



A Sierra Monitor Company

Driver Manual
(Supplement to the FieldServer Instruction Manual)

FS-8700-21 LonWorks

APPLICABILITY & EFFECTIVITY

Effective for all systems manufactured after January 2010

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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 0 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 6.1.3. 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 3rd Party Equipment

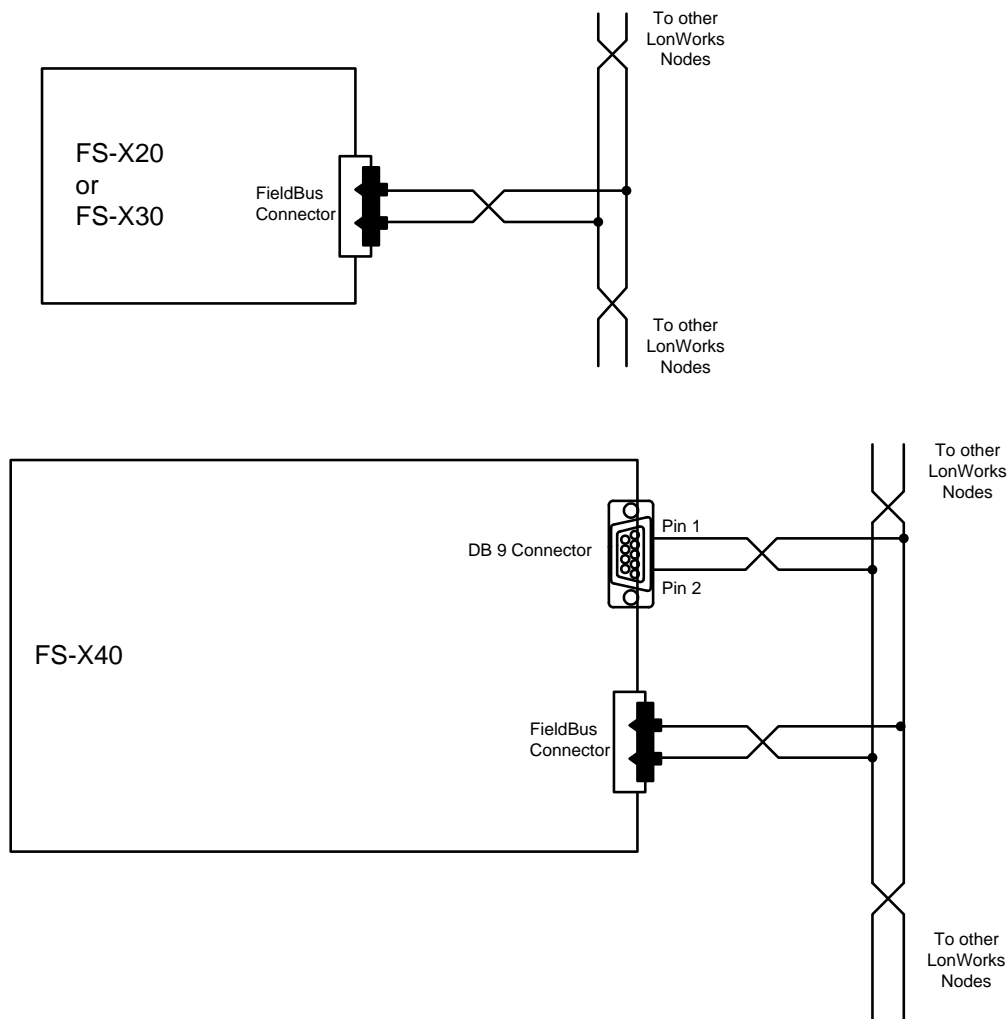
Part #	Description
N/A	LonMaker® Integration Tool from Echelon Corporation (Optional Network Management Software)
N/A	LonWatcher from Distech Controls Inc. (Optional Network Management Software)
N/A	Circon System Integrator from Circon Systems Corporation (Optional Network Management Software)
PCC10	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 7.1.4
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.4.

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 DATA ARRAY PARAMETERS

Data Arrays are “protocol neutral” data buffers for storage of data to be passed between protocols. It is necessary to declare the data format of each of the Data Arrays to facilitate correct storage of the relevant data. More information is available in Appendix D.

Section Title		
Data_Arrays		
Column Title	Function	Legal Values
Data_Array_Name	Provide name for Data Array	Up to 15 alphanumeric characters
Data_Array_Format	Provide data format. Each Data Array can only take on one format.	Float, Bit, UInt16, Sint16, Int32, Sint32. Refer to Appendix D
Data_Array_Length	Number of Data Objects. Must be larger than the data storage area required by the Map Descriptors for the data being placed in this array.	1-10,000

Example

```
// Data Arrays
Data_Arrays
Data_Array_Name , Data_Array_Format , Data_Array_Length
DA_AI_01        , UInt16,           , 200
DA_AO_01        , UInt16           , 200
DA_DI_01        , Bit              , 200
DA_DO_01        , Bit              , 200
```

6 IMPLICIT CONFIGURATIONS

6.1 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.

6.1.1 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.

6.1.2 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 0
CFG_NVUI	Configuration Network Variable Update Input	PASSIVE

6.1.3 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.

6.1.4 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).

6.1.5 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.

6.1.6 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.

Note that in the tables, * indicates an optional parameter, with the bold legal value being the default.

6.2 Client Side Mapping

6.2.1 Client Side Connection Parameters

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

Example

```
// Client Side Connections
```

```
Connections
```

```
Adapter      , Protocol
```

```
LonWorks    , LonWorks
```

6.2.2 Client Side 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
Startup_Write	Initiate a send on startup. Refer to Appendix A.3 for more information	Enabled, Disabled

Example

```
// Client Side Nodes

Nodes
Node_Name , Protocol
LON_1 , LonWorks
```

6.2.3 Client Side Map Descriptor Parameters

6.2.3.1 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 defined in Section 5
Data_Array_Offset	Starting location in Data Array	0 to (Data_Array_Length-1) as specified in Section 5
Lon_Function	Detailed Function of Client Map Descriptor	See Section 6.1.2 for a list of valid entries for Implicit Connections.
Function	Function of Client Map Descriptor	See Section 6.1.2 for a list of valid entries based on the Lon_Function.

6.2.3.2 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 Section 6.2.2
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, used on other Lon Functions. It is possible to configure a start-up write option for throttling Map Descriptor functions instead of waiting for the minimum scan time to pass. Refer to Appendix A.3.	See 0
NV_Selfdoc_Text*	The Self-Documenting String for this Network Variable.	Normal Text up to a length of 40 characters. Defaults to "" for parameters using string values and 0 for parameters using numeric values

6.2.3.3 Timing Parameters

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

6.2.4 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 6.1.2 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.

7 EXPLICIT CONFIGURATIONS

7.1 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.

7.1.1 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.

7.1.2 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 7.1.5

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

7.1.3 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.

7.1.4 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.

