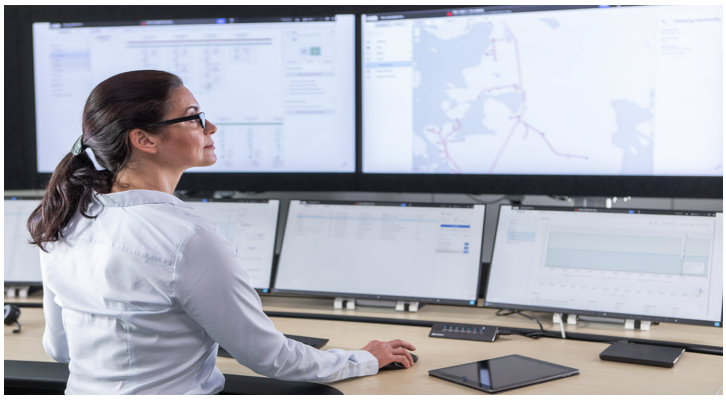
GRID AUTOMATION PRODUCTS

MicroSCADA X SYS600 10.2

Connecting LONWORKS Devices



Document ID: 1MRK 511 470-UEN
Issued: March 2021
Revision: A
Product version: 10.2

Table of contents

Section 1 Copyrights

The information in this document is subject to change without notice and should not be construed as a commitment by Hitachi Power Grids. Hitachi Power Grids assumes no responsibility for any errors that may appear in this document.

In no event shall Hitachi Power Grids be liable for direct, indirect, special, incidental or consequential damages of any nature or kind arising from the use of this document, nor shall Hitachi Power Grids be liable for incidental or consequential damages arising from the use of any software or hardware described in this document.

This document and parts thereof must not be reproduced or copied without written permission from Hitachi Power Grids, and the contents thereof must not be imparted to a third party nor used for any unauthorized purpose.

The software or hardware described in this document is furnished under a license and may be used, copied, or disclosed only in accordance with the terms of such license.

Trademarks

ABB is a registered trademark of ABB Asea Brown Boveri Ltd. Manufactured by/for a Hitachi Power Grids company. All other brand or product names mentioned in this document may be trademarks or registered trademarks of their respective holders.

Guarantee

Please inquire about the terms of guarantee from your nearest Hitachi Power Grids representative.

Third Party Copyright Notices

List of Third Party Copyright notices are documented in "3rd party licenses.txt" and other locations mentioned in the file in SYS600 and DMS600 installation packages.

This product includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit. (https://www.openssl.org/). This product includes cryptographic software written by Eric Young (eay@cryptsoft.com). This product includes software written by Tim Hudson (tjh@cryptsoft.com).

Section 2 Introduction

2.1 This manual

This manual provides information on connecting the LONWORKS devices.

2.2 Use of symbols

This publication includes warning, caution and information symbols where appropriate to point out safety-related or other important information. It also includes tips to point out useful hints to the reader. The corresponding symbols should be interpreted as follows:

Warning icon indicates the presence of a hazard which could result in personal injury.

Caution icon indicates important information or a warning related to the concept discussed in the text. It might indicate the presence of a hazard, which could result in corruption of software or damage to equipment/property.

Information icon alerts the reader to relevant factors and conditions.

Tip icon indicates advice on, for example, how to design a project or how to use a certain function.

Although warning hazards are related to personal injury, and caution hazards are associated with equipment or property damage, it should be understood that operation of damaged equipment could, under certain operational conditions, result in degraded process performance leading to personal injury or death. Therefore, comply fully with all warnings and caution notices.

2.3 Related documents

Name of the manual	Document ID
SYS600 10.2 Installation and Administration Manual	1MRK 511 496-UEN
LNT 505, LON Network Tool	1MRS750829-MBG
RER 111 LON Star Coupler, Technical Reference Manual	1MRS750104-MUM
SYS600 10.2 Status Codes	1MRK 511 480-UEN
SYS600 10.2 System Configuration	1MRK 511 481-UEN
SYS600 10.2 System Objects	1MRK 511 482-UEN
SLCM, Option Card for LON Star Coupler RER 111, Technical Reference Manual	1MRS750985-MUM
SLCM, Option Card for LON Star Coupler RER 111, Technical Overview Brochure	1MRS751180-MBG
SPA-ZC 100/102, LON / SPA Gateway, Programming Manual	1MRS750743-MUM

Other related documents:

- PCLTA card and transceiver card documentation
- Echelon's transceiver manual: LONWORKS® SMX™ TRANSCEIVER Installation Instruction

2.4 Document conventions

The following conventions are used for the presentation of material:

- The words in names of screen elements (for example, the title in the title bar of a dialog, the label for a field of a dialog box) are initially capitalized.
- Capital letters are used for file names.
- Capital letters are used for the name of a keyboard key if it is labeled on the keyboard. For example, press the CTRL key. Although the Enter and Shift keys are not labeled they are written in capital letters, e.g. press ENTER.
- Lowercase letters are used for the name of a keyboard key that is not labeled on the keyboard. For example, the space bar, comma key and so on.
- Press CTRL+C indicates that the user must hold down the CTRL key while pressing the C key (in this case, to copy a selected object).
- Press ALT E C indicates that the user presses and releases each key in sequence (in this case, to copy a selected object).
- The names of push and toggle buttons are boldfaced. For example, click **OK**.
- The names of menus and menu items are boldfaced. For example, the **File** menu.
  - The following convention is used for menu operations: **Menu Name/Menu Item/ Cascaded Menu Item**. For example: select **File/Open/New Project**.
  - The **Start** menu name always refers to the **Start** menu on the Windows Task Bar.
- System prompts/messages and user responses/input are shown in the Courier font. For example, if the user enters a value that is out of range, the following message is displayed: `Entered value is not valid`.
  The user may be told to enter the string MIF349 in a field. The string is shown as follows in the procedure: `MIF349`
- Variables are shown using lowercase letters: sequence name

2.5 Document revisions

Revision	Version number	Date	History
A	10.2	31.03.2021	New document for SYS600 10.2

Section 3 Safety information

This section has information on the prevention of hazards and taking backups from the system.

3.1 Backup copies

3.1.1 Taking backup copies

We recommend taking backup copies before making any changes, especially ones that might have side effects. Software and data need to be copied to another place.

Backup copying makes it easier to restore the application software in case of disk crash or other severe failure where stored data is lost. It is therefore recommended that backup copies are taken regularly.

There should be at least two system backup copies and two application copies. A new backup is copied over the oldest backup. This way the latest version is always available, even if the backup procedure fails.

Detailed information on how to take backup copies should be delivered to the customer with the application.

3.1.2 System backup

Usually a system back up is taken after the application is made. It should be taken again when changes are made to the SYS600 system. This is required when the driver configuration or the network setup is changed.

3.1.3 Application backup

An application backup is also taken at the same time with the system backup, after the application is made. It should be taken again when changes are made to the application, for example, if pictures or databases are edited or new pictures are added.

3.2 Fatal errors

A fatal error is an error that causes a breakdown or a locked situation in the SYS600 program execution.

3.2.1 Handling

In case of a fatal error:

1. Write down the possible SYS600 error messages.
2. Shut down the SYS600 main program. If this cannot be done in the SYS600 Control Panel, try to end the task in Windows Task Manager.

Files may be damaged if the base system computers are shut down by switching the power off.

3. The data kept in the main memory at the moment of a fatal error is placed in the drwtsn32.log file with Windows 2003 Server, Windows XP and earlier. By default it is placed under %SYSTEMDRIVE%\Documents And Settings\All Users\Application Data \Microsoft\Dr Watson. Log and dump file paths can be checked with the drwtsn32 application. (Start -> run -> drwtsn32.exe). Analyze and copy the data in these files. Starting with Windows Server 2008 and Windows 7 the crash handling has changed. The location of the dump files can be read from the registry under the key HKEY_LOCAL_MACHINE\SOFTWARE\Microsoft\Windows\Windows Error Reporting \LocalDumps. The DumpFolder value tells the location of the dump files. Collect the data from this location.
4. Restart the system.

Report the program break-down together with the possible SYS600 error messages and the information from the drwtsn32.log file to the SYS600 supplier.

3.2.2 Status codes

Error messages in SCIL are called status codes. A list of status codes and short explanations for them can be found in SYS600 Status Codes.

Section 4 Instructions

From the SYS600 viewpoint, the installation and configuration of devices that use the LonTalk protocol consists of three phases:

- Hardware installation of the transceiver card and the network interface card, which is the PCLTA-20 (32-bit Windows only). With SYS600 version 9.4 FP2 HF3 or newer, it is possible to use a network connected Loytec device for LON communication also in 64-bit Windows versions. See separate Application Note SYS600 LON setup using Loytec interface for configuration and installation instructions. XLON PCI SMX card from DH Electronics Gmbh is not supported anymore.
- Software installation
  - Device driver
  - PC-NET
  - Configuration tools
- Configuration

If the CAP 505 or LNT 505 configuration tools are installed on the same computer as the SYS600 base system, the configuration tools reserve one PCLTA card when they are in use.

4.1 Hardware installation

To enable communication with LONWORKS network, the network interface, i.e. the LonTalk Adapter, is required. It may be a PCLTA-20 (a PCI-bus card) for a PC with a slot for a transceiver card or a PCCLON-1 card for a laptop, or it may be an SLTA card as an option card in a star coupler or as a stand-alone unit.

4.1.1 Transceiver card installation

Before installing the PCLTA card, install the transceiver card on the PCLTA card. The type definition for the transceiver card supplied by ABB Oy is RER 107. The transceiver module is powered from the PCLTA-20 card.

Plug the transceiver card into the SMX connector of the PCLTA card as shown in Figure 1.

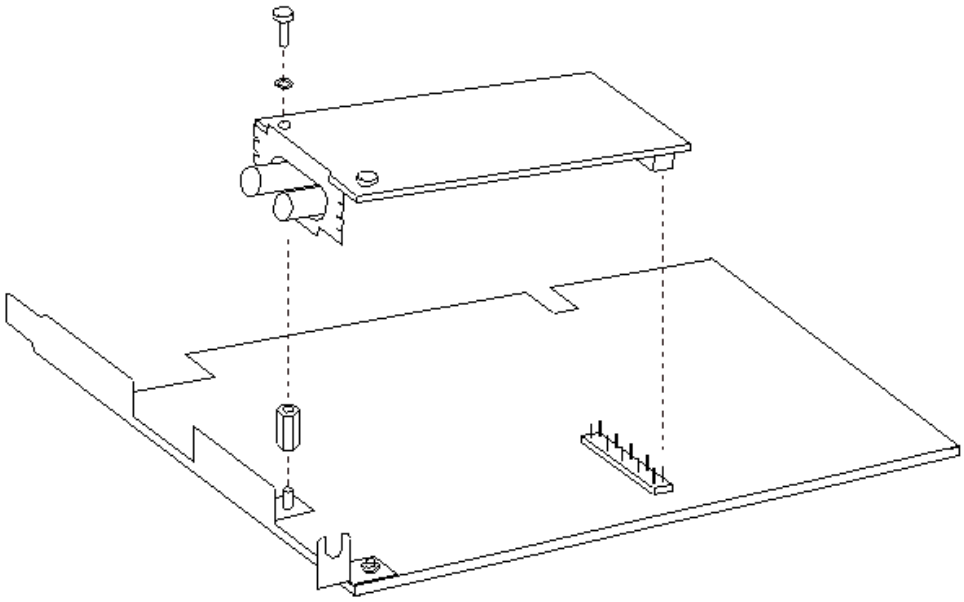


Figure 1: Installation of the transceiver card

For more information, see LONWORKS® SMX™ TRANSCEIVER Installation Instruction.

Each transceiver is a NET line connected to a star coupler. The transceiver module can be connected to a glass fiber-optic or a plastic fiber-optic LONWORKS network with the communication rate of 1.25 Mbits/s maximum.

Install the PCLTA card into a free PCI card slot of the base system computer or COM 500 computer. For more information about installing the PCLTA card, see the manual delivered with the card.

4.2 Software installation

The software installation procedure is described in the SYS600 Installation and Administration Manual.

4.2.1 Complementary software

4.2.1.1 LSG device configuration software

The LSG device configuration requires the LON Network Tool and NetAgent. They are included in the LNT 505 software package, available from ABB Oy. Install the LNT 505 software package according to the instructions in the LNT 505 Installation and Commissioning Manual. User instructions can be found in the LNT 505 Operator’s manual.

4.2.1.2 PCLTA card configuration software

The CAP 505 tool can be used for configuring the PCLTA card, but it is recommended to use the SYS600 System Configuration Tool.

If needed, CAP 505 can be installed according to the instructions in the CAP 505 Installation and Commissioning Manual. User instructions can be found in CAP 505 Operator’s Manual.

4.3 Device driver

To enable communication through the PCLTA-20 or Loytec device, the device driver must be installed and configured.

4.3.1 Loytec device installation

Loytec is a network-based device to communicate with the LON devices through TP-1250 twisted pair interface connected SROUT-C card of the LON Star coupler. A separate Application Note for the cabling, driver installation and PC-NET configuration is provided. The configuration of the LON lines and REX, LMK and SPA objects for is similar to card-based LON-lines. The Application Note provides instructions to prepare the Loytec device to certain subnet / node address but the setting of other neuron chip parameters is not necessary. Unlike the extension cards, the driver installation is possible also in virtual environments. If Loytec device is used, PCLTA card related information can be skipped and continue from Section 4.5

4.3.2 PCLTA-20 driver installation

The device driver can be installed through Windows Control Panel. The installation of the device drive is described in the manufacturer’s manual.

Configure the Neuron Chip of the PCLTA 20 card. For more information about installing Neuron Chip, see Section 4.5.1.

If a PCLTA-20 driver is already configured in the system, the driver version can be checked as described in the SYS600 Installation and Administration Manual.

4.3.3 Installing and configuring PCLTA-20 card

To install and configure a PCLTA-20 card:

1. Install RER 107 to a PCLTA-20 module. For more information about installing RER 107, see Section 4.1.1.
2. Install the PCLTA-20 module to the computer's PCI slot.
3. Install the PCLTA-20 driver according to the manual delivered with the card.
4. Select **Start/Control Panel/LonWorks Interfaces** to open the LonWorks Interfaces application, see Figure 2.
5. Select the driver name in list view on the left side of the LonWorks Interfaces application.
6. For the PCLTA-20 card, select PCC10L7 Network Interface Image from **NI Application** property.

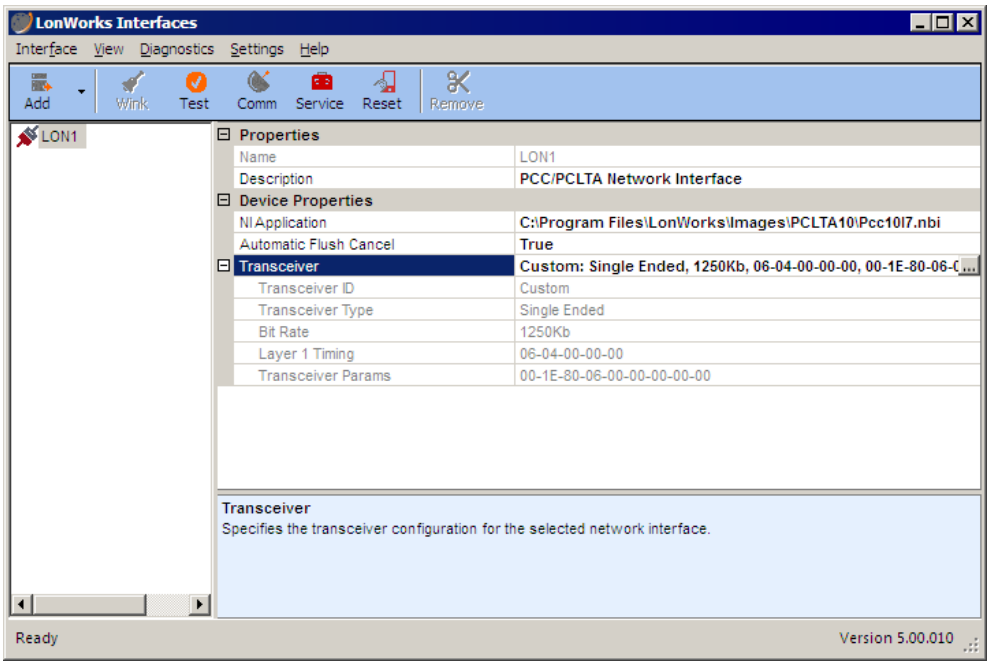


Figure 2: LonWorks Interfaces application

7. Open the **Transceiver Configuration** dialog from **Transceiver** property, see Figure 3.
8. Define the settings as shown in Figure 3.

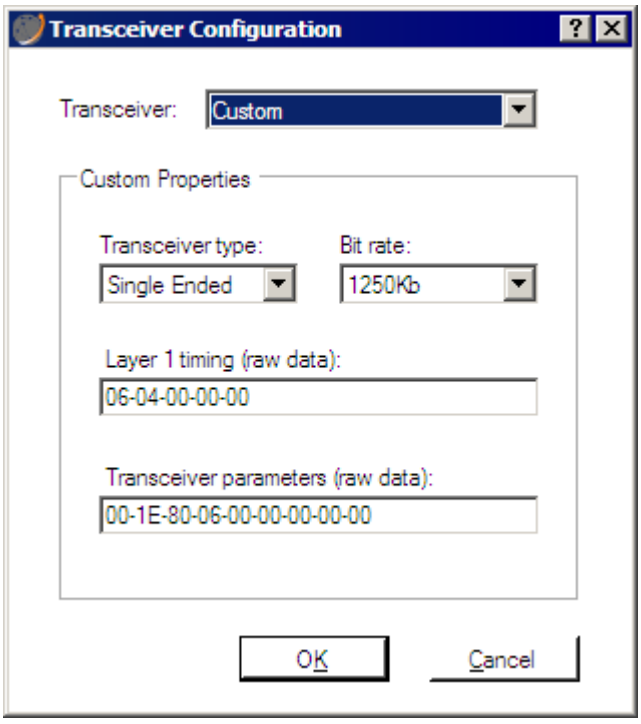


Figure 3: Transceiver Configuration dialog

9. Click **OK** to save the transceiver parameters.
10. Select the driver name in list view on the left side of the LonWorks Interfaces application.
11. Click **Test** button to perform a communication test with the PCLTA-20 card.
12. Repeat the previous steps for each PCLTA-20 driver.
13. Close the LonWorks Interfaces application.
14. Ensure that there are no fibers connected to the PCLTA-20 card.
15. Start System Configuration Tool.

4.3.4 Device driver start-up

When configuring the driver for the first time, it does not start automatically after booting, so it must be started manually and tested. This helps to avoid problems caused by incorrect configuration settings. If the settings do not cause any conflicts, automatic start-up can be configured for the driver. For more information on configuring automatic start-up, see SYS600 System Configuration.

4.4 System configuration basics in LONWORKS network

In SYS600, the LONWORKS network and device configuration is done with System Configuration Tool, which is situated on the Tool Manager System Configuration page. For more information about System Configuration Tool, see SYS600 System Configuration.

The SYS600 System Objects manual should also be available during the configuration work.

In addition to System Configuration Tool in SYS600, the LNT 505 software (LON Network Tool and NetAgent) is needed for configuring and binding the LSG devices. This part of the configuration work is described in the LNT 505 and LON®/SPA Gateway manuals.

If other transceivers than RER 107 are used, the user will probably need to configure the PCLTA for the transceivers. For more information, see the PCLTA and transceiver card documentation.

For more detailed technical and functional information, see Section 5.

4.4.1 LONWORKS network

Each communicating device in the network is a LONWORKS node identified by a node number and subnet number. These numbers are configured and stored in the devices.

Create an outline of the system configuration or a table that includes the following information:

- The node numbers and station addresses of the base system and NETs.
- Application numbers and possible names.
- NET line numbers.
- Station numbers (in NET and in the base system if different) and the station addresses (slave numbers) of all devices.

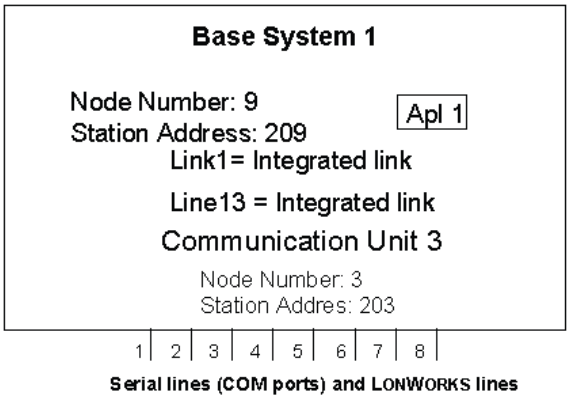


Figure 4: An example of a configuration with one PC-NET in a base system

4.5 Preparatory operations and offline engineering

This section describes how to use System Configuration Tool to do the preparatory operations and offline configuration for the system that has been installed.

4.5.1 Preparing LON interface for communication

To enable communication with LONWORKS devices, the Neuron chip of the PCLTA card must be prepared. Initialization is needed also with Loytec devices, see related Application Note. LON communication initialization done using System Configuration Tool. If PCLTA card has already been used in a LONWORKS network, no initialization is needed.

Before the PCLTA card can be prepared, a LONWORKS communication line (a LON line) must be created (or existing) and PC-NET must be started as described in this section.

When System Configuration Tool is opened, only the SYS600 Configuration object exists.

4.5.1.1 Creating LON line

1. From the menu bar, choose **Configuration/Open Active**.
   The Open Active command opens the default configuration that is saved in the Sysconf.ini file. The default Sysconf.ini file, which is included in the configuration tool, includes an Object tree with Link 3 (INTEGRATED) and Node 3 (NET).
2. From the Object tree, select Node 3(NET) and from the menu bar, choose **Object/New**(or Ctrl+N on the keyboard). See Figure 5.

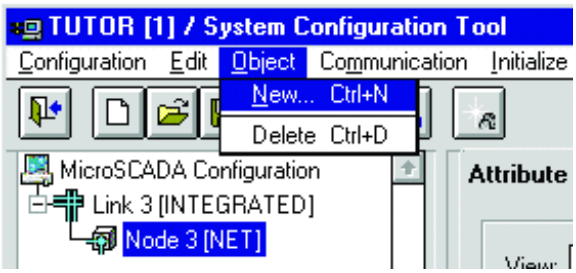


Figure 5: Adding a new line in the configuration tree

3. Select LON Line and click **Insert**.
4. Enter a line number and click **OK**.

The PCLTA card can be initialized only if the LON line IU (In Use) attribute value is 0 (Not In Use).

4.5.1.2 Changing IU attribute value

1. Select **Configuration/Open Active**. In the Configuration tree, select a LON line. See Figure 6.

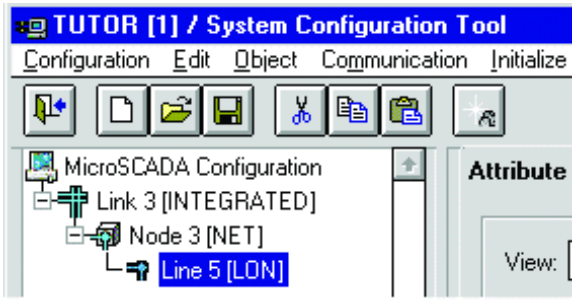


Figure 6: Selecting a LON line in the configuration tree

2. In the Attribute tree, double-click the text Basic Line Attributes. See Figure 7.

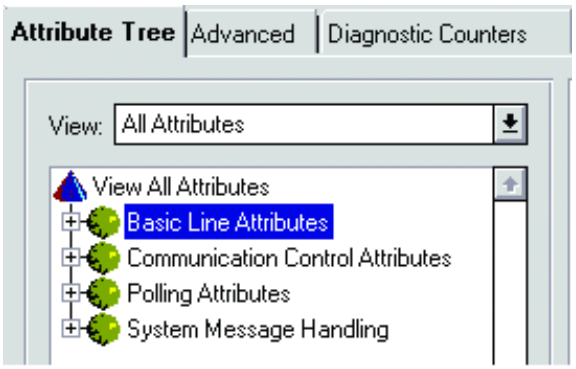


Figure 7: Line 5 (LON) attribute groups

3. If the IU (In Use) attribute value is 1 (In Use), change it to 0 (Not In Use) in the following way:
   - In the Attribute tree, click the IU attribute line.
   - In the attribute editing area, click the IU check box to clear it (to the 0 / Not In Use state).

