in Throttling Mode	WRBC See Appendix A.3
CFG_NVUI	Configuration Network Variable Update Input	PASSIVE

#### 5.1.3 SNVT\_Index

For implicitly addressed Client Map Descriptors and all Server side Map Descriptors the driver will assign an index to each one, starting from 0 and incrementing to 4095, in the order they appear in the configuration file.

#### 5.1.4 Address Table Limit

It is important to note the limitation within LonWorks Implicit addressing that the Address Table used for storing the addresses of all active connections made with the FieldServer is limited to 16 Device Addresses including that of the FieldServer. This is a LonWorks limitation, not a FieldServer limitation, and it means that the FieldServer can only make active implicit connections to 15 other devices. If active connections to more than 15 devices are required, then it is necessary to use Explicit Configuration (NMFETCHC is recommended).

Devices that write to passive Map Descriptors in the FieldServer only are not placed in this table and therefore this limitation does not apply. (A Passive Map Descriptor is recognized by the Passive Parameter in the Function Field).

### 5.1.5 Network Management Capability

When commissioning an implicitly configured FieldServer using the "Traditional" binding method, the configuration parameters below are all that is needed to achieve this purpose. For hints and tips on how to commission the FieldServer using the various Vendor devices that do this, see Appendix B

It is possible to set the FieldServer Online and Offline using the Network Management Tools. This is a LonWorks function, and is different from the traditional Online and Offline Status discussed in other FieldServer documentation. When the FieldServer is set offline using this LonWorks feature it will not communicate with other LonWorks devices.

### 5.1.6 Client vs Server Mapping

Distinguishing Client from Server in the LonWorks Environment is more difficult due to the "Peer to Peer" nature of LonWorks design. Clients and Servers can be identified in this environment as follows:

- Clients will write Setpoints and have status written to them, so expect Setpoints and Control Points on the Output side, and Status and Alarms on the Input side
- Servers will have the opposite structure, with Setpoints and Control Points on the Input Side and Status and Alarms on the Output side

Distinguishing Client from Server is important to ensure correct matching with other protocols being used on a FieldServer. For example, it would not be useful to map an Output to a BACnet AI point as both points will be expecting to push data out of the FieldServer.

## 5.2 Client Side Mapping

### 5.2.1 Connection Parameters

Section Title		
Connections		
Column Title	Function	Legal Values
Protocol	Specify protocol used	LonWorks
Connection_Type*	Specify Network Management. Primarily used for Circon_SI, refer to Appendix C.5.	LonMaker, LonWatcher, Circon_SI, None

#### Example

```
// Client Side Connections

Connections
Adapter      ,Protocol
LonWorks     ,LonWorks
```

5.2.2 Node Parameters

Section Title		
Nodes		
Column Title	Function	Legal Values
Node_Name	Provide name for Node	Up to 32 alphanumeric characters
Protocol	Specify protocol used	LonWorks

**Example**

```
// Client Side Nodes

Nodes
Node_Name ,Protocol
LON_1 ,LonWorks
```

5.2.3 FieldServer Related Map Descriptor Parameters

Column Title	Function	Legal Values
Map_Descriptor_Name	Name of this Map Descriptor. (Network Variable Name)	Up to 16 alphanumeric characters.
Data_Array_Name	Name of Data Array where data is to be stored or fetched from in the FieldServer	One of the Data Array names from “Data Array” section above
Data_Array_Offset	Starting location in Data Array	0 to maximum specified in “Data Array” section above
Lon_Function	Detailed Function of Client Map Descriptor	See Section 5.1.2 for a list of valid entries for Implicit Connections.
Function	Function of Client Map Descriptor	See Section 5.1.2 for a list of valid entries based on the Lon_Function.

## 5.2.4 Driver Related Map Descriptor Parameters

Column Title	Function	Legal Values
Node_Name	Name of Node to fetch data from or send data to. Needed for Explicit Addressing.	One of the node names specified in "Client Node Descriptors" above
SNVT_Type	Standard network variable type of the data	See Appendix D
SNVT_Option*	Specifies which record out of a complex SNVT we are after.	See Appendix A.9.1
SNVT_Units*	Specifies the measurement units (e.g. Metric or English)	See Appendix A.9.2
UNVT_Byte_Length*	Specifies the length in bytes of an UNVT. This Parameter is compulsory when SNVT_Type is set to UNVT, the parameter is not used in conjunction with SNVT's	1-255. See Appendix A.1
UNVT_ID	Specifies the Type Number to apply to this particular UNVT. This Parameter is optional when SNVT_Type is set to UNVT, the parameter is not used on conjunction with SNVT's	0, 146-255. See Appendix A.1
NV_Min_Value*	Network Variable updates with values less than specified in this field will be ignored.	See Appendix A.2
NV_Max_Value*	Network Variable updates with values higher than specified in this field will be ignored.	See Appendix A.2
NV_Delta_Value*	Network Variable updates where the value's delta change is less than specified in this field will be ignored unless the Max_Scan_Time Condition has been met. Compulsory for Throttling Lon Functions only. Not used on other Lon Functions.	See Appendix A.3
NV_Selfdoc_Text*	The Self-Documenting String for this Network Variable.	Normal Text up to a length of 40 characters

## 5.2.5 Timing Parameters

Column Title	Function	Legal Values
Scan_Interval	Seconds per scan	0-32000
Min_Scan_Time	Minimum Scan Time in seconds.	See Appendix A.3
Max_Scan_Time	Maximum Scan Time in seconds.	See Appendix A.3

### 5.2.6 Client Side Map Descriptor Example

```
// Client Side Map Descriptors
```

Map_Descriptors	Map_Descriptor_Name	,Data_Array_Name	,Data_Array_Offset	,Lon_Function	,Function	,Node_Name	,SNVT_Type	,Nv_Delta_Value	,Min_Scan_Time	,Max_Scan_Time	,Scan_Interval
TempOut1	,DA_FO_01	,0	,NVUOIMT	,Wrbc	,LON_1	,SNVT_Temp_f	,10	,5	,20	,-	,-
TempOut2	,DA_FO_01	,1	,NVUOIMX	,Wrbc	,LON_1	,SNVT_Temp_f	,-	,-	,-	,-	,-
TempOut3	,DA_FO_01	,2	,NVUOIMC	,Wrbc	,LON_1	,SNVT_Temp_f	,-	,-	,-	,-	,20
TempIn	,DA_FI_01	,0	,NVPIIMT	,Rdbc	,LON_1	,SNVT_Temp_f	,-	,-	,-	,-	,5

This field determines the Map Descriptor's function. See Section 5.1.2 for more information.

Required for Throttling Mode: This field specifies the minimum change needed for a Network Variable's value to invoke an NV Update.

The Data Array will be sampled and evaluated for delta change once every Min Scan Time (seconds)

If found during Min\_Scan\_Time sampling (Throttling Mode) that Max\_Scan\_Time has elapsed since the last NV Update, a new NV Update will be transmitted.

For Non-Throttled Client Map Descriptors the Scan\_Interval determines the update rate.

## 6 EXPLICIT CONFIGURATIONS

### 6.1 Special considerations

With Explicit configuration, the FieldServer communicates directly with other devices by specifying the remote device address in the FieldServer configuration.

All the Servers and their Clients need to be on the same domain to be able to communicate. If the LonWorks device’s Node ID is not known, it may be read using a utility program e.g. NodeUtil or using a LonWorks Analyzer. All the Client Node CSV files need to have their Subnet\_ID and Node\_ID parameters set to point to their respective Server Subnet and Node ID values. Once the FieldServers are restarted the network should function correctly.

#### 6.1.1 Map Descriptor Names (Network Variable Names)

As a Server, the LonWorks driver provides a table of Network Variables for other Nodes to read. These Nodes access the variables according to Index numbers which are automatically assigned by the driver according to the Map Descriptor definition order in the configuration file. The driver also creates an identification table for configuration nodes to read the name and types of variables available on the FieldServer. Within the LonWorks protocol, this table size is limited to 64K bytes. If the application requires a large number of Server mappings (up to 4096), it will be necessary to limit the variable name length. Each Server mapping requires 4 bytes plus the length of the name from this 64K block.

#### 6.1.2 Lon functions

Explicit Map Descriptors are distinguished from Implicit Map Descriptors by the function used in the Lon\_Function field of the Map Descriptor. Depending on the nature and direction of Data Transfer needed different explicit functions are available as shown below

**NOTE:**

- Function field MUST pair up with the Lon\_Function field as shown in the table
- NMFETCHC is the preferred Lon Function for most applications. See Section 6.1.5

Lon_Function	Description	Function Field
NVUI	Network Variable Update Input	SERVER
NVPO	Network Variable Polled Output	
NVPIEXC	Network Variable Polled Input Explicitly addressed Continuously sent	RDBC
NVUOEXC	Network Variable Update Output Explicitly addressed Continuously sent	WRBC
NVUOEXX	Network Variable Update Output Explicitly addressed and sent on Change	WRBX
NVUOEXT	Network Variable Update Output Explicitly addressed sent in Throttling Mode	WRBC
NMFETCHC	Network Management Network Variable Fetch Continuously sent (Explicit Addressing only)	RDBC
CFG_NVUI	Configuration Network Variable Update Input	SERVER

#### 6.1.3 SNVT\_Index

The SNVT\_Index field must be specified for all explicitly addressed Client Map Descriptors. These Client Map Descriptors use this field to index their relevant Map Descriptors on the Server side.

#### 6.1.4 Domain Table Setup

To be able to communicate with other nodes on the LonWorks network, the FieldServer must have its Domain, Subnet and Node ID's set. Explicit configuration requires the user to set these parameters.

There are 3 ways in which the FieldServer DSN (Domain,Subnet,Node address) can be set:

- Set the DSN using a Network manager by commissioning the FieldServer into the Network Manager Project. When doing it this way, it is extremely important that the DSN is not forced in the FieldServer Configuration, as the Configuration address will override the Network Manager Address every time the FieldServer is restarted.
- Set the DSN from the Lon.ini file. Using this option provides a default DSN if the FieldServer does not have a DSN assigned. If a Network Manager or the FieldServer Configuration provides a DSN, then the Lon.ini DSN will be ignored.
- Set the DSN in the FieldServer configuration. This option takes precedence over the 2 other addressing options, and should therefore **not** be used when commissioning a FieldServer into a Network with a Network Manager.

#### **Example 1 - Setting the Domain and Subnet from the lon.ini file**

The Domain Table and Subnet IDs can be set from a lon.ini file on the FieldServer. The FieldServer's LonWorks Node ID will be set from the System\_Station\_Address field in the configuration file if specified, otherwise a default value will be used.

lon.ini file contents:

```
:D50:S01:
```

FieldServer configuration file contents ( config.csv )

FieldServer
System_Station_Address ,Title
12 ,Your title

**Example 2: Setting the Domain and Subnet from the configuration file**

```
FieldServer
System_Station_Address ,Title
[node_id] ,":D[Domain_ID]:S[Subnet_ID]:[Title continued...]"
```

The Title field must start with “:D”, followed by the Domain\_ID in hexadecimal notation, followed by “:S”, followed by the Subnet\_ID in hexadecimal notation and enclosed by “:”. The domain length is automatically determined by the number of digits in the [Domain\_ID] field. Since 2 hexadecimal digits constitute 1 byte, “:D123456:” for example would have a length of 3.