7.1.5 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.

7.2 Client Side Configuration

7.2.1 Client Side Connection Parameters

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
```

7.2.2 Client Side Node Parameters

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
Startup_Write	Initiate a send on startup. Refer to Appendix A.3 for more information	Enabled, Disabled

Example

```
// Client Side Nodes

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

7.2.3 Client Side Map Descriptor Parameters

7.2.3.1 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 Section 7.2.2
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, not used on other Lon Functions. It is possible to configure a start-up write option for throttling Map Descriptor functions instead of waiting for the minimum scan time to pass. Refer to Appendix A.3.	See Appendix A.2
NV_Selfdoc_Text*	The Self-Documenting String for this Network Variable.	Normal Text up to a length of 40 characters. Defaults to "" for parameters using string values and 0 for parameters using numeric values

7.2.3.2 Timing Parameters

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

7.2.4 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 7.1.2 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.

7.2.5 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.

7.2.6 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 7.1.4

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

On the Client side add a new field under Nodes 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 , , 0s
SNVT_amp
```

7.3 Server Side Configuration

7.3.1 Server Side Connection Parameters

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
```

7.3.2 Server Side 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
Startup_Write	Initiate a send on startup.	Enabled, Disabled

Example

```
// Server Side Nodes

Nodes
Node_Name   , Protocol
LON_1       , LonWorks
```

7.3.3 Server Side Map Descriptor Parameters

7.3.3.1 FieldServer Related Map Descriptor Parameters

Column Title	Function	Legal Values
Map_Descriptor_Name	Name of this Map Descriptor	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 defined in Section 5
Data_Array_Offset	Starting location in Data Array	0 to (Data_Array_Length-1) as specified in Section 5
Lon_Function	Detailed Function of Client Map Descriptor	See Section 7.1.2 for a list of valid entries..
Function	Function of Client Map Descriptor	

7.3.3.2 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 under Client Node Parameters
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.3
NV_Selfdoc_Text	The Self-Documenting String for this Network Variable.	Normal Text up to a length of 40 characters. Defaults to "" for parameters using string values and 0 for parameters using numeric values

7.3.3.3 Timing Parameters

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

7.3.4 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 7.2.3

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 6.2.4 and 0.

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 6.2.4 and 0.

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

It is possible to configure the driver to initiate a send on startup rather than waiting for the minimum scan interval to pass. The following example describes the configuration required.

Nodes

Node_Name	Node_ID	Protocol	Startup_Write
Lon_Srv_11	11	Lonworks	Enabled

Map_Descriptors

Map_Descriptor_Name	Data_Array_Name	Data_Array_Offset	Lon_Function	Function	Node_Name	SNVT_Index	SNVT_Type	Min_Scan_Time	Max_Scan_Time	NV_Delta_Value
nvoAmp	DA_001	0	NVUOEXT	WRBC	Lon_Srv_11	000	SNVT_amp	30s	60s	30

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[®]. 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 0

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

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

The example below shows how LonMark Objects can be assigned in FieldServer configuration files:

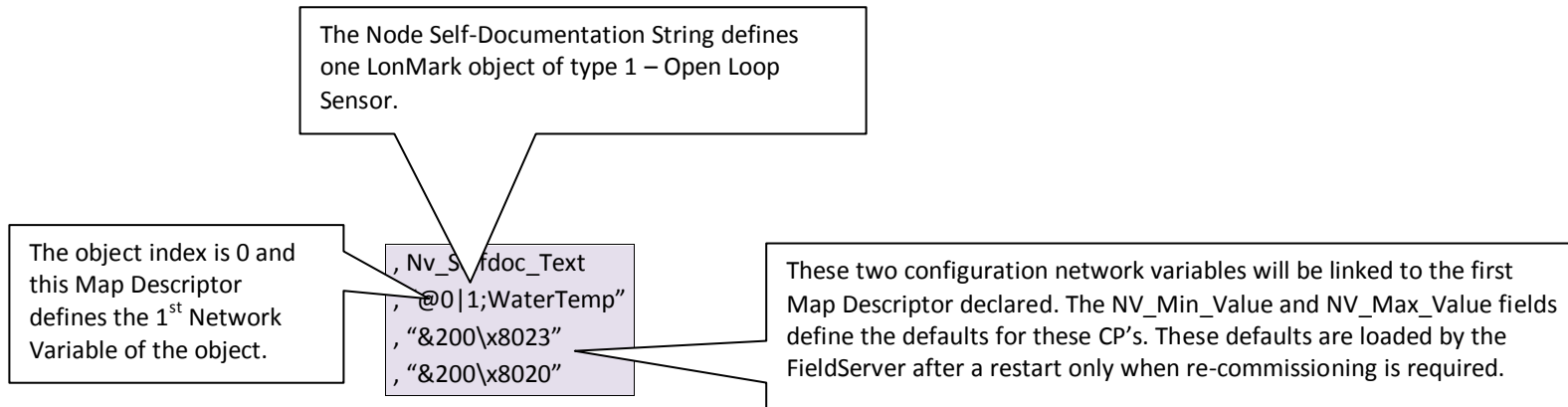
In this example the standard Open Loop Sensor Object (Type 1) is used to create a Water Temperature Sensor that will send out its current status via Network Variable Updates.

LonMark Config file Example – 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 entries under Nv_Selfdoc_Text are described in more detail below:



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 ¹	All	Raw	2	Raw, unadjusted data
	Value	Raw	1	Raw, unadjusted data
		Percent	1	Percent (%)
	State	Raw	1	Raw, unadjusted data

¹ 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. Checking LONWORKS® Network Using Echelon's NodeUtility.exe