4.5.1.3 Selecting driver for line

1. Start System Configuration Tool, see Figure 8.

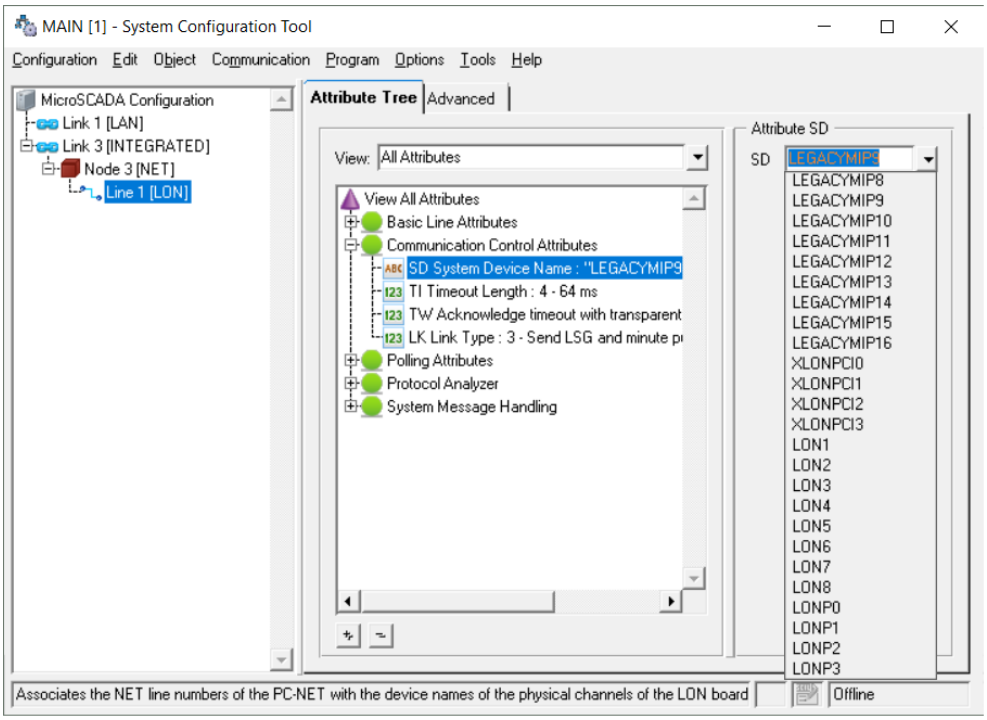


Figure 8: System Configuration Tool

2. Select the driver for the line's attribute SD:
   - LON1...8 for the PCLTA-20 card
3. Ensure that the LON line is out of use during the configuration.

4.5.1.4 Saving changes and starting PC-NET

1. Select **Configuration/Save Active**.
2. If PC-NET is running, choose **Stop PC-NET** from the **Communication** menu.
3. Choose **Start PC-NET** from the **Communication** menu.

Now the PCLTA card can be prepared (initialized) through the LON line as in Section 4.5.1.5.

If PC-NET does not start:
If PC-NET is not started, an error message is shown in the Notify Window in the following form:

Date	Time	Type	Description
Status:	Code	STATUS_MESSAGE	

Example:

xx-xx-xx 09:14:07 ERROR Could not start PC_NET (StartPCNET.scl)

Status: 7143 SYST_NODE_ROUTING_ERROR

4.5.1.5 Preparing PCLTA card

1. Select the LON line from the object tree.
2. Select **Initialize/PCLTA-card** from the menu bar.
   If the configuration includes more than one PC-NET, a separate dialog is displayed before the Initialize dialog.

If the configuration includes only one PC-NET, the Initialize dialog is displayed, see Figure 9.

3. Select the device to be prepared from the drop-down menu.
4. Click the **Prepare** option button in the **Operation Mode** field.
5. Click **Initialize**.

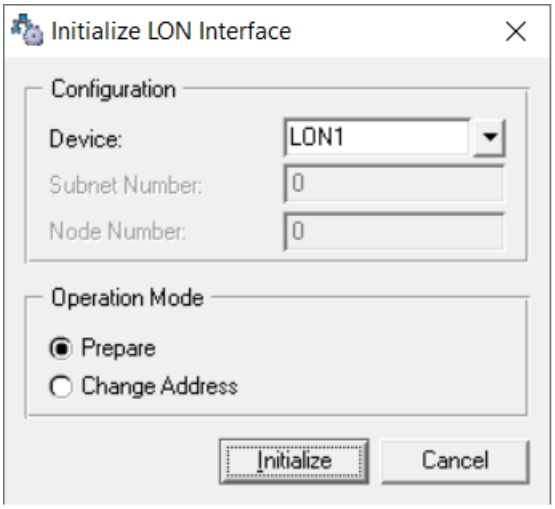


Figure 9: Initialize PCLTA-card dialog

When the Prepare function has run successfully, the following message is displayed:

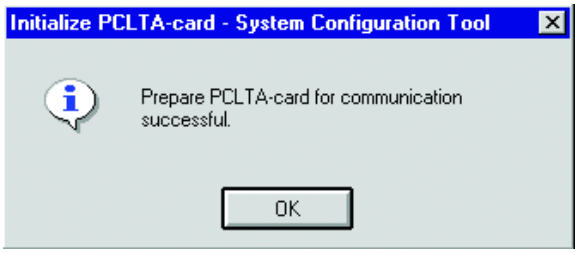


Figure 10: Message about successful Prepare function

6. Click **OK**.
7. Exit the configuration program by clicking **Cancel** in the configuration menu.

4.5.2 Changing the PCLTA card address

To change the PCLTA card address:

1. Select the LON line from the object tree in System Configuration Tool.
2. Select **Initialize/PCLTA-card** from the menu bar.
3. In the **Operation Mode** field, click the **Change Address** option button.
4. Type the address.
5. Click **Initialize**.
   The address of the PCLTA card channel is changed and the Nettools.ini file is updated if the file exists in the system.
6. Click the **Prepare option** button in the **Operation Mode** field.

To set the PCLTA card to communication mode again, perform the Prepare operation after the Change Address operation.

7. Click **Initialize**.
8. Click **OK**.
9. Exit the configuration program by clicking **Cancel** in the configuration menu.

The PCLTA card is ready to communicate with LONWORKS devices. For more detailed settings, see Section 5.

If multiple PCLTA card channels are initialized, stop PC-NET and start again before starting the initialization of the next PCLTA card channel. Start PC-NET by selecting **Communication/Stop PC-NET** and **Communication > Start PC-NET**.

4.5.2.1 Prepare function

When preparing the PCLTA card, the configuration program makes the following settings:

Table 1: PCLTA card settings made by the initialization program:

comm_type	**1**	Single-Ended
comm_pin_dir	**0x0E**	Direct Mode - Single-Ended
direct_param_struct		Collision detection
comm_clock	**0**	(8:1)
input_clock	**5**	10.0 MHz
LON Bit Rate		1.25 Mb/s

The program performs a reset operation to implement the settings.

The PCLTA card address is read but not changed by the program. The factory setting is subnet 1 / node 109, but for SYS600, this address is not significant.

4.5.2.2 Address setting

If there is a need to change the PCLTA card address, the new address is written into the Neuron chip domain. If the LON Network Tool is installed, the address is also updated in the Nettools.ini file (Windows system folder).

The configuration program performs the following operations:

1. The new address is sent to the Neuron chip domain.
2. If the address is received successfully, the Neuron chip is set to configured online state.
3. The program checks that the whole operation has been successful and carries out a reset operation.

4.5.3 LON node address and service pin method

When Neuron 3150 chips are shipped from the manufacturer they are assigned a unique, 6-byte identifier, the Neuron ID. Each LON-node has a service pin, which can be pressed to make the Neuron chip transmit a Service Pin Message containing its Neuron ID. The network management device can use this information to install the node (assign the node its logical node address).

Normally, the node installation procedure goes as follows:

1. Start the Install Node command of the device that is responsible for network management functions (usually the master node). This function asks the user to press the service pin of the node that is being installed.
2. Press the service pin of the node (SLCM card, for example).
3. When the network manager node receives the Service Pin Message, it will set the address of the node.

The node address is stored to the Neuron chip's internal EEPROM memory (in the domain table), and usually, to the node list of the network manager node as well.

4.5.4 Checking parameters

Test the LON network and change the devices' parameters with help of LON Network Tool (LNT). The Neuron Structure parameter values set with LNT are shown in Figure 13.

To check the parameters:

1. Select **Start/Programs/LNT 505 1.1.1 Add-On 1/LNT Server/NETagent/Configure**to start LNT.
2. Define the configurations in the Lon NETAgent configuration dialog as shown in Figure 11.
3. Click **Add** to add a new device.
4. Click **Save** to save the configuration.

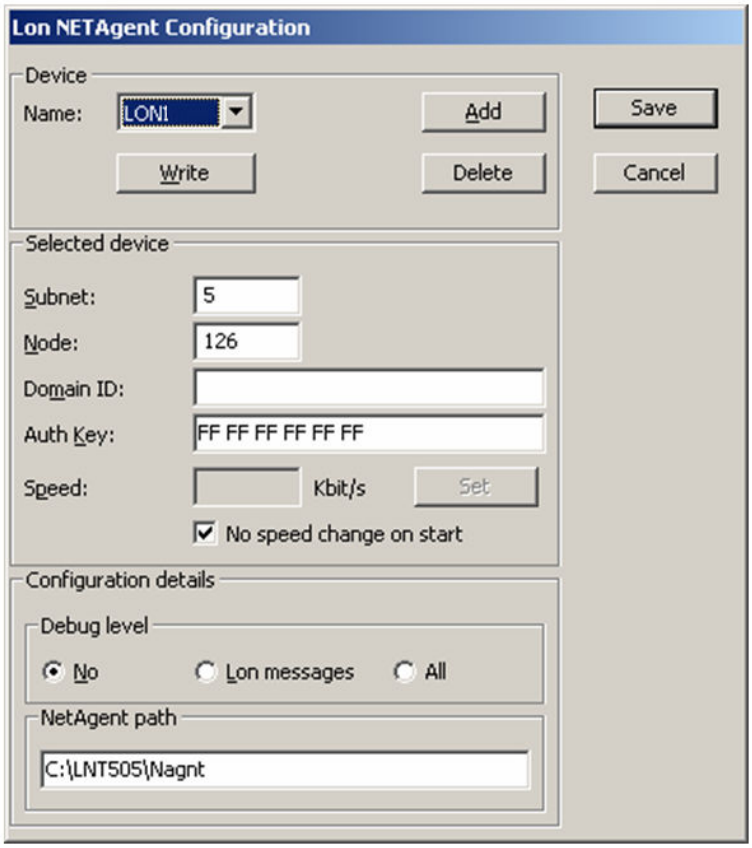


Figure 11: Lon NETAgent Configuration dialog

5. Select **NETagent/NET Interface**to open the **Network Interface Configuration** dialog.
6. Define the settings shown in Figure 12.

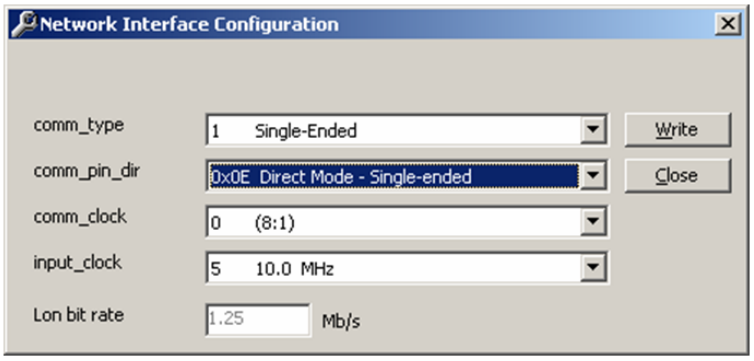


Figure 12: Network Interface Configuration dialog

7. Select **Start/Programs/LNT 505 1.1.1 Add-On 1/LNT Server/Network/Node Structures/ Edit Structures**.
8. Type Subnet and Node numbers to the **Select Target** dialog.
9. Click **OK** to open the **Neuron Structures** dialog, see Figure 13.

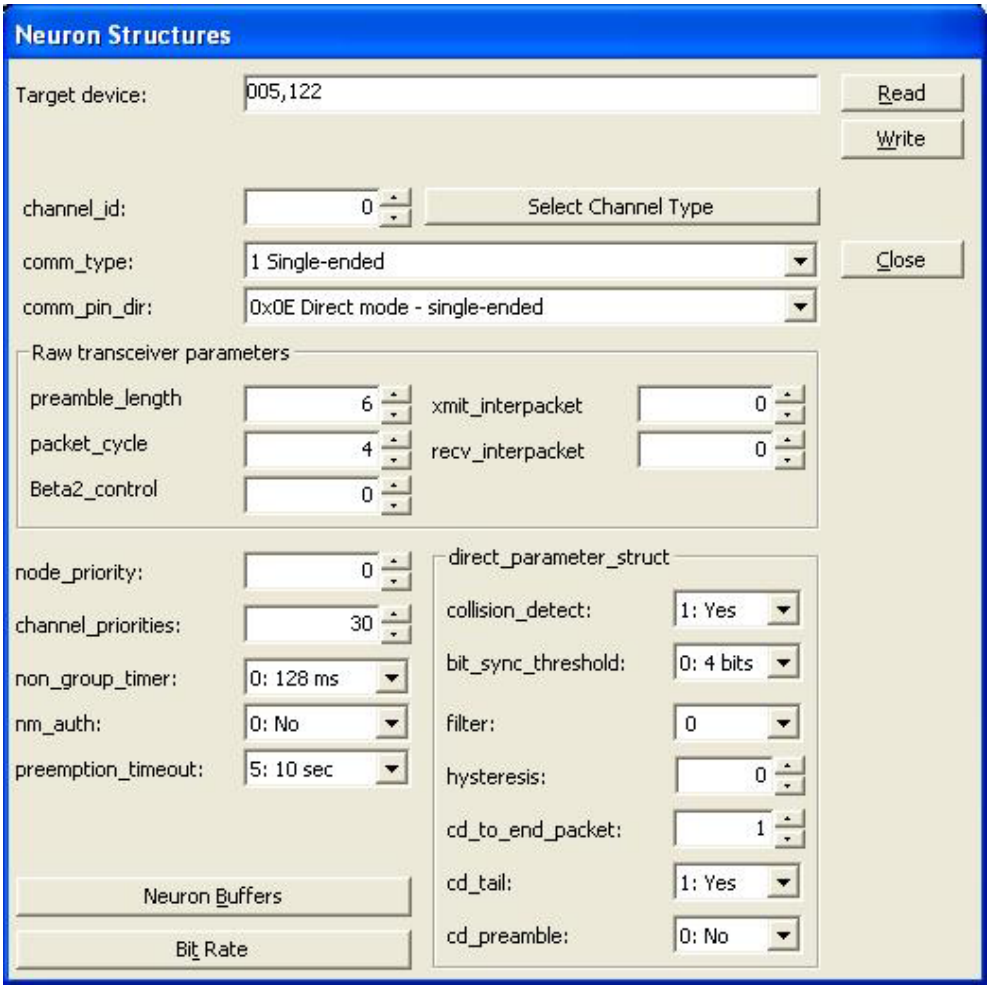


Figure 13: Neuron Structure parameter values set with LNT

For LON Clock Master, node_priority is 3 and collision_detect 0.

10. Click **Neuron Buffers** to define the Neuron Buffer parameter values. The values for the different cards are shown in Figure 14 - Figure 17.

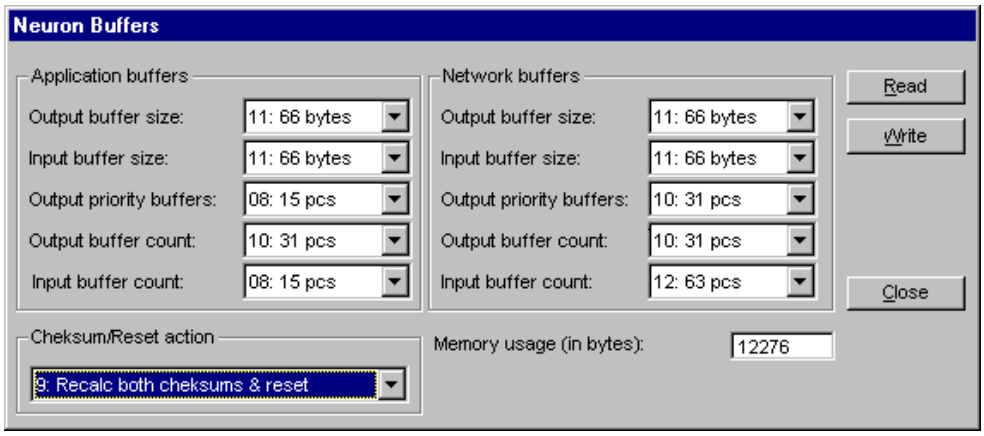


Figure 14: Neuron Buffer parameter values for the PCLTA-20 card

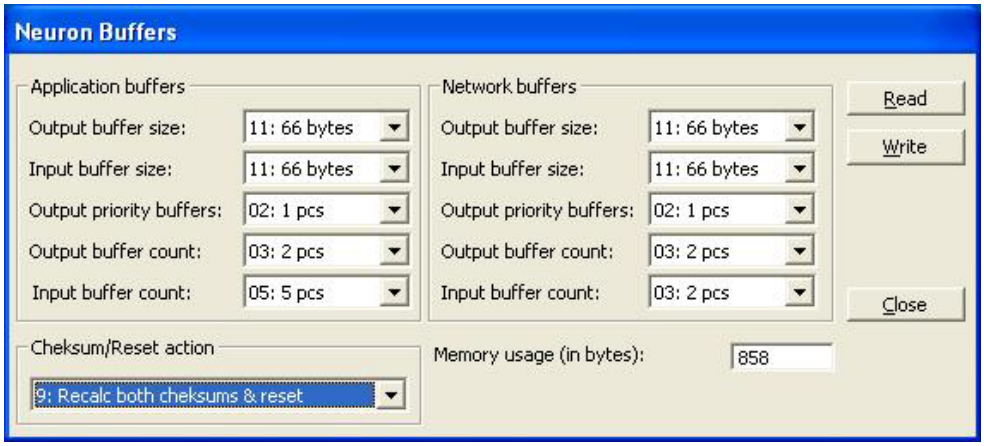


Figure 15: Neuron Buffer parameter values for LON Clock Master

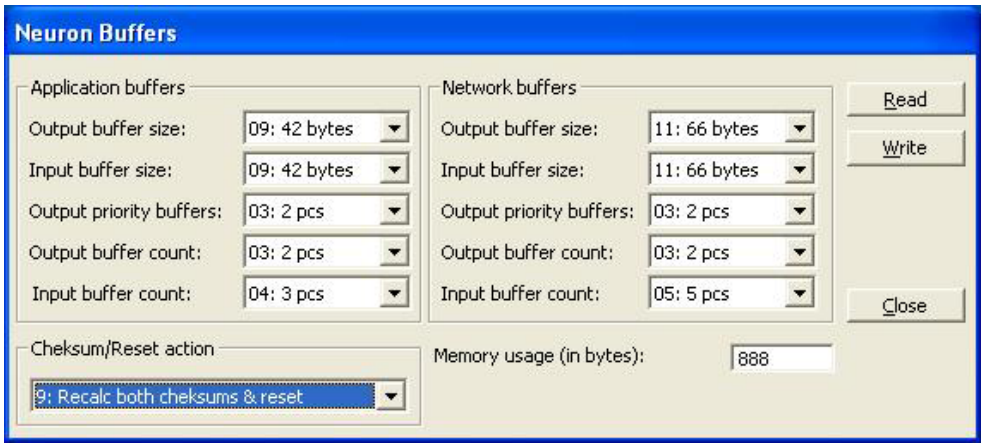


Figure 16: Neuron Buffer parameter values for Star Coupler

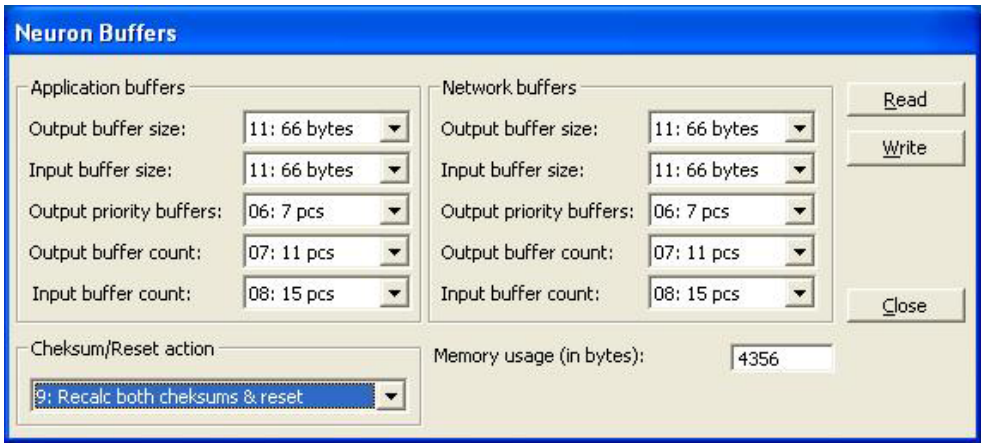


Figure 17: Neuron Buffer parameter values for LMK (LSG)

4.5.5 Saving a configuration from a former release

If a configuration from a former SYS600 release is read in System Configuration Tool, it can be saved with the Configuration - Save Active command. It is saved in the default files Sysconf.ini and Signals.ini.

The configuration is available when SYS600 or subsequent SYS_BASCON.COM (SYS_BASCON $COM) template is taken into use.

4.5.6 Creating a new configuration

From the menu bar, choose **Configuration/New**.

This command opens a configuration that is delivered with System Configuration Tool. This configuration includes an Object tree with Link 3 (INTEGRATED) and Node 3 (NET).

If there is another configuration open in the tool, all the configuration data is cleared from the tool. To save the configuration, the Sysconf.ini and Signals.ini files in the sys/active/sys_ folder should be copied or renamed.

The new configuration can be saved with the **Configuration > Save Active** command. If the Link object and/or the NET Node object are not present, PC-NET does not start up successfully. Therefore, it is not possible to save this kind of invalid configuration with the **Save/Active** command.

SYS600 must be restarted to take the new configuration into use.

4.5.7 Default configuration

The default configuration is stored in a configuration file called Sysconf.ini.

To open the default configuration file:

- From the menu bar, choose **Configuration/Open Active**.

The default configuration is loaded in the tool. The tool is opened in offline mode, which is shown in the status bar.

To save a configuration as the default configuration:

- From the menu bar, choose **Configuration/Save Active**.

This command saves the configuration currently open in the tool as the default configuration in the Sysconf.ini file. The configuration can be saved at any time and this can be done in both online and offline mode.

Online saving is not recommended

4.5.8 Taking lines and stations in use or out of use in PC-NET

When taking LONWORKS lines and stations in use in PC-NET, it is essential that the line is taken in use before any station (on that specific line) is taken in use. Likewise, all stations must be taken out of use before the line is taken out of use.

4.5.9 LSG device

Before an LSG device (LON/SPA gateway) can be used in a SYS600 configuration, the subnet and node numbers of the device must be configured using the LNT 505 program. The subnet and node numbers are set using the LSG Configuration tool and the Service Pin method. See Section 4.5.3.

Configuration using the LON Network Tool is described in the LNT 505 Operator's Manual and the SPA-ZC 100/102 LON®/SPA Gateway Programming Manual.

SYS600 views the LSG device as a special version of an LMK device. Therefore, the rest of the configuration work should be done using System Configuration Tool in SYS600 Tool Manager.

4.5.10 LON star coupler

LON Star Coupler is seen in the LON line as an LMK station with LMK specific attributes.

To add a LON Star Coupler into the configuration, use System Configuration Tool in offline mode:

1. From the object tree, select the LON line to where to add the device.
2. Choose **Object/New** from the menu bar.
3. Select LON Star Coupler and click **Insert**.
4. Enter the number planned for this device and click **OK**.

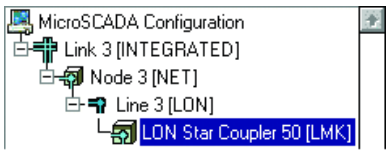


Figure 18: LON Star Coupler in the configuration tree

To save the configuration:

- From the menu bar, choose **Configuration/Save Active**.

For more information, see Section 4.7.5.

4.5.10.1 Router option card

The Service Pin produces a service-pin message, which is used by the network management device to install and configure the router option card. When the service pin is pressed and released, the router generates a message to both sides of it. Each side of the router must be installed and configured separately. See also Section 4.7.5.

For more information, see LNT 505 and RER 111 manuals.

4.5.11 LON clock master

SLCM option card includes an internal clock and an application program, which uses the internal clock to generate various kinds of synchronization messages and signals in order to synchronize other devices in the LONWORKS network.

In System Configuration Tool, LON Clock Master is created as a special version of an LMK device. More information can be found in section Section 4.7.11.

4.5.12 Changing the station address of a SPACOM relay

If several SPACOM relays are situated in the same configuration, the addresses of the relays should be changed (factory setting for all of them is 99). In some relays, it is not possible to change the address from the front panel, and it must be done with SCIL commands in the following way:

```
#SET STA1:SSA=99; DEFAULT VALUE
#SET STA1:SSM=("WV200:11:"); SENDS THE STATION ADDRESS 11 TO THE RELAY
#SET STA1:SSA=11; TELLS THE RELAY'S ADDRESS TO MicroSCADA
#SET STA1:SSM=("WV151:1:"); STORES THE ADDRESS TO THE RELAY EEPROM (~5 s)
```

4.5.13 Checking and changing the address of a REx device

The node, subnet and unit numbers of the REx device are needed when configuring the system for communication. This instruction concerns REF Terminals made by ABB Oy.

1. Press any button on the HSI of the device to turn on the backlight.
   - In idle mode, the MIMIC configuration picture is shown in the main window.
   - In the help window, some help messages are displayed.
2. Press and hold **E** for at least 2 seconds to enter the MAIN MENU.
   - A password is requested. The factory setting for the password is 3.
3. Select the password using the up and down arrows and press **E** briefly.
4. In the MAIN MENU use the up and down arrows to select Communic.lib.
5. Use the right arrow to open the library.

4.5.13.1 To check the SPA address:

1. In the Communication library, select SPA using the up and down arrows and open the SPA library with the right arrow.
2. Check the address and change it, if necessary.
3. Note down the address.