Once the domain table has been set, the “:Dxx:Sxx:” part of the Title field will be removed. Now the Title field will be left with [Title continued...] which may be the Node self-documentation string or any title

lon.ini file contents

The file may contain any values or be removed from the FieldServer.

FieldServer configuration file contents ( config.csv )

```
FieldServer
System_Station_Address ,Title
12 ,":D48:S01:TESTING"
```

Specifying the Domain and Subnet in the configuration file will override the settings from the lon.ini file.

### 6.1.5 Network Management

The NVPIEXC command generally used for polling has the limitation that data can only move in one direction (Server to Client). The added functionality of a Write-through was added to the network management fetch command (NMFETCHC) to provide movement of data back to the polled node. Thus, should the data in the Data Array linked to a NMFETCHC Map Descriptor change by another process, the data will be propagated to the polled node by means of a network variable update.

Another useful feature of the NMFETCHC function is that it can perform reads to any other type of Node function (NVUI, CFG\_NVUI, NVUOEXX, NVPIIMC, etc.) This means that even Client Map Descriptors can be read this way.

Network management fetch requests received on polled nodes are handled differently from normal NV Poll requests. The response to a NV Poll will contain valid data. Data is valid if the node that is the source of the data is online and if this data is not too old. The data in the response to a network management fetch will not be checked for validity, however, it will simply respond with the current data in the variable.



## 6.2 Client Side Configuration

### 6.2.1 Connections

Section Title		
Connections		
Column Title	Function	Legal Values
Adapter	Adapter Name	LonWorks
Protocol	Specify protocol used	LonWorks

**Example**

```
// Client Side Connections

Connections
Adapter      ,Protocol
LonWorks     ,LonWorks
```

### 6.2.2 Nodes

Section Title		
Nodes		
Column Title	Function	Legal Values
Node_Name	Provide name for Node	Up to 32 alphanumeric characters
Subnet_ID	Server (destination) Node's Subnet ID of an explicitly addressed message	1-255
Node_ID	Server (destination) Node's Node ID of an explicitly addressed message	1-127
Protocol	Specify protocol used	LonWorks
Adapter	Specify port Adapter used	LonWorks

**Example**

```
// Client Side Nodes

Nodes
Node_Name ,Subnet_ID ,Node_ID ,Protocol ,Adapter
LON_1     ,1         ,1         ,LonWorks ,LonWorks
```

## 6.2.3 Driver Related Map Descriptor Parameters

Column Title	Function	Legal Values
Node_Name	Name of Node to fetch data from or send data to. Needed for Explicit Addressing.	One of the node names specified in "Client Node Descriptors" above
SNVT_Index	Server Network Variable Index	0-4095
SNVT_Type	Standard network variable type of the data	See Appendix D
SNVT_Option*	Specifies which record out of a complex SNVT we are after.	See Appendix A.9.1
SNVT_Units*	Specifies the measurement units if something other than Metric is required	See Appendix A.9.2
UNVT_Byte_Length*	Specifies the length in bytes of an UNVT. This Parameter is compulsory when SNVT_Type is set to UNVT, the parameter is not used on conjunction with SNVT's	1-255. See Appendix A.1
UNVT_ID	Specifies the Type Number to apply to this particular UNVT. This Parameter is optional when SNVT_Type is set to UNVT, The parameter is not used on conjunction with SNVT's	0, 146-255. See Appendix A.1.
NV_Min_Value*	Network Variable updates with values less than specified in this field will be ignored.	See Appendix A.2
NV_Max_Value*	Network Variable updates with values higher than specified in this field will be ignored.	See Appendix A.2
NV_Delta_Value*	Network Variable updates where the value's delta change is less than specified in this field will be ignored unless the Max_Scan_Time Condition has been met. Compulsory for Throttling Lon Functions only. Not used on other Lon Functions.	See Appendix A.2
NV_Selfdoc_Text*	The Self-Documenting String for this Network Variable.	Normal Text up to a length of 40 characters

## 6.2.4 Timing Parameters

Column Title	Function	Legal Values
Scan_Interval*	Seconds per scan	0-32000, <b>2s</b>
Min_Scan_Time*	Minimum Scan Time in seconds. Compulsory for Throttling Lon Functions only. Not used on other Lon Functions.	See Appendix A.3
Max_Scan_Time*	Maximum Scan Time in seconds. Compulsory for Throttling Lon Functions only. Not used on other Lon Functions.	See Appendix A.3

### 6.2.5 Map Descriptor Example 1 - Explicit Configuration using Network Management Polls

The Map Descriptor pollTemp\_p shows the use of SNVT\_Units for Scaling when polling temperature

The Map Descriptor pollSwitch shows the use of SNVT\_Option for Selective data scanning. This only brings in the "State" portion of SNVT\_Switch

Map_Descriptors	Map_Descriptor_Name	,Data_Array_Name	,Data_Array_Offset	,Lon_Function	,Function	,Node_Name	,SNVT_Index	,SNVT_Type	,SNVT_Units	,SNVT_Option	,Scan_Interval
	pollTemp_p	,DA_Explicit	,1	,NMFETCHC	,Rdbc	,Remote_Node	,0	,SNVT_temp_p	,Deg_F	,-	,1.0s
	pollSwitch	,DA_Explicit	,2	,NMFETCHC	,Rdbc	,Remote_Node	,1	,SNVT_switch	,-	,State	,1.0s

This field determines the Map Descriptor's function. See Section 6.1.2 for more information.

Explicitly Addressed Client Map Descriptors use this field to point to their relevant Server Map Descriptors.

For Non-Throttled Client Map Descriptors the Scan\_Interval determines the update rate.

### 6.2.6 Map Descriptor Example 2 – Polling UNVT's

Map_Descriptors	Map_Descriptor_Name	,Data_Array_Name	,Data_Array_Offset	,Lon_Function	,Function	,Node_Name	,SNVT_Index	,SNVT_Type	,UNVT_Byte_Length	,Scan_Interval
	pollUNVT	,DA_Explicit	,101	,NMFETCHC	,Rdbc	,Remote_Node	,2	,UNVT	,31	,1.0s

UNVT Byte length must be specified for correct operation.

6.2.7 Using Neuron ID to Address Devices (Client Drivers only)

It is possible to poll remote LonWorks devices using their Neuron ID's instead of the traditional Network Manager method. The Neuron ID is the 12 Digit Hex identifier of the associated LonWorks Device. An example configuration follows.

Note that Neuron ID addressing is considered explicit addressing so the station address, domain ID and subnet ID must be set as described in Section 6.1.4

Bridge
System_Station_Address ,Title
110 ,":D01:S01:Neuron ID Example:"

On the Client side Nodes add a new field as shown below:

Nodes
Node_Name ,Node_ID ,Protocol ,Neuron_ID
Lon_Srv_11 ,11 ,Lonworks ,F912AB440100

Create a Map Descriptor as Follows:

Map_Descriptors
Map_Descriptor_Name ,Data_Array_Name ,Data_Array_Offset ,Lon_Function ,Function ,Node_Name ,SNVT_Index ,SNVT_Type ,Scan_Interval
1nviAmp1 ,DA_001 ,0 ,NMFETCHC ,RDBC ,Lon_Srv_11 ,000 ,SNVT_amp ,0s

## 6.3 Server Side Configuration

### 6.3.1 Connections

Section Title		
Connections		
Column Title	Function	Legal Values
Adapter	Adapter Name	LonWorks
Protocol	Specify protocol used	LonWorks

#### Example

```
// Server Side Connections

Connections
Adapter      ,Protocol
LonWorks     ,LonWorks
```

### 6.3.2 Nodes

Section Title		
Nodes		
Column Title	Function	Legal Values
Node_Name	Provide name for Node	Up to 32 alphanumeric characters
Protocol	Specify protocol used	LonWorks

#### Example

```
// Server Side Nodes

Nodes
Node_Name   ,Protocol
LON_1       ,LonWorks
```

### 6.3.3 FieldServer Related Map Descriptor Parameters

Column Title	Function	Legal Values
Map_Descriptor_Name	Name of this Map Descriptor	Up to 16 alphanumeric characters. See Section 6.1.1, 0
Data_Array_Name	Name of Data Array where data is to be stored or fetched from in the FieldServer	One of the Data Array names from "Data Array" section above
Data_Array_Offset	Starting location in Data Array	0 to maximum specified in "Data Array" section above
Lon_Function	Detailed Function of Client Map Descriptor	See Section 6.1.2 for a list of valid entries.
Function	Function of Client Map Descriptor	See Section 6.1.2 for a list of valid entries.

## 6.3.4 Driver Related Map Descriptor Parameters

Column Title	Function	Legal Values
Node_Name	Name of Node to fetch data from or send data to. Needed for Explicit Addressing.	One of the node names specified in "Client Node Descriptors" above
SNVT_Index	Server Network Variable Index	0-4095
SNVT_Type	Standard network variable type of the data	See Appendix D
SNVT_Option	Specifies which record out of a complex SNVT we are after.	See Appendix A.9.1
SNVT_Units	Specifies the measurement units if something other than Metric is required	See Appendix A.9.2
UNVT_Byte_Length*	Specifies the length in bytes of an UNVT. This Parameter is compulsory when SNVT_Type is set to UNVT, the parameter is not used on conjunction with SNVT's	1-255. See Appendix A.1
UNVT_ID	Specifies the Type Number to apply to this particular UNVT. This Parameter is optional when SNVT_Type is set to UNVT, the parameter is not used on conjunction with SNVT's	0, 146-255. See Appendix A.1.
NV_Min_Value*	Network Variable updates with values less than specified in this field will be ignored.	See Appendix A.2
NV_Max_Value*	Network Variable updates with values higher than specified in this field will be ignored.	See Appendix A.2
NV_Delta_Value*	Network Variable updates where the value's delta change is less than specified in this field will be ignored unless the Max_Scan_Time Condition has been met. Compulsory for Throttling Lon Functions only. Not used on other Lon Functions.	See Appendix A.2
NV_Selfdoc_Text	The Self-Documenting String for this Network Variable.	Normal Text up to a length of 40 characters

## 6.3.5 Timing Parameters

Column Title	Function	Legal Values
Scan_Interval*	Seconds per scan	0-32000, <b>2s</b>
Min_Scan_Time*	Minimum Scan Time in seconds. Compulsory for Throttling Lon Functions only. Not used on other Lon Functions.	See Appendix A.3
Max_Scan_Time*	Maximum Scan Time in seconds. Compulsory for Throttling Lon Functions only. Not used on other Lon Functions.	See Appendix A.3

### 6.3.6 Map Descriptor Example

```
// Server Side Map Descriptors
Map_Descriptors
Map_Descriptor_Name ,Data_Array_Name ,Data_Array_Offset ,Lon_Function ,Function ,Node_Name ,SNVT_Index ,Nv_Delta_Value ,SNVT_Type ,Nv_Min_Value ,Nv_Max_Value ,Nv_Selfdoc_text
NviTemp ,DA_FI_01 ,0 ,NVUI ,Server ,LON_1 ,- ,10 ,SNVT_Temp_f ,0 ,- ,@0|1;WaterTemp"
NviTemp ,DA_FO_01 ,1 ,NVPO ,Server ,LON_1 ,- ,- ,SNVT_Temp_f ,0 ,150 " ,&200\x8023"
NviTemp ,- ,- ,CFG_NVUI ,Server ,LON_1 ,- ,- ,SNVT_Temp_f ,- ,150 ,&200\x8020
```

Server NVUI can be grouped with Client NV Update types and NMFETCHC. Server NVPO can be grouped with Client NV Poll types and NMFETCHC.