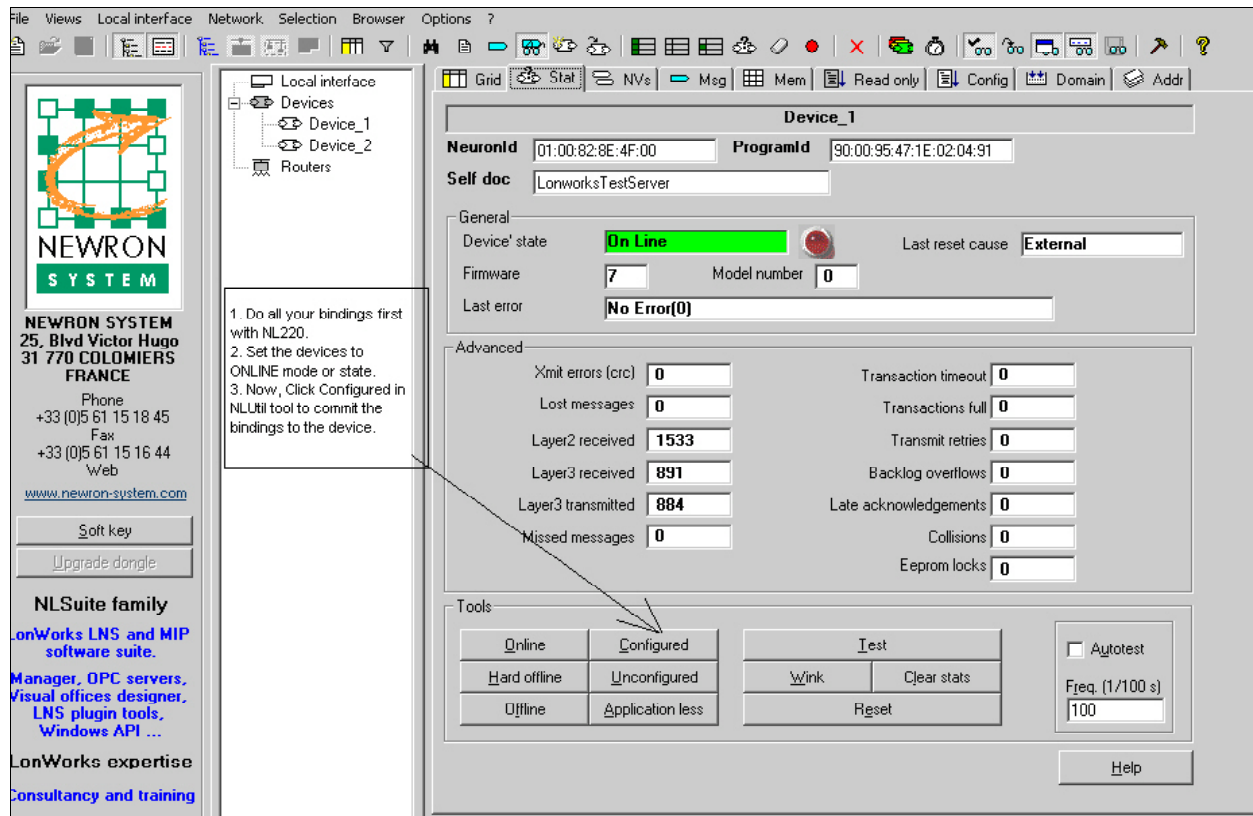
- Run Nodeutil.exe.
- Press Service Pin on all LONWORKS® Devices.
- Press 'F' to find Nodes.
- Press 'L' to List Nodes, Confirm that all Nodes can be seen.
- Press 'G' (Goto) each Node and:
 - Dump Node Domain Table ('D', Enter).
 - Confirm Domain ID is correct (usually , "F").
 - Record Node.
 - Confirm that Subnet is "1".
 - Confirm that Size is "1".
- Press 'L' (List) Network Variables.
 - Record SNVT Type and Index.

Appendix B.3. 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.



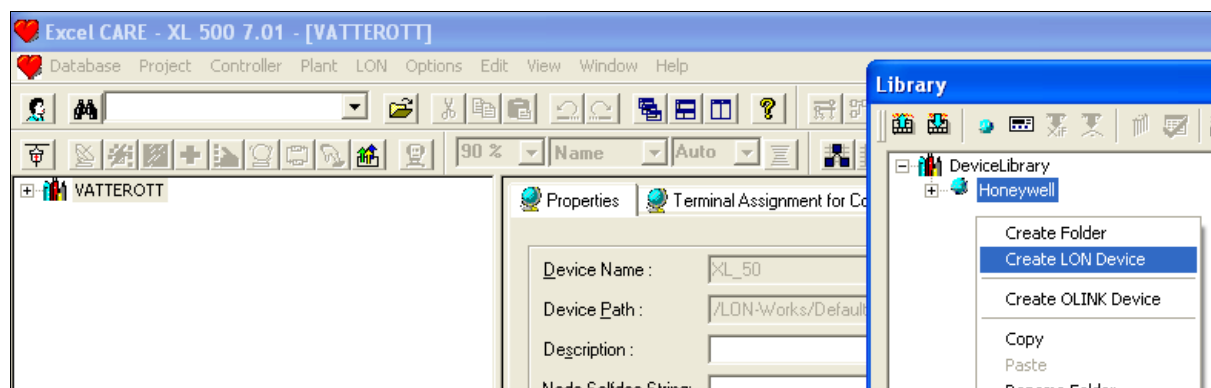
Appendix B.4. Honeywell Care

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

Appendix B.5. CARE and LON PT link Integration

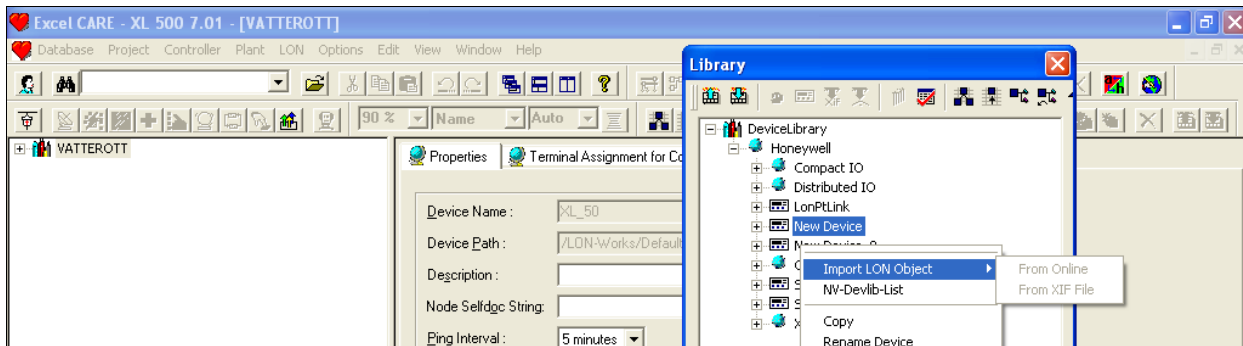
The procedure that follows describes a successful integration from a LonPtLink using Honeywell Care ver 7.0.

- Set the PT Link configuration file as follows for LonWorks: Implicit, Update, Update.
- Open the device library in Care and create a new Lon device as shown in the example below.



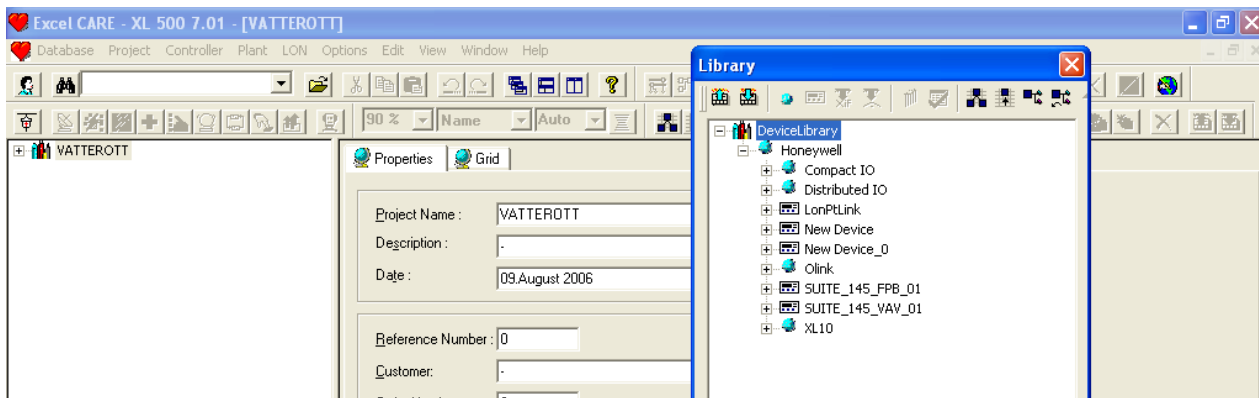
- Connect to the Lon side of the PT Link using the Lon network interface cable and set Care to Onnet.