4.5.13.2 To change the SPA address:

1. Select the SPA address using the up and down arrows and press **E**.
2. Use the arrow keys to change the address.
3. Press **E** to confirm the setting.
4. Use the left arrow to return to the previous menu.

4.5.13.3 Subnet and Node Number:

1. Select LON and use the right arrow to open the library.
2. Check the Subnet number and the Node number.
3. If necessary, change the address as described earlier, and write it down.
4. Press the left arrow repeatedly to navigate back to the MAIN MENU.
5. Press **E** for 2 seconds.
6. Press **E** to confirm the settings or **C** to cancel them.

Now you should be in the MIMIC picture again.

The communication protocol can also be checked and changed in the Communication library of the protection terminal.

4.6 Object types

4.6.1 Integrated link

Parent Object:	SYS600 Configuration
Link number range:	1-20

Choosing **Configuration/New** from the menu bar, opens a default configuration, which includes an integrated link to System Configuration Tool.

4.6.2 NET node

Parent Object:	Link (Integrated)
NET Node number range:	1-99

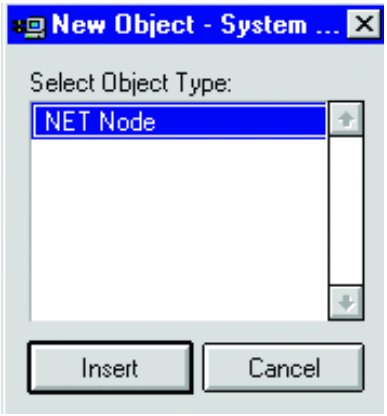


Figure 19: Adding a NET Node

4.6.3 Line

Parent object:	Node (NET)
Line number range:	1-12

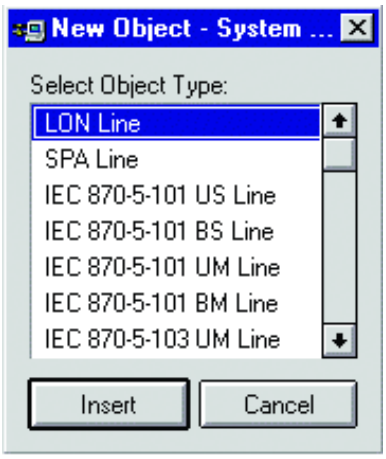


Figure 20: Select the line type and click Insert

4.6.4 Stations in LON lines

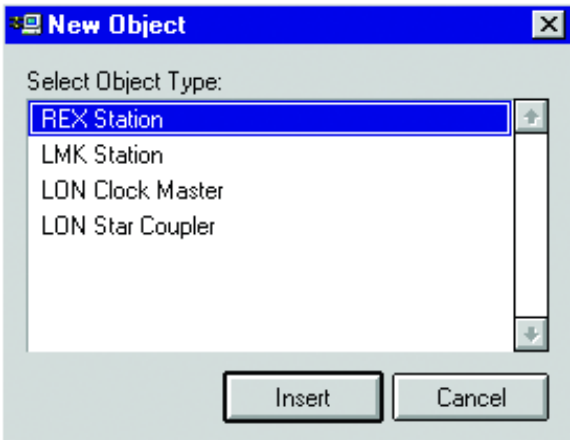


Figure 21: Station type selection dialog in a LON line

4.6.5 REX Station

Parent object:	Line (LON)
Station number range:	1-5000

4.6.6 LMK Station

Parent object:	Line (LON)
Station number range:	1-5000
Recommendation:	10, 20, 30 etc.

4.6.7 LON Clock Master

Parent object:	Line (LON)
Station number range:	1-5000

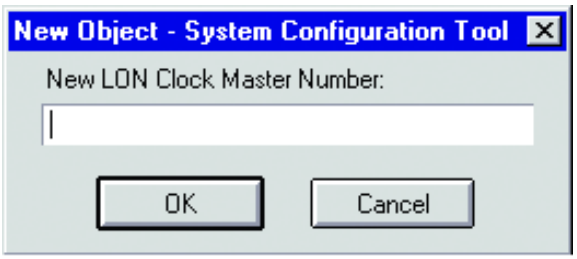


Figure 22: Entering the device number for a new LON Clock Master device

4.6.8 LON Star Coupler

Parent object:	Line (LON)
Station number range:	1-5000

4.6.9 SPA Station in a LON Line

Parent object:	LMK Station
Station number range:	1-5000

Recommendation:

LMK Station number 10: SPA Station numbers 11, 12, 13 etc.

LMK Station number 20: SPA Station numbers 21, 22, 23 etc.

4.7 Online configuration

The online configuration is the current configuration in the SYS600 system.

4.7.1 Loading

To load the current SYS600 system configuration in the tool:

1. Select **Configuration/Open Online**.
2. Select **Stepwise** or alternatively **All**.
   The **Stepwise** button opens the fast configuration saved with System Configuration Tool. The **All** button reads reading configuration from the system itself. This selection is more time-consuming.

This changes System Configuration Tool to online mode.

Under the MicroSCADA Configuration node there is a node called Station Type Definitions. See Figure 23. This object includes all different station types and it appears when the MicroSCADA Configuration node is expanded. Deleting this object is not possible.

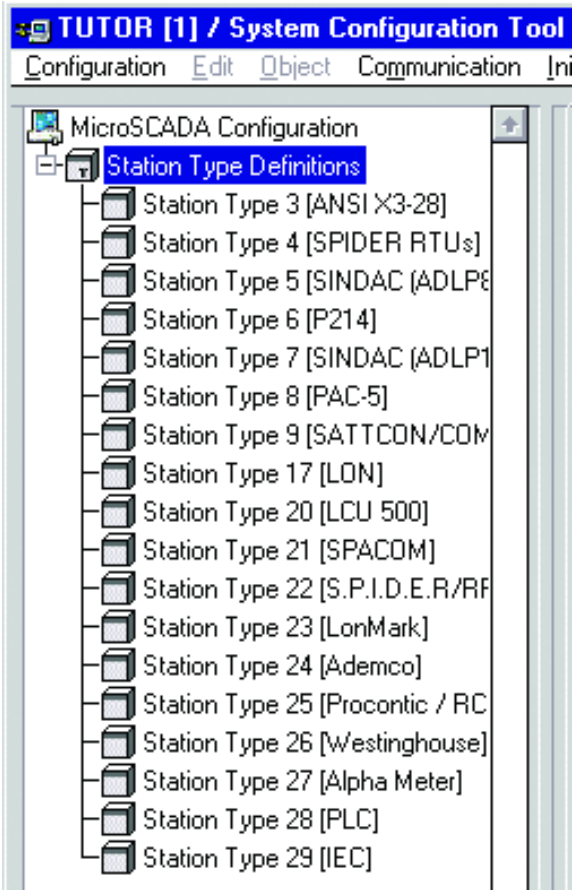


Figure 23: Station type definitions in an online configuration

4.7.2 Saving

The online configuration can be saved using the menu bar command **Configuration/Save Active**.

This action overrides the current active configuration in System Configuration Tool and saves the online configuration as the default configuration. Note that if, for some reason, some stations do not communicate in the online mode, they are removed from the active configuration.

Online saving is not recommended

If the menu bar command **Configuration/Save Active** is selected, the configuration must include a Link object and a NET Node object related to that Link.
If the Link object and/or the NET Node object are not present, PC-NET does not start up successfully. Therefore, it is not possible to save this kind of invalid configuration with the **Save/Active** command.

4.7.3 Signal engineering on station level

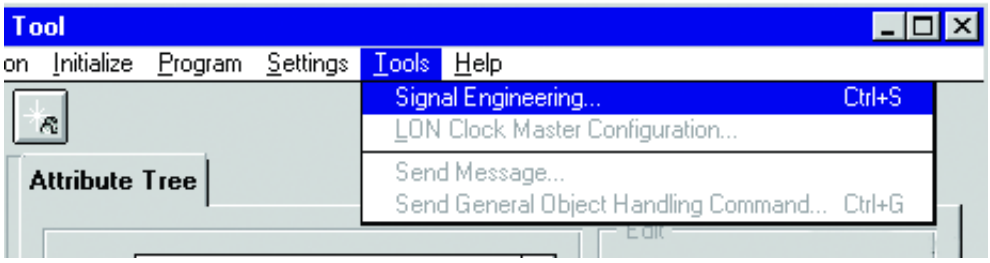


*Figure 24: Signal engineering is started with the menu bar command **Tools > Signal Engineering***

To edit signal information:

1. In the Object Tree, select the station to be engineered.
2. From the menu bar, select **Tools/Signal Engineering**. See Figure 24.

The configuration page that is opened includes all the signal information for the selected station.

4.7.4 LON configuration attributes

If a LON line is selected in the configuration tree in System Configuration Tool, the LON configuration attributes can be seen on the **Advanced** page. The Configuration attributes are called Network Variable Configuration (NV) attributes and Extended Address Table (XA) attributes. Editing and adding indices can be managed using the NC Editor for NV attributes and XA Editor for XA attributes.

NV	Network Variable
Network variables are used to deliver small data items such as measurement values, status changes, interlocking data, blocking signals, alarms and events. Network variables are addressed using network variable selectors.	

XA	Extended Address table
Using this attribute, the LONWORKS device address table configuration can be read and written. A more profound description of these attributes can be found in the System Objects manual. If LON Configuration attributes have been defined in System Configuration Tool, they are automatically set during PC-NET start-up via the System Configuration Tool interpreter mechanism. When System Configuration Tool is set to online mode, these and XA attribute indices are read from the SYS600 system.	

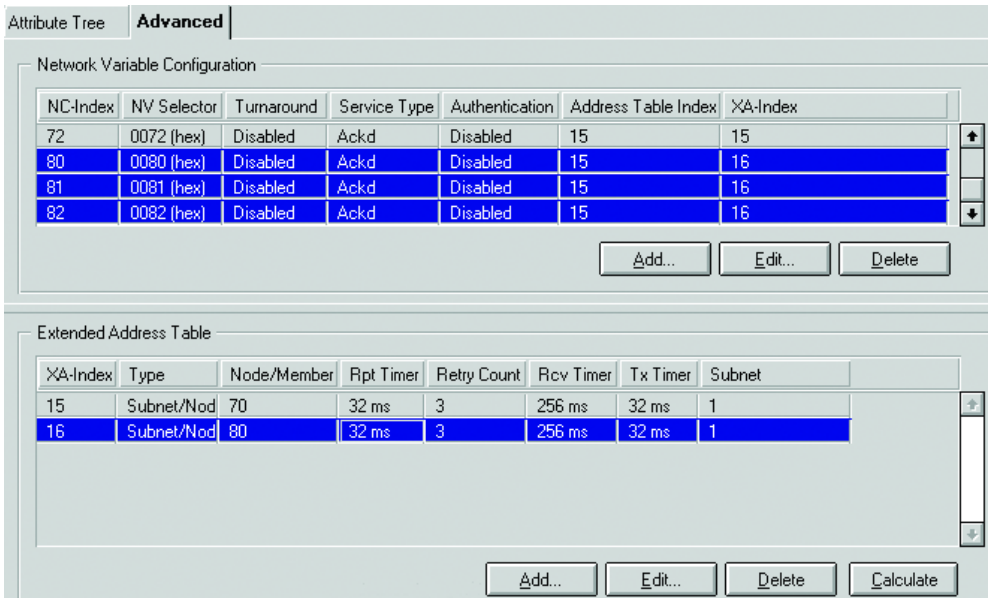


Figure 25: Advanced page of a LON line.

If a line is selected from the Extended Address Table, the corresponding lines are shown colored in the Network Variable Configuration table and vice versa. See Figure 25.

- **Add**
  When **Add** is clicked in the Network Variable Configuration table or in the Extended Address Table, the relevant editor opens and the index is calculated automatically as the first free index on that LON line.
- **Edit...**
  When **Edit...** is clicked in the Network Variable Configuration table or in the Extended Address Table, or a line in the index list is double-clicked, the relevant editor opens. The element values are assigned into the corresponding text fields. Editing can be cancelled with the **Cancel** button or accepted with the **OK** button.
- **Delete**
  When an index line is selected and the **Delete** button is clicked in the Network Variable Configuration table or in the Extended Address Table, a caution dialog with the text "Do you really want to delete the selected network variable configuration index?" or "Do you really want to delete the selected extended address table index?" is displayed. Clicking **Yes** deletes the selected index. Clicking **No** cancels the delete operation. Only one index can be deleted at a time.
- **Calculate**
  When all LMK stations are installed in the configuration tree or some changes have been made, this function can be used to calculate all the XA indices automatically. The node and subnet numbers are fetched from the configuration tree and the timers get their default values.

4.7.5 LON star coupler configuration

Device configuration can be done, when the active configuration is opened in online mode.

1. From the menu bar, choose **Configuration/Open Online**.
2. From the object tree, select a star coupler to configure. See Figure 18.
3. From the menu bar, choose **Tools/LON Star Coupler Configuration**.
   The device configuration page opens, if the connection to the selected LON Star Coupler is established. See Figure 26. If no connection is established, an error dialog is shown. In this case, check that the configuration data includes the correct subnet and node numbers and then try again.

The LON Star Coupler device configuration page is divided into three sections: General Information, Network Variable Configuration and Address Table. See Figure 26. The information is updated in each section, when the **Refresh** button in the bottom of the page is clicked.

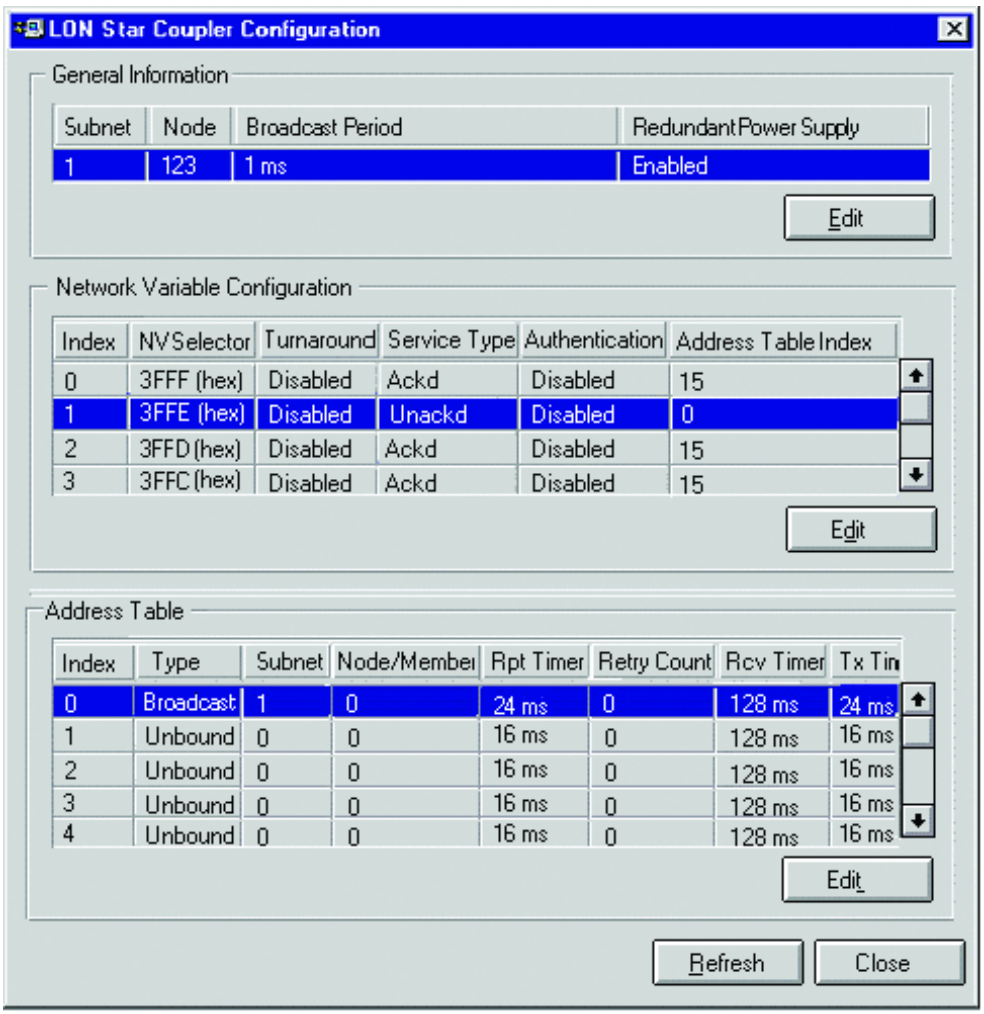


Figure 26: LON Star Coupler Configuration page

4. To edit the configuration information, select a row item to edit and click **Edit**, or alternatively double-click the row item.
   The appropriate edit dialog opens.

4.7.5.1 General information dialog

The **General Information** dialog displays and allows editing of LON Star Coupler settings. See Figure 27. The information displayed in this dialog is read from the neuron chip of the selected LON Star Coupler device. General information is divided into address, timing and hardware information categories.

Changing of address information, i.e. subnet and node number, and clicking **Send** updates the domain table of LON Star Coupler device.

Note that in order to have connection to the star coupler after the change operation, the values of NET attributes SN (= subnet number) and NN (= node number) must be changed to the same as the values that were typed into the **General Information** dialog. This is done automatically by the tool, if the **Yes** button is clicked in the dialog that opens after the change operation.

If an error occurs while sending the information, a message is displayed with the received status code and status message.

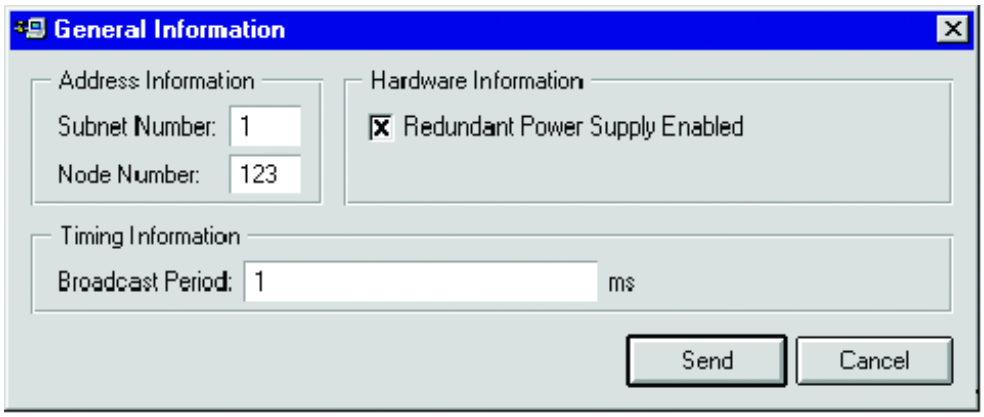


Figure 27: Edit dialog for general information of a LON Star Coupler

4.7.5.2 Network variable configuration editor dialog

The Network Variable Configuration Editor dialog displays and allows editing of the LON Star Coupler network variable configuration entry. The information displayed in this dialog is read from the neuron chip of the selected LON Star Coupler device. Network variable information includes index, network variable priority bit, direction, NV selector, turnaround bit, service type (acknowledged, unacknowledged/repeated, unacknowledged), authentication bit and address table index. For more information, see section Section 4.7.6.

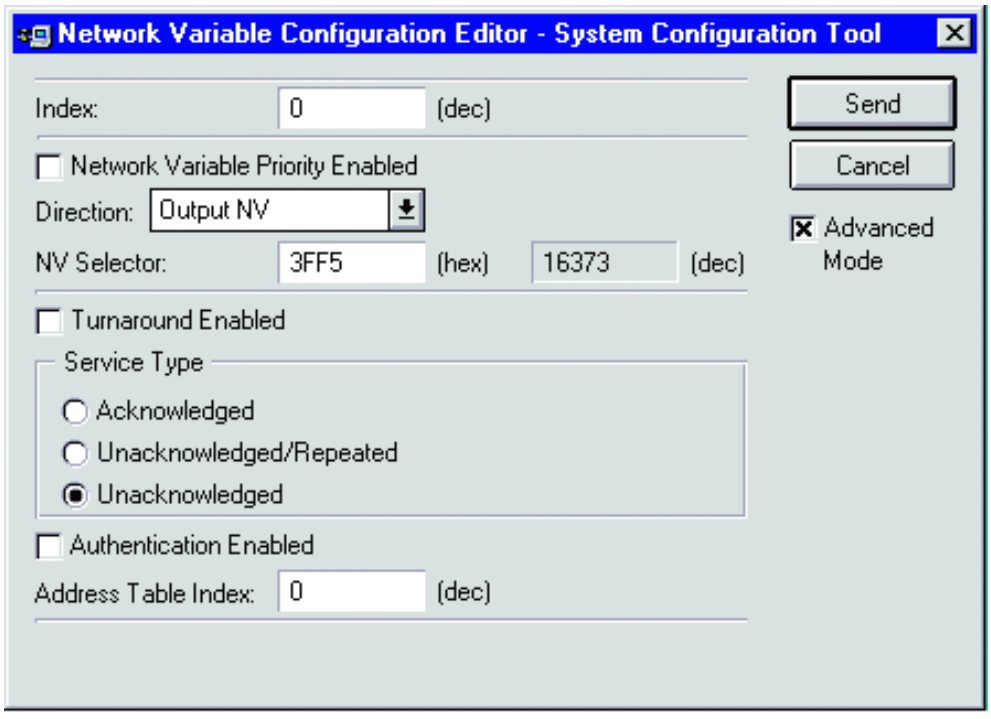


Figure 28: Network Variable Configuration Editor dialog for a LON Star Coupler device

Updating the information and clicking **Send** updates the network variable configuration entry that is stored in the neuron chip of the LON Star Coupler device. Note that the indices and NV selector values have a relationship to the firmware that is stored in the LON Star Coupler device.

If an error occurs during the send operation to the device, a message is displayed to the user. In the case of a successful send operation, the editor dialog is closed and the contents of the Network Variable Configuration section is refreshed by reading all network variable configuration information from the device.

4.7.5.3 Address table editor dialog

The address table information dialog displays and allows editing of LON Star Coupler address table entry. The information displayed in this dialog is read from the neuron chip of LON Star Coupler device. The address table information includes index, service type (unbound address table entry, turnaround address, subnet or node address, broadcast address), group address bit, group size, domain index bit, node or member number, repetition timer, retry count, group message receive timer, transmit timeout and subnet or group number. For more information, see Section 4.7.6 and Section 4.7.7.

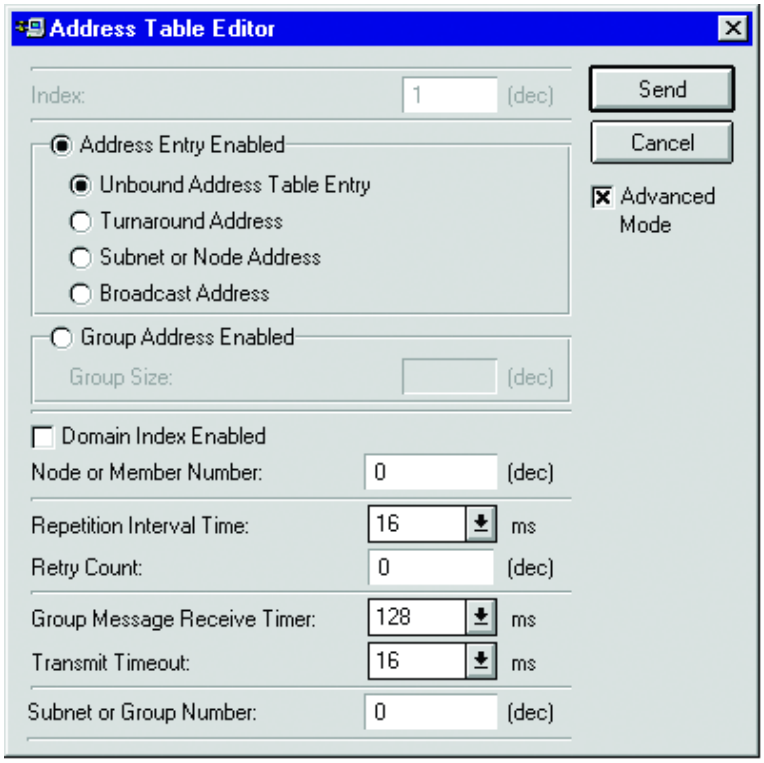


Figure 29: LON Star Coupler Address Table Editor dialog

Updating the information and clicking **Send** updates the address table entry definition to the neuron chip of the LON Star Coupler device.

Note that the indices have a relationship to the firmware that is stored to the LON Star Coupler device. If an error occurs while sending the address table entry to the device, an information message is displayed to the user. In the case of a successful send operation, the dialog is closed and the content of the address table is refreshed by reading all the address table entries from the LON Star Coupler device.

4.7.6 Network variable configuration

Each LON line acts as an interface to the LONWORKS device bus. Using the NC Editor, it is possible to write the network variable indices from 0 to 4095 for each LON line.

We recommend using the NC Editor in the default mode and letting System Configuration Tool enter the default values in most of the fields. However, it is possible to change the default values using the advanced mode in the NC Editor.