Explicitly Addressed Client Map Descriptors use this field to point to their relevant Server Map Descriptors.

Required for Throttling Mode: This field specifies the minimum change needed for a Network Variable's value to invoke an NV Update.

If specified for a Floating point or Integer SNVT then NV Updates with values lower than specified here will not be written to its relevant Data Array location.

If specified for a Floating point or Integer SNVT then NV Updates with values higher than specified here will not be written to its relevant Data Array location.

The Self-documenting String for a Network Variable can be up to 40 characters wide.

## Appendix A. Useful Features

### Appendix A.1. Using UNVT's

UNVT's are User-defined Network Variable Types and are defined in the configuration file by filling the SNVT\_Type field with "UNVT". The UNVT's size in bytes should also be added to the UNVT\_Byte\_Length field and the UNVT's type number in the UNVT\_ID field. Valid UNVT\_IDs are 0 and the range 146 to 255. The UNVT\_ID value will be substituted with the default value of 0 if the field is left empty. Refer to the example in Section 6.2.3

### Appendix A.2. Using NV\_Min, NV\_Max etc.

The NV\_Min\_Value, NV\_Max\_Value functionality were added to stop the propagation of 'out of bounds' network variables across a LonWorks network. NV values higher than assigned by the NV\_Max\_Value field or lower than assigned by NV\_Min\_Value field will not be sent out on the network or copied to their relevant Data Arrays. If one or both of these fields are not assigned values, limit checking will not be performed on that particular field. This functionality applies only to SNVT's of either Floating point or Integer formats. Refer to the examples in Sections 5.2.6 and 6.3.6.

One or both of these fields can be linked to a configuration network variable update input in order to create an interoperable configuration property. For further information refer to Appendix A.5

### Appendix A.3. Throttling Mode

When the Lon\_Function field specifies a Throttling Mode Client Map Descriptor the NV\_Delta\_Value, Min\_Scan\_Time and Max\_Scan\_Time fields all need to be assigned values.

When operating in Throttling Mode, a Network Variable's value will be sampled at the Min\_Scan\_Time period. If the value differs by an amount greater than or equal to that specified by the NV\_Delta\_Value field from the previously transmitted value, the NV update will be transmitted. Otherwise an NV update will be only sent if the time since the last update is greater than or equal to the Max\_Scan\_Time field value. Refer to the examples in Sections 5.2.6 and 6.3.6.

This functionality applies only to SNVT's of either Floating point or Integer formats.

### Appendix A.4. XIF Generation

After start-up the FieldServer creates a XIF (version 4.0) according to the configuration loaded. This file is called fServer.xif and can be uploaded from the FieldServer using the RuiNet utility.

The FieldServer's XIF file is internally generated by the LonWorks driver using the information contained in the FieldServer's configuration file (CONFIG.CSV). It is not possible to download an externally created XIF file using NodeUtil or LonMaker<sup>®</sup>. It is also not possible to download any type of externally created network variables default values file. The FieldServer's configuration can be changed by uploading and editing the CONFIG.CSV file, and therefore the XIF file must be obtained by uploading it from the FieldServer. Remember that this XIF file will change whenever the configuration file has been changed, downloaded and the FieldServer restarted.



## Appendix A.5. Configuration Properties

Configuration Properties are implemented on the FieldServer using configuration Network Variables. Configuration Network Variables take the form of update inputs in order to be updated or read by a network management tool. Each Configuration Network Variable will have its own Map Descriptor. Since the data carried by a Network Variable is intended as a configuration property for other already declared non-configuration Network Variable(s), no Data Array needs to be assigned to its Map Descriptor.

Configuration Properties can be declared to belong to the entire Node, to an Object(s) or to a Network Variable(s). This declaration defines the *scope* of the Configuration Property. Configuration Properties that belong to an Object are declared as a part of the Object; Configuration Properties associated with a Network Variable(s) are declared as belonging to the Network Variable(s) etc.

A Configuration Property's Type and Responsible Map Descriptor(s) are declared by the Configuration Network Variable's self-documentation string as follows:

For linking to the entire node:

```
"&0,,0\x80,[SCPT Index]"
```

Example: "&0,,0\x80,20"

For linking to object(s):

```
"&1,[Object Index(s)],0\x80,[SCPT Index]"
```

Example: "&1,0.2.3,0\x80,23"

For linking to network variable(s):

```
"&2,[NV Index(s)],0\x80,[SCPT Index]"
```

Example: "&2,0.1.2.4.7,0\x80,20"

Examples of configuration network variables are presented in Section 6.3.6

## Appendix A.6. LonMark Object Creation

For more information on filling out the Node Self-Documentation String as well as the relevant Network Variable Self-Documentation Strings in order to create a LonMark Object please consult the following documentation from the LonMark Interoperability Association at [www.lonmark.org](http://www.lonmark.org)

- Understanding LonMark Self-Documentation
- LonMark Application Layer Interoperability Guidelines

The two examples given below will show how LonMark Objects can be assigned in FieldServer configuration files:

The first example uses the standard Open Loop Sensor Object (Type 1) to create a Water Temperature Sensor that will send out its current status via Network Variable Updates.

A typical recipient of these updates is given by example #2 which uses the LonMark Open Loop Actuator Object (Type 3) to create a Water Heating Element object that will interpret the Network Variable it receives and adjust power to its heating element accordingly.

**LonMark Config file Example #1 – Open Loop “Water Temperature” Sensor:**

```
// Client Side Map Descriptors

Map_Descriptors
Map_Descriptor_Name ,Data_Array_Name ,Data_Array_Offset ,Lon_Function ,Function ,Node_Name ,SNVT_Index ,SNVT_Type ,Nv_Min_Value ,Nv_Max_Value ,Nv_Selfdoc_text
nvoTemp ,DA_FI_01 ,0 ,NVUOIMC ,Wrbc ,LON_1 ,-, ,SNVT_Temp_f ,-, ,-, ,"@0|1;WaterTemp"
NviTempMin ,-, ,-, ,CFG_NVUI ,Server ,LON_1 ,-, ,SNVT_Temp_f ,10 ,-, ,"&200\x8023"
NviTempMax ,-, ,-, ,CFG_NVUI ,Server ,LON_1 ,-, ,SNVT_Temp_f ,-, ,300 ,"&200\x8020"
```

The Node Self-Documentation String defines one LonMark object of type 1 – Open Loop Sensor.

These two configuration network variables will be linked to the first Map Descriptor declared. The NV\_Min\_Value and NV\_Max\_Value fields define the defaults for these CP's. These defaults are loaded by the FieldServer after a restart only when re-commissioning is required.

The object index is 0 and this Map Descriptor defines the 1<sup>st</sup> Network Variable of the object.

**LonMark Config file Example #2 – “Water Heating Element” Actuator:**

```
// Client Side Map Descriptors

Map_Descriptors
Map_Descriptor_Name ,Data_Array_Name ,Data_Array_Offset ,Lon_Function ,Function ,Node_Name ,SNVT_Index ,SNVT_Type ,Nv_Min_Value ,Nv_Max_Value ,Nv_Selfdoc_text
nvoTemp ,DA_FI_01 ,0 ,NVUOIMC ,Wrbc ,LON_1 ,-, ,SNVT_Temp_f ,-, ,-, ,"@0|1;WaterTemp"
NviTempMin ,-, ,-, ,CFG_NVUI ,Server ,LON_1 ,-, ,SNVT_Temp_f ,10 ,-, ,"&200\x8023"
NviTempMax ,-, ,-, ,CFG_NVUI ,Server ,LON_1 ,-, ,SNVT_Temp_f ,-, ,300 ,"&200\x8020"
```

The Node Self-Documentation String defines one LonMark object of type 3 – Open Loop Actuator.

These two configuration network variables will be linked to the first Map Descriptor declared. The NV\_Min\_Value and NV\_Max\_Value fields define the defaults for these CP's. These defaults are loaded by the FieldServer after a restart only when re-commissioning is required.

The object index is 0 and this Map Descriptor defines the 1<sup>st</sup> Network Variable of the object.

## Appendix A.7. Node Status Operation

When binding network variables on the FieldServer, the node status will be on-line before binding as well as after un-binding network variables. A Node will go off-line only when a bound network variable of that node goes off-line (e.g. is disconnected).

When using a network tool to commission the FieldServer (implicit addressing), the FieldServer LonWorks Node must be placed ONLINE on the LonWorks network before it will pass data with other bound network variables. The following messages may appear on the driver screen when using Ruinet which indicates that the FieldServer has not been put into the ONLINE state yet:

```
"Not sending NV msg for [variable name], Node OFFLINE!"
```

To set the FieldServer to ONLINE using LonMaker:

- Right-click on the FieldServer device and select Manage.
- On the Devices Tab, click the ONLINE button.

The FieldServer LonWorks Node is always ONLINE when using explicit addressing.

Note: The FieldServer Node\_Status function (refer to the Bridge Configuration Manual) looks at the Node\_ID configured in order to monitor Node status. In implicit applications this may not be the real Node\_ID since Node\_ID is allocated by the network manager.

## Appendix A.8. Working with Binary Data

When sending binary data on a LonWorks network, there are two SNVT's that are most commonly used, namely SNVT\_State and SNVT\_Switch.

SNVT\_State is a 16 bit integer that allows the user to send 16 data bits to the remote device. To do this, the 16 data bits need to be packed into an integer word. If this packing is already done when the value is transferred into the FieldServer, then the SNVT need only be linked to the relevant Data Array offset for transfer out of the FieldServer. However, if the FieldServer is picking up 16 separate bits from another network for this variable, then the FieldServer Packed\_Bit function can be used to achieve the packing. See the FieldServer Configuration manual for more details on the Packed\_Bit function.

SNVT\_Switch is a two byte value consisting of an analog value in the left hand byte (VALUE portion), and a binary state in the right hand byte (STATE portion). LonMark guidelines for this SNVT stipulate that the VALUE portion has a range from 0-100%, and that the STATE portion can assume a value of 1 or 0. However, since the raw data type for these two values is byte (a value ranging from 0-255), care needs to be taken when transferring values into this SNVT to make sure the source values are within the legal range. If a value is placed into one of these bytes that is deemed out of range, then a -1 value will be sent on the LonWorks network to indicate out of range. Also note that when sending binary status in a SNVT Switch, some devices expect the VALUE portion to change when the STATUS portion changes, so an analog value that changes in sympathy with the binary state may be necessary.

## Appendix A.9. Filtering SNVT Variables

### Appendix A.9.1. SNVT\_Option Field

This field can be used to isolate a specific record within a complex SNVT. Appendix D shows which SNVTs are currently attributed with SNVT\_Option capabilities.

### Appendix A.9.2. SNVT\_Units Field

The measurement units of a SNVT is fixed as far as it is transported across the LonWorks network, but by the setting of the SNVT\_Units field it is possible to specify how the data is made available in Data Arrays. For example SNVT\_temp\_f is always transported across the LonWorks network as degrees Celsius, but by setting the SNVT\_Units field to Deg\_F the measurement units of the Map Descriptor's data will be set to degrees Fahrenheit. The following table shows which SNVT's currently have SNVT\_Units capabilities.