- Right click on the new Lon device created in the device library and select Import Lon Object>From Online. This will upload the PT Link configuration into the new device.



Note: All Controllers that will be connected to the PT Link must be powered up and communicating to the PT Link before uploading the new device.

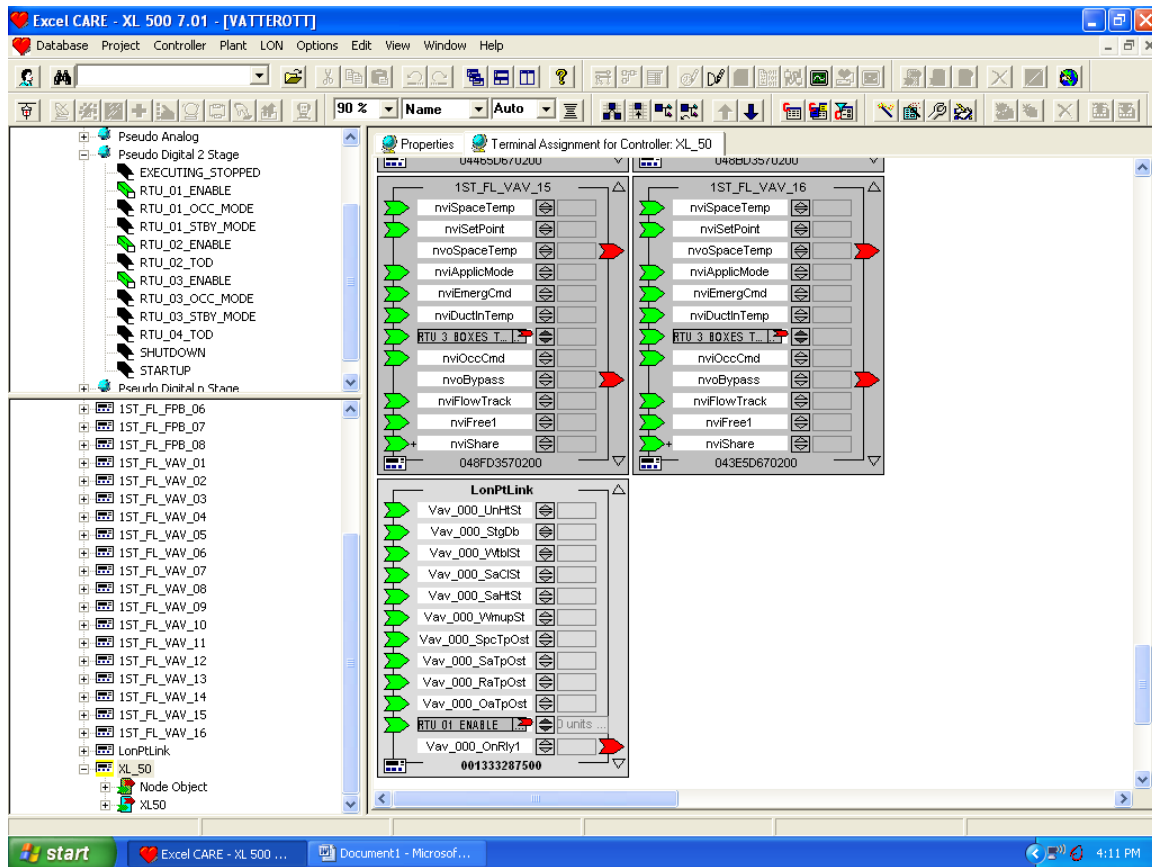
- Rename the new device e.g. LonPtLink, and drag it into the default channel.



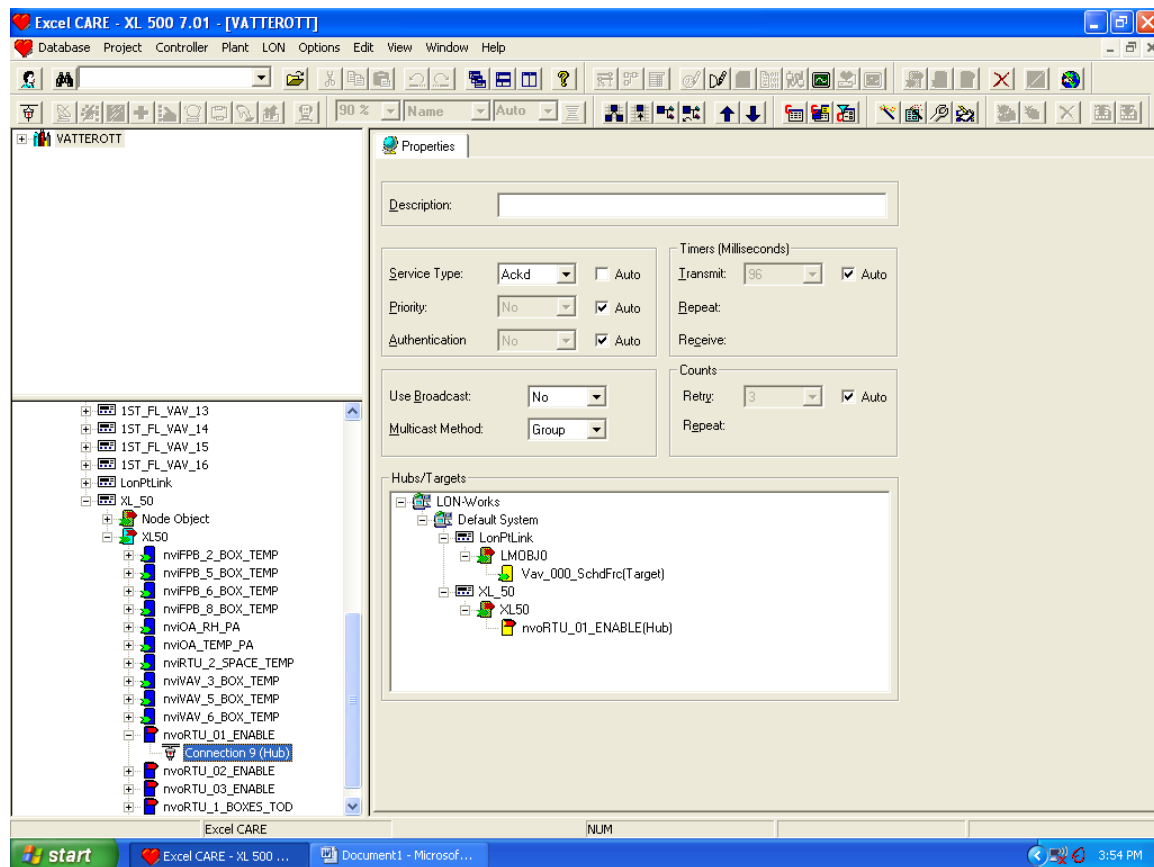
- Create the pseudo points to be bound to the PT Link. Leave them as non Lon Points for now and setup any engineering units.
- Open the Controller that you are binding from in the network tree and go to the Terminal Assignments tab.
- Drag the newly created LonPtLink device into the Terminal Assignment window.
- Now drag the pseudo points from the XL5000 controller and drop them onto the appropriate NV'S.