4.7.6.1 NC editor, default mode

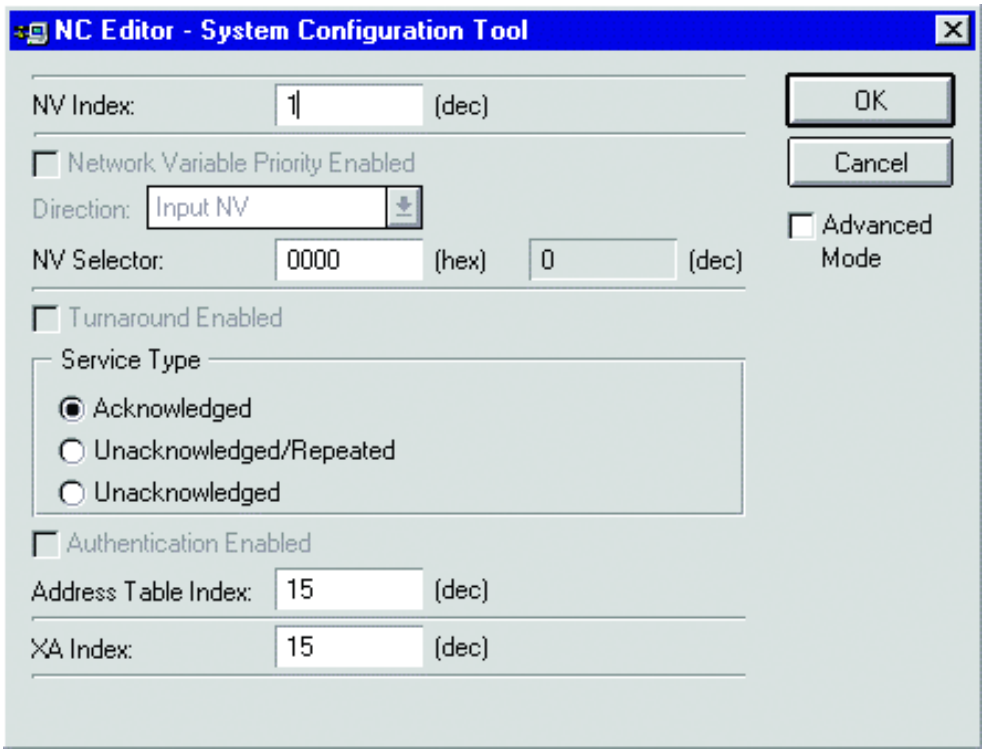


Figure 30: NC Editor in default mode

The following fields need to be configured in default mode:

- **NV Index**.
- **NV Selector**.
- **Service Type**.
- **Address Table Index**.
- **XA Index**.

All the unavailable fields are given the default values by System Configuration Tool.

In this editor it is not possible to enter values which are out of range. The configuration tool also checks that the entered NV and XA indices are free. If the entered index value is already in use, the tool informs the user that the configuration already includes an entry with the same index, and the editor stays open.

4.7.6.2 NV Selector

Network variables are addressed using network variable selectors. The selector is a 14-bit number in the range 0 H to 3FFF H (0 to 16383).

The decimal value of the NV Selector changes automatically when the hexadecimal value is changed.

Table 2: NC Editor value ranges

	Range
NV Index	0 to 4095
NV Selector	0 to 3FFF (hex)
Service type	Acknowledged Unacknowledged/Repeated Unacknowledged
Address table Index	0 to 15
XA Index	0 to 255 Default 15 0 to 14 not recommended!

XA index values from 0 to 14 are reserved for the Neuron Chip. Some of them might be available, but to ensure that the Neuron Chip does not overwrite the information entered here, we recommend that the XA Index numbering is started from 15.

4.7.6.3 Service types:

- Acknowledged:
  When a message is sent to a node or a group of nodes, individual acknowledgements are expected from each receiver. If the acknowledgements are not all received, the sender times out and retries the transaction.
- Unacknowledged/Repeated:
  The message is sent to a node or a group of nodes multiple times and no response is expected. This is typically used when multicasting to a large group of nodes. In this situation the traffic generated by all the responses would otherwise overload the network.
- Unacknowledged:
  The message is sent once to a node or a group of nodes and no response is expected. This is typically used when the highest attainable transmission rate is required or large amounts of data are to be transferred. When using this service, the application must not be sensitive to the occasional loss of a message.

4.7.6.4 NC editor, advanced mode

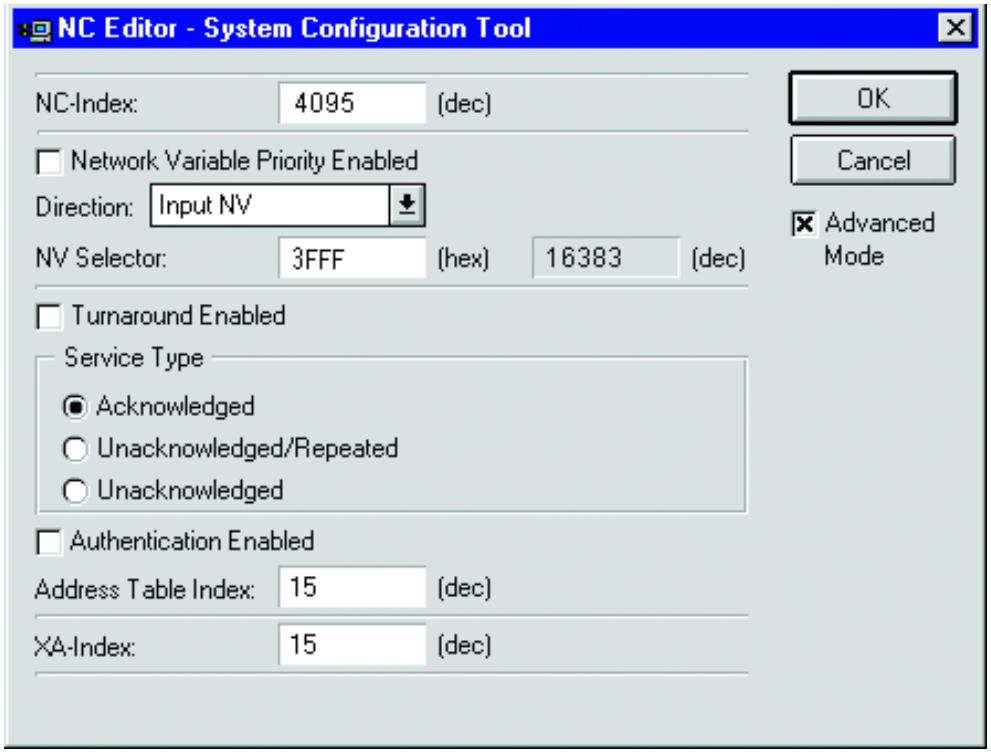


Figure 31: NC Editor in Advanced Mode

If the **Advanced Mode** check box is set in the NC Editor, it is possible to edit the following fields:

- **NV Index**.
- Network Variable Priority.
- **Direction**.
- **NV Selector**.
- Turnaround.
- **Service Type**.
- Authentication.
- **Address Table Index**.
- **XA Index**.

NV Index, NV Selector, Service Type, Address Table Index and XA Index are as described earlier.

4.7.6.5 Network Variable Priority Enabled:

The priority mechanism improves the response time for critical packets. The user can specify priority time slots dedicated to priority nodes on a channel. Each priority time slot on a channel adds time to the transmission of every message, but dedicated bandwidth is available at the end of each packet for priority access without any contention for the channel.

4.7.6.6 Direction:

- Input Network Variable.
- Output Network Variable.

In the LonTalk protocol terminology, an input network variable is a variable which is received by the node, and an output network variable is a variable which is sent from the node.

4.7.6.7 Turnaround Enabled:

This field is checked if the NV is a turnaround network variable, which means that it is bound to another network variable in the same node. If turnaround is enabled, the node sends back the opposite object with the same selector.

4.7.6.8 Authentication Enabled:

Authenticated messages allow the receivers to determine whether the sender is authorized to send a message. By checking this field, it is possible to prevent unauthorized access to, and control of, nodes and their applications.

Note that the used network variable indices are the same as the ones defined in LON Points for LMK devices in LMK Configuration tool and the ones defined in LON/SPA Analog Inputs for SPA devices in SPA Configuration tool.

Example:

LMK Device 70 could contain a LON Point:

```
#set sta70:slp1=(3,70,"SPAC SNVT_ALARM",88,1); where 70 = network
variable index
```

SPA Device 72 could contain SPA Points:

```
#set sta72:ssp1=(22,71,5,"L1_CUR_I1",0,1,0) ; where 71 = network variable
index
#set sta72:ssp2=(22,72,5,"I0_CUR_I4",0,2,0) ; where 72 = network variable
index
```

4.7.7 Extended address table

The LON address table configuration can be managed using the Extended Address Table attribute. This attribute is indexed in a similar way as the NV attribute.

4.7.7.1 XA editor, default mode

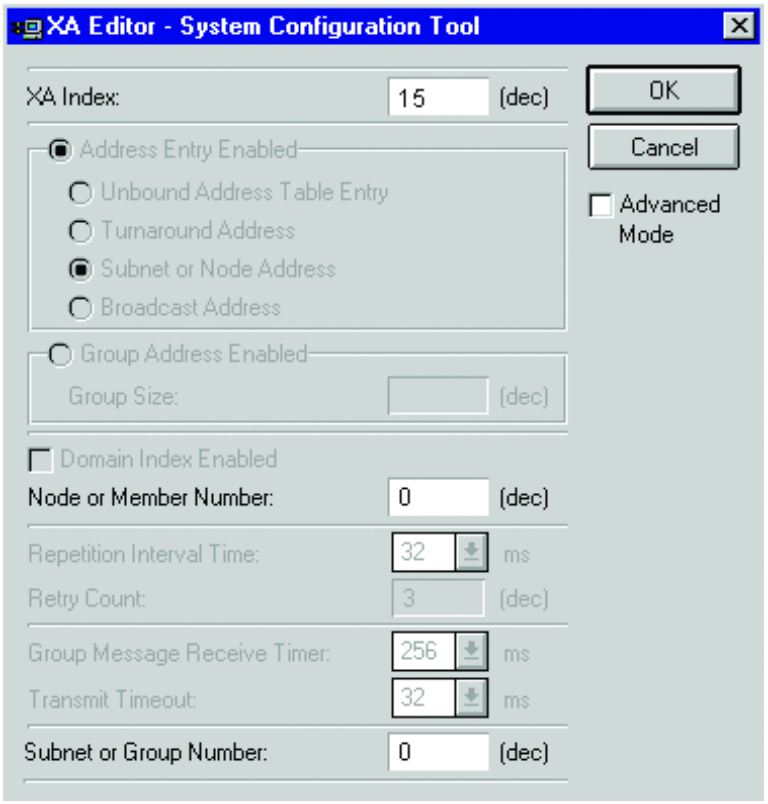


Figure 32: Default values in the XA Editor

In the default mode, the user can enter the following values:

- XA Index.
- Node or Member Number.
- Subnet or Group Number.

Table 3: XA Editor value ranges in the default mode

	Value range
XA Index	0 to 255 Default 15 0 to 14 NOT recommended!
Node or Member Number	0 to 127
Subnet or Group Number	0 to 255

In this editor, it is not possible to enter values which are out of range. The configuration tool also checks that the entered XA index is free. If the entered index value is already in use, the tool informs the user that the configuration already includes an entry with the same index, and the editor stays open.

4.7.7.2 XA editor, advanced mode

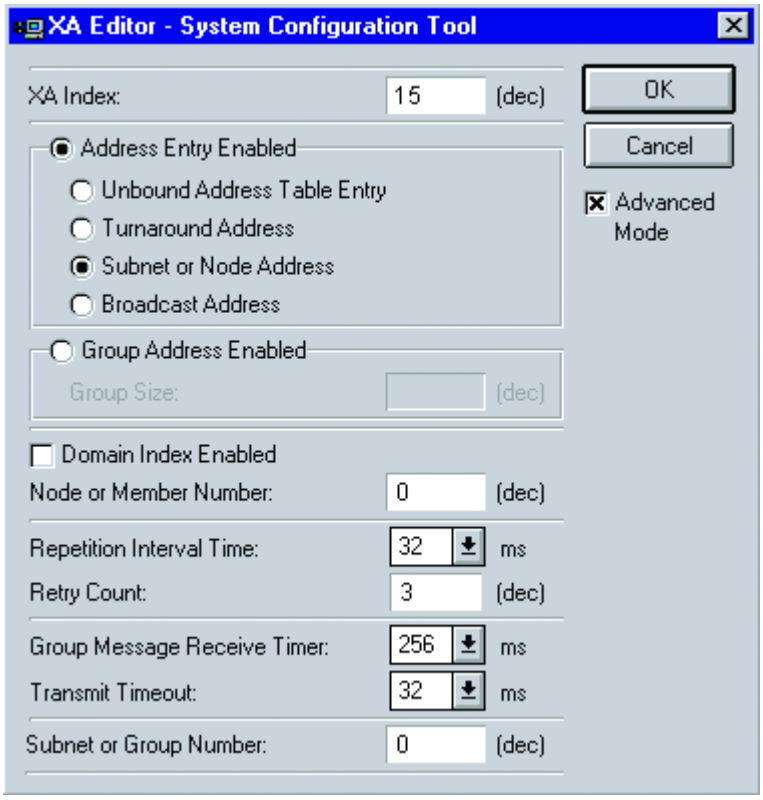


Figure 33: XA Editor in the advanced mode

XA Index, Node or Member Number and Subnet or Group Number ranges are as described earlier.

4.7.7.3 XA Index

When a new XA index is added to the Extended Address Table, it gets the first free index value on the line. Note that the values 0 to 14 are reserved for the Neuron Chip.

To avoid the loss of set values, we recommend starting the XA Index numbering from 15 and continuing upwards.

Value range: 0 to 255

Default value: 15

Recommended value range: 15 to 255

4.7.7.4 Address Entry Enabled / Group Address Enabled

The Address Entry Enabled and the Group Address Enabled are mutually exclusive. The default setting is the Address Entry Enabled and Subnet or Node Address.

4.7.7.5 Address Entry Enabled

- If the **Unbound Address Table Entry** is selected, the **Domain Index Enabled** check box and the **Node or Member Number** field become unavailable and the latter gets the default value 0.
- If the **Turnaround Address** is selected, the **Domain Index Enabled** check box and the **Node or Member Number** field become unavailable and the latter gets the default value 1.
- If the **Subnet and Node Address** is selected, the **Domain Index Enabled** check box and the **Node or Member Number** field are available.
- If the **Broadcast Address** is selected, the **Domain Index Enabled** check box and the **Node or Member Number** field are available. All nodes listen to subnet 0. This means that when subnet 0 is broadcasting, it is received by all the LONWORKS devices

4.7.7.6 Group Address Enabled

If the group address is enabled, a value in the range 0 to 127 can be entered in the Group Size text box.

4.7.7.7 Domain Index Enabled

Checking the check box enables the domain index. Domain is the top level of the addressing hierarchy. If different network applications are implemented on a shared communication medium, different domain identifiers can be used to keep the applications completely separate. A single node can be a member of up to two domains.

4.7.7.8 Node or Member Number

Range:	0 to 127.

4.7.7.9 Repetition Interval Time

The time interval between the messages sent with the unacknowledged repeated service. See Table 4.

4.7.7.10 Retry Count

Range:	0 to 15
Default:	3

4.7.7.11 Group Message Receiver Timer

Receive timeout for group messages. See Table 4.

4.7.7.12 Transmit Timeout

Timeout between retries. See Table 4.

Table 4: Time ranges and default values in the XA Editor Advanced Mode

	Range/ms	Default Value/ms
Repetition Interval Time	16, 24, 32, 48, 64, 96, 128, 192, 256, 384, 512, 768, 1024, 1536, 2048, 3072	32
Group Message Receive Timer	128, 192, 256, 384, 512, 768, 1024, 1536, 2048, 3072, 4096, 6144, 8192, 12288, 16384, 24576	256
Transmit Timeout	16, 24, 32, 48, 64, 96, 128, 192, 256, 384, 512, 768, 1024, 1536, 2048, 3072	32

4.7.8 Engineering REx devices

In a REx device, the SPA point attribute defines the binary output objects (SPA commands) as SPA points to the NET. It ties together the SPA command identifications and the corresponding process objects.

A unique SPA point number is assigned for each SPA point, when a new SPA point is added. Numbering is started from number 1 and increased with one up to 65535. This means that the REx Configuration tool is responsible for taking care of the uniqueness of the SPA point numbers.

4.7.8.1 Adding SPA points

Adding a SPA point for a REx device is performed using the **Add** button on the **SPA Points** page. Clicking **Add** opens a definition dialog and the SPA point information can be entered.

During add operation, the Channel 1 element value is copied automatically into Channel 2, if the text field Channel 2 is focused. This mechanism is also valid between the Data 1 and Data 2 element values.

Each SPA point consists of 8 elements of data. Element 1 is assigned to fixed number 10. Number 10 identifies the type information of a SPA point belonging to a REx device.

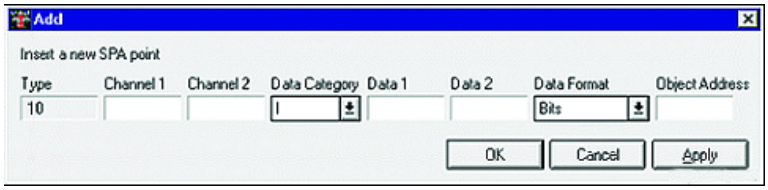


Figure 34: Dialog for adding a SPA point

The 8 SPA point elements consist of the types and values that are shown in Table 5. See also Figure 34.

Table 5: The SPA point value ranges

Description	Value range
Type	10 (fixed)
Channel 1	0 to 999 (integer)
Channel 2	0 to 999 (integer)
Data Category	I, O, S, V, M, C, F, T, D, L or B (text)
Data 1	0 to 999999 (integer)
Table continues on next page	

Description	Value range
Data 2	0 to 999999 (integer)
Data Format	Bits, Hexadecimal, Real or Long integer
Object Address	0 to 65535 (integer)

4.7.8.2 Editing SPA points

Editing SPA points is performed by clicking **Edit...** or double-clicking a point on the **SPA Points** page. The **Edit** dialog with the SPA point definition information opens and can be edited.

OK button accepts entered values into the signal list of the REx device and closes the **add/edit** dialog. The **Cancel** button cancels the add/edit operation. The **Apply** button accepts entered values into the signal list without closing the dialog.

4.7.8.3 Deleting SPA points

Selecting a SPA point and clicking **Delete** deletes the SPA point. A caution dialog is displayed to the user with the text "Do you really want to delete the selected object?". Clicking **Yes** deletes the SPA point and clicking **No** cancels the delete operation.

4.7.8.4 Closing the REx configuration tool

When the REx Configuration tool is closed, the signals related to the selected REx device are transferred to System Configuration Tool. If **Configuration/Save Active** is chosen in System Configuration Tool, the signals are saved into the configuration files and become a part of the configuration data. The REx device signals are interpreted automatically when the NET communication starts up.

4.7.8.5 SCIL commands

The SCIL commands that are automatically constructed from the REx device signals can be located by choosing **Configuration** from System Configuration Tool.

The SCIL commands from the NET part of the configuration could be as follows:

```
#set sta1:ssp1=(10,120,120,"V",6,6,2,1)
#set sta1:ssp10=(10,123,123,"V",7,7,2,10)
#set sta1:ssp11=(10,123,123,"V",11,11,2,11)
#set sta1:ssp12=(10,123,123,"V",10,10,2,12)
#set sta1:ssp13=(10,124,124,"V",6,6,2,13)
#set sta1:ssp14=(10,124,124,"V",7,7,2,14)
#set sta1:ssp15=(10,124,124,"V",11,11,2,15)
#set sta1:ssp16=(10,124,124,"V",10,10,2,16)
#set sta1:ssp2=(10,120,120,"V",7,7,2,2)
#set sta1:ssp3=(10,120,120,"V",11,11,2,3)
#set sta1:ssp4=(10,120,120,"V",10,10,2,4)
#set sta1:ssp5=(10,122,122,"V",6,6,2,5)
#set sta1:ssp6=(10,122,122,"V",7,7,2,6)
#set sta1:ssp7=(10,122,122,"V",11,11,2,7)
#set sta1:ssp8=(10,122,122,"V",10,10,2,8)
#set sta1:ssp9=(10,123,123,"V",6,6,2,9)
```

4.7.8.6 Send general object handling command

This command is available in System Configuration Tool, when the tool is used in online mode and a REx device is selected from the Object tree.

1. Select a REx device in the object tree.
2. From the menu bar, select **Tools/Send General Object Handling Command**. See Figure 35.

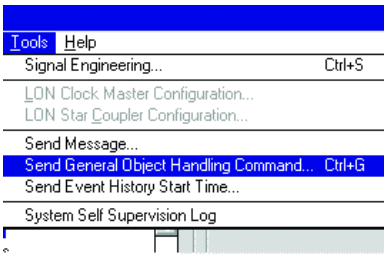


Figure 35: Send General Object Handling Command is selected from the Tools menu

The **General Object Handling command** dialog is opened. See Figure 36.

3. Enter the appropriate values and click **Send**.

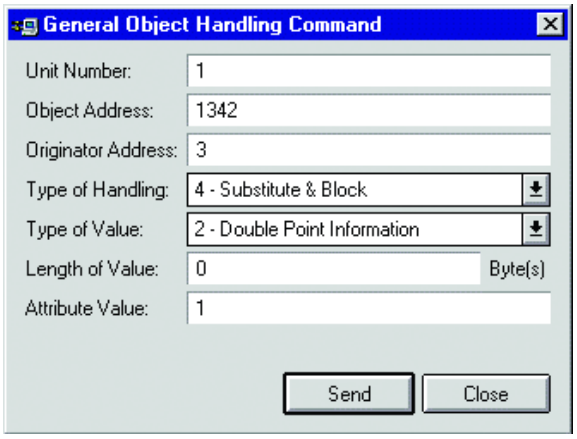


Figure 36: General Object Handling Dialog with example values

Example:

If you enter the value definitions that are shown in Figure 36 and click **Send** (or press ENTER on the keyboard), the following SCIL command is sent to REx device number 1:

```
#SET STA1:SGO = (1, 1342, 3, 4, 2, 0, 1).
```

4.7.8.7 Send event history start time

This command is available, if the tool is in online mode and a REx device is selected from the Object tree.

1. Select a REx device in the object tree.
2. From the menu bar, select **Tools/Send Event History Start Time**. See Figure 37.

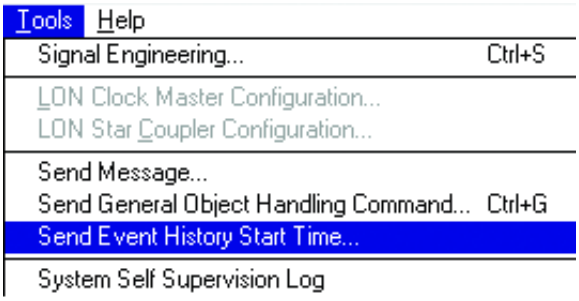


Figure 37: Send Event History Start Time is selected from the Tools menu

The Send Event History Start Time dialog is opened. See Figure 38.

3. Enter the appropriate values and click **Send**.

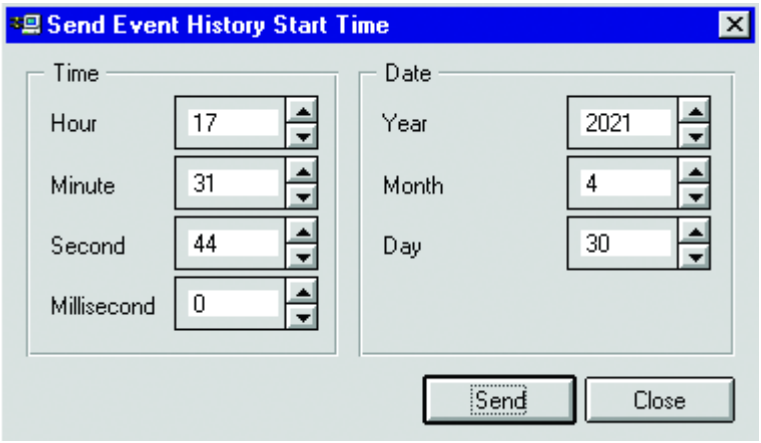


Figure 38: The dialog for sending event history start time information

After a successful send operation, the HS attribute value is changed in the Attribute tree. This attribute is described in the System Objects manual.

4.7.9 Engineering LMK devices

Managing the LMK device signals means that in System Configuration Tool, a device of the type LMK is selected. Signal Information shows the number of the LON points defined for this device number. By selecting **Tools _ Signal Engineering** from the menu bar the LMK Configuration tool opens and signals dedicated to the device are assigned into the list of signals.

In an LMK station, the LON point attribute ties together the LON Network Variable indices with the process objects in the SYS600 process database. A unique LON point number assigns each LON point in the NET, when a new LON Point is added. Numbering is started from number 1 and increased with one up to 4095. In this case, the LMK Configuration tool is responsible for taking care of the uniqueness of the LON point numbers.

Each LON point consists of 6-7 elements of data. Element 1 is assigned for the point type information. This field cannot be edited. Possible point types and their values are the following:

- Digital Input (6).
- Analog Input (2).
- Digital Output (4).
- Analog Output (5).
- Structure Input (3).

Numbers 2, 3, 4, 5 and 6 identify the type information of a LON point that belongs to an LMK station.

4.7.9.1 Adding LON points

To add a LON point for an LMK device:

1. In the **LON Points** page, click the **Add** button.
   This opens the LON **Point definition** dialog, which shows a list of the possible LON point types. See Figure 39.