SNVT_Type	SNVT_Option	SNVT_Units	Length	Measurement Units
SNVT_press_f	N/A	Inch_H2O	1	Inches of water
SNVT_press_p	N/A	Inch_H2O	1	Inches of water
SNVT_temp	N/A	Raw	1	Raw, unadjusted data
		Deg_C	1	Degrees Celsius (°C)
		Deg_F	1	Degrees Fahrenheit (°F)
SNVT_temp_f	N/A	Deg_C	1	Degrees Celsius (°C)
		Deg_F	1	Degrees Fahrenheit (°F)
SNVT_temp_p	N/A	Raw	1	Raw, unadjusted data
		Deg_C	1	Degrees Celsius (°C)
		Deg_F	1	Degrees Fahrenheit (°F)
SNVT_switch <sup>1</sup>	All	Raw	2	Raw, unadjusted data
	Value	Raw	1	Raw, unadjusted data
		Percent	1	Percent (%)
	State	Raw	1	Raw, unadjusted data

<sup>1</sup> See Also Appendix A.8

SNVT_Type	SNVT_Option	SNVT_Units	Length	Measurement Units
SNVT_temp_setpt	All	Raw	12	Raw, unadjusted data
		Deg_C	6	Degrees Celsius (°C)
		Deg_F	6	Degrees Fahrenheit (°F)
	Occupied_cool	Raw	1	Raw, unadjusted data
		Deg_C	1	Degrees Celsius (°C)
		Deg_F	1	Degrees Fahrenheit (°F)
	Standby_cool	Raw	1	Raw, unadjusted data
		Deg_C	1	Degrees Celsius (°C)
		Deg_F	1	Degrees Fahrenheit (°F)
	Unoccupied_cool	Raw	1	Raw, unadjusted data
		Deg_C	1	Degrees Celsius (°C)
		Deg_F	1	Degrees Fahrenheit (°F)
	Occupied_heat	Raw	1	Raw, unadjusted data
		Deg_C	1	Degrees Celsius (°C)
		Deg_F	1	Degrees Fahrenheit (°F)
	Standby_heat	Raw	1	Raw, unadjusted data
		Deg_C	1	Degrees Celsius (°C)
		Deg_F	1	Degrees Fahrenheit (°F)
	Unoccupied_heat	Raw	1	Raw, unadjusted data
		Deg_C	1	Degrees Celsius (°C)
		Deg_F	1	Degrees Fahrenheit (°F)

## Appendix B. Vendor Information

### Appendix B.1. Echelon LonMaker

#### Appendix B.1.1. Using LonMaker to commission the FieldServer

- Ensure that the correct firmware and latest configuration is loaded on the FieldServer (Each change in the FieldServer requires re-commissioning of the FieldServer in LonMaker)
- Ensure that the FieldServer and the LonMaker machine are on the same network.
- Open the existing Network in LonMaker, or create a new Network
- Click on “Create New Network” and follow the network wizard, making the following selections:
- Network Interface: Choose Network Attached
- Management Mode: Choose Onnet unless you are working offline
- Register Plug-ins required. None
- Once Visio is open with the Network showing, drag a new device onto the drawing from the toolbox.
- Follow the Device Network, making the following selections
- Enter Device Name: Choose commission device
- Specify Device Template: Choose upload from device
- Specify Device Channel: Choose Auto Detect
- Specify Device Properties: Leave as is (Ping is optional)
- Identify Device: Choose service pin
- Device Application Image: Leave unchecked
- Initial State: Leave as is
- Press the service pin on the FieldServer when asked to do so, and the FieldServer will be commissioned.
- Drag a new function block onto the drawing from the toolbox. Give the function block a name and ensure that it is allocated to the FieldServer device.
- Once the function block is on the drawing, drag input and output variables onto the function block. LonMaker will display the variables available for binding. Click on the variables you require (or use the select all option), and they will be commissioned onto the function block.
- Connect these variables to other devices by dragging connections from the toolbox and connecting the variables.

#### Appendix B.1.2. Removing Previous FieldServer Device Templates in LonMaker.

If you have previously used LonMaker to commission a FieldServer or ProtoCessor onto a LonWorks network, LonMaker saves the properties of that device as a device template. It is important to remove all previous device templates from LonMaker when moving onto your next FieldServer product as some parameters might transfer to your new device.

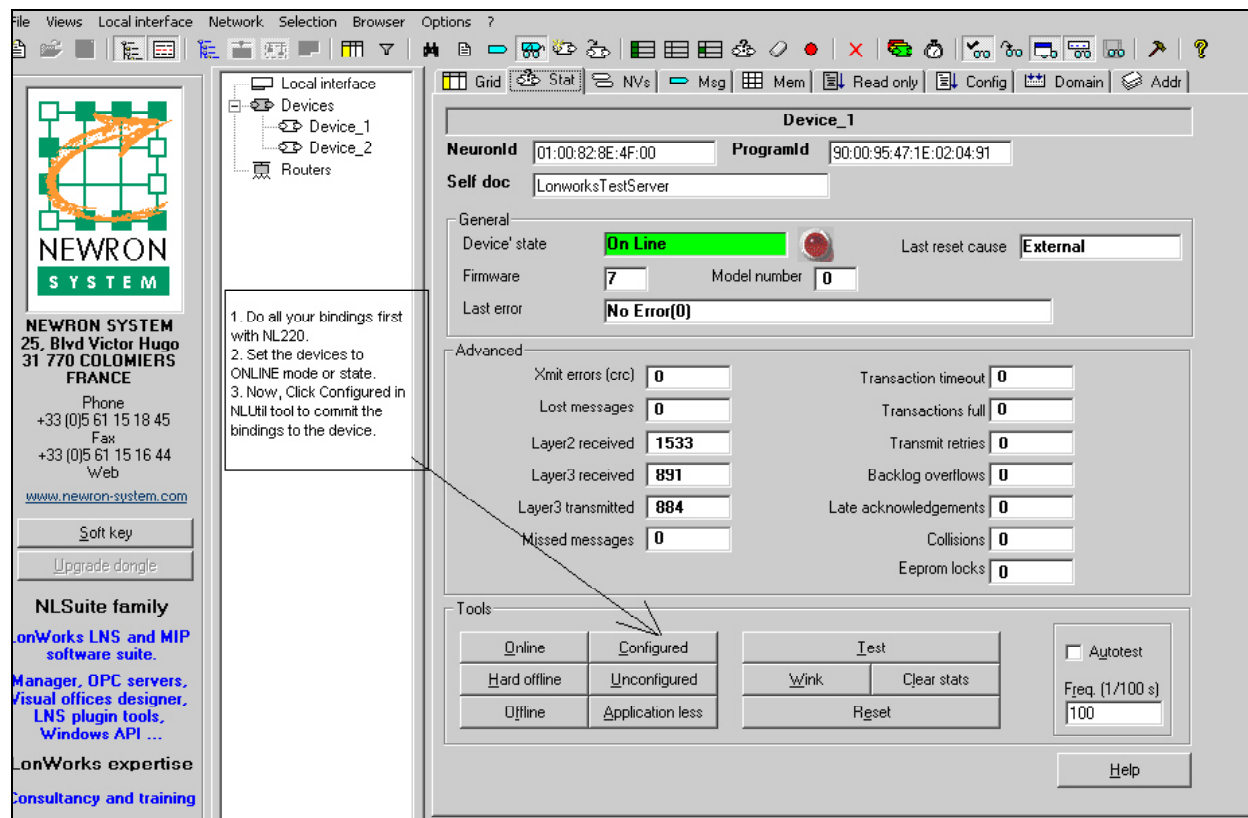
To remove the device templates, open your LonMaker workspace as you would normally do. Then choose the LonMaker toolbar and choose the Device Templates option. This will bring up a list of all device templates. Highlight and then remove all device templates that do not contain “Echelon” or “LNS”. This will ensure a fresh commission of your FieldServer product.

### Appendix B.2. Neuron Systems

Newron Systems may produce the following Error message “bindings lost after power-cycle” The solution to this is to place the FieldServer in the Configured state which will cause the bindings to be committed to the Neuron and they will remain after a power cycle.

**Procedure:**

- 1) Make the bindings in NL220
- 2) Place devices in ONLINE mode or state.
- 3) Refer to the following Screenshot for assistance in placing the FieldServer in the Configured state.



### Appendix B.3. Honeywell Care

This system uses unacknowledged service as default. This protocol driver requires acknowledged service to operate correctly.

### Appendix B.4. Tridium JACE

This system uses unacknowledged service as default. This protocol driver requires acknowledged service to operate correctly.

Note that Tridium calls Acknowledged service “critical bindings”.

## Appendix B.5. Trane Rover

Use Trane Rover Service Pack 4 or later when commissioning the FieldServer. This does not ship from Trane by default and may have to be requested from the local Trane representative.

When using Pre-Service Pack 4 software, you will be able to see the FieldServer in Rover, but none of the FieldServer variables will be available for binding even though they are present. Service Pack 4 has been tested to ensure that the variables show and the bindings work well.



## Appendix C. Troubleshooting Tips

### Appendix C.1. Debugging a LonWorks connection: Hints and tips

- To test connections, set the configuration tool into a mode that will display service requests, and then push the button on the FieldServer. A request should appear.
- In order for variables to appear as outputs, they need to be declared as write variables in the FieldServer. Declaring the Map Descriptor functions as WRBC, or WRBX can do this. See Section 5.1.2 for more information.
- If the domain and Subnet ID are defined in the configuration file of the FieldServer, these values will be used when power is cycled to the FieldServer. If the values set here are different to what the Network Manager has set up for the FieldServer for clients using implicit addressing, the FieldServer will stop communicating. In this case, change these settings or remove them from the configuration file completely and recommission the FieldServer.

### Appendix C.2. Error Messages

Message	Description
"LON:#03 FYI. Standard driver build. This is normal.	This message is informational and can be safely ignored.

#### Appendix C.2.1. Error Message Lonlive.c 121

If the following error message is returned:

```
DRIVER-> LON : Error, timeout while waiting for Lon I/F to reset!----- Configuration Error -----
```

It is possible that the FieldServer hardware in use may not support LonWorks, or the firmware loaded contains LonWorks but is the wrong firmware for the application. Remove LonWorks from the configuration or get new firmware/hardware.

### Appendix C.3. Exposing Operation Statistics.

If this driver is appropriately configured, it can expose operation statistics in a Data Array which can be monitored by a remote device to check that the driver is performing without error.