The example below shows the pseudo digital 2 stat RTU_01_ENABLE in the XL50 bound to the NVI schedule force (schdfrc) on the PT Link. Using the autobind in Care will automatically configure the required snvt and lon nv.

Note: The schdfrc nv is the occupancy point. The pseudo point has to be set to a logical 1 for occupied and a logical 0 for unoccupied.



- Next, open up the nv points bound from your controller under the controller in the network tree and set your nvo points to Ackd bindings in the service type as shown below. Care automatically defaults to unacknowledged bindings.



- Now go onnet in Care and commission your controllers.
- If this will be installed on a SymmetrE frontend you will need to create an XIF file for LNS to use to commission the device on synchronization. Use the Ruinet software or NodeUtil182 (available for free download at www.echelon.com). Ensure that the XIF is not created until everything has been configured and commissioned properly.

Appendix B.6. 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.7. 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 B.8. Circon_SI

- 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. Troubleshooting

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 6.1.2 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. Communication Errors using Neuron_ID Polling

In order to allow communication across routers when using Neuron_ID based polling, routers need to be set up to forward NID addressed messages to/from the connected channels.

Appendix C.4. 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.5. “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.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 update between two FieldServers (acknowledged service)	-	40	-	Milli-seconds
4	Time to complete a network poll message between two FieldServers (request/response service)	-	125	-	Milli-seconds
5	Time to complete a network management variable fetch message between two FieldServers (request/response service)	-	125	-	Milli-seconds

Appendix D. Reference

Appendix D.1. 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	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Absolute humidity	gram/kilogram	0.. 655.34	Raw: 65,535 (0xFFFF) Type: 655.35

SNVT_address	Data Length			1
	Suggested Data Array Formats			Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Neuron Chip Address	16-bit address value	16,384 .. 64,767	N/A
SNVT_alarm	Data Length			25
	Suggested Data Array Formats			Uint16, Float
	Data Item 1-6			Alm_Location00, ..Alm_Location05
	Measurement	Units	Values Range	Invalid Value
	Location array element	8-bit unsigned byte	0 .. 255	N/A
	Data Item 7			Object_ID
	Measurement	Units	Values Range	Invalid Value
	Object ID	object index	0 .. 65,535	N/A
	Data Item 8			Alarm_type
	Measurement	Units	Values Range	Invalid Value
	alarm_type_t	N/A	0 .. 254	255 (0xFF)(AL_NUL)
	Data Item 9			Priority_level
	Measurement	Units	Values Range	Invalid Value
	Priority_level_t	N/A	0 .. 11	255 (0xFF)(PR_NUL)
	Data Item 10			Index_to_SNVT
	Measurement	Units	Values Range	Invalid Value
	Index to NV	index of NV causing alarm	0 .. 65,535	N/A
	Data Item 11-14			Alm_Value00, ..Alm_Value03
	Measurement	Units	Values Range	Invalid Value
	Value array element	specific to NVT	0 .. 255	N/A
	Data Item 15			Year
	Measurement	Units	Values Range	Invalid Value
	Year	year	0 .. 3000	N/A
	Data Item 16			Month
	Measurement	Units	Values Range	Invalid Value
	Month	month of year	0 ..12	N/A
	Data Item 17			Day
	Measurement	Units	Values Range	Invalid Value
	Day	day of month	0 ..31	N/A
	Data Item 18			Hour
	Measurement	Units	Values Range	Invalid Value
	Hour	Hour of day	0 ..23	N/A
	Data Item 19			Minute
	Measurement	Units	Values Range	Invalid Value
	Minute	Minutes	0 ..59	N/A
	Data Item 20			Second
	Measurement	Units	Values Range	Invalid Value
	Second	Seconds	0 ..59	N/A
	Data Item 21			Millisecond
	Measurement	Units	Values Range	Invalid Value
	Millisecond	Milliseconds	0 ..999	N/A
	Data Item 22-25			Alm_limit00, ..Alm_limit03
	Measurement	Units	Values Range	Invalid Value
	Alarm limit array element	specific to NVT	0 .. 255	N/A

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

SNVT_btu_f	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Thermal Energy	British Thermal Units	0 .. 3.40282E38	N/A
SNVT_btu_kilo	Data Length			1
	Suggested Data Array Formats			Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Thermal Energy	Kilo-British Thermal Units	0 .. 65,535	N/A
SNVT_btu_mega	Data Length			1
	Suggested Data Array Formats			Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Thermal Energy	Mega-British Thermal Units	0 .. 65,535	N/A
SNVT_char_ascii	Data Length			1
	Suggested Data Array Formats			Byte, Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Character	8-bit ASCII Character	0 .. 255	N/A
SNVT_chlr_status	Data Length			3
	Suggested Data Array Formats			Byte, Uint16, Float
	Data Item 1			chlr_run_mode
	Measurement	Units	Values Range	Invalid Value
	Byte, Uint16, Float	8-bit ASCII Character	0 .. 255	N/A
	Data Item 2			chlr_op_mode
	Measurement	Units	Values Range	Invalid Value
	hvac_t	N/A	0 .. 17	255 (0xFF)(HVAC_NUL)
	Data Item 3			chlr_state
	Measurement	Units	Values Range	Invalid Value
		N/A	0 .. 255	N/A
SNVT_color	Data Length			3
	Suggested Data Array Formats			Float
	Data Item 1			L_star
	Measurement	Units	Values Range	Invalid Value
	Lightness	Lightness	0.0 .. 100.0	N/A
	Data Item 2			a_star
	Measurement	Units	Values Range	Invalid Value
	Redness/Greenness	Redness/Greenness	-200.0 .. 200.0	N/A
	Data Item 3			b_star
	Measurement	Units	Values Range	Invalid Value
	Yellowness/Blueness	Yellowness/Blueness	-200.0 .. 200.0	N/A
SNVT_config_src	Data Length			1
	Suggested Data Array Formats			Byte, Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Config_source_t	N/A	0 .. 1	255 (0xFF)(CFG_NUL)
SNVT_count	Data Length			1
	Suggested Data Array Formats			Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Event Count	Count	0 .. 65,535	N/A