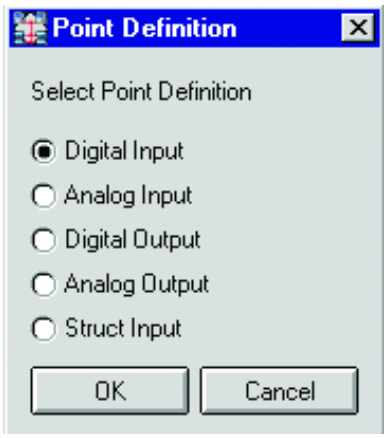


Figure 39: LON point types

2. Select a LON point type and click **OK**
   This opens the definition dialog.
3. Enter values to the signal list of the LMK device.
   Depending on the LON point type, the user interface of the add (and edit) dialog may be different (Figure 40).

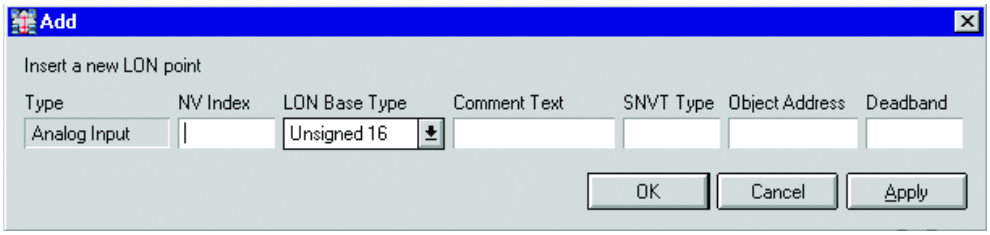


Figure 40: The LON point definition dialog for Analog Inputs

4. Click the **OK** button to accept the entered values to the signal list of the LMK device and close the **Add** dialog.
   Or click **Apply** to add the entered values to the signal list without closing the LON **Point definition** dialog.
   Or click **Cancel** to close the dialog without adding the entered values to the signal list.

4.7.9.2 Base type element

LON Base Type element of the LON point definition is selected from the drop-down list, where the text strings represent the following values:

- Unsigned 16 (1)
- Signed 16 (2)
- Unsigned 8 (3)
- Signed 8 (4)
- Signed 32 (5)

- Float iee754 (7)
- Structure (8)
- LSG control (9)
- LSG bit write (10)

4.7.9.3 SNVT type

A node may be installed in a network and logically connected to other nodes via network variables as long as the data types match. A list of all the available SNVTs and details of their definitions are provided in The Master SNVT List, which is available in the Internet.

4.7.9.4 Default:

Alarm state	SNVT_alarm	type 88

The different LON point types have the following value ranges:

4.7.9.5 Digital Input

Table 6: Element value ranges for the digital Inputs

Element	Description	Value range
1	Definition	6 (fixed)
2	(Network Variable) Index	0 to 4095 (integer)
3	(LON) Base Type	1 to 8 (integer)
4	Text	max. of 30 characters (text)
5	(SNVT) Type	(integer)
6	(Process) Object Address	0 to 65535 (integer)

4.7.9.6 Analog Input

Table 7: Element value ranges for the Analog Inputs

Element	Description	Value range
1	Definition	2 (fixed)
2	(Network Variable) Index	0 to 4095 (integer)
3	(LON) Base Type	1 to 8 (integer)
4	Text	max. of 30 characters (text)
5	(SNVT) Type	(integer)
6	(Process) Object Address	0 to 65535 (integer)
7	Dead Band	0 to 0.9999 (real)

4.7.9.7 Digital Output

Table 8: Element value ranges for the Digital Outputs

Element	Description	Value range
1	Definition	4 (fixed)
2	(Network Variable) Index	0 to 4095 (integer)
3	(LON) Base Type	1 to 10 (integer)
4	Text	max. of 30 characters (text)
5	(SNVT) Type	(integer)
6	(Process) Object Address	0 to 65535 (integer)

4.7.9.8 Analog Output

Table 9: Element value ranges for the Analog Outputs

Element	Description	Value range
1	Definition	5 (fixed)
2	(Network Variable) Index	0 to 4095 (integer)
3	(LON) Base Type	1 to 8 (integer)
4	Text	max. of 30 characters (text)
5	(SNVT) Type	(integer)
6	(Process) Object Address	0 to 65535 (integer)

4.7.9.9 Structure Input

Table 10: Element value ranges for the Structure Inputs

Element	Description	Value range
1	Definition	3 (fixed)
2	(Network Variable) Index	0 to 4095 (integer)
4	Text	max. of 30 characters (text)
5	(SNVT) Type	(integer)
6	(Process) Object Address	0 ... 65535 (integer)

4.7.9.10 Editing LON points

To edit the LON points of an LMK device:

- Click **Edit...** or double-click a point in the **LON Points** page.
  The **Edit** dialog with the LON point information opens and allows editing of the LON point definition information.

4.7.9.11 Deleting LON points

To delete a LON point, select a LON point to remove and click **Delete**.

4.7.10 Engineering SPA devices

1. From the Object tree, select an SPA device to engineer.
2. From the menu bar, choose **Tools/Signal Engineering**.

The SPA Configuration tool is opened. The signals dedicated to the device are assigned into the list of signals in the SPA Configuration tool. Signal Information shows the number of the SPA points that are defined for this device number.

If the SPA device is connected to a LON/SPA gateway (LMK device) in a LON line, the LON/SPA Analog Inputs page is also visible. LON points can be added using **Add** button in the LON/SPA Analog Inputs page.

4.7.10.1 Adding SPA points

To add an SPA point for an SPA device:

1. In the **SPA Points** page, click the **Add** button. This opens the SPA **Point definition** dialog, which shows the list of the possible SPA point types. See Figure 41.

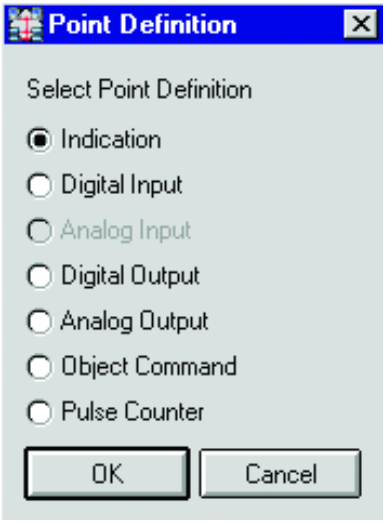


Figure 41: The SPA point types

Each SPA point consists of 6-11 elements of data. Element 1 is assigned for the point type information. This field cannot be edited.

2. Select a point type and click **OK** to open the **Add** dialog.
The user interface of this dialog may vary depending on the SPA point type. See Figure 42.

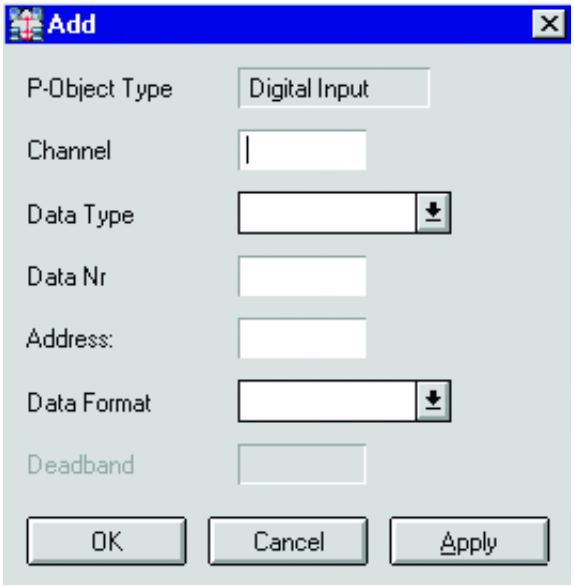


Figure 42: The SPA point definition dialog for Digital Inputs

The SPA point elements consist of the following element value ranges in the different point types:

4.7.10.2 Indication

Table 11: The element value ranges for indication

Element	Description	Value range
1	P-Object Type	Indication (0) (fixed)
2	Channel	0 to 16 (integer)
3	Channel	0 to 16 (integer)
4	Data Type	I (Input Data) O (Output Data) S (Setting Values) V (Variables) M (Memory Data) C (Slave Status) (text)
5	Data NR	0 to 16 (integer)
6	Data NR	0 to 16 (integer)
7	(Process Object) Address	0 to 65535 (integer)
8	Data Format	Bits, Hexadecimal, Real
9	Bit Type Mask	Single Indication Double Indication
10	Update Method	Cyclical Polling Event Update Event Consume Event Code Parsing Event Code Par. Consume
11	Bit Transpose Mask	Check box selection

4.7.10.3 Digital Input

Table 12: The element value ranges for the Digital Inputs

Element	Description	Value range
1	P-Object Type	Digital Input (0) (fixed)
2	Channel	0 to 16 (integer)
3	Data Type	I (Input Data) O (Output Data) S (Setting Values) V (Variables) M (Memory Data) C (Slave Status)
4	Data NR	0 to 16 (integer)
5	(Process Object) Address	0 to 65535 (integer)
6	Data Format	Bits, Hexadecimal, Real

4.7.10.4 Analog Input

Table 13: The element value ranges for the Analog Inputs

Element	Description	Value range
1	P-Object Type	Analog Input (2) (fixed)
2	Channel	0 to 16 (integer)
3	Data Type	I (Input Data) O (Output Data) S (Setting Values) V (Variables) M (Memory Data) C (Slave Status) (text)
4	Data NR	0 to 16 (integer)
5	(Process Object) Address	0 to 65535 (integer)
6	Data Format	Bits, Hexadecimal, Real
7	Dead Band	0 to 65535 (real)

4.7.10.5 Digital Output

Table 14: The element value ranges for the Digital Outputs

Element	Description	Value range
1	P-Object Type	Digital Setpoint (3) (fixed)
2	Channel	0 to 16 (integer)
3	Data Type	I (Input Data) O (Output Data) S (Setting Values) V (Variables) M (Memory Data) C (Slave Status) (text)
4	Data NR	0 to 16 (integer)
5	(Process Object) Address	0 to 65535 (integer)
6	Data Format	Bits, Hexadecimal, Real

4.7.10.6 Analog Output

Table 15: The element value ranges for the Analog Outputs

Element	Description	Value range
1	P-Object Type	Analog Setpoint (4) (fixed)
2	Channel	0 to 16 (integer)
3	Data Type	I (Input Data) O (Output Data) S (Setting Values) V (Variables) M (Memory Data) C (Slave Status) (text)
4	Data NR	0 to 16 (integer)
5	(Process Object) Address	0 to 65535 (integer)
6	Data Format	Bits, Hexadecimal, Real

4.7.10.7 Object Command

Table 16: The element value ranges for the object commands

Element	Description	Value range
1	P-Object Type	Object Command (5) (fixed)
2	Channel	0 to 16 (integer)
3	Data Type	I (Input Data) O (Output Data) S (Setting Values) V (Variables) M (Memory Data) C (Slave Status)
4	Data NR	0 to 16 (integer)
5	(Process Object) Address	0 to 65535 (integer)
6	Data Format	Bits, Hexadecimal, Real

4.7.10.8 Pulse Counter

Table 17: The element value ranges for the pulse counter

Element	Description	Value range
1	P-Object Type	Pulse Counter (6) (fixed)
2	Channel	0 to 16 (integer)
3	Data Type	I (Input Data) O (Output Data) S (Setting Values) V (Variables) M (Memory Data) C (Slave Status)
4	Data NR	0 to 16 (integer)
5	(Process Object) Address	0 to 65535 (integer)
6	Data Format	Bits, Hexadecimal, Real
7	Dead Band	0 to 65535 (real)

4.7.10.9 Editing SPA points

To edit an SPA point of a SPA device:

1. Click **Edit...** or double-clicking a point on the **SPA Points** page.
   The **Edit** dialog opens and allows editing of the SPA point definition information.
2. Select the Data Type element from the drop-down list, where the text strings represent the following characters: Input Data (I), Output Data (O), Setting Values (S), Variables (V), Memory Data (M) and Slave Status (C).
3. Select the Data Format element from the drop-down list, where the text strings represent the following values: Bits (1), Hexadecimal (2) and Real (3). Depending on the SPA point type; the user interface of this edit dialog may vary. See id(95234)Instructions.xml#SpaPoint_Dl.
4. Click **OK** to accept the entered values to the signal list and close the edit dialog.
   Or click **Apply** to accept the entered values to the signal list without closing the dialog.
   Or click **Cancel** to cancel the edit operation.

4.7.10.10 Deleting SPA points

To delete an SPA point:

1. Click **Delete**.
   A caution text appears.
2. Click **Yes** to delete the selected data elements.
   Or click **No** to cancel the delete operation.

4.7.10.11 LON points

The LON point attribute ties the LON Network Variable indices together with the process objects in the SYS600 process database. A unique LON point number is assigned each LON point in the NET. The numbering starts from 1 and increases by one up to 4095.

4.7.10.12 Adding LON points

Click **Add** in the **LON/SPA Analog Inputs** page to open the LON Point add dialog for the LON/SPA Analog Inputs. See Figure 43.

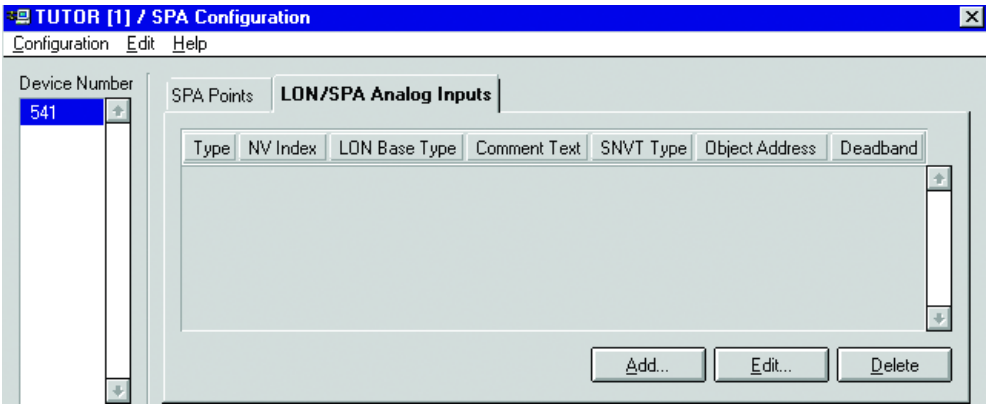


Figure 43: LON/SPA Analog Inputs page. Click Add... to create a new LON point

Table 18: Element value ranges for the LON/SPA Analog Input.

Element	Description	Value range
1	Definition	Analog Input (2) (fixed)
2	(Network Variable) Index	0 to 4095 (integer)
3	(LON) Base Type	Drop down list. See the text later.
4	Text	max. of 30 characters (text)
5	(SNVT) Type	(integer)
6	(Process) Object Address	0 to 65535 (integer)
7	Dead Band	0 to 65535 (real)

4.7.10.13 Editing LON/SPA analog inputs

To edit a LON point of a SPA device which has LON/SPA Analog Inputs:

- Click **Edit...** or double-click a point on the **LON/SPA Analog Inputs** page.
  The **Edit** dialog opens and allows changes to the LON point definition information.

The LON Base Type element of the LON point definition is displayed/selected from a drop-down list, where the text strings represent the following values: unsigned 16 (1), signed 16 (2), unsigned 8 (3), signed 8 (4), signed 32 (5), float iee754 (7) and Structure (8).

The SCIL-commands from the NET part of the configuration could be as follows:

```
#set sta71:ssp1=(0,1,3,"I",2,3,1,1,63,0,3)
#set sta71:sed1=(0,1,3,2,2,1,2,2,1,3,3,4,0) ; Event to Data
#set sta71:ssp2=(5,2,2,"V",1,1,1,1)
#set sta71:ssp3=(5,2,2,"V",2,2,1,2)
#set sta71:ssp4=(5,2,2,"V",3,3,1,3)
#set sta71:ssp5=(5,2,2,"V",4,4,1,4)
#set sta72:ssp1=(22,71,5,"L1_CUR_I1",0,1,0) ; LON/SPA Analog Input
#set sta72:ssp2=(22,72,5,"I0_CUR_I4",0,2,0) ; LON/SPA Analog Input
```

4.7.11 LON clock master configuration

See also section Section 4.5.11.

To start the configuration:

1. Open the configuration in online mode.
2. From the menu bar choose **Tools - LON Clock Master Configuration...**

LON Clock Master Configuration page opens. See Figure 44. The information shown on this page is read from the Neuron Chip of the LON Clock Master device. Clicking the **Refresh** button on the bottom of the page updates the information.

It is not possible to add or delete configuration objects on the **LON Clock Master Configuration** page.

There are two ways to change the settings:

- Double-click the row item that needs to be edited.
- Alternatively, select the item to edit and click the **Edit** button in the same section of the page.

This opens the configuration page, where settings can be changed.

After selecting an Address Table entry, all the related entries in Network Variable Configuration become selected. Relationship is found from the Index element of the Address Table and the Address Table Index element of the Network Variable Configuration entry.

Multiple entries may exist in Network Variable Configuration related to one entry in Address Table. If the selected entry in Network Variable Configuration includes the value 15 in Address Table, no entry should be selected in Address Table, because value 15 means that it is not associated with Address Table.

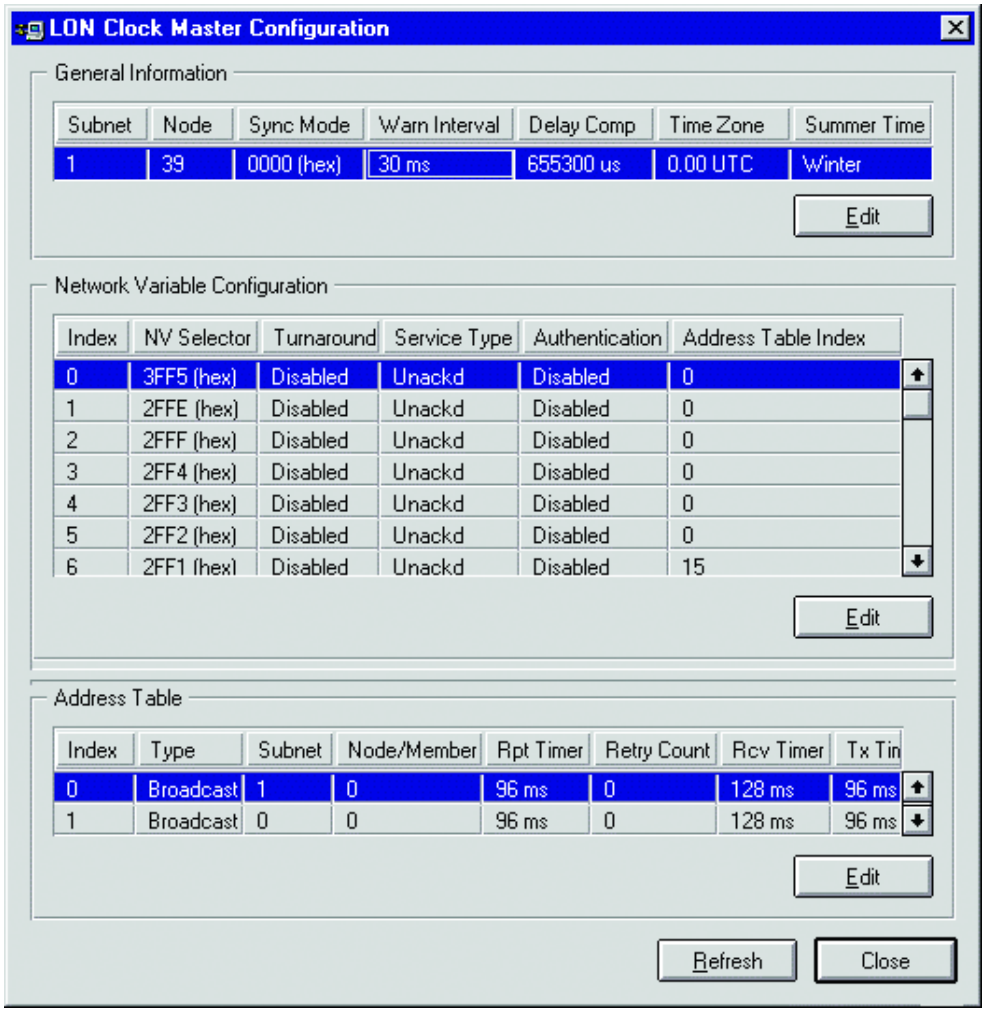


Figure 44: Figure 35.LON Clock Master Configuration

4.7.11.1 General information page

Subnet and Node Number:

Subnet and Node numbers are set, when the LON Clock Master device with System Configuration Tool is created in offline mode. If required, the address can be changed in this editor. See Figure 45. If any other information besides the Subnet and Node Number is changed, fill in the pre-set Subnet and Node values.

If the Subnet or Node number are changed, the configuration data must also be changed in order to have a connection to this LON Clock Master again. The attribute values of the NET attributes SN (subnet number) and NN (node number) must be changed to equal the values that are entered on this General Information page.

Subnet Number

Range: 0 ... 255

Node Number

Range: 0 ... 127

Warning Interval

Range: 30 ... 100 ms

Default: 30 ms

Delay Compensation

Range: 0 ... 655300 µs

Default value: 0 µs

Time Zone

Range: -127.59 ... +127.59 UTC

Default value: 0.00 UTC

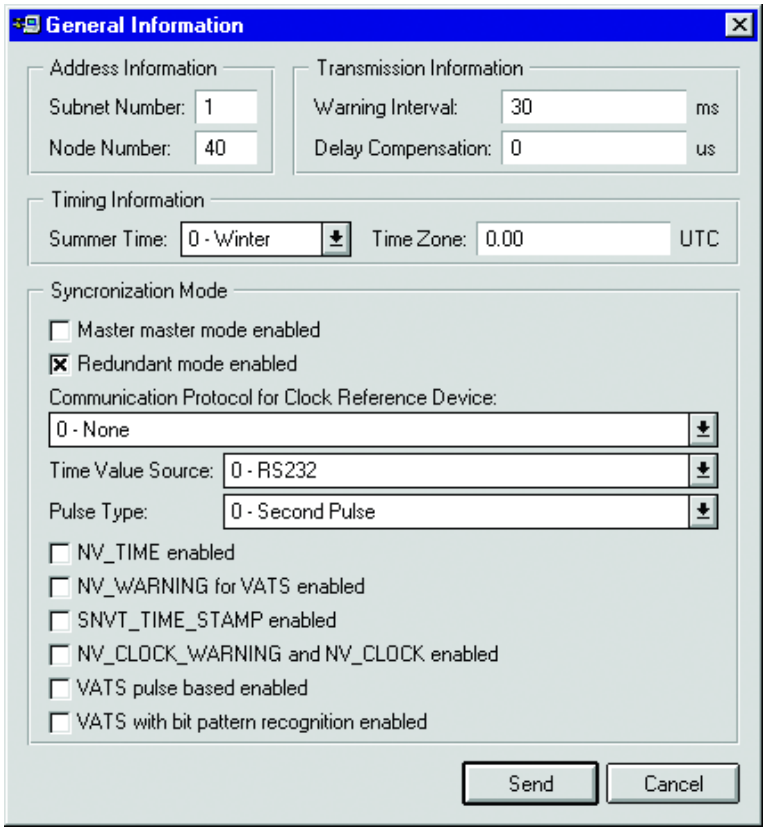


Figure 45: LON Clock Master General Information editor

4.7.11.2 Parameter information

The configured parameter information is read from the LON Clock Master into System Configuration Tool, if the configuration is opened in online mode.

4.7.11.3 Time settings

LON Clock Master's internal clock is adjusted to the UTC time when it receives a time message and a second pulse from the GPS receiver device.

4.7.11.4 NV_time

LON Clock Master’s internal clock can be adjusted to the UTC time by receiving a second or a minute pulse from other time references than GPS (e.g. DCF77). When there is no time message available from time reference, the given time can be delivered through the LONWORKS device bus using network variables.

Accuracy:	10...100 ms

4.7.11.5 Synchronization using SNVT_time_stamp

Network variable of type SNVT_time_stamp is broadcast to the network by a clock master node. The nodes that own this type of network variable receive the time in the network variable and synchronize the internal real-time clocks accordingly.

SNVT_time_stamp contains year, month, day, hour, minute and second. It can be expected that in the best case the real-time clocks of the clock master node and the other nodes are synchronized to each other with the accuracy of 10...100 ms, if the clock master node attempts to send the SNVT_time_stamp exactly when the full second is elapsing.

Accuracy:	10...100 ms (Strongly dependent on the network load and the input load of the synchronized nodes.)

4.7.11.6 Synchronization using NV_clock_warning and NV_clock

Network variables NV_clock_warning and NV_clock messages are broadcast to the LONWORKS network by a clock master node once a second, one after another, with a delay of 30...100 milliseconds.

When a node receives the NV_clock_warning, it must stop sending other than high priority messages and start waiting for NV_clock. The time received in NV_clock is used to adjust the real-time clock of the node.

The length of time interval between NV_clock_warning and NV_clock message is user configurable and it is given in network variable nv_warn_interval.

Accuracy:	1...5 ms (Provided that after broadcasting NV_clock_warning, all system nodes suspend transmission of normal priority messages, otherwise may be more than 5 ms.)

4.7.11.7 VATS pulse based synchronization

Note that the REF 5xx relays do not support the VATS based synchronization methods yet.