The lines from the example below can be cut and pasted into a configuration file to expose these stats.

```
Data_Arrays,

Data_Array_Name   ,Data_Format   ,Data_Array_Length
Lonworks-stats    ,UINT32      ,1000
```

Data Array Offset	Description
1	Increments each time Neuron ID is read. Used for scripting
2	Overwritten each time Neuron ID is read. Contains 1st byte of Neuron ID
3	Overwritten each time Neuron ID is read. Contains 2nd byte of Neuron ID
4	Overwritten each time Neuron ID is read. Contains 3rd byte of Neuron ID
5	Overwritten each time Neuron ID is read. Contains 4th byte of Neuron ID
6	Overwritten each time Neuron ID is read. Contains 5th byte of Neuron ID
7	Overwritten each time Neuron ID is read. Contains 6th byte of Neuron ID
8	Not Used
9	Not Used
10	Overwritten each time Neuron ID is read. Contains 1st nibble of 1st byte of Neuron ID as an ASCII char. e.g. if 1st byte=0x12 then the value stored here is 0x32 - the ASCII char for the digit 2
11	Overwritten each time Neuron ID is read. Contains 2nd nibble of 1st byte of Neuron ID as an ASCII char. e.g. if 1st byte=0x12 then the value stored here is 0x31 - the ASCII char for the digit 1
12	Overwritten each time Neuron ID is read. Contains 1st nibble of 2nd byte of Neuron ID as an ASCII char
13	Overwritten each time Neuron ID is read. Contains 2nd nibble of 2nd byte of Neuron ID as an ASCII char.
14	Overwritten each time Neuron ID is read. Contains 1st nibble of 3rd byte of Neuron ID as an ASCII char.
15	Overwritten each time Neuron ID is read. Contains 2nd nibble of 3rd byte of Neuron ID as an ASCII char.
16	Overwritten each time Neuron ID is read. Contains 1st nibble of 4th byte of Neuron ID as an ASCII char.
17	Overwritten each time Neuron ID is read. Contains 2nd nibble of 4th byte of Neuron ID as an ASCII char.
18	Overwritten each time Neuron ID is read. Contains 1st nibble of 5th byte of Neuron ID as an ASCII char.
19	Overwritten each time Neuron ID is read. Contains 2nd nibble of 5th byte of Neuron ID as an ASCII char.
20	Overwritten each time Neuron ID is read. Contains 1st nibble of 6th byte of Neuron ID as an ASCII char.
21	Overwritten each time Neuron ID is read. Contains 2nd nibble of 6th byte of Neuron ID as an ASCII char.

#### Appendix C.4. “Illegal” Characters in Network Variable Names

- Spaces** Spaces may not be used in Network Variable Names. The driver automatically replaces all spaces with underscores at start-up.
- Brackets** Lonmaker truncates a name from where a bracket is used. e.g. a name like nviTest[1]Input shows as nviTest . Brackets are therefore not able to be used in Network Variable Names.

#### Appendix C.5. Circon\_SI Limitations

- Circon\_SI does not recognize whitespace; %; -
- The maximum number of Network Variables under Circon\_SI is limited to 255 per node.

Set the Connection\_Type parameter in the configuration file per the following example. This will ensure that *all* illegal characters are replaced with underscores, and that the number of Network Variables per Node is limited to 255 in the configuration.

#### Example

```
// Client Side Connections

Connections
Adapter      ,Protocol      ,Connection_Type
LonWorks     ,LonWorks     ,Circon_SI
```

#### Appendix C.6. Service types currently supported for network variable messages

Currently the service type for network variable update messages is fixed to acknowledged service. Request-response service is used for network variable poll and network management fetch messages.

#### Appendix C.7. Combining Explicit and Implicit

To ensure undisturbed communication between the network management tool and the FieldServer during the commissioning, binding or monitoring processes, the timeouts of the explicitly addressed variables (Map Descriptors) might need to be set to values lower than the message timeouts used by the network management tool (LonMaker for Windows).

#### LonWorks FieldServer Performance

No	Description	Min	Typ	Max	Units
1	FieldServer startup time with 4096 network variables	-	6.5	-	Minutes
2	Time to commission FieldServer with 4096 network variables	-	-	40	Minutes
3	Time to complete a network variable updFieldServersbetween two FieldServers (acknowledged service)	-	40	-	Milli-seconds
4	Time to complete a networFieldServersoll message between two FieldServers (request/response service)	-	125	-	Milli-seconds
5	Time to complete a network manageFieldServers variable fetch message between two FieldServers (request/response service)	-	125	-	Milli-seconds

Appendix D. SNVT\_Type

The following section describes each SNVT as implemented on the FieldServer LonWorks driver.

**Data Length** – The number of Data Array elements required when specifying a Data Array name under a Map Descriptor.

**Suggested Data Array Formats** – This field suggests FieldServer Data Array formats in ascending order of storage space required while ensuring data integrity. It is not recommended to store a byte value in a bit Data Array since only the values 0 and 1 will be retained from the byte value resulting in a loss of resolution. If a byte value is stored in a Floating point Data Array, 3 bytes will go to waste. A SNVT with more than one data item may require a float Data Array format to prevent loss of resolution. Since FieldServer Map Descriptors can only work with one type of Data Array format for all the data items in a SNVT, it is sometimes necessary to use a Float Data Array element for all data items of which some may only have required a Byte. Fortunately, all SNVT’s are short in length and RAM is adequately provided for on the FieldServer. If a loss in resolution can be tolerated, any Data Array format may be used.

The range of FieldServer Data Arrays formats are:

Data Array Format	Description	Values Range
BIT	1-bit	0,1
BYTE	8-bit Byte	0.. 255
SINT16	16-bit Signed Integer	-32,768... 32,767
UINT16	16-bit Unsigned Integer	0.. 65,535
SINT32	32-bit Signed Integer	-2,147,483,647... 2,147,483,647
UINT32	32-bit Unsigned Integer	0.. 4,294,967,295
FLOAT	32-bit Float	-3.40282E38... 3.40282E38

**Values Range** – These are the only values that will be allowed for the SNVT, e.g. a value of 101 will not be processed in a read or write on SNVT\_Switch’s Value data item.

**Invalid Value** – The Invalid value is used to force the data item’s value should a value outside the value range be encountered in a read or write. Should the invalid value be N/A ( Not Applicable ), the data item’s value will be bounded by the indicated values range, e.g. an incoming read value of 101 will be stored as 100 for SNVT\_Switch’s Value data item. Note that in some cases both the type and raw values are specified. Raw values are not of the same type of the SNVT’s measurement type, i.e. they are not scaled.

**Data Item** – SNVT’s containing more than one data item have a name specified for each item. This name can be used in the SNVT\_Option field of a Map Descriptor to isolate only this one item.

SNVT_abs_humid	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Absolute humidity	gram/kilogram	0.. 655.34	Raw: 65,535 (0xFFFF) Type: 655.35
SNVT_address	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Neuron Chip Address	16-bit address value	16,384 .. 64,767	N/A

SNVT_alarm	<b>Data Length</b>			25
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1-6</b>			Alm_Location00, ..Alm_Location05
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Location array element	8-bit unsigned byte	0 .. 255	N/A
	<b>Data Item 7</b>			Object_ID
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Object ID	object index	0 .. 65,535	N/A
	<b>Data Item 8</b>			Alarm_type
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	alarm_type_t	N/A	0 .. 254	255 (0xFF)(AL_NUL)
	<b>Data Item 9</b>			Priority_level
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Priority_level_t	N/A	0 .. 11	255 (0xFF)(PR_NUL)
	<b>Data Item 10</b>			Index_to_SNVT
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Index to NV	index of NV causing alarm	0 .. 65,535	N/A
	<b>Data Item 11-14</b>			Alm_Value00, ..Alm_Value03
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Value array element	specific to NVT	0 .. 255	N/A
	<b>Data Item 15</b>			Year
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Year	year	0 .. 3000	N/A
	<b>Data Item 16</b>			Month
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Month	month of year	0 ..12	N/A
	<b>Data Item 17</b>			Day
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Day	day of month	0 ..31	N/A
	<b>Data Item 18</b>			Hour
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Hour	Hour of day	0 ..23	N/A
	<b>Data Item 19</b>			Minute
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Minute	Minutes	0 ..59	N/A	
<b>Data Item 20</b>			Second	
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Second	Seconds	0 ..59	N/A	
<b>Data Item 21</b>			Millisecond	
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Millisecond	Milliseconds	0 ..999	N/A	
<b>Data Item 22-25</b>			Alm_limit00, ..Alm_limit03	
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Alarm limit array element	specific to NVT	0 .. 255	N/A	
SNVT_amp	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
Electric current	Amperes	-3,276.8... 3,276.7	N/A	

SNVT_amp_ac	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Alternating electric current	Amperes	0 .. 65,534	65,535 (0xFFFF)
SNVT_amp_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Electric current	Amperes	-3.40282E38 .. 3.40282E38	N/A
SNVT_angle	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Phase/Rotation	Radians	0 .. 65.535	N/A
SNVT_angle_deg	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Angular distance	degrees	-359.98 .. 360.00	Type: 655.34 Raw: 32,767 (0x7FFF)
SNVT_angle_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Phase/Rotation	Radians	-3.40282E38 .. 3.40282E38	N/A
SNVT_angle_vel	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Angular velocity	Radians/second	-3,276.8 .. 3,276.7	N/A
SNVT_angle_vel_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Angular Velocity	Radians/Second	-3.40282E38 .. 3.40282E38	N/A
SNVT_area	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Area	Square meters (m <sup>2</sup> )	0 .. 13.1068	Type: 13.107 Raw: 0xFFFF (65,535)
SNVT_btu_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Thermal Energy	British Thermal Units	0 .. 3.40282E38	N/A
SNVT_btu_kilo	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Thermal Energy	Kilo-British Thermal Units	0 .. 65,535	N/A

SNVT_btu_mega	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Thermal Energy	Mega-British Thermal Units	0 .. 65,535	N/A
SNVT_char_ascii	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Character	8-bit ASCII Character	0 .. 255	N/A
SNVT_chlr_status	<b>Data Length</b>			3
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Byte, Uint16, Float	8-bit ASCII Character	0 .. 255	N/A
	<b>Data Item 2</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	hvac_t	N/A	0 .. 17	255 (0xFF)(HVAC_NUL)
	<b>Data Item 3</b>			
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
	N/A	0 .. 255	N/A	
SNVT_color	<b>Data Length</b>			3
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Lightness	Lightness	0.0 .. 100.0	N/A
	<b>Data Item 2</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Redness/Greenness	Redness/Greenness	-200.0 .. 200.0	N/A
	<b>Data Item 3</b>			
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Yellowness/Blueness	Yellowness/Blueness	-200.0 .. 200.0	N/A	
SNVT_config_src	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Config_source_t	N/A	0 .. 1	255 (0xFF)(CFG_NUL)
SNVT_count	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Event Count	Count	0 .. 65,535	N/A
SNVT_count_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Event Count	Count	0 .. 3.40282E38	N/A
SNVT_count_inc	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Sint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Incremental Count	Count	-32,768 .. 32,767	N/A

SNVT_count_inc	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Incremental Count	Count	-3.40282E38 .. 3.40282E38	N/A
SNVT_color	<b>Data Length</b>			3
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Receiver ID	ID number	1 .. 65,535	0
	<b>Data Item 2</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Sender ID	ID number	1 .. 65,534	65,535 (0xFFFF)
	<b>Data Item 3</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
Sender priority	Priority value	0 .. 200	N/A	
SNVT_ctrl_resp	<b>Data Length</b>			5
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	control_resp_t	N/A	0 .. 5	255 (0xFF)(CTRLR_NUL)
	<b>Data Item 2</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Sender ID	ID number	1 .. 65,534	65,535 (0xFFFF)
	<b>Data Item 3</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Sender Range Lower ID	ID number	1 .. 65,534	65,535 (0xFFFF)
	<b>Data Item 4</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	ctl_rsp_snd_rupper	ID number	1 .. 65,534	65,535 (0xFFFF)
	<b>Data Item 5</b>			
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Controller ID	ID number	1 .. 65,534	65,535 (0xFFFF)	
SNVT_currency	<b>Data Length</b>			3
	<b>Suggested Data Array Formats</b>			Sint32
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Currency_t	N/A	0 .. 56	255 (0xFF)(CU_NUL)
	<b>Data Item 2</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Magnitude	Power of 10	-128 .. 127	N/A
	<b>Data Item 3</b>			
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Value	Currency Value	-2,147,483,648 .. 2,147,483,647	N/A	
SNVT_count_inc	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	days_of_week_t	N/A	0 .. 6	255 (0xFF)
SNVT_defr_mode	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	defrost_t	N/A	0 .. 2	255 (0xFF)(DFM_MODE_NUL)