SNVT_count_f	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Event Count	Count	0 .. 3.40282E38	N/A
SNVT_count_inc	Data Length			1
	Suggested Data Array Formats			Sint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Incremental Count	Count	-32,768 .. 32,767	N/A
SNVT_count_inc_f	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Incremental Count	Count	-3.40282E38 .. 3.40282E38	N/A
SNVT_ctrl_req	Data Length			3
	Suggested Data Array Formats			Uint16, Float
	Data Item 1			ctl_req_rcvr_id
	Measurement	Units	Values Range	Invalid Value
	Receiver ID	ID number	1 .. 65,535	0
	Data Item 2			ctl_req_sndr_id
	Measurement	Units	Values Range	Invalid Value
	Sender ID	ID number	1 .. 65,534	65,535 (0xFFFF)
	Data Item 3			ctl_req_sndr_pri
	Measurement	Units	Values Range	Invalid Value
	Sender priority	Priority value	0 .. 200	N/A
SNVT_ctrl_resp	Data Length			5
	Suggested Data Array Formats			Uint16, Float
	Data Item 1			ctl_rsp_status
	Measurement	Units	Values Range	Invalid Value
	control_resp_t	N/A	0 .. 5	255 (0xFF)(CTRLR_NUL)
	Data Item 2			ctl_rsp_snd_id
	Measurement	Units	Values Range	Invalid Value
	Sender ID	ID number	1 .. 65,534	65,535 (0xFFFF)
	Data Item 3			ctl_rsp_snd_rlower
	Measurement	Units	Values Range	Invalid Value
	Sender Range Lower ID	ID number	1 .. 65,534	65,535 (0xFFFF)
	Data Item 4			ctl_rsp_snd_rupper
	Measurement	Units	Values Range	Invalid Value
	ctl_rsp_snd_rupper	ID number	1 .. 65,534	65,535 (0xFFFF)
	Data Item 5			ctl_rsp_cntrl_id
	Measurement	Units	Values Range	Invalid Value
	Controller ID	ID number	1 .. 65,534	65,535 (0xFFFF)
SNVT_currency	Data Length			3
	Suggested Data Array Formats			Sint32
	Data Item 1			Currency
	Measurement	Units	Values Range	Invalid Value
	Currency_t	N/A	0 .. 56	255 (0xFF)(CU_NUL)
	Data Item 2			Power_of_10
	Measurement	Units	Values Range	Invalid Value
	Magnitude	Power of 10	-128 .. 127	N/A
	Data Item 3			Currency_Value
	Measurement	Units	Values Range	Invalid Value
	Value	Currency Value	-2,147,483,648 .. 2,147,483,647	N/A

SNVT_date_day	Data Length			1
	Suggested Data Array Formats			Byte, Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	days_of_week_t	N/A	0 .. 6	255 (0xFF)
SNVT_defr_mode	Data Length			1
	Suggested Data Array Formats			Byte, Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	defrost_t	N/A	0 .. 2	255 (0xFF)(DFM_MODE_NUL)
SNVT_defr_state	Data Length			1
	Suggested Data Array Formats			Byte, Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	defrost_state_t	N/A	0 .. 4	255 (0xFF)(DFS_NUL)
SNVT_defr_term	Data Length			1
	Suggested Data Array Formats			Byte, Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	defrost_term_t	N/A	0 .. 100	255 (0xFF)(DFT_NUL)
SNVT_density	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Density	Kg/m ³ : kilograms per cubic meter	0 .. 32,767.5	N/A
SNVT_density_f	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Density	Kilograms per Cubic Meter (kg/m ³)	0 .. 3.40282E38	N/A
SNVT_dev_c_mode	Data Length			1
	Suggested Data Array Formats			Byte, Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	device_c_mode_t	N/A	0 .. 29	255 (0xFF)(DCM_NUL)

SNVT_earth_pos	Data Length			6
	Suggested Data Array Formats			Float
	Data Item 1			epos_dir_bits
	Measurement	Units	Values Range	Invalid Value
	Latitude/Longitude	Direction	0 .. 255	N/A
	Data Item 2			epos_lat_degs
	Measurement	Units	Values Range	Invalid Value
	Latitude degrees	Degrees	1 .. 90	255 (0xFF)
	Data Item 3			epos_lat_mins
	Measurement	Units	Values Range	Invalid Value
	Latitude Minutes	Minutes	1 .. 59.999	Raw: 65,535 (0xFFFF) Type: 65.535
	Data Item 4			epos_long_degs
	Measurement	Units	Values Range	Invalid Value
	Longitude Degrees	Degrees	1 .. 180	255 (0xFF)
	Data Item 5			epos_long_mins
	Measurement	Units	Values Range	Invalid Value
	Longitude Minutes	Minutes	1 .. 59.999	Raw: 65,535 (0xFFFF) Type: 65.535
	Data Item 6			epos_htabv_sea
	Measurement	Units	Values Range	Invalid Value
	Height Above Sea Level	Meters (m)	-3.40282E38 .. 3.40282E38	N/A
SNVT_elapsed_tm	Data Length			5
	Suggested Data Array Formats			Uint16, Float
	Data Item 1			etm_day
	Measurement	Units	Values Range	Invalid Value
	Days	Days	0 .. 65,534	65,535 (0xFFFF)
	Data Item 2			etm_hour
	Measurement	Units	Values Range	Invalid Value
	Hours	Hours	0 .. 23	N/A
	Data Item 3			etm_minute
	Measurement	Units	Values Range	Invalid Value
	Minutes	Minutes	0 .. 59	N/A
	Data Item 4			etm_second
	Measurement	Units	Values Range	Invalid Value
	Seconds	Seconds	0 .. 59	N/A
	Data Item 5			etm_millisecond
	Measurement	Units	Values Range	Invalid Value
	Milliseconds	Milliseconds	0 .. 999	N/A
SNVT_elec_kwh	Data Length			1
	Suggested Data Array Formats			Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Electrical energy	Kilowatt-hours	0 .. 65,535	N/A
SNVT_elec_kwh_I	Data Length			1
	Suggested Data Array Formats			Sint32
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Electricity	Kilowatt-hour	-214,748,364.8 .. 214,748,364.6	-214,748,364.7 (0x7FFFFFFF)
SNVT_elec_whr	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Electric energy	Watt-hours	0 .. 6,553.5	N/A