VATS pulse based synchronization uses the common NV_clock_warning message of the previously defined method. After some delay there will be a synchronization pulse transmitted in the preamble of a data package. This pulse (predefined length min. 80ìs, max. 120ìs) can be detected by the hardware added for this purpose. The detection of the pulse occurs in the master end and in the slave end of the LONWORKS device bus. After the pulse has been broadcast, a clock message including the master's pulse detection time will be transmitted. Using this message and the own time of pulse detection, the slave adjusts its internal clock.

Accuracy: 100 µs

4.7.11.8 VATS with bit pattern recognition

This method is quite similar to the pulse based VATS method, although a different synchronization event is used. A pulse in the preamble of a message is substituted by a predefined bit pattern in the message. The detection of this bit pattern requires a special hardware to be added.

Accuracy: 100 µs

4.7.11.9 Reference time

If some cyclical sending of reference time is needed, the valid interval times are between 1 minute and 1 hour. The reference time is always in the form of local time.

If the Master - Master concept is being used, the sending of the reference time is handled by one LON Clock Master. In this case, SYS600 is not involved in sending the reference time at all. There is a need to use this kind of solution, if routers are used in the configuration. There should be a LON Clock Master before and after a router.

4.7.11.10 Clock synchronization attribute

System Configuration Tool is used for setting the related synchronization attribute LK. See Table 19.

Table 19: LK attribute value

LK value	Meaning
0	No clock synchronization
1	Send LSG Clock synchronization pulse
2	Send minute pulse
3	Send LSG and minute pulse

4.7.11.11 Network variable configuration editor page

Index range: 0 - 4095

NV Selector value range: 0000H - 3FFFH

The limit range for selector values is 0000H - 3FFFH inside NC attribute. The network variables that are configured into this range can be separated into bounded network variables (0000H - 2FFFH) and unbounded network variables (3000H - 3FFFH).

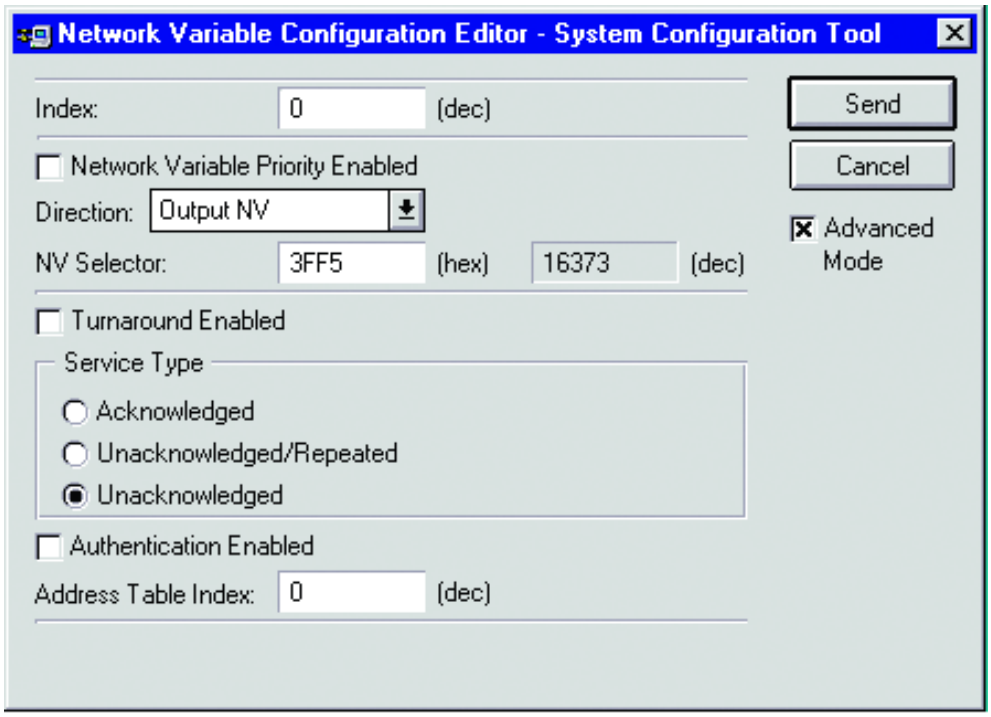


Figure 46: LON Clock Master Network Variable Configuration Editor

4.7.11.12 Bounded network variable

During the start-up of PC-NET, the initial state of a bounded network variable is read through the NV Poll LON network management command, if the Diagnostic Interval (DI) attribute of station with type LMK is higher than 0. It is also possible to configure the background network variable polling mechanism into PC-NET by defining the interval time in minutes to the Consistency Check Time (CT) attribute of station with type LMK. See Figure 47.

Small interval time increases the LON load, because of the repeated collections of the NV Poll commands in that LON line. Value 0 in CT attribute disables this mechanism.

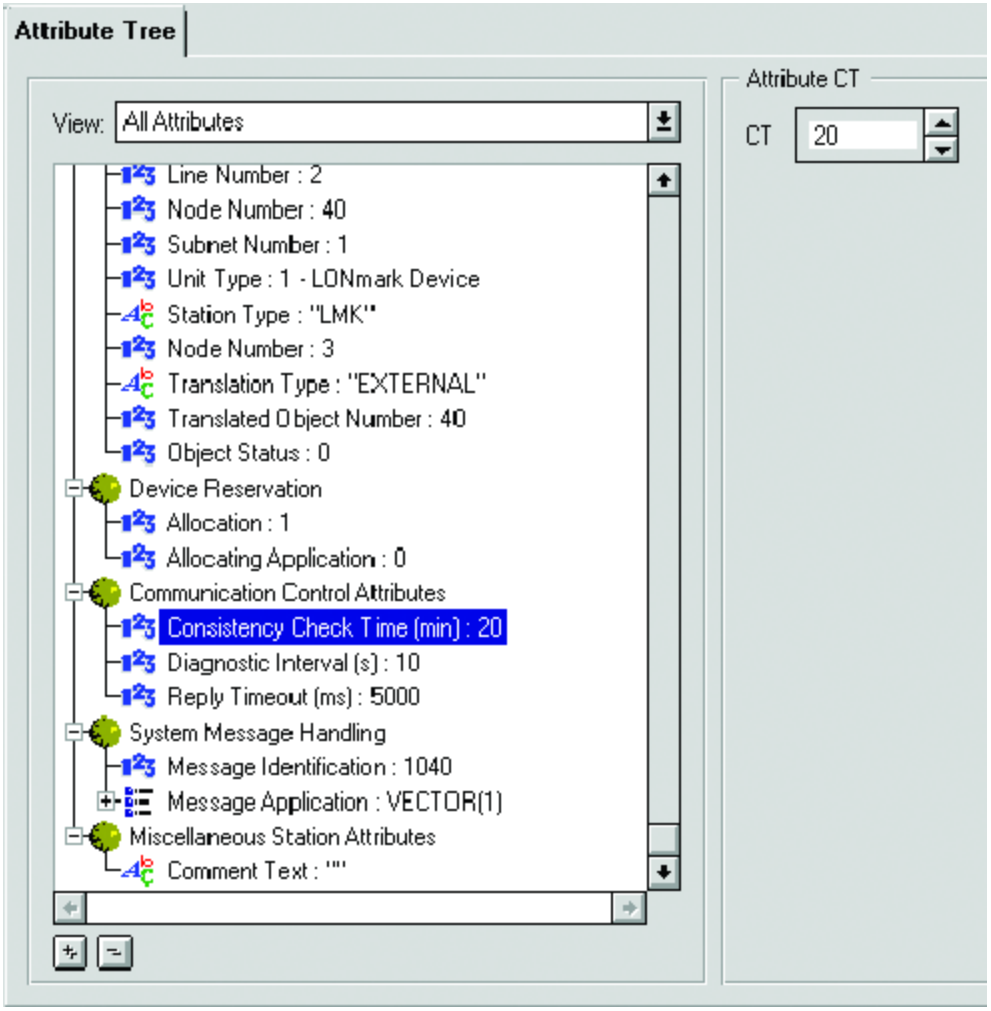


Figure 47: It is possible to configure the background network variable polling mechanism into PC-NET by defining the interval time in minutes to the Consistency Check Time (CT) attribute of an LMK station

4.7.11.13 Unbounded network variable

If unbounded network variables are defined into PC-NET, their initial state is not read during PC-NET start-up in spite of the station's DI attribute value. The network variable update occurs only to the unbounded network variable, if the device itself sends an NV Update LON network management command. As a default, when network variables are included into the neuron chips of the LON devices, the default selector values are usually located inside an unbounded network variable range. This means that during LON configuration engineering the selector values have to be configured inside a bounded network variable range with System Configuration Tool or LON Network Tool inside the neuron chip of a LON device. These definitions have to be consistent with the contents of the NC attribute of the LON line.

For further information, see the text earlier in this section (Direction and NV Selector) and the descriptions in Section 4.7.6.

4.7.11.14 Address table editor page

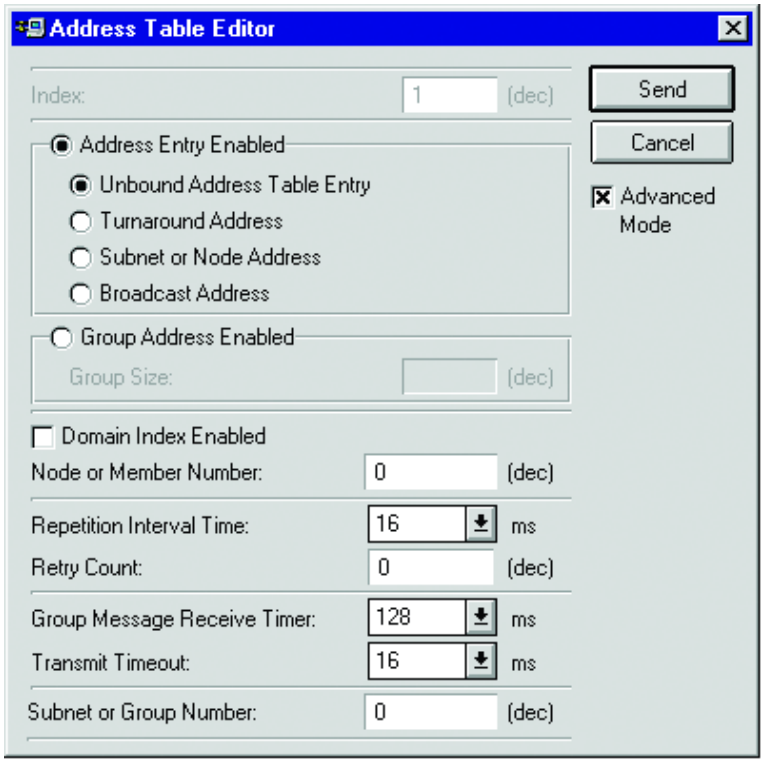


Figure 48: LON Clock Master Address Table Editor

Index range:	0 ... 14
Node or Member Number range:	0 ... 127
Subnet or Group Number range:	0 ... 255

See Figure 48. Further information can be found in Section 4.7.7.

4.8 Signal data transfer from LON network tool

It is possible to transfer signal engineering data from LON Network Tool to System Configuration Tool. Only the information that is needed for vertical communication is transferred.

To start the data transfer:

1. From your configuration, select a LON line.
2. From the menu bar, choose **Configuration/LON Network Variables**. See Figure 49.
3. Select **Import Single Node** or **Import Multiple Nodes**.

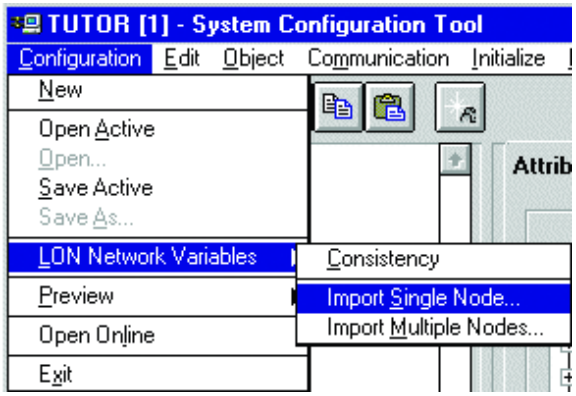


Figure 49: Single node data transfer will be started from LON Network Tool

Importing of single node means that the data is read from a certain LON node only (e.g. from file S001N001.lon). Importing multiple nodes means that data is read from certain specified LON nodes or from all LON nodes that are included in a LON Network Tool project (e.g. all files with .lon extension). The LON file is selected using the File Chooser. See Figure 50.

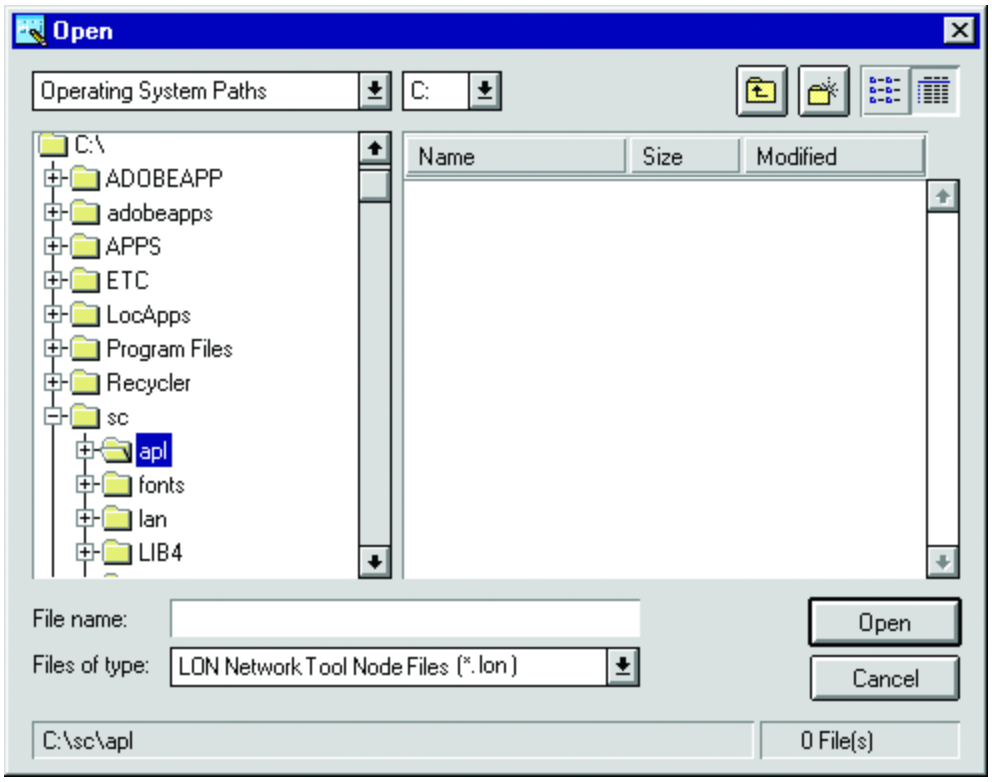


*Figure 50: The file to be imported can be chosen from the File Chooser (shown above) that opens automatically, when **Configuration/LON Network Variables/ Import Single Node**(or Import Multiple Nodes) is selected from the menu bar.*

4.8.1 Importing a single node

If a Single Node is going to be imported, the exported LON file is selected using the File Chooser. See Figure 50.

When a LON file with the .lon extension is opened, a dialog with information about the incoming data is shown. See Figure 51. Clicking **Import** starts the import of a single node.

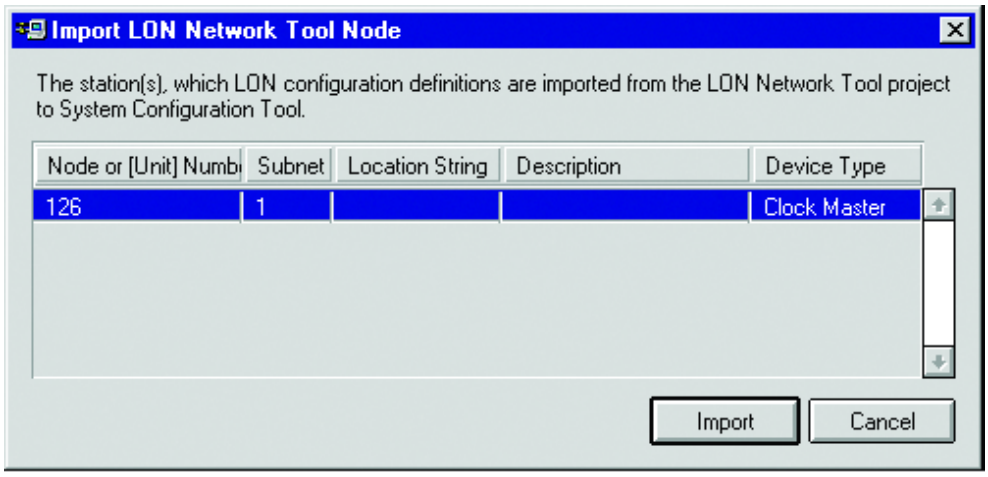


Figure 51: Clock Master device with node number 126 and subnet number 1 will be imported from LON Network Tool to SYS600 System Configuration Tool

Example:

Before data importation, the LON line is selected from the Object tree. See Figure 52.

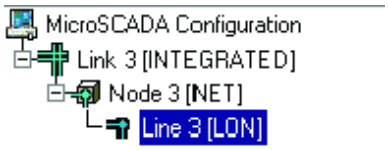


Figure 52: Object tree before the Single Node is imported

A LON/SPA Gateway with two child objects (two SPACOM devices) is imported from LNT (LON Network Tool). The object information is shown in the import dialog.

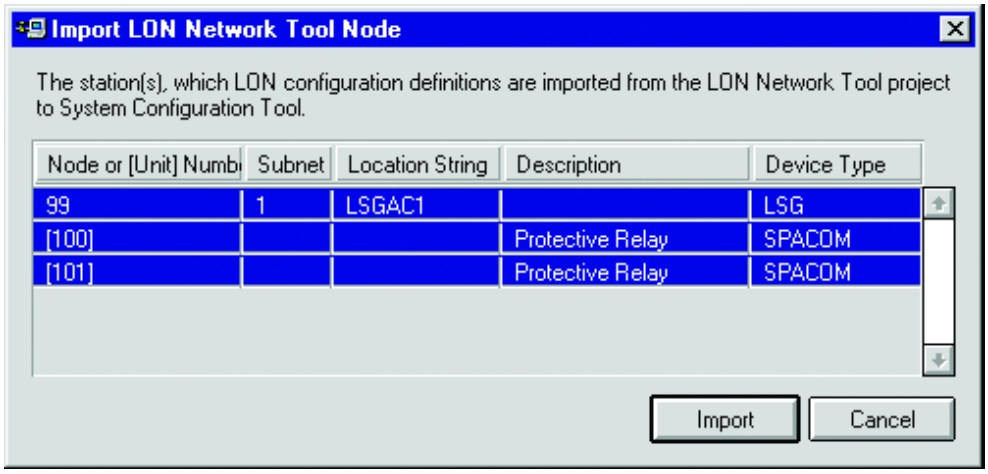


Figure 53: Object data in the Single Node import dialog

When the **Import** button is clicked in the import dialog, the data is transferred to System Configuration Tool. The new object with its child objects is shown in the object tree.

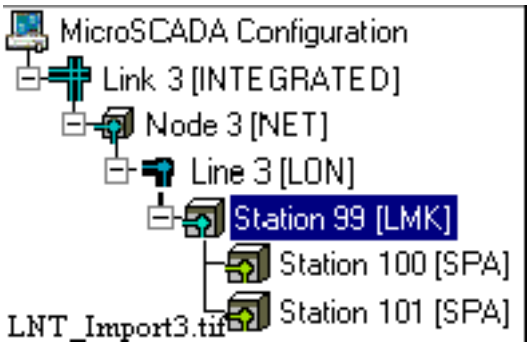


Figure 54: After the import operation, there is a new LMK station with two child objects in the Object tree

The imported configuration data can be seen and edited if the device is selected from the Object tree and **Tools/Signal Engineering** is chosen from the menu bar.

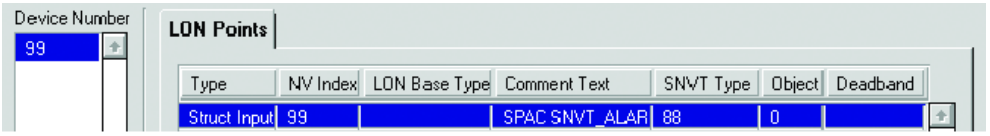


Figure 55: LON Point information for LMK device number 99

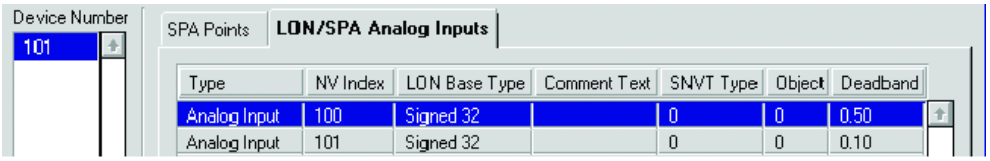


Figure 56: LON/SPA Analog Input information for SPA device number 101

The LON line number 3 imported information can be seen and edited, if the line is selected from the Object tree and the **Advanced** page is clicked visible.

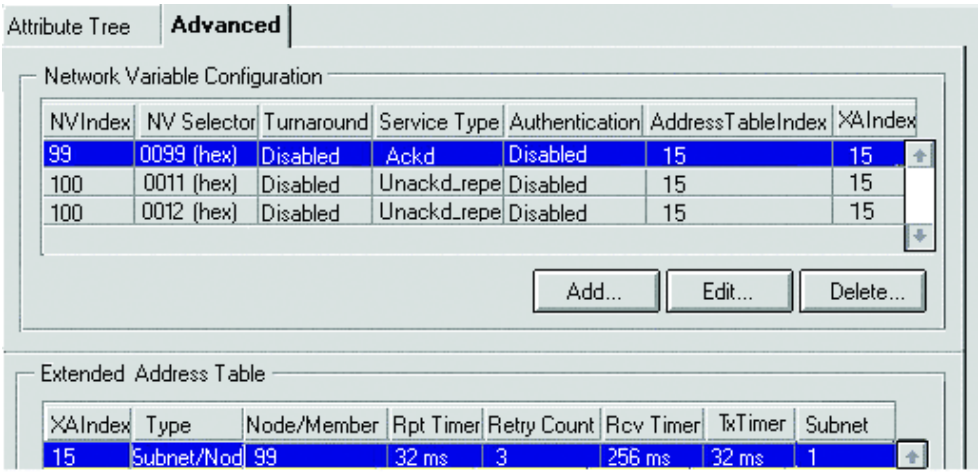


Figure 57: New entries for Network Variables and Extended Address Table for LON line number 3

4.8.2 Importing Multiple Nodes

If Multiple Nodes are going to be imported, the LON file is selected using the File Chooser. See Figure 50. When a LON file folder is selected, a dialog that shows the incoming data is

displayed. See Figure 59. Clicking **Import** starts the import of multiple nodes (clicking **Cancel** closes the dialog without importing any data).

When the import operation is completed, the signal information can be seen in System Configuration Tool by selecting **Tools/Signal Information** from the menu bar.

Example:

Before importing data, the LON line is selected from the Object tree. See Figure 58.

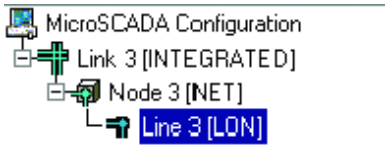


Figure 58: The Object tree before multiple nodes have been imported

Two REx devices, a LON/SPA Gateway with two child objects (two SPACOM devices) and four LON Clock Masters are imported from LNT (LON Network Tool). The object information is shown in the import dialog. See Figure 59.

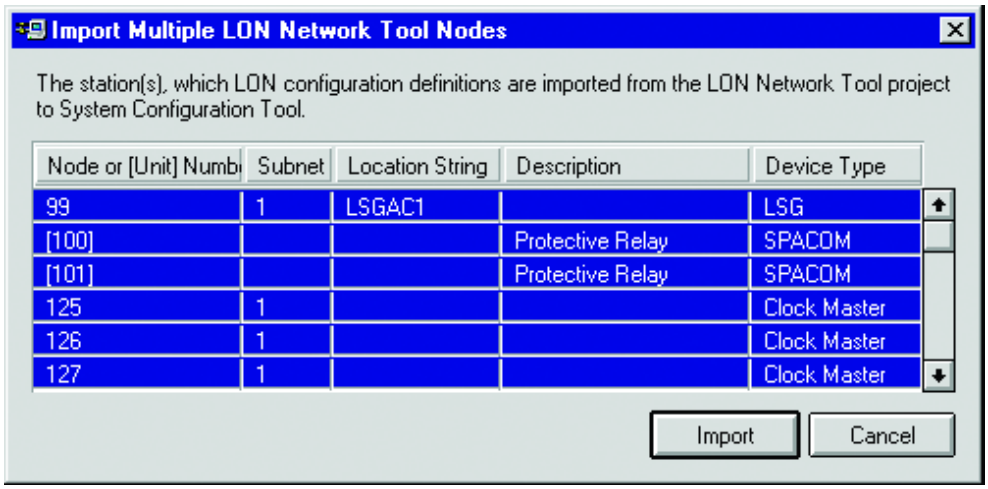


Figure 59: Multiple LON files are imported to System Configuration Tool when the Import button is clicked

When **Import** is clicked in the import dialog box, the data is transferred to System Configuration Tool. The new objects and their the possible child objects are shown in the object tree.