SNVT_defr_state	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	defrost_state_t	N/A	0 .. 4	255 (0xFF)(DFS_NUL)
SNVT_defr_term	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	defrost_term_t	N/A	0 .. 100	255 (0xFF)(DFT_NUL)
SNVT_density	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Density	Kg/m <sup>3</sup> : kilograms per cubic meter	0 .. 32,767.5	N/A
SNVT_density_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Density	Kilograms per Cubic Meter (kg/m <sup>3</sup> )	0 .. 3.40282E38	N/A
SNVT_dev_c_mode	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	device_c_mode_t	N/A	0 .. 29	255 (0xFF)(DCM_NUL)
SNVT_earth_pos	<b>Data Length</b>			6
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Latitude/Longitude	Direction	0 .. 255	N/A
	<b>Data Item 2</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Latitude degrees	Degrees	1 .. 90	255 (0xFF)
	<b>Data Item 3</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Latitude Minutes	Minutes	1 .. 59.999	Raw: 65,535 (0xFFFF) Type: 65.535
	<b>Data Item 4</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Longitude Degrees	Degrees	1 .. 180	255 (0xFF)
	<b>Data Item 5</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Longitude Minutes	Minutes	1 .. 59.999	Raw: 65,535 (0xFFFF) Type: 65.535
	<b>Data Item 6</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Height Above Sea Level	Meters (m)	-3.40282E38 .. 3.40282E38	N/A

SNVT_elapsed_tm	<b>Data Length</b>			5
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Days	Days	0 .. 65,534	65,535 (0xFFFF)
	<b>Data Item 2</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Hours	Hours	0 .. 23	N/A
	<b>Data Item 3</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Minutes	Minutes	0 .. 59	N/A
	<b>Data Item 4</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Seconds	Seconds	0 .. 59	N/A
<b>Data Item 5</b>				
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Milliseconds	Milliseconds	0 .. 999	N/A	
SNVT_elec_kwh	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Electrical energy	Kilowatt-hours	0 .. 65,535	N/A
SNVT_elec_kwh_l	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Sint32
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Electricity	Kilowatt-hour	-214,748,364.8 .. 214,748,364.6	-214,748,364.7 (0x7FFFFFFF)
SNVT_elec_whr	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Electric energy	Watt-hours	0 .. 6,553.5	N/A
SNVT_elec_whr_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Electric Energy	Watt-hour	0 .. 3.40282E38	N/A
SNVT_enthalpy	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Enthalpy	KiloJoules per Kilogram kJ/kg	-327.68 .. 327.66	Raw: 32,767 (0x7FFF) Type: 327.67
SNVT_evap_state	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	evap_t	N/A	0 .. 2	255 (0xFF)(EVAP_NUL)

SNVT_ex_control	<b>Data Length</b>			10
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			ex_ctrl_status
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	ex_control_t	N/A	0 .. 2	255 (0xFF)(EX_CONTROL_NUL)
	<b>Data Item 2-7</b>			ex_ctrl_domid_0, ..ex_ctrl_domid_5
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Domain ID	Byte	0 .. 255	N/A
	<b>Data Item 8</b>			ex_ctrl_domid_len
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Domain length	Number of bytes	0 .. 6	N/A
	<b>Data Item 9</b>			ex_ctrl_subnet
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Subnet	Subnet number	1 .. 255	N/A
<b>Data Item 10</b>			ex_ctrl_node	
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Node	Node number	1 .. 127	N/A	
SNVT_file_pos	<b>Data Length</b>			2
	<b>Suggested Data Array Formats</b>			Uint32
	<b>Data Item 1</b>			ops_rw_ptr
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Read/Write Pointer	File Byte Address	0 .. 2,147,483,647	N/A
	<b>Data Item 2</b>			ops_rw_len
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
Read/Write Length	Number of Bytes	0 .. 65,535	N/A	
SNVT_file_req (only raw data supported)	<b>Data Length</b>			12
	<b>Suggested Data Array Formats</b>			Byte
SNVT_file_status (only raw data supported)	<b>Data Length</b>			27
	<b>Suggested Data Array Formats</b>			Byte
SNVT_fire_test	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
fire_test_t	N/A	0 .. 3	255 (0xFF)(FT_NUL)	
SNVT_flow	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
Flow volume	Liters/Second	0 .. 65,534	65,535 (0xFFFF)	
SNVT_flow_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
Flow Volume	Liters/Second	-3.40282E38 .. 3.40282E38	N/A	
SNVT_flow_mil	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Flow volume	Milliliters/Second (ml/s)	0 .. 65,535	N/A

SNVT_flow_p	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Flow volume	Cubic metres per hour	0 .. 655.34	Raw: 65,535 (0xFFFF) Type: 655.35
SNVT_freq_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Frequency	Hertz	0 .. 3.40282E38	N/A
SNVT_freq_hz	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Frequency	Hertz	0 .. 6,553.5	N/A
SNVT_freq_kilohz	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Frequency	Kilohertz	0 .. 6,553.5	N/A
SNVT_freq_milhz	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Frequency	Hertz	0 .. 6.5535	N/A
SNVT_fire_init	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	fire_initiator_t	N/A	0 .. 16	255 (0xFF)(FI_NUL)
SNVT_fire_indcte	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	fire_indicator_t	N/A	0 .. 8	255 (0xFF)(FN_NUL)
SNVT_gfci_status	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	gfci_status_t	N/A	0 .. 5	255 (0xFF)(GFCI_NUL)
SNVT_grammage	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Grammage	Grams/Square-meter	0 .. 6,553.5	N/A
SNVT_grammage_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Grammage	Grams/Square-meter	0 .. 3.40282E38	N/A
SNVT_hvac_emerg	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	emerg_t	N/A	0 .. 5	255 (0xFF)(EMERG_NUL)

SNVT_hvac_mode	<b>Data Length</b>			1	
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float	
	<b>Data Item 1</b>				
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
	Hvac_t	N/A	0 .. 17	255 (0xFF)(HVAC_NUL)	
SNVT_hvac_overid	<b>Data Length</b>			3	
	<b>Suggested Data Array Formats</b>			Float	
	<b>Data Item 1</b>				
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
		hvac_overid_t	N/A	0 .. 48	255 (0xFF)(HVO_NUL)
	<b>Data Item 2</b>				
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
		Percent	Percent of Full Scale	-163.840 .. 163.830	Type: 163.835 Raw: 32,767 (0x7FFF)
	<b>Data Item 3</b>				
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
	Flow	Liters per Second	0 .. 65,534	65,535 (0xFFFF)	
SNVT_hvac_status	<b>Data Length</b>			7	
	<b>Suggested Data Array Formats</b>			Float	
	<b>Data Item 1</b>				
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
		hvac_t	N/A	0 .. 17	255 (0xFF)(HV_NUL)
	<b>Data Item 2</b>				
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
		Primary Heat Output	Percent of Full Scale	-163.840 .. 163.830	Type: 163.835 Raw: 32,767 (0x7FFF)
	<b>Data Item 3</b>				
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
		Secondary Heat Output	Percent of Full Scale	-163.840 .. 163.830	Type: 163.835 Raw: 32,767 (0x7FFF)
	<b>Data Item 4</b>				
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
		Cooling Output	Percent of Full Scale	-163.840 .. 163.830	Type: 163.835 Raw: 32,767 (0x7FFF)
	<b>Data Item 5</b>				
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
		Economizer Output	Percent of Full Scale	-163.840 .. 163.830	Type: 163.835 Raw: 32,767 (0x7FFF)
	<b>Data Item 6</b>				
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
		Fan Output	Percent of Full Scale	-163.840 .. 163.830	Type: 163.835 Raw: 32,767 (0x7FFF)
	<b>Data Item 7</b>				
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>		
	In Alarm State	Alarm value	0 .. 1	N/A	
SNVT_hvac_type	<b>Data Length</b>			1	
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float	
	<b>Data Item 1</b>				
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
	Hvac_hvt_t	N/A	0 .. 9	255 (0xFF)(HVT_NUL)	
SNVT_length	<b>Data Length</b>			1	
	<b>Suggested Data Array Formats</b>			Float	
	<b>Data Item 1</b>				
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
	Length	Meters (m)	0 .. 6,553.5	N/A	

SNVT_length_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Length	Meters	0 .. 3.40282E38	N/A
SNVT_length_kilo	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Length	Kilometers (km)	0 .. 6,553.5	N/A
SNVT_length_micr	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Length	Micrometers, Microns	0 .. 6,553.5	N/A
SNVT_length_mil	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Length	Millimeters (mm)	0 .. 6,553.5	N/A
SNVT_length_cont	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Continuous Level	Percent of Full Level	0 .. 100.0	N/A
SNVT_length_cont_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Continuous Level	Percent of Full Scale	0 .. 100	N/A
SNVT_length_disc	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Discrete_levels_t	N/A	0 .. 4	255 (0xFF)(ST_NUL)
SNVT_length_percent	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Percentage Level	Percent of Full Scale, or Parts-per Million (ppm)	-163.840 .. 163.830	Type: 163.835 Raw: 32,767 (0x7FFF)
SNVT_lux	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Illumination	Lux	0 .. 65,535	N/A
SNVT_magcard (only raw data supported)	<b>Data Length</b>			20
	<b>Suggested Data Array Formats</b>			Byte
	<b>Data Item 1</b>			
SNVT_mass	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Mass	Grams	0 .. 6,553.5	N/A

SNVT_mass_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Mass	Grams	0 .. 3.40282E38	N/A
SNVT_mass_kilo	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Mass	Kilograms (kg)	0 .. 6,553.5	N/A
SNVT_mass_mega	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Mass	Metric Tons; Tonne	0 .. 6,553.5	N/A
SNVT_mass_mil	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Mass	Milligrams (mg)	0 .. 6,553.5	N/A
SNVT_motor_state	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	motor_state_t	N/A	0 .. 7	255 (0xFF)(MOTOR_NUL)
SNVT_mul_div	<b>Data Length</b>			2
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Multiplier	N/A	0 .. 65,535	N/A
	<b>Data Item 2</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
Divisor	N/A	1 .. 65,535	0	
SNVT_multiplier	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Multiplier	N/A	0 .. 32.7675	N/A