SNVT_elec_whr_f	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Electric Energy	Watt-hour	0 .. 3.40282E38	N/A
SNVT_enthalpy	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Enthalpy	KiloJoules per Kilogram kJ/kg	-327.68 .. 327.66	Raw: 32,767 (0x7FFF) Type: 327.67
SNVT_evap_state	Data Length			1
	Suggested Data Array Formats			Byte, Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	evap_t	N/A	0 .. 2	255 (0xFF)(EVAP_NUL)
SNVT_ex_control	Data Length			10
	Suggested Data Array Formats			Byte, Uint16, Float
	Data Item 1			ex_ctrl_status
	Measurement	Units	Values Range	Invalid Value
	ex_control_t	N/A	0 .. 2	255 (0xFF)(EX_CONTROL_NUL)
	Data Item 2-7			ex_ctrl_domid_0, ..ex_ctrl_domid_5
	Measurement	Units	Values Range	Invalid Value
	Domain ID	Byte	0 .. 255	N/A
	Data Item 8			ex_ctrl_domid_len
	Measurement	Units	Values Range	Invalid Value
	Domain length	Number of bytes	0 .. 6	N/A
	Data Item 9			ex_ctrl_subnet
	Measurement	Units	Values Range	Invalid Value
	Subnet	Subnet number	1 .. 255	N/A
	Data Item 10			ex_ctrl_node
	Measurement	Units	Values Range	Invalid Value
	Node	Node number	1 .. 127	N/A
SNVT_file_pos	Data Length			2
	Suggested Data Array Formats			Uint32
	Data Item 1			ops_rw_ptr
	Measurement	Units	Values Range	Invalid Value
	Read/Write Pointer	File Byte Address	0 .. 2,147,483,647	N/A
	Data Item 2			ops_rw_len
	Measurement	Units	Values Range	Invalid Value
	Read/Write Length	Number of Bytes	0 .. 65,535	N/A
SNVT_file_req (only raw data supported)	Data Length			12
	Suggested Data Array Formats			Byte
SNVT_file_status (only raw data supported)	Data Length			27
	Suggested Data Array Formats			Byte
SNVT_fire_indcte	Data Length			1
	Suggested Data Array Formats			Byte, Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	fire_indicator_t	N/A	0 .. 8	255 (0xFF)(FN_NUL)

SNVT_fire_init	Data Length			1
	Suggested Data Array Formats			Byte, Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	fire_initiator_t	N/A	0 .. 16	255 (0xFF)(FI_NUL)
SNVT_fire_test	Data Length			1
	Suggested Data Array Formats			Byte, Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	fire_test_t	N/A	0 .. 3	255 (0xFF)(FT_NUL)
SNVT_flow	Data Length			1
	Suggested Data Array Formats			Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Flow volume	Liters/Second	0 .. 65,534	65,535 (0xFFFF)
SNVT_flow_f	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Flow Volume	Liters/Second	-3.40282E38 .. 3.40282E38	N/A
SNVT_flow_mil	Data Length			1
	Suggested Data Array Formats			Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Flow volume	Milliliters/Second (ml/s)	0 .. 65,535	N/A
SNVT_flow_p	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Flow volume	Cubic metres per hour	0 .. 655.34	Raw: 65,535 (0xFFFF) Type: 655.35
SNVT_freq_f	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Frequency	Hertz	0 .. 3.40282E38	N/A
SNVT_freq_hz	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Frequency	Hertz	0 .. 6,553.5	N/A
SNVT_freq_kilohz	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Frequency	Kilohertz	0 .. 6,553.5	N/A
SNVT_freq_milhz	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Frequency	Hertz	0 .. 6.5535	N/A
SNVT_gfci_status	Data Length			1
	Suggested Data Array Formats			Byte, Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	gfci_status_t	N/A	0 .. 5	255 (0xFF)(GFCI_NUL)

SNVT_grammage	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Grammage	Grams/Square-meter	0 .. 6,553.5	N/A
SNVT_grammage_f	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Grammage	Grams/Square-meter	0 .. 3.40282E38	N/A
SNVT_hvac_emerg	Data Length			1
	Suggested Data Array Formats			Byte, Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	emerg_t	N/A	0 .. 5	255 (0xFF)(EMERG_NUL)

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

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

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

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

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

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

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

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

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

SNVT_pumpset_sn	Data Length			14
	Suggested Data Array Formats			Float
	Data Item 1			pset_sn_dil_flow
	Measurement	Units	Values Range	Invalid Value
	Total Dilution Flow Volume	Milliliters per second	0 .. 65,534	N/A
	Data Item 2			pset_sn_exh_temp
	Measurement	Units	Values Range	Invalid Value
	Exhaust Temperature	Degrees Celcius	-274.0 .. 6,279.4	N/A
	Data Item 3			pset_sn_exh_press
	Measurement	Units	Values Range	Invalid Value
	Exhaust Pressure	Kilo-pascals	-3,276.8 .. 3,276.6	N/A
	Data Item 4			pset_sn_seal_press
	Measurement	Units	Values Range	Invalid Value
	Shaft seal purge pressure	Kilo-pascals	-3,276.8 .. 3,276.6	N/A
	Data Item 5			pset_sn_inlet_vacuum
	Measurement	Units	Values Range	Invalid Value
	Inlet vacuum pressure	Kilo-pascals	-3.40282E38 .. 3.40282E38	N/A
	Data Item 6			pset_sn_supply_volts
	Measurement	Units	Values Range	Invalid Value
	Supply voltage	Volts	-3,276.8 .. 3,276.6	N/A
	Data Item 7			pset_sn_cool_flow
	Measurement	Units	Values Range	Invalid Value
	Total coolant flow	Milliliters per second	0 .. 65,534	N/A
	Data Item 8			pset_sn_cool_fl_low
	Measurement	Units	Values Range	Invalid Value
	Boolean	Bit	0, 1	255 (0xFF)(BOOL_NUL)
	Data Item 9			pset_sn_dil_active
	Measurement	Units	Values Range	Invalid Value
	Boolean	Bit	0, 1	255 (0xFF)(BOOL_NUL)
	Data Item 10			pset_sn_bal_dil_act
	Measurement	Units	Values Range	Invalid Value
	Boolean	Bit	0, 1	255 (0xFF)(BOOL_NUL)
	Data Item 11			pset_sn_inl_p_dil_act
	Measurement	Units	Values Range	Invalid Value
	Boolean	Bit	0, 1	255 (0xFF)(BOOL_NUL)
	Data Item 12			pset_sn_exh_dil_act
	Measurement	Units	Values Range	Invalid Value
	Boolean	Bit	0, 1	255 (0xFF)(BOOL_NUL)
	Data Item 13			pset_sn_dil_fl_oor
	Measurement	Units	Values Range	Invalid Value
	Boolean	Bit	0, 1	255 (0xFF)(BOOL_NUL)
	Data Item 14			pset_sn_pwr_sup_on
	Measurement	Units	Values Range	Invalid Value
	Boolean	Bit	0, 1	255 (0xFF)(BOOL_NUL)
SNVT_pwr_fact	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Power Factor	Multiplier	-1.00000 .. 1.00000	N/A