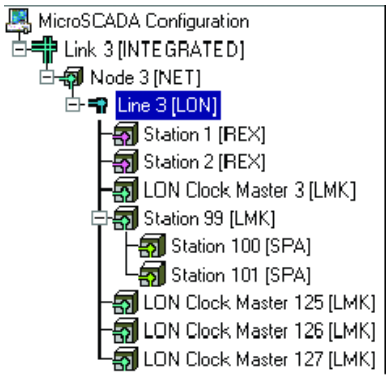


Figure 60: The Object tree after multiple LON files have been imported

The imported configuration data can be seen and edited by selecting the device from the Object tree and choosing **Tools/Signal Engineering** from the menu bar.

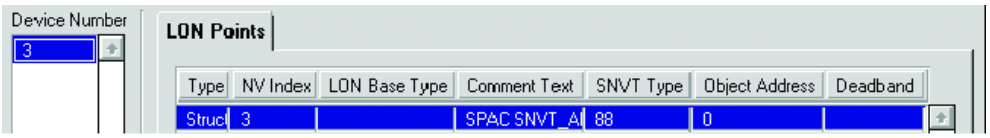


Figure 61: LON Point data for the imported LON Clock Master device number 3

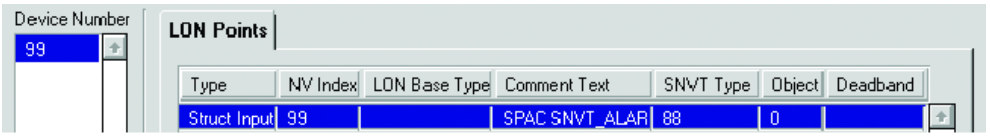


Figure 62: LON Point data for the imported LMK device number 99

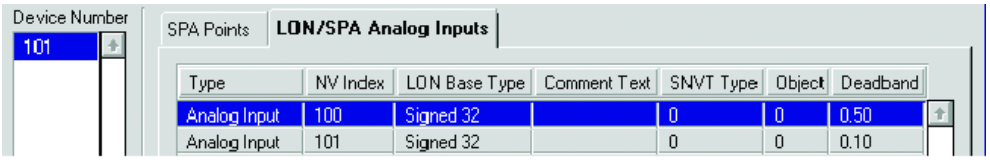


Figure 63: LON/SPA Analog Input data for the imported SPA device number 101

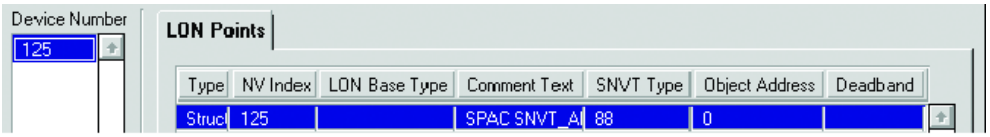


Figure 64: LON Point data for the imported LON Clock Master device number 125

The LON line number 3 imported information can be seen and edited by selecting the line from the Object tree and clicking the **Advanced** page visible.

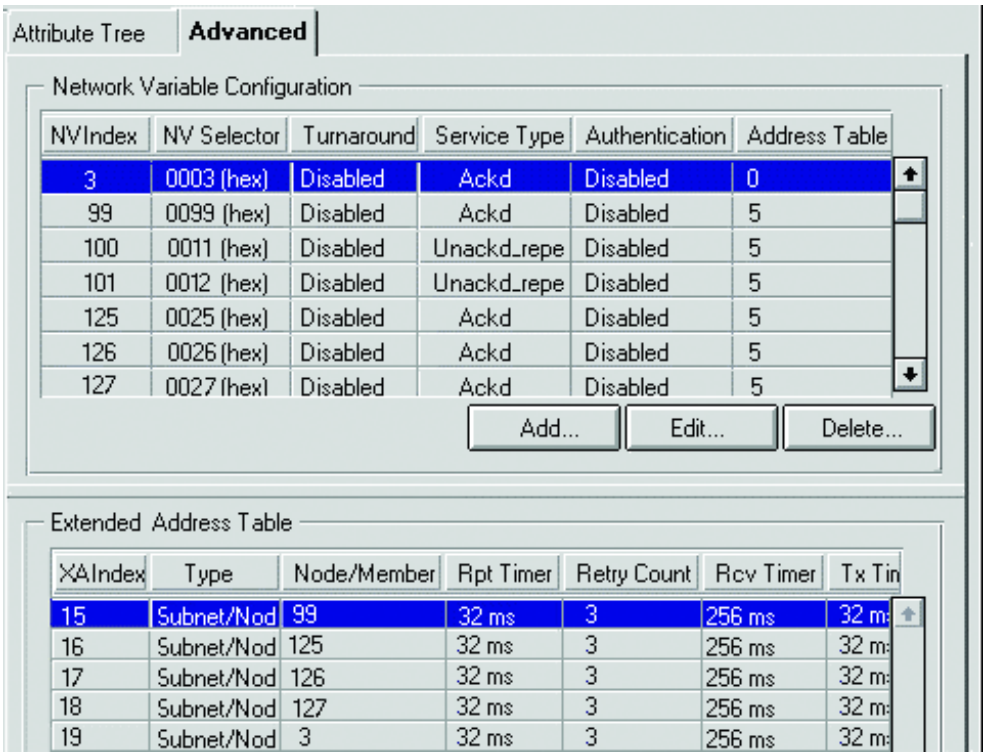


Figure 65: Network Variables and Extended Address table for LON line number 3

4.9 Optimizing the Configuration

4.9.1 Priority setting: SPA device connected through an LSG device

If the priority setting is used when connecting an SPA device through an LSG device. The setting must be as follows:

The first high-priority DI must be DI[15] (where 15 is the network variable) and the next high-priority DIs must have smaller indices in numerical order (DI[14], DI[13] etc.).

The same rule applies to the digital outputs.

The SYS:BTI setting must always be high enough in relation to the RT settings of the SPA and the LSG stations. In order to make sure that every RT poll can be finished successfully before the next RT poll is sent, the reply timeout for the SPA station behind the LSG must be greater than the reply timeout of the LSG multiplied with the number of the SPA stations behind the LSG.

One tested configuration is:

TI = 60s
SPA modules = 3
RT_{SPA} = 20s
RT_{LMK} = 5s

$N \times RT_{LSG} < RT_{SPA}$
$3 \times 5s < 20s$
$15s < 20s$

N is the number of SPA devices connected to the LSG device.

4.10 Event filtering between RED500 devices and SYS600

It is recommended to mask out unnecessary events in the bay unit to reduce the busload.

Event client (SYS600) orders the events from the relay according to event filter STA'n':SEF. In the relay the event filter refers to the corresponding event mask, which defines the events that are sent to the particular event client.

In SYS600, the event filter (EF attribute) must be defined before setting the station in use.

4.11 Testing the communication (SYS600 - REx device)

There are different methods for testing the communication between the SYS600 and REx devices:

In System Configuration Tool:

1. In online mode choose the REx device (Station) to be tested.
2. Choose **Tools** - **Send Message...** from the menu bar.
   The **Send Message** dialog opens.
3. Click **Send RF**, or write SPA message RF: and click **Send**. See Section 4.8.2.

If you get an identification to your message in the text field Reply from SPA, the communication is **OK**.

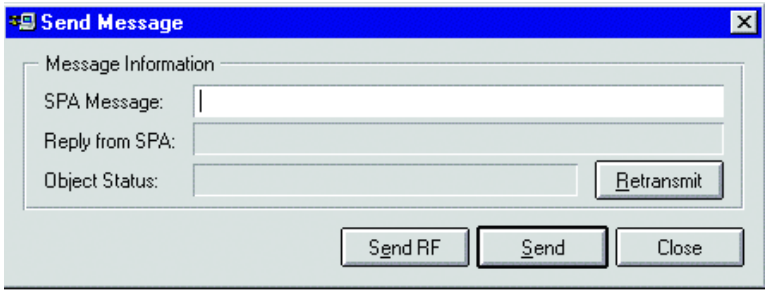


Figure 66: Testing communication with System Configuration Tool

Example 1:

Reply to the RF: message from a REF terminal:

<1D:REF543 :2A, when the station/node number is 1 and the terminal is REF 543.

It is also possible to test the connection to a SPA device the similar way:

Example 2:

Reply to the RF: message from a SPA device:

<11D:SPTO 1D2:07, when the station number is 11 and the SPA module is SPTO 1D2

It is also possible to test the connection to an LMK device by sending the node status poll.

In the Test Dialog:

1. Enter the following text on the command line:

```
#SET STA<station number>:SSM="RF:"
```

2. Press ENTER.
3. Read the value in a field with the notation STA<station number>:SSM.

In the REx tool picture:

1. Select SPA MESSAGE.
2. Enter the following command on the line SEND MESSAGE:
   RF:

The identification of the relay appears on the next line.

<1D:REF543 :2A, when the station/node number is 1 and the terminal is REF 543.

<11D:SPTO 1D2:07, when the station number is 11 and the SPA module is SPTO 1D2

4.12 Troubleshooting

4.12.1 Timeout setting

The SYS:BTI setting must always be high enough in relation to the STAnn:SRT setting.

One tested configuration is:

TI=60s and RT=5...20 s.

If the RT setting is too high it may cause a failure in answering the transparent SPA command (error 152). This happens if the SPA message through an LSG device fails and TI time elapses before a new SPA message has been sent.

4.12.2 Error message when connecting to a REC device

The possible reasons for getting the error message TRANSP_MSG_..., when sending SPA commands to a REC device are:

- Transmission of the command has failed because of a problem on the LONWORKS communication bus.
- The rerouting of an input signal has failed because of e.g. a wrong SPA address.

Check the configuration of the REC device.

Section 5 Technical description

5.1 Functional description

5.1.1 Summary of the LonTalk protocol based functions

The LonTalk protocol is a peer-to-peer protocol, which enables all devices connected to the network to talk to each other. Network nodes are identified by their own subnet and node number.

The LonTalk protocol supports two types of application layer objects: network variables and explicit messages.

- **Network variables** are used to deliver small data items, such as measurement values, status changes, interlocking data, blocking signals, alarms and events.
- **Explicit messages** are used to transfer longer pieces of information, such as packed sequences of events and explicit read and write messages to access device data. SPA-bus messages can also be sent transparently in explicit messages in order to transfer, for example, device parameters.

In a system supported by a high performance peer-to-peer communication network, data acquisition can be handled efficiently and reliably. Bay level devices can spontaneously transmit measured process values, status changes and events to multiple higher level devices. Higher level devices can read and write memorized values, settings and other parameter data from bay level devices when required. Additionally, the LONWORKS device bus enables the implementation of distributed control algorithms and distributed fault localization algorithms. Bay level devices can communicate directly with each other, in order to transfer, for example, interlocking information between bay controllers and blocking signals between protection relays.

5.1.2 Vertical communication

In ABB station automation systems, the following data is sent spontaneously from bay level devices to higher level devices:

- Measurement values.
- Status of the circuit breakers and isolators.
- Time-tagged alarms and events.
- Fault currents at the time of a relay trip.
- Distance to the fault location.
- Other recorded data related to the detected fault.

All this information can also be explicitly requested by higher level devices.

The following information is transmitted to higher level devices only upon request:

- Setting values and other parameters.
- Disturbance recordings.

Higher level devices transmit the following data to lower level devices:

- Control commands.
- Setting values and other parameters.
- Clock synchronization.
- Interrogation requests.

5.1.3 Summary of the PC-NET function

The task of the PC-NET is to convert the external protocols used for communicating with process units, such as relays and RTUs, to the ACP protocol which is used between PC-NET and the SYS600 base system. PC-NET also supports a number of slave protocols, which may be used for connecting to a higher level system.

5.1.4 Summary of the PCLTA card function

The PCLTA card acts as a LONWORKS network interface for the PC-based hosts.

5.1.5 Summary of the transceiver module RER 107 function

The RER 107 transceiver module acts as an interfacing unit between the PCLTA card and the fiber-optic LONWORKS network. The module converts the data signal from the PCLTA card to an optical signal and vice versa.

5.1.6 Summary of the Star-coupler RER 111 functions

The LONWORKS technology based star-coupler RER 111 is a device which enables the interconnection of various modules using the LONWORKS communication bus.

The RER 111 provides a star connection point where other LONWORKS technology- based devices can be connected. This is achieved by using five types of cards that can be connected within the nine slots provided. Each option card has a different role within a LONWORKS network.

- The fiber-optic option card provides three fiber-optic transceiver pairs for the following optional connection types:
  - The interconnection of the bay level devices.
  - Connection between two RER 111 units equipped with a fiber-optic option card.
  - Connection between the RER 111 unit and higher level devices, e.g. SYS600.
- The RS-485 option card is used for connecting a device using an RS-485 interface to the LONWORKS network. This card also comprises a fiber-optic transceiver pair.
- The SLTA option card provides an RS-232 interface for the network. It may be an interconnection between higher level devices (e.g. monitoring terminals, PCs etc.) and the LONWORKS network, or it may be a connection between RER 111 units using a fiber-optic transceiver pair.
- The router option card connects two different communication channels and passes LonTalk messages between them. One channel is the open collector bus of a RER 111 unit while the other can be either fiber-optic or transformer isolated twisted pair with a speed of 78 kbit/s or 1.25 Mbit/s speed (TP/XF-78 or TP/XF-1250). The router option card also provides a means of dividing a system into multiple sub-systems.
- The double connection option card can be used for connecting devices together with double connections. It can be used for connecting two fiber-optic transceiver pairs to any device that supports double connection (e.g. in HSB systems). If a fault occurs in one fiber-optic connection, the other can still receive and transmit data to the device.
- The SLCM option card provides a connection from time reference to the LONWORKS network. The SLCM option card includes an internal clock and an application program, which uses the internal clock to generate various kind of synchronization messages and signals in order to synchronize other devices in the LONWORKS network.

5.1.6.1 PCLTA card configuration

System Configuration Tool includes a mechanism for configuring the transceiver of the PCLTA card. This operation is usually done only once, when a new PCLTA-20 card is installed into a computer. If the transceiver becomes unable to communicate at a later date, it must be reconfigured.

System Configuration Tool also includes a mechanism for changing the node and subnet number of the PCLTA-20 card. This is done if there is a need to rearrange the addresses of the system. The mechanism is compatible with the LON Network Tool. This means that System Configuration Tool verifies that the parameter file (Nettools.ini) of the LON Network Tool is consistent with the address settings made by System Configuration Tool.

5.1.6.2 Default values

Link
If a valid link object number is entered, this new object becomes a child object of the SYS600 Configuration. During the addition of this new object, its attributes are given the following default values:

Table 20: Attribute values for a Link object

LT	Link Type:	"INTEGRATED"
SC	Start Command:	"\sc\prog\pc_net\pc_nets.exe"
CX	Comment Text:	""

Node
If a valid node object number is entered as an object number, this new object becomes a child object of a Link [INTEGRATED]. During the addition of this new object, its attributes are given the following default values:

Table 21: Attribute values for a Node object

LI	Link Number:	number of the parent object Link [INTEGRATED], e.g. 1
NN	LAN Node Name:	""
NT	Node Type:	"NET"
RN	Routing Node:	0
SA	Station Address:	203
DI	Diagnostic Interval:	0
DT	Diagnostic Time-out:	60
CX	Comment Text:	""

LON Line
During the addition of a new LON Line object, its attributes are given the following default values:

Table 22: Default values for the LON Line attributes

IU	In Use:	0
PO	Protocol:	27
PS	Buffer Pool Size:	50
Table continues on next page		

SD	System Device Name:	PCLTA 20: LON1...LON4
TI	Time-out Length:	7
LK	Link Type:	0
PD	Repeat Time Delay:	7
MI	Message Identification:	6101, where 6101 = 6100 + line number
MS	Message System:	1 (current application number)

SPA Line

During the addition of a new SPA Line object, its attributes are given the following default values:

Table 23: Default values for the SPA Line attributes

IU	In Use:	0
PO	Protocol:	14
PS	Buffer Pool Size:	50
BR	Baud Rate:	9600
PY	Parity:	2
SB	Stop Bits:	1
RD	Receiver Data Bit Count:	7
TD	Transmitter Data Bit Count:	7
DE	CTS Delay:	500
LK	Link Type	0
HT	Header Time-out:	1200
RL	Retry Limit:	2
PP	Polling Period:	10
PD	Polling Delay:	7
MI	Message Identification:	6102, where 6102 = 6100 + line number
MS	Message System:	1 (current application number)

REX Station

If a valid REX Station object number is entered, this new object becomes a child object of a Line [LON]. During the addition of a new REX station object, its attributes are given the following default values:

Table 24: Default values for the REX Station attributes

IU	In Use:	0
LI	Link Number:	1 (number of the parent object Line [LON])
NN	Node Number:	1 (station number)
SN	Subnet Number:	1
UN	Unit Number:	1 (station number)
UT	Unit Type:	0
ST	Station Type:	"REX" (type of the new station object)
ND	Node Number:	1 (parent object number of the Line [LON])
TT	Translation Type:	"EXTERNAL"

Table continues on next page

TN	Translated Object Number:	1 (station number)
AL	Allocation:	0
AS	Allocating Application:	0
SC	Session Nack Time-out:	500
SI	Session Idle Time-out:	5000
SK	Session Keep alive Time-out:	60000
SR	Session Retransmit Time-out:	2000
SS	Session in Sequence Response Delay:	500
SH	Session Setup Handling	0 (Not Configured) Possibility to configure session with or without downloading the substitution information for the station.
RQ	Receive Quota:	10
TQ	Transmit Quota:	10
RT	Reply Time-out:	20
EF	Event Filter Number:	0
HI	Historical Events:	0
HS	Event History Start Time:	(78-01-01 00:00:00, 0)
RM	Running Mode:	7
MI	Message Identification:	1001, where 1001 = 1000 + station number
MS	Message System:	1 (current application number)
CX	Comment Text:	""
GO	General Object Handling Command	• This attribute offers the possibility to send a command to the relay unit in the online mode. • The attribute is not shown in the attribute list and the information is not saved in a permanent configuration file of System Configuration Tool. • The errors, which may occur when sending these attribute values to PC-NET, are handled in System Configuration Tool.

LMK Station (in a LON Line)

During the addition of a new LMK station object, its attributes are given the following default values:

Table 25: Default attribute values for the LMK Station in a LON Line

IU	In Use:	0
LI	Link Number:	1 (number of the parent object Line [LON])
NN	Node Number:	2 (station number)
SN	Subnet Number:	1
UT	Unit Type:	3
ST	Station Type:	"LMK" (type of the new station object)
ND	Node Number:	1 (parent object number of the Line [LON])
TT	Translation Type:	"EXTERNAL"
TN	Translated Object Number:	2 (station number)

Table continues on next page

AL	Allocation:	0
AS	Allocating Application:	0
CT	Consistency Check Time:	0
DI	Diagnostic Interval:	0
RT	Reply Time-out:	5000
MI	Message Identification:	1002, where 1002 = 1000 + station number
MS	Message System:	1 (current application number)
CX	Comment Text:	""

SPA Station in a LON Line

If a valid SPA Station object number is entered, this new object becomes a child object of a Line [LON]. During addition of this new SPA station object, its attributes are given the following default values:

Table 26: Default attribute values for the SPA Station in a LON Line

IU	In Use:	0
LI	Link Number:	1 (number of the parent object Line [LON])
SA	Station Address:	3 (station number)
UT	Unit Type:	3
RL	Router LMK	2 (number of the parent object Station [LMK])
ST	Station Type:	"SPA" (type of the new station object)
ND	Node Number:	1 (parent object number of the Line [LON])
TT	Translation Type:	"EXTERNAL"
TN	Translated Object Number:	3 (station number)
AL	Allocation:	0
AS	Allocating Application:	0
UP	Update Points:	0
RT	Reply Time-out:	60
EC	Event to Data Consistency Check Period	20
EP	Event Poll Priority Class	1
MI	Message Identification:	1003, where 1003 = 1000 + station number
MS	Message System:	1 (current application number)
CX	Comment Text:	""

SPA Station in a SPA Line

If a valid SPA Station object number is entered, this new object becomes a child object of a Line [SPA]. During the addition of a new SPA station object, its attributes are given the following default values:

Table 27: Default attribute values for the SPA Station in a SPA Line

IU	In Use:	0
LI	Link Number:	2 (number of the parent object Line [SPA])
SA	Station Address:	4 (station number)
UT	Unit Type:	0
ST	Station Type:	"SPA" (type of the new station object)

Table continues on next page

ND	Node Number:	1 (parent object number of the Line [SPA])
TT	Translation Type:	"EXTERNAL"
TN	Translated Object Number:	4 (station number)
AL	Allocation:	0
AS	Allocating Application:	0
UP	Update Points:	0
RT	Reply Time-out:	60
EC	Event to Data Consistency Check Period	20
EP	Event Poll Priority Class	1
MI	Message Identification:	1004, where 1004 = 1000 + station number
MS	Message System:	1 (current application number)
CX	Comment Text:	""

5.1.6.3 Delete function

Deleting a configuration object means that the user navigates to the top of a tree leaf and selects the delete operation. The selected item is deleted.

Delete operation is not allowed for the MicroSCADA Configuration object (the main object) or configuration objects which include child objects.

Before the delete operation occurs, a caution dialog is displayed with the text "Do you really want to delete the selected object?" Clicking **Yes** deletes the selected object and clicking **No** cancels the delete operation. If the object to be deleted includes user-defined SCIL-programs or signals, those are deleted as well.

5.1.6.4 Cut, copy and paste functions

It is possible to cut, copy and paste the already defined objects in the configuration tree. Configuration object is copied to clipboard by selecting **Edit** and **Copy** or **Cut**. When the Cut operation is used, the copied object is also deleted from the configuration tree. Cutting an object is not possible, if the selected object contains child objects. Information copied to clipboard includes object attributes, values, user-defined SCIL-programs and signals.

Clipboard can only contain information of one configuration object. This means that when, for example, a LON Line is copied, the stations allocated to that line are not copied. The stations have to be copied separately. When a new object is copied to clipboard, any previous information located there is lost. Clipboard is also cleared, when System Configuration Tool is closed.

Pasting is done by first selecting an object to paste the copied object to, and then selecting **Edit** - **Paste** from the menu bar. During the paste operation some attributes are automatically set. What the attributes are depends on the copied configuration object. If the paste operation is not possible, a notification dialog with the text "It is impossible to paste the copied object from clipboard under selected object." and **OK** button are displayed to the user.

5.1.6.5 Preview function

When **Configuration** - **Preview** is selected from the menu bar of System Configuration Tool, the interpreter part of the tool constructs SCIL -commands from current configuration files. This is the same operation which is activated during the start-up of SYS600 when SYS_BASCON.COM template is used. The output of the preview functionality is also a SCIL-

program, which includes base system object commands and NET object commands for configuring SYS600. This output is seen in read-only mode in the SCIL Editor and it can be copied/printed. When the interpretation of this preview functionality is finished, a notification dialog with the text "This preview functionality includes interpreted SCIL-commands for base system and NET objects based on current configuration files." and **OK** button are displayed to the user.

5.1.6.6 Configuration of the station types

A SYS_BASCON.COM template is delivered together with System Configuration Tool. This new template modifies the contents of station types (STY:B) in the following way:

Table 28: The Station type configuration made by the SYS_BASCON.COM template

Number	Station Type Description CX	NA	DB
3	"ANSI X3-28"	**STA**	**STA**
4	"SPIDER RTUs"	**RTU**	**RTU**
5	"SINDAC (ADLP80 S)"	**SIN**	**SIN**
6	"P214"	**PCL**	**PCL**
7	"SINDAC (ADLP180)"	**SID**	**SID**
8	"PAC-5"	**PAC**	**PAC**
9	"SATTCON/COMLI"	**SAT**	**SAT**
17	"LON"	**REX**	**REX**
20	"LCU 500"	**LCU**	**LCU**
21	"SPACOM"	**SPA**	**SPA**
22	"S.P.I.D.E.R/RP570"	**SPI**	**STA**
23	"LonMark"	**LMK**	**REX**
24	"Ademco"	**ADE**	**STA**
25	"Procontic / RCOM"	**PCO**	**STA**
26	"Westinghouse"	**WES**	**STA**
27	"Alpha Meter"	**ATR**	**STA**
28	"PLC"	**PLC**	**RTU**
29	"IEC"	**IEC**	**IEC**

In System Configuration Tool there is a view called "All Attributes" for each station type. This view includes two categories: "Basic Attributes" and "Miscellaneous Station Type Attributes". System Configuration Tool displays following information about the station types:

Table 29: Station type information in the All Attributes view

View: All Attributes		Modifiable
Basic Attributes		
NA	Type Name	No
DB	Database Interface	No
Miscellaneous Station Type Attributes		
CX	Comment Text	Yes
CT	Cause of Transmission	Yes

5.1.6.7 Signal engineering

System Configuration Tool is integrated to subtools for handling signal information for devices. For each REX, LMK and SPA device type there is a corresponding configuration tool for managing SPA points, LON points and Event to Data information. These subtools can be launched from the **Advanced** page of a REX, LMK or SPA station using the **Edit...** button. The **Advanced** page also includes the number of signals for the selected station.