SNVT_nv_type	<b>Data Length</b>			15
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1-8</b>			nv_type_pid0, ..nv_type_pid7
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Program ID	N/A	0 .. 255	N/A
	<b>Data Item 9</b>			nv_type_scope
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Scope	N/A	0 .. 6	N/A
	<b>Data Item 10</b>			nv_type_index
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Type index	N/A	1 .. 65,535	0
	<b>Data Item 11</b>			nv_type_cat
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	nv_type_category_t	N/A	1 .. 14	255 (0xFF)(NVT_CAT_NUL)
	<b>Data Item 12</b>			nv_type_length
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Type length	Bytes	1 .. 31	0
	<b>Data Item 13</b>			nv_type_scale_a
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Scaling multiplier	N/A	-32,768 .. 32,766	32,767
<b>Data Item 14</b>			nv_type_scale_b	
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Scaling exponent	N/A	-32,768 .. 32,766	32,767	
<b>Data Item 15</b>			nv_type_scale_c	
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Scaling offset	N/A	-32,768 .. 32,766	32,767	
SNVT_obj_request	<b>Data Length</b>			2
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			obj_request_id
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	obj_request_id	File Byte Address	0 .. 2,147,483,647	N/A
	<b>Data Item 2</b>			obj_request
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
object_request_t	N/A	0 .. 17	255 (0xFF)(RO_NUL)	
SNVT_obj_status	<b>Data Length</b>			2
	<b>Suggested Data Array Formats</b>			Uint32
	<b>Data Item 1</b>			obj_status_id
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Functional Block ID	N/A	0 .. 65,535	N/A
	<b>Data Item 2</b>			obj_status_bits
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
object_status_bits	Bits	0 .. 4,294,967,295	N/A	
SNVT_occupancy	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Occup_t	N/A	0 .. 3	255 (0xFF)(OC_NUL)
SNVT_override	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	override_t	N/A	0 .. 2	255 (0xFF)(OV_NUL)



SNVT_pH	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
Acidity	pH	-32.768 .. 32.767	N/A	
SNVT_pH_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
Acidity	pH	-3.40282E38 .. 3.40282E38	N/A	
SNVT_pos_ctrl	<b>Data Length</b>			9
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Receiver ID	ID number	1 .. 65,535	0
	<b>Data Item 2</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Controller ID	ID number	1 .. 65,534	65,535 (0xFFFF)
	<b>Data Item 3</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Controller priority	Priority value	0 .. 200	N/A
	<b>Data Item 4</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	cam_func_t	N/A	0 .. 2	255 (0xFF)(CMF_NUL)
	<b>Data Item 5</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	cam_act_t	N/A	0 .. 2	255 (0xFF)(CMA_NUL)
	<b>Data Item 6</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Action number	Action number	1 .. 255	0
	<b>Data Item 7</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Pan position	Degrees	-359.98 .. 360.00	Raw: 32,767 (0x7FFF) Type: 655.34
	<b>Data Item 8</b>			
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Tilt position	Degrees	-359.98 .. 360.00	Raw: 32,767 (0x7FFF) Type: 655.34	
<b>Data Item 9</b>				
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Zoom position	Percent of full-scale or ppm	-163.840 .. 163.830	Raw: 32,767 (0x7FFF) Type: 163.835	
SNVT_power	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
Power	Watts (W)	0 .. 6,553.5	N/A	
SNVT_power_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
Power	Watts	-3.40282E38 .. 3.40282E38	N/A	

SNVT_power_kilo	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Power	KiloWatts	0 .. 6,553.5	N/A
SNVT_ppm	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Concentration	Parts per Million (ppm)	0 .. 65,535	N/A
SNVT_ppm_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Concentration	Parts per Million	0 .. 3.40282E38	N/A
SNVT_preset	<b>Data Length</b>			11
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	learn_mode_t	N/A	0 .. 3	255 (0xFF)(LN_NUL)
	<b>Data Item 2</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Selector	N/A	0 .. 65,535	N/A
	<b>Data Item 3-6</b>			preset_value00, ..preset_value03
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Value	Specific to SNVT	0 .. 255	N/A
	<b>Data Item 7</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Days	Days	0 .. 65,534	65,535 (0xFFFF)
	<b>Data Item 8</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Hours	Hour	0 .. 23	N/A
	<b>Data Item 9</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Minutes	Minutes	0 .. 59	N/A
	<b>Data Item 10</b>			
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Seconds	Seconds	0 .. 59	N/A	
<b>Data Item 11</b>				
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Milliseconds	Milliseconds	0 .. 999	N/A	
SNVT_press	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Pressure (gauge)	KiloPascals	-3,276.8 .. 3,276.6	Type: 3,276.7 Raw: 32,767 (0x7FFF)
SNVT_press_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Pressure (gauge)	Pascals	-3.40282E38 .. 3.40282E38	N/A

SNVT_press_p	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Sint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Pressure (gauge)	Pascals	-32,768 .. 32,766	32,767 (0x7FFF)
SNVT_privacyzone	<b>Data Length</b>			3
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	privacyzone_t	N/A	0 .. 5	255 (0xFF)(PZ_NUL)
	<b>Data Item 2</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Zone number	Privacy zone number	1 .. 255	0
	<b>Data Item 3</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
Camera ID	ID number	1 .. 65,535	0	
SNVT_ptz	<b>Data Length</b>			6
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	ptz_pan_dir	Direction	0 .. 255	N/A
	<b>Data Item 2</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Pan speed	Percent of full level	0.0 .. 100.0	N/A
	<b>Data Item 3</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	tilt_dir_t	N/A	0 .. 2	255 (0xFF)(TILT_NUL)
	<b>Data Item 4</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Tilt speed	Percent of full level	0.0 .. 100.0	N/A
	<b>Data Item 5</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	zoom_t	N/A	0 .. 2	255 (0xFF)(ZOOM_NUL)
	<b>Data Item 6</b>			
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
ptz_zoom_speed	Meters (m)	-3.40282E38 .. 3.40282E38	N/A	

SNVT_pump_sensor	<b>Data Length</b>			13
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			pump_sn_rot_speed
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Frequency	Hertz	0 .. 6,553.4	N/A
	<b>Data Item 2</b>			pump_sn_body_temp
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Body temperature	Degrees celcius	-274.0 .. 6,279.4	N/A
	<b>Data Item 3</b>			pump_sn_mot_ext_temp
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Motor external temperature	Degrees celcius	-274.0 .. 6,279.4	N/A
	<b>Data Item 4</b>			pump_sn_mot_int_temp
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Motor internal temperature	Degrees celcius	-274.0 .. 6,279.4	N/A
	<b>Data Item 5</b>			pump_sn_mot_overload
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Boolean	Bit	0, 1	255 (0xFF)(BOOL_NUL)
	<b>Data Item 6</b>			pump_sn_oil_low
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Boolean	Bit	0, 1	255 (0xFF)(BOOL_NUL)
	<b>Data Item 7</b>			pump_sn_ph_imbal
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Boolean	Bit	0, 1	255 (0xFF)(BOOL_NUL)
	<b>Data Item 8</b>			pump_sn_curr_use
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Electric current usage	Ampere	-3,276.8 .. 3,276.6	N/A
	<b>Data Item 9</b>			pump_sn_pwr_usage
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Power usage	Kilowatts	0 .. 6,553.4	N/A
	<b>Data Item 10</b>			pump_sn_temp_ctrl
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	unit_temp_t	N/A	0 .. 3	255 (0xFF)(TEMP_NUL)
	<b>Data Item 11</b>			pump_sn_em_brake_act
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Boolean	Bit	0, 1	255 (0xFF)(BOOL_NUL)	
<b>Data Item 12</b>			pump_sn_fric_brk_act	
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Boolean	Bit	0, 1	255 (0xFF)(BOOL_NUL)	
<b>Data Item 13</b>			pump_sn_gas_brk_act	
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Boolean	Bit	0, 1	255 (0xFF)(BOOL_NUL)	

SNVT_pumpset_mn	<b>Data Length</b>			8
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			pset_main_pump
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	motor_state_t	N/A	0 .. 7	255 (0xFF)(MOTOR_NUL)
	<b>Data Item 2</b>			pset_booster_pump
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	motor_state_t	N/A	0 .. 7	255 (0xFF)(MOTOR_NUL)
	<b>Data Item 3</b>			pset_prio_level
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	priority_level_t	N/A	0 .. 11	255 (0xFF)(PR_NUL)
	<b>Data Item 4</b>			pset_process_ready
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Boolean_t	Bit	0, 1	255 (0xFF)(BOOL_NUL)
	<b>Data Item 5</b>			pset_emerg_stop
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Boolean_t	Bit	0, 1	255 (0xFF)(BOOL_NUL)
	<b>Data Item 6</b>			pset_main_pumpd_ena
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Boolean_t	Bit	0, 1	255 (0xFF)(BOOL_NUL)
	<b>Data Item 7</b>			pset_boost_pumpd_ena
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Boolean_t	Bit	0, 1	255 (0xFF)(BOOL_NUL)
	<b>Data Item 8</b>			pset_maint_req
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Boolean_t	Bit	0, 1	255 (0xFF)(BOOL_NUL)	

SNVT_pumpset_mn	<b>Data Length</b>		14
	<b>Suggested Data Array Formats</b>		Float
	<b>Data Item 1</b>		pset_sn_dil_flow
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>
	Total Dilution Flow Volume	Milliliters per second	0 .. 65,534
	<b>Data Item 2</b>		pset_sn_exh_temp
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>
	Exhaust Temperature	Degrees Celcius	-274.0 .. 6,279.4
	<b>Data Item 3</b>		pset_sn_exh_press
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>
	Exhaust Pressure	Kilo-pascals	-3,276.8 .. 3,276.6
	<b>Data Item 4</b>		pset_sn_seal_press
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>
	Shaft seal purge pressure	Kilo-pascals	-3,276.8 .. 3,276.6
	<b>Data Item 5</b>		pset_sn_inlet_vacuum
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>
	Inlet vacuum pressure	Kilo-pascals	-3.40282E38 .. 3.40282E38
	<b>Data Item 6</b>		pset_sn_supply_volts
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>
	Supply voltage	Volts	-3,276.8 .. 3,276.6
	<b>Data Item 7</b>		pset_sn_cool_flow
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>
	Total coolant flow	Milliliters per second	0 .. 65,534
	<b>Data Item 8</b>		pset_sn_cool_fl_low
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>
	Boolean	Bit	0, 1
	<b>Data Item 9</b>		pset_sn_dil_active
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>
	Boolean	Bit	0, 1
	<b>Data Item 10</b>		pset_sn_bal_dil_act
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	
Boolean	Bit	0, 1	
<b>Data Item 11</b>		pset_sn_inl_p_dil_act	
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	
Boolean	Bit	0, 1	
<b>Data Item 12</b>		pset_sn_exh_dil_act	
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	
Boolean	Bit	0, 1	
<b>Data Item 13</b>		pset_sn_dil_fl_oor	
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	
Boolean	Bit	0, 1	
<b>Data Item 14</b>		pset_sn_pwr_sup_on	
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	
Boolean	Bit	0, 1	
SNVT_pwr_fact	<b>Data Length</b>		1
	<b>Suggested Data Array Formats</b>		Float
	<b>Data Item 1</b>		
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>
Power Factor	Multiplier	-1.00000 .. 1.00000	