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

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

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

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

SNVT_temp_diff_p	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Temperature difference	Degrees Celcius	-327.68 .. 327.66	Raw: 32,767 (0x7FFF) Type: 655.34
SNVT_temp_f	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Incremental Count	Degrees Celcius	-3.40282E38 .. 3.40282E38	N/A
SNVT_temp_p	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Temperature	Degrees celsius	-273.17 .. 327.66	Type: 327.67 Raw: 32,767 (0x7FFF)
SNVT_temp_ror	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	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	Data Length			6
	Suggested Data Array Formats			Float
	Data Item 1			Occupied_cool
	Measurement	Units	Values Range	Invalid Value
	Occupied Cooling Setpoint	Degrees Celsius	-273.17 .. 327.66	Type: 327.67 Raw: 32,767 (0x7FFF)
	Data Item 2			Standby_cool
	Measurement	Units	Values Range	Invalid Value
	Standby Cooling Setpoint	Degrees Celsius	-273.17 .. 327.66	Type: 327.67 Raw: 32,767 (0x7FFF)
	Data Item 3			Unoccupied_cool
	Measurement	Units	Values Range	Invalid Value
	Unoccupied Cooling Setpoint	Degrees Celsius	-273.17 .. 327.66	Type: 327.67 Raw: 32,767 (0x7FFF)
	Data Item 4			Occupied_heat
	Measurement	Units	Values Range	Invalid Value
	Occupied Heating Setpoint	Degrees Celsius	-273.17 .. 327.66	Type: 327.67 Raw: 32,767 (0x7FFF)
	Data Item 5			Standby_heat
	Measurement	Units	Values Range	Invalid Value
	Standby Heating Setpoint	Degrees Celsius	-273.17 .. 327.66	Type: 327.67 Raw: 32,767 (0x7FFF)
	Data Item 6			Unoccupied_heat
	Measurement	Units	Values Range	Invalid Value
	Unoccupied Heating Setpoint	Degrees Celsius	-273.17 .. 327.66	Type: 327.67 Raw: 32,767 (0x7FFF)
SNVT_therm_mode	Data Length			1
	Suggested Data Array Formats			Byte, Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	therm_mode_t	N/A	0 .. 2	255 (0xFF)(THERM_NUL)

SNVT_time_f	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Elapsed Time	Seconds	-3.40282E38 .. 3.40282E38	N/A
SNVT_time_hour	Data Length			1
	Suggested Data Array Formats			Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Elapsed Time	Hours	0 .. 65,535	N/A
SNVT_time_min	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Elapsed Time	Minutes	0 .. 65,535	N/A
SNVT_time_sec	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Elapsed time	Seconds	0 .. 6,553.4	65,535 (0xFFFF)
SNVT_time_stamp	Data Length			6
	Suggested Data Array Formats			Uint16, Float
	Data Item 1			ts_year
	Measurement	Units	Values Range	Invalid Value
	Year	Year	0 .. 3000	65,535 (0xFFFF)
	Data Item 2			ts_month
	Measurement	Units	Values Range	Invalid Value
	Month	Month of Year	0 .. 12	N/A
	Data Item 3			ts_day
	Measurement	Units	Values Range	Invalid Value
	Day	Day of Month	0 .. 31	N/A
	Data Item 4			ts_hour
	Measurement	Units	Values Range	Invalid Value
	Hours	Hours of Day	0 .. 23	N/A
	Data Item 5			ts_minute
	Measurement	Units	Values Range	Invalid Value
	Minutes	Minute of Hour	0 .. 59	N/A
	Data Item 6			ts_second
	Measurement	Units	Values Range	Invalid Value
	Second	Second of Minute	0 .. 59	N/A
SNVT_time_zone (only raw data supported)	Data Length			15
	Suggested Data Array Formats			Byte
SNVT_tod_event	Data Length			3
	Suggested Data Array Formats			Uint16, Float
	Data Item 1			tod_cur_state
	Measurement	Units	Values Range	Invalid Value
	occup_t	N/A	0 .. 3	255 (0xFF)(OC_NUL)
	Data Item 2			tod_nxt_state
	Measurement	Units	Values Range	Invalid Value
	occup_t	N/A	0 .. 3	255 (0xFF)(OC_NUL)
	Data Item 3			tod_tm_to_nxt
	Measurement	Units	Values Range	Invalid Value
	Time to Next State	Minute of Hour	0 .. 65,535	N/A

SNVT_trans_table	Data Length			8
	Suggested Data Array Formats			Float
	Data Item 1-7			tr_point00, ..tr_point06
	Measurement	Units	Values Range	Invalid Value
	Axis-points Array	N/A	-3.40282E38 .. 3.40282E38	N/A
	Data Item 8			interp_methods
	Measurement	Units	Values Range	Invalid Value
SNVT_turbidity	interp_t	N/A	0 .. 65,535	N/A
	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
SNVT_turbidity_f	Turbidity	Nephelometric Turbidity Units (NTU)	0 .. 65.534	65,535 (0xFFFF)
	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
SNVT_valve_mode	Turbidity	Nephelometric Turbidity Units (NTU)	0 .. 3.40282E38	N/A
	Data Length			1
	Suggested Data Array Formats			Byte, Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
SNVT_vol	valve_mode_t	N/A	0 .. 7	255 (0xFF)(VALVE_NUL)
	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
SNVT_vol_f	Volume	Liters	0 .. 6,553.5	N/A
	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
SNVT_vol_kilo	Volume	Liters	0 .. 3.40282E38	N/A
	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
SNVT_vol_mil	Volume	Kiloliters (kl)	0 .. 6,553.5	N/A
	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
SNVT_volt	Volume	Milliliters	0 .. 6,553.5	N/A
	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
SNVT_volt_ac	Electric Voltage	Volts	-3,276.8...3,276.7	N/A
	Data Length			1
	Suggested Data Array Formats			Uint16, Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
SNVT_volt_ac	Electric Voltage	Volts, Alternating Current (VAC)	0 .. 65,534	65,535 (0xFFFF)

SNVT_volt_dbmv	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Electric Voltage	Decibels-millivolts, Direct Current	-3,276.8 .. 3,276.7	N/A
SNVT_volt_f	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Electric Voltage	Volts	-3.40282E38 .. 3.40282E38	N/A
SNVT_volt_kilo	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Electric Voltage	Kilovolts	-3,276.8 .. 3,276.7	N/A
SNVT_volt_mil	Data Length			1
	Suggested Data Array Formats			Float
	Data Item 1			
	Measurement	Units	Values Range	Invalid Value
	Electric Voltage	Millivolts	-3,276.8 .. 3,276.7	N/A
SNVT_zerospan	Data Length			2
	Suggested Data Array Formats			Float
	Data Item 1			zero
	Measurement	Units	Values Range	Invalid Value
	Zero-term	Percent (%) or Parts- per-Million (ppm)	-163.840 .. 163.835	N/A
	Data Item 2			span
	Measurement	Units	Values Range	Invalid Value
	Span-factor	Percent (%) or Parts- per-Million (ppm)	0 .. 32.7675	N/A