Table 30: The subtools that are integrated into System Configuration Tool

Tool	Configuration objects
REX Configuration Tool	SPA Points for REX devices
LMK Configuration Tool	LON Points for LMK devices
SPA Configuration Tool	SPA Points for SPA devices on LON and SPA lines, Event to Data for SPA devices

To transfer signal information from a subtool:

- Select **Configuration/Update** from the subtools menu bar.
  Information is transferred to System Configuration Tool, when **Configuration/Exit** is selected.

In each of the tools there is a possibility to cut, copy and paste signal information. Each of the tools handles signals dedicated to a station number selected in the configuration tree of System Configuration Tool. The station number can also be found from the Device Number list in subtool. Signals that belong to a station are listed in the subtool page(s). The page name(s), the number of pages and the number of columns vary depending on the station type.

The signals are managed using the **Add**, **Edit...** and **Delete** buttons of the page(s). The **Add** and **Edit...** operations open the signal **add/edit** dialog, where signal information can be entered and changed. Depending on the station type, the user interface of the **add/edit** dialog may be different. Before the Delete operation is carried out, a caution dialog, where the operation can be canceled, is displayed for the user.

5.2 Design

The LONWORKS device bus connects different parts of a protection and control system, including bay level devices (protection relays, control units, alarm annunciators, disturbance recorders) and higher level devices (control panel, operator terminal, SMS or SCS computer, RTU, process controller, Programmable Logic Controller or a gateway to the network control center). The ABB protection and control systems use a fiber-optic medium to protect against the electromagnetic noise generated by the primary equipment.

The integration of third party devices or subsystems, e.g. distributed I/O modules or condition monitoring equipment, can be supported using routers with transceivers to other media, e.g. twisted pair. In a similar way, remote devices can be connected to the main system with routers using e.g. a radio channel or a telephone line with modems.

5.2.1 System design

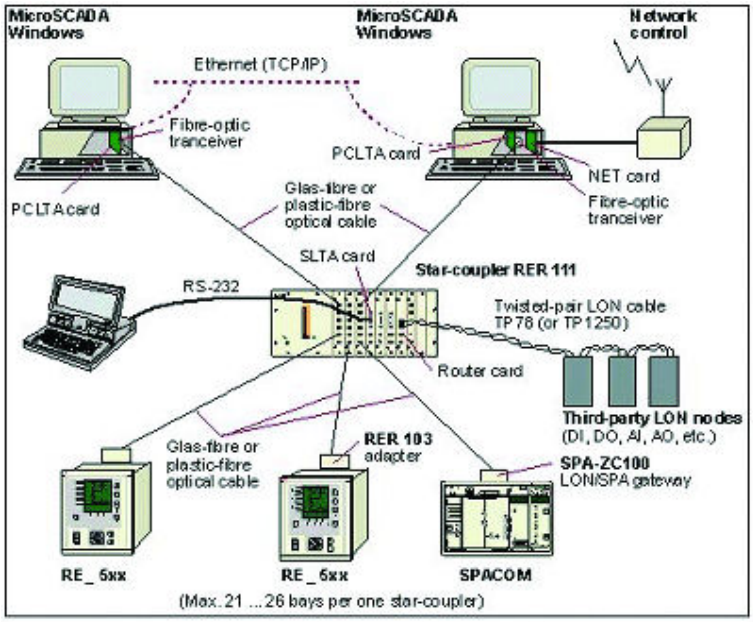


Figure 67: An example of a LONWORKS technology-based substation communication network

The physical structure of a LONWORKS technology based interbay bus is a star coupled fiber-optic bus. Up to 27 fiber-optic connections can be made to one star-coupler RER 111. The RER 111 can be linked to another RER 111 either directly or via a router.

A fiber-optic transceiver RER 107 is used for the connection between a PCLTA card and the star-coupler. A fiber-optic connection unit RER 103 is required for connecting a RE_54_ series terminal to the network.

The following modules are usually required when building a network that uses the LonTalk protocol using PCLTA-20 card:

- SPA-ZC 400
- RER 103 - Interface module for the RE_ 5_ _ series devices.
- RER 107 - SMX fiber-optic transceiver for the PCLTA card.
- PCLTA-20 card.
- RER 111 - Star-coupler.
    - SFIBER - fiber-optic option card, glass fiber or plastic fiber connection.
    - SRS485 - RS485 option card.
    - SREDU - Double connection option card, glass fiber or plastic fiber connection.
    - SSLTA - SLTA option card (serial LonTalk adapter).
    - SROUT - Router option card.
    - SLCM - LON Clock Master card.
- SPA-ZC 100/102 - LSG device.

5.2.2 Communication design

5.2.2.1 PC-NET

PC-NET is communication software that runs on the main processor of a Windows computer in parallel with the base system. The PC-NET software can use the serial line COM ports of the PC and the optical lines of the PCLTA card as communication channels.

5.2.2.2 PC LonTalk Adapter

PC-NET uses a PCI bus card called PCLTA-20 (PC LonTalk Adapter) from Echelon Corporation as a direct communication channel to the LONWORKS technology based interbay bus. One PCLTA card can have one channel (i.e. communication lines).

5.2.2.3 Master devices

LONWORKS technology-based bay level devices from ABB typically support two or more master devices simultaneously at the station level. This means that configurations with the independent SYS600-based station control system and the NCC gateway (COM 500i) are possible.

5.2.2.4 Subnets

A LONWORKS technology-based network may be divided into segments called subnets. Subnets can be connected together with or without routers. For performance reasons, it is recommended that no more than approximately 25 high performance devices are connected to one subnet.

When connecting PC-NET to a LONWORKS technology-based network, one channel of the PCLTA card should be reserved for each subnet.

5.2.2.5 Lines

The LONWORKS communication channel corresponds to a line in PC-NET.

Currently, one PC-NET supports up to 12 lines. Since 2 PCLTA cards, with 2 channels each, can be installed in one base system computer, only four LONWORKS channels can be used in one base system.

Each communication channel occupies one IRQ level on the base system computer and LNT 505 occupies one communication channel.

5.2.2.6 LSG device

The LSG device, type designation SPA-ZC 100/102, is a connection module for devices including the SPA-bus interface.

For a LonWorks network interface, the device includes a fiber-optic transmitter and receiver for glass core or plastic core fiber-optic cables.

For an SPA-bus interface the module includes a 9-pin male D-connector. The signal types used are RS-232, RS-485 or logic/TTL. The voltage levels used are +5V, +8V and +12V.

The SPA-bus device to which this module is connected can be any protective relay, control module or alarm annunciator, which has an interface for the SPA-bus. The SPA interface type (signal type and voltage level) is selected with the DIP-switches located between the D9-connector and fiber-optic connectors.

5.2.2.7 Fiber-optic interface

The fiber-optic LONWORKS bus can be implemented using either glass core or plastic core fiber-optic cables depending on the cost, physical distance and performance requirements. When a device is not transmitting, no light is sent to the fiber.

5.2.2.8 The router option card

The Router option card connects two different communication channels and passes LonTalk messages between them. One channel is the open collector bus of the RER 111 unit, while the other can be fiber-optic or transformer isolated twisted pair with a speed of 78 kbit/s or 1.25 Mbit/s.

The router option card can be used for improving network performance by dividing a large communication network into smaller sub-groups of nodes, or as a media converter to twisted pair media.

5.2.2.9 LON® clock master, SLCM option card

The LON® Clock Master (SLCM option card for the RER 111 unit) is designed to be used as a part of a communication system with LONWORKS data communication. The SLCM is a RER 111 compatible option card and connection to the LONWORKS network is provided by other RER 111 option cards.

The SLCM option card, when integrated within the RER 111 unit, provides a connection from a clock reference device to the LONWORKS network. The SLCM option card includes an internal clock and an application program. The program uses the internal clock to generate various kinds of synchronization messages and signals in order to synchronize other devices with the LONWORKS network.

According to the configuration, the internal real time clock is adjusted and one or more of five synchronization methods are accomplished sequentially. Configuration can be set via the LonTalk protocol.

For more information, see:

- SLCM Option card for LON® Star Coupler RER 111, Technical reference manual.
- SLCM Option card for LON® Star Coupler RER 111, Buyers guide TOB.

5.2.2.10 The transceiver module RER 107

The communication speed of the RER 107 is 1.25 Mbits/s. The transceiver module is provided with a LED which flashes when a message is being received from the fiber-optic cable.

5.2.3 System Configuration Tool design

5.2.3.1 Base system and PC-NET configuration

The configuration tool manages the base system and PC-NET configuration data for the following single computer/application system configuration:

- Several PC-NETs in the base system.
- 1-12 lines in the PC-NET with LonTalk and/or SPA protocol.
- REX devices connected to a LONWORKS line.
- LMK devices connected to a LONWORKS line.
- SPA devices connected to a LONWORKS line through an LSG device.
- SPA devices connected to a SPA line.
- All station type definitions (STY objects).

One PC-NET in the base system
The configuration tool configures the LIN and NOD base system objects needed for PC-NET. The PC-NET initialization file pc_net.cf1 is also updated automatically.

All configurable attributes of the LIN:B object and the NOD:B object can be changed from the configuration tool.

Before signal information between devices and the SYS600 process database has been established, LONWORKS points and SPA points have to be defined. The purpose of these points is to provide a routing mechanism between network variable indices and process database addresses.

LSG devices must be used when connecting SPACOM relays to the LONWORKS device bus. To build a valid LONWORKS configuration, the address tables and bindings have to be created between LSG devices and node objects using the configuration tool.

User-defined SCIL programs can be attached to each station. Each program receives as an input parameter its environment, which in station level is a station number. From station level, user-defined SCIL programs can also be attached to NET links, i.e. Lines. In the Line level environment parameters are NET and Line numbers. Also NET Nodes can contain user-defined SCIL programs. In NET Node level the environment parameter is NET Number.

Several PC-NET Support
When PC-NET is started or stopped and PC-NET communication software is included in the configuration, it is possible to identify, in a separate dialog, the PC-NET to which the operation is applied.

PC-NETs are numbered in a list. The net that has the lowest NET node number receives the number 1. The NET node number is also displayed in this list. One selected item in the list could, for example, be PC-NET 1 in Node 3.

Before the dialog is displayed, the PC-NETs, which can be started and stopped, are checked. For example, if PC-NET 1 in Node 3 is already running, it is not included in the list, if **Communication/Start PC-NET...** is selected from the menu bar.

Each PC-NET configuration can be previewed separately. This is done by selecting **Configuration > Preview/PC-NET...** In the case of several PC-NETs, a selection dialog is opened. This dialog lists all the PC-NETs that are included in the current configuration in the tool.

System Configuration Tool saves constructed NET specific SCIL statements with the name sys_net'node_number', where node number refers to the NET node number of the PC-NET. For example, if the configuration includes two PC-NETs assigned to NET nodes 3 and 4, the files which include their constructed SCIL statements are named sys_net3.scl and sys_net4.scl.

If several PC-NETs are included in the configuration, a separate dialog is displayed to identify which PC-NET the selected LONWORKS channel is connected to.

General mechanism for the base system configuration at system start-up
The base system objects, depending on the configuration entered in the configuration tool, are created when the base system starts. In the SYS_BASCON.COM file there is a call to a procedure which configures the base system objects.

General mechanisms for automatic starting and configuration of the PC-NETs
System Configuration Tool creates procedures for automatic start-up and configuration of the PC-NET(s). The automatic starting/configuration can be switched on or off. PC-NET can be started and stopped manually in online mode.

The automatic starting and configuration of the PC-NET works in the following way:

- A command procedure SYS_INIT_1:C is connected to the event channel APL_INIT_1:A as the first secondary object. If the list of secondary objects is full, the last one is removed and a warning is generated (notify window, log file).
- The command procedure SYS_INIT_1:C calls a text file (StartPCNET.scl) which starts PC-NET. The program in the text file first updates the sys_/pc_net.cf1 file and then starts PC-NET by setting the corresponding base system link object type to INTEGRATED.

For each PC-NET found in the permanent configuration file SysConf.ini located in folder \sc \sys\active\sys_, the following information is acquired to fill the contents of the pc_net.cf1 file:

Table 31: Basic information for each PC-NET that is found from the SysConf.ini file

	Source	Key name	Example
Station address (PC-NET)	SysConf.ini	local_node.sa	204 (NOD4:BSA)
Node number (PC-NET)	SysConf.ini	local_node.nn	4 (NOD4)
Station address (base system)	SYS_BASCON.COM	ext_node(1).sa	209 (SYS:BSA)
Node number (base system)	SYS_BASCON.COM	ext_node(1).nn	9 (SYS:BND)
Node number (application)	SYS_BASCON.COM	ext_apl(1).nn	9 (SYS:BND)
Application number	SYS_BASCON.COM	ext_apl(1).an	1 (APL:BAN)

- PC-NET sends a system message to the application when it is started. This message is received by a process object to which an event channel, SYS_NET'net_number'D:A, is connected. This event channel calls a command procedure SYS_NET'net_number'D:C. If the process object exists (e.g. created by LIB5xx) and has an event channel connected to it, all objects connected to that event channel are moved to the SYS_NET'net_number'D:A event channel as secondary objects. In other cases, the tool automatically creates a process object SYS_NETD:P('net_number'), to which the event channel SYS_NET'net_number'D:A is connected.
- The command procedure SYS_NET'net_number'D:C checks the message coming from PC-NET and if this is the start message (10001), PC-NET is configured according to the information entered in the tool.

All error messages which occur during the start-up or configuration of PC-NET are shown in the Notification window and logged in a log file which can be viewed in the configuration tool.

Online monitoring of the base system and the NET configuration
The online configuration can be read into the tool by selecting **Configuration**/**Open Online**. Reading the online configuration sets the tool in online mode. Online mode includes the following functions:

- Diagnostic counters of the links.
- Diagnostic counters of the NET lines.
- Diagnostic counters of the stations.
- Starting/stopping PC-NET.
- PCLTA initialization/LON address setting.

The following information is read from the online configuration:

- Station type definitions, STYn:B (where n = 3 .. 9, 17, 20 .. 29).
- Integrated link between the base system and PC-NET, LINn:B and base system links of the type LAN and RAM.
- PC-NET node object, NODn:B.
- PC-NET lines with protocol: LonTalk, SPA, IEC 60870-5-101/103 and DNP V3.00 Slave.
- Lines with protocol: ANSI X3.28 XF, RAM, ASCII, RP570M/RP571M and RP570S.
- Stations of the type REX, LMK, SPA, LON Clock Master, IEC, SPI and RTU.
- LON and SPA-points for REX, LMK and SPA devices.

5.2.3.2 System configuration methods

The following System Configuration methods are used to read configuration information from an active configuration file. These methods are ordinary SCIL-files with a certain number of parameters. The functions are used internally by System Configuration Tool and system start-up methods related to it.

These files are all located in \sc\Stool\SysConf\ folder. They can also be found using sys_tool logical path. Each function has an argument called Object Type. This argument can have following values and meanings

Table 32:

Value	Meaning
"BASE_SYSTEM_LINK"	A LINK object located in the base system (LINn:Bxx)
"BASE_SYSTEM_NODE"	A NODE object located in the base system (NODn:Bxx)
"BASE_SYSTEM_STATION"	A STATION object located in the base system (STAb:Bxx)
"BASE_SYSTEM_STATION_TYPE"	A STATION TYPE object located in the base system (STYb:Bxx)
"NET_STATION"	A NET STATION object located in NET (STAn:Sxx)
"NET_LINK"	A NET LINK object located in NET (NETn:Sxxy)

In the table above:

n = any valid number for the current object type

xx = any valid two character attribute convention for the current object type

y = any valid line number for the current NET LINK object

5.2.3.3 PCLTA card initialization

Prepare function
When preparing the PCLTA card, the configuration program makes the following settings:

Table 33: PCLTA card settings made by the initialization program:

comm_type	**1**	Single-Ended
comm_pin_dir	**0x0E**	Direct Mode - Single-Ended
direct_param_struct		Collision detection
comm_clock	**0**	(8:1)
input_clock	**5**	10.0 MHz
LON Bit Rate		1.25 Mb/s

The program performs a reset operation to implement the settings.

The PCLTA card address is read but not changed by the program. The factory setting is subnet 1 / node 109. For SYS600, this address is not significant.

Address setting
If there is a need to change the PCLTA card address, the new address is written into the Neuron chip domain. If the LON Network Tool is installed, the address is also updated in the Nettools.ini file (Windows system folder).

The configuration program performs the following operations:

1. The new address is sent to the Neuron chip domain.
2. If the address is received successfully, the Neuron chip is set to configured online state.
3. The program checks whether the whole operation was successful and carries out a reset operation.

Section 6 Terminology

Term	Description
Application	An application contains all the data and tools which are needed for the supervision and control of a system. It contains supervisory pictures, event lists, alarm lists, event and alarm printouts, reports on a daily, weekly and monthly basis, etc. It stores actual values, which are essential to allow the supervisory staff to monitor the current state of the system. It also stores data and performs calculations for reports. The application may also contain automatic functions which carry out not only simple routine tasks, such as verifying user authorizations and printing out reports, but also operational sequences which are activated, for instance, in fault situations.
Attribute	Individual data items which form a part of an object are called attributes. Each object has a set of attributes that store information and describe the qualities of the object. The attributes contain measured values, texts, program lines, time stamps etc., depending on which object type is concerned.
Collision detection	Collision detection is used optionally in our systems. It is not mandatory for all devices connected to the system to support collision detection. This would not be possible for some devices which interface with specific network media. Collision detection should be used by devices which send time-critical messages, e.g. interlocking data or blocking signals. Collision detection, together with priority slot assignment, is used to guarantee deterministic transfer of these messages especially in high load situations. If a collision occurs and is detected, the transmitting nodes terminate transmission and start waiting for their time slot within the next packet cycle. This allows the retransmission of a priority message to be started immediately within the next packet cycle. It is then extremely unlikely that a collision should occur with this message.
Communication channel	A physical connection layer established for communication between devices, specified by the medium used, transmission speed and other timing parameters.
Configuration properties	Configuration properties contain configuration and parametrization data used to customize and optimize the behavior of a node or a particular application in the node. Configuration properties are represented either by network variables (configuration network variables) or by configuration parameters. The latter can be accessed using the LonTalk file transfer protocol or memory read and write messages.
Explicit message	An application layer object containing a maximum of 229 bytes of data. Explicit messages are used to transfer longer pieces of information, such as packed sequences of events and explicit read and write messages, to access device data. SPA-bus messages can also be sent transparently in explicit messages to transfer e.g. device parameters.
Gateway	See LSG device.
Horizontal communication	Direct communication between bay level devices, for example, REF54x protection terminals.
Interoperability	A property which ensures that different devices (from the same or different manufacturers) which communicate with one another can be integrated into the same network without any need for the customization of device-specific features.
LonMark	See LonMark Interoperability Association.
LONMARK device bus	A LONMARK device bus is a peer-to-peer bus, in which all nodes (e.g. protection terminals) in the system can talk to each other. This allows horizontal communication at station level.
LonMark Interoperability Association	An independent world-wide industry association, which facilitates the development and implementation of open, interoperable LONWORKS technology based control products and systems. The LonMark association includes manufacturers, end-users and integrators of LONWORKS products. The association establishes guidelines, such as "LonMark Application Layer Interoperability Guidelines", defines standard functional profiles of control devices and certifies products on compliance with interoperability guidelines.

Table continues on next page

Term	Description
LonMark compliance	Conformance to LonMark interoperability guidelines. On the application layer interoperability between LONWORKS technology-based products is facilitated through the use of SNVTs and LonMark objects.
LonMark object	A set of one or more network variables implemented as SNVTs with definitions relating to the behavior of the object and the network variable values, as well as to the set of configuration properties. LonMark functional profiles serve as classes for LonMark objects.
LON/SPA Gateway	See LSG device.
LonTalk protocol	The communication protocol used in LONWORKS networks. The LonTalk protocol is an open protocol Which follows the reference model for open system interconnection (OSI) designed by the International Standardisation Organisation (ISO). The LonTalk protocol is a CSMA-type protocol (Carrier Sense Multiple Access) with a built-in predictive collision avoidance algorithm and optional collision detection. The collision avoidance algorithm is based on synchronized random selection of the time slot by all nodes that are ready to transmit. The number of randomized slots can be dynamically increased when a higher network load is predicted by the protocol.
LONWORKS network	"Local Operating Network". (The abbreviation LON is used in some documents, but should not be used as a separate word.) A network based on LONWORKS technology. Intended for short-range communication and typically used when a set of devices located physically close to one another need to communicate with one another.
LONWORKS technology	Communication technology developed by Echelon Corporation.
LONWORKS technology-based system	A system that uses the LonTalk protocol as a communication protocol in some or all parts of the system. The communication network is based on LONWORKS technology.
LSG device	A protocol converter. Carries out conversions between the SPA protocol and the LonTalk protocol. This means that SPACOM relays can be connected to the LONWORKS network.
Network variable	An application layer data object, which contains a maximum of 31 bytes of data. Network variables are used to deliver small data items, such as measurement values, status changes, interlocking data, blocking signals, alarms and events. Network variables are addressed using network variable selectors. A selector is a 14-bit number in the range 0 to 12287 (2FFFH).
Neuron chip	An 8-bit microcontroller with a communication interface, manufactured by Motorola and Toshiba. The LonTalk protocol is implemented in firmware. In simple devices the Neuron chip can execute both the protocol firmware and an application program. In complex devices (e.g. PC-based) an application program is run in the host microprocessor, while the Neuron chip is used only as a LonTalk protocol processor.
Node	A device in a subnet, e.g. REF Protection Terminal.
Node number	A unique identifier of the node within a subnet.
Object	The data in the process and report databases is organized into objects. These are entities that contain sets of different data. The objects have logical names and they are able to communicate with each other according to the rules defined by application programming.
PCLTA card	LONWORKS network interface card for a PC. A PCI bus card with a slot for a transceiver card for optical connections to the network. PCLTA-20 card is manufactured by Echelon Corporation.
PCLTA-20	The LON connection card from Echelon Corporation is suitable to use only in the 5 V PCI slot. The card has one channel and needs one RER 107 module.
Priority slots	Dedicated time windows to be used for transmitting emergency messages. Each configured time slot is exclusively assigned to a selected node. A maximum of 255 priority time slots can be configured in the LonTalk protocol. Each device which transmits time-critical data, such as interlocking/blocking messages or clock synchronization messages, must be assigned as a priority slot to enable prioritized access to the communication medium.
Process Unit	An interface between the process and the SYS600 system.

Table continues on next page

Term	Description
REX device	A unit which communicates vertically with SYS600, as defined in the LON Applications Guidelines (e.g. a REF54x protection terminal).
Router	A device equipped with two network interfaces. A router is capable of interconnecting two different communication channels. These channels may use different network media, different network speeds and timing parameters or may be used by different subsystems identified by subnet numbers.
SI/SD information	Self Identification / Self Documentation information, which is stored as an ASCII text array in a node's memory and contains information about the node and its network variables.
SPA device	A SPACOM module connected to the LONWORKS network via a protocol converter. The converter is called an LSG device.
Star-coupler	A star-coupler (RER 111) is a device which provides connectivity to 3 or more devices with fiber-optic interfaces. Each external interface of the star-coupler is a fiber-optic transmitter-receiver pair, internally connected to a common bus. The star-coupler itself does not contain a network node, but its operation is restricted to the physical layer of the protocol. A signal provided to the receiver from one external connection is forwarded to the transmitters of all other external connections.
Subnet	Part of a network. A network may include several subnets separated from each other by star-couplers. For example, HV (high voltage) devices may constitute one subnet and a group of MV (medium voltage) devices another one.
Vertical communication	Communication between bay level devices and higher level devices, for example, between a REF54x Protection Terminal and SYS600.

Section 7 Abbreviations

Abbreviation	Description
HSI	Human System Interface
ISO	International Standardisation Organisation.
LAN	Local area network. Workplaces and communication units can be connected to the base system via a LAN.
LMK	LonMark device. See LMK device in "Abbreviations".
LON	See LONWORKS network in "Abbreviations".
LSG	See LSG device in "Abbreviations".
MMI	Man Machine Interface.
NV	See Network variable in "Abbreviations".
OSI	Open system interconnection.
PCLTA	PC LonTalk Adapter. See also PCLTA card in "Abbreviations".
RTS	Request to send.
RTU	Remote terminal unit.
SCIL	Supervisory Control Implementation Language. SCIL is a picture and object oriented, high level language for application programming in SYS600. SCIL is used in pictures and in command procedures. SCIL expressions and conditions are also used in datalog objects and time channels.
SCPT	Standard Configuration Property Type. The definition of an SCPT includes unit, range, resolution and data format. SCPTs are listed in "The SCPT Master List", which is updated by Echelon Corp. and includes configuration property types commonly agreed on by a large number of manufacturers.
SLTA	Serial LonTalk Adapter. An option card with a serial interface for the star-coupler RER 111. Enables a serial line connection (e.g. RS-232) to the LONWORKS network.
SNVT	Standard Network Variable Types (SNVTs) facilitate interoperability by providing a well-defined interface for communication between nodes made by different manufacturers. A node may be installed in a network and logically connected to other nodes via network variables as long as the data types match. The definition of an SNVT includes unit, range, resolution and data format. SNVTs are listed in "The SNVT Master List and Programmer's Guide". This list is updated by Echelon Corporation and includes network variable types which are commonly agreed on by a large number of manufacturers.

Index

Hitachi ABB Power Grids
Grid Automation Products
PL 688
65101 Vaasa, Finland

https://hitachiabb-powergrids.com/microscadax

Scan this QR code to visit our website

1MRK 511 470-UEN