SNVT_pwr_fact_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Power Factor	N/A	-1 .. 1	N/A
SNVT_pwr_fact_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Power Factor	N/A	-1 .. 1	N/A
SNVT_reg_val	<b>Data Length</b>			3
	<b>Suggested Data Array Formats</b>			Sint32
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Raw value	Defined by unit field	-2,147,483,638 .. 2,147,483,647	N/A
	<b>Data Item 2</b>			reg_val_unit
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	reg_val_unit_t	N/A	0 .. 43	255 (0xFF)(RVU_NUL)
	<b>Data Item 3</b>			reg_val_decimals
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
Decimal Place	Digits to Right of Decimal Point	0 ..7	N/A	
SNVT_reg_val_ts	<b>Data Length</b>			9
	<b>Suggested Data Array Formats</b>			Sint32
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Raw Value		-2,147,483,648 .. 2,147,483,647	N/A
	<b>Data Item 2</b>			reg_val_ts_unit
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	reg_val_unit_t	N/A	0 .. 43	255 (0xFF)(RVU_NUL)
	<b>Data Item 3</b>			reg_val_ts_bits
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	See SNVT tables	See SNVT tables	0 .. 255	N/A
	<b>Data Item 4</b>			reg_val_ts_year
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Year	Year	0 .. 300	N/A
	<b>Data Item 5</b>			reg_val_ts_month
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Month	Month of Year	0 .. 12	N/A
	<b>Data Item 6</b>			reg_val_ts_day
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Day	Day of Month	0 .. 31	N/A
	<b>Data Item 7</b>			reg_val_ts_hour
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Hour	Hour of day	0 .. 23	N/A
	<b>Data Item 8</b>			reg_val_ts_min
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Minutes	Minute of Hour	0 .. 59	N/A
	<b>Data Item 9</b>			reg_val_ts_secs
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Minutes	Minute of Hour	0 .. 59	N/A

SNVT_res	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Electrical Resistance	Ohms	0 .. 6,553.5	N/A
SNVT_res_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Electrical Resistance	Ohms	0 .. 3.40282E38	N/A
SNVT_res_kilo	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Electrical Resistance	KiloOhms	0 .. 6,553.5	N/A
SNVT_rpm	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Angular Velocity	Revolutions per Minute (RPM)	0 .. 65,534	65,535 (0xFFFF)
SNVT_scene	<b>Data Length</b>			2
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Scene_t	N/A	0 .. 23	255 (0xFF)(SC_NUL)
	<b>Data Item 2</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
Scene Number	Scene Number	1 .. 255	N/A	
SNVT_scene_cfg	<b>Data Length</b>			7
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	scene_config_t	N/A	0 .. 4	255 (0xFF)(SCF_NUL)
	<b>Data Item 2</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Scene Number	Scene Number	1 .. 255	N/A
	<b>Data Item 3</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Scene Setting Level	Percent of Full Level	0 .. 100.0	N/A
	<b>Data Item 4</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Scene Rotation Angle	Degrees	-359.98 .. 360.00	Raw: 32,767 (0x7FFF) Type: 655.34
	<b>Data Item 5</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Scene Fade Time	Seconds	0.0 to 6,553.4	Raw: 65,535 (0xFFFF) Type: 6553.5
	<b>Data Item 6</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Scene Delay Time	Seconds	0.0 to 6,553.4	Raw: 65,535 (0xFFFF) Type: 6553.5
<b>Data Item 7</b>				
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Scene Priority	Priority Value	0 .. 255	N/A	



SNVT_setting	<b>Data Length</b>			3
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			setting_function
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	setting_t	N/A	0 .. 5	255 (0xFF)(SET_NUL)
	<b>Data Item 2</b>			setting_setting
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Scene Setting Level	Percent of Full Level	0 .. 100.0	N/A
	<b>Data Item 3</b>			setting_rotation
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
Rotation Angle	Degrees	-359.98 .. 360.00	Raw: (0x7FFF) 32,767 Type: 655.34	
SNVT_smo_obscur	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Smoke Obscuration	Percent Obscuration	0.000 .. 5.000	N/A
SNVT_sound_db	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Sound Level	Decibels	-327.68 .. 327.67	N/A
SNVT_sound_db_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Sound Level	Decibels from Sound Pressure Level	-3.40282E38 .. 3.40282E38	N/A
SNVT_speed	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Linear Velocity	Meters per Second	0 .. 6,553.5	N/A
SNVT_speed_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Speed	Meters per Second	-3.40282E38 .. 3.40282E38	N/A
SNVT_speed_mil	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Linear Velocity	Millimeters per Second	0 .. 65,535	N/A
SNVT_state	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	16 state bits	Bits	0 .. 65,535	N/A

SNVT_state_64	<b>Data Length</b>			4
	<b>Suggested Data Array Formats</b>			Packed_Bit, Uint16, Float
	<b>Data Item 1</b>			state_64_word0
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Boolean	Bit	0, 1 per bit ( 16 bits in word )	N/A
	<b>Data Item 2</b>			state_64_word1
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Boolean	Bit	0, 1 per bit ( 16 bits in word )	N/A
	<b>Data Item 3</b>			state_64_word2
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Boolean	Bit	0, 1 per bit ( 16 bits in word )	N/A
	<b>Data Item 4</b>			state_64_word3
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Boolean	Bit	0, 1 per bit ( 16 bits in word )	N/A	
SNVT_str_asc	<b>Data Length</b>			31
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1 - 31</b>			ascii00, ascii01, .. ascii30
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
Character String	N/A	0 .. 255	N/A	
SNVT_str_int	<b>Data Length</b>			16
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			char_set
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Locale Code	N/A	0 .. 255	N/A
	<b>Data Item 2 - 16</b>			wide_char00, .. wide_char14
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Wide-character string with NULL terminator	N/A	0 .. 65,535	N/A	
SNVT_scene	<b>Data Length</b>			2
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			Value
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Value	Percentage of full scale	0 .. 100.0	N/A
	<b>Data Item 2</b>			State
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
State	N/A	0 .. 1	-1	
SNVT_telcom	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
telcom_states_t	N/A	0 .. 20	255 (0xFF)(TEL_NUL)	
SNVT_temp	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
Temperature	Degrees Celsius	-274.0 .. 6,279.5	N/A	
SNVT_temp_diff_p	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Temperature difference	Degrees Celcius	-327.68 .. 327.66	Raw: 32,767 (0x7FFF) Type: 655.34

SNVT_temp_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Incremental Count	Degrees Celcius	-3.40282E38 .. 3.40282E38	N/A
SNVT_temp_p	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Temperature	Degrees celsius	-273.17 .. 327.66	Type: 327.67 Raw: 32,767 (0x7FFF)
SNVT_temp_ror	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Temperature Rate of Change/Rise	Degrees Celsius per Minute (°C/min)	-16,384.0 .. 16,383.0	Raw: 32,767 (0x7FFF) Type: 16,383.5
SNVT_temp_setpt	<b>Data Length</b>			6
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Occupied Cooling Setpoint	Degrees Celsius	-273.17 .. 327.66	Type: 327.67 Raw: 32,767 (0x7FFF)
	<b>Data Item 2</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Standby Cooling Setpoint	Degrees Celsius	-273.17 .. 327.66	Type: 327.67 Raw: 32,767 (0x7FFF)
	<b>Data Item 3</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Unoccupied Cooling Setpoint	Degrees Celsius	-273.17 .. 327.66	Type: 327.67 Raw: 32,767 (0x7FFF)
	<b>Data Item 4</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Occupied Heating Setpoint	Degrees Celsius	-273.17 .. 327.66	Type: 327.67 Raw: 32,767 (0x7FFF)
	<b>Data Item 5</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Standby Heating Setpoint	Degrees Celsius	-273.17 .. 327.66	Type: 327.67 Raw: 32,767 (0x7FFF)
	<b>Data Item 6</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Unoccupied Heating Setpoint	Degrees Celsius	-273.17 .. 327.66	Type: 327.67 Raw: 32,767 (0x7FFF)
SNVT_therm_mode	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	therm_mode_t	N/A	0 .. 2	255 (0xFF)(THERM_NUL)
SNVT_time_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Elapsed Time	Seconds	-3.40282E38 .. 3.40282E38	N/A

SNVT_time_hour	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Elapsed Time	Hours	0 .. 65,535	N/A
SNVT_time_min	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Elapsed Time	Minutes	0 .. 65,535	N/A
SNVT_time_sec	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Elapsed time	Seconds	0 .. 6,553.4	65,535 (0xFFFF)
SNVT_time_stamp	<b>Data Length</b>			6
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Year	Year	0 .. 3000	65,535 (0xFFFF)
	<b>Data Item 2</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Month	Month of Year	0 .. 12	N/A
	<b>Data Item 3</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Day	Day of Month	0 .. 31	N/A
	<b>Data Item 4</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Hours	Hours of Day	0 .. 23	N/A
	<b>Data Item 5</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Minutes	Minute of Hour	0 .. 59	N/A
	<b>Data Item 6</b>			
<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>	
Second	Second of Minute	0 .. 59	N/A	
SNVT_time_zone (only raw data supported)	<b>Data Length</b>			15
	<b>Suggested Data Array Formats</b>			Byte
SNVT_tod_event	<b>Data Length</b>			3
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	occup_t	N/A	0 .. 3	255 (0xFF)(OC_NUL)
	<b>Data Item 2</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	occup_t	N/A	0 .. 3	255 (0xFF)(OC_NUL)
	<b>Data Item 3</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
Time to Next State	Minute of Hour	0 .. 65,535	N/A	
SNVT_trans_table	<b>Data Length</b>			8
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1-7</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Axis-points Array	N/A	-3.40282E38 .. 3.40282E38	N/A
	<b>Data Item 8</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
interp_t	N/A	0 .. 65,535	N/A	

SNVT_turbidity	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Turbidity	Nephelometric Turbidity Units (NTU)	0 .. 65.534	65,535 (0xFFFF)
SNVT_turbidity_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Turbidity	Nephelometric Turbidity Units (NTU)	0 .. 3.40282E38	N/A
SNVT_valve_mode	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Byte, Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	valve_mode_t	N/A	0 .. 7	255 (0xFF)(VALVE_NUL)
SNVT_vol	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Volume	Liters	0 .. 6,553.5	N/A
SNVT_vol_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Volume	Liters	0 .. 3.40282E38	N/A
SNVT_vol_kilo	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Volume	Kiloliters (kl)	0 .. 6,553.5	N/A
SNVT_vol_mil	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Volume	Milliliters	0 .. 6,553.5	N/A
SNVT_volt_ac	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Uint16, Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Electric Voltage	Volts, Alternating Current (VAC)	0 .. 65,534	65,535 (0xFFFF)
SNVT_volt_dbmv	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Electric Voltage	Decibels-milliVolts, Direct Current	-3,276.8 .. 3,276.7	N/A
SNVT_volt_f	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Electric Voltage	Volts	-3.40282E38 .. 3.40282E38	N/A

SNVT_volt_kilo	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Electric Voltage	Kilovolts	-3,276.8 .. 3,276.7	N/A
SNVT_volt_mil	<b>Data Length</b>			1
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Electric Voltage	Millivolts	-3,276.8 .. 3,276.7	N/A
SNVT_zerospan	<b>Data Length</b>			2
	<b>Suggested Data Array Formats</b>			Float
	<b>Data Item 1</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
	Zero-term	Percent (%) or Parts-per-Million (ppm)	-163.840 .. 163.835	N/A
	<b>Data Item 2</b>			
	<b>Measurement</b>	<b>Units</b>	<b>Values Range</b>	<b>Invalid Value</b>
Span-factor	Percent (%) or Parts-per-Million (ppm)	0 .. 32.7675	N/A	

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