

Data Concentrator TELEM-GW6e

User Manual

**Martem AS
2013**

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1. Main Tasks

The tasks of the Data Concentrator TELEM-GW6e (GW6e) include the following:

- To control and monitor the system from the control center using data communication protocols IEC 60870-5-101 and IEC 60870-5-104
- To concentrate data collection from lower level peripheral devices and control them by using different data exchange protocols

2. Possible Applications

- Data acquisition and control of regional and national electricity utilities in SCADA systems for remote control and substation automation
- Comprehensive integration of different devices
- As a communication gateway

3. Features

- TELEM-GW6e base model includes basic card with built-in communication ports
- Expansion card 1 and 2 are optional extras (see 5. Technical Data)
- Data concentrator with an associated event annunciator performing substation level master unit functions in the substation secondary equipment system
- Duplex data communications between the feeder and the equipment level versus the station control level in substations using different communication protocols and cross-referencing between the protocols
- Full scale data exchange between the levels of the substation control system including setting values, measurement values, registered fault parameter values, changes of state with associated time markings etc
- Data concentrator provided with serial interfaces to facilitate the connection between local output devices and external host systems
- All the settings can be changed using software configuration tool
- Output channel to the remote control system can be connected to a leased or a dial-up line using a copper line-, radio- or GSM modem
- Built-in 3xEthernet connections, GPS time synchronization port and console port
- Transparent TCP/IP connections via Ethernet ports
- Cross-referencing of data exchange protocols
- User friendly configuration tool
- Firewall functionality
- Available VPN connection
- Configurable remotely over communication line
- Fiber-optic serial, fiber-optic GPS, RS-422 and RS-485 connections expansion card with internal fault relay contact
- 8xRS-232 connections expansion card
- Real-time clock with back-up capacitor

- Data concentrator GW6e is provided with control input for clock synchronizing purposes using GPS
- GW6e time synchronization by communication protocol (IEC 60870-5-101, IEC 60870-5-104) from control center's channels (GW6e time synchronization is possible from multiple control centers)
- Time synchronization of substation devices by communication protocol (IEC 60870-5-101, IEC 60870-5-103)
- Time synchronization by NTP protocol (on Ethernet connection)
- Logical operations between digital and analog signals can be described
- PLC logic support, configuration tool with integrated PLC editor in compliance with IEC-61131-3 standard
- TELEM RTU devices can be remotely configured across TELEM-GW6e
- Configuration export to ASCII, CSV format files
- A user-friendly user interface similar to Microsoft® Windows™
- Data sending with time and quality stamp

4. View

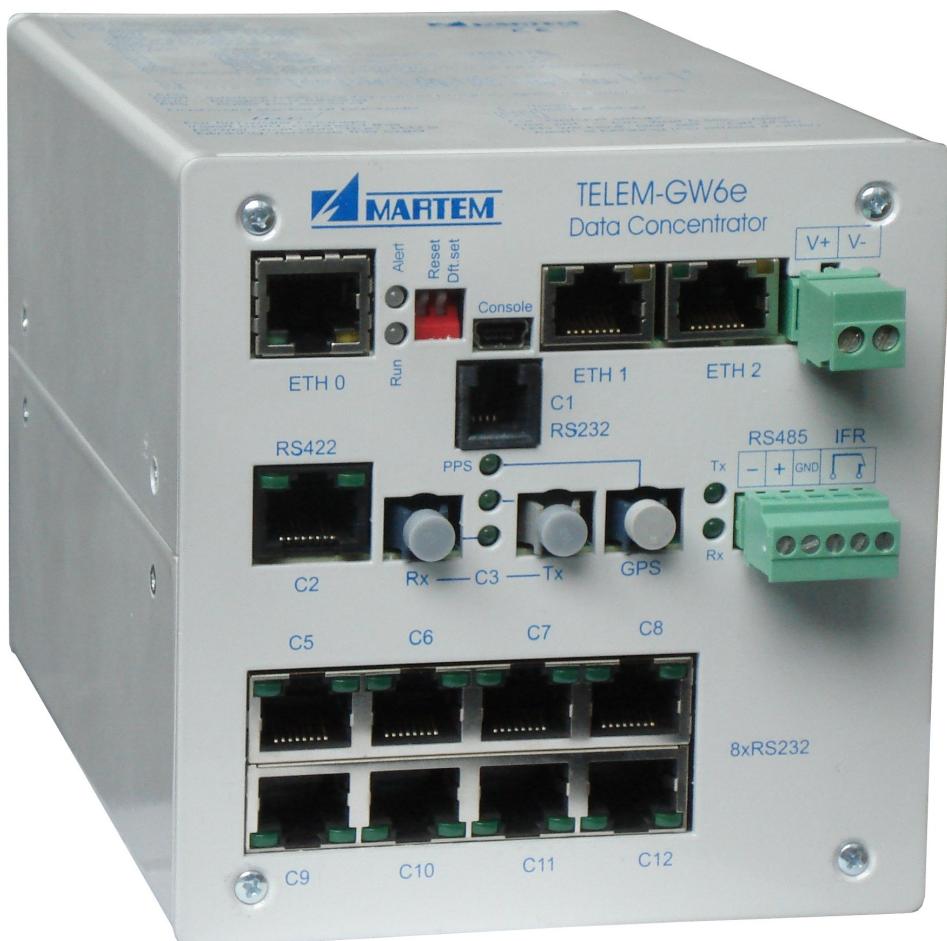


Figure 4 TELEM-GW6e view

5. Technical Data

Data communication protocols

- To higher level systems IEC 60870-5-101 unbalanced and balanced, IEC 60870-5-104
- To lower level devices IEC 61850, IEC 60870-5-104, IEC 60870-5-103, IEC 60870-5-101 Unbalanced, SPA-Bus, IEC 62056-21 (IEC 1107), Modbus-RTU, Modbus-TCP

Communication ports

Communication ports may be freely configured for upper or lower level communication

Built-in

- 1,2 GHz CPU, 1 GB RAM and 256 MB flash memory
- 3x Ethernet connection with RJ45 connector (galvanically isolated)
- 1x RS-232 connection with RJ12 (4P4C) connector
- 1x miniUSB console port

Expansion card 1

- 1x Fiber-optic connection with ST or Versalink connectors
- 1x RS-422 serial connection (optically isolated)
- 1x RS-485 serial connection (optically isolated)
- 1x GPS Fiber-optic connection with Versalink connector
- 1x Internal fault relay contact

Expansion card 2

- 8x RS232 with serial connections with RJ45 connectors

Data communication parameters

- 1 start bit
- Odd, even or no parity
- Communication rates from 300 to 115200 bit/sec

Electrical characteristics of isolated input

- | | |
|---------------------------------|--------------------------|
| • Dielectric withstand | IEC 60255-5 |
| • Withstand to static discharge | IEC 61000-4-2 |
| • Withstand to surges, bursts | IEC 61000-4-4, 61000-4-5 |

Mechanical parameters

- | | |
|------------------------------------|--|
| • Degree of protection | IP 30 |
| • Dimensions (W x H x D) | 108 x 110 x 165 (190 with protruding parts) mm |
| • Ambient temperature in operation | -20°C...+50 °C |
| • Weight | 925 g |
| • Mounting | DIN rail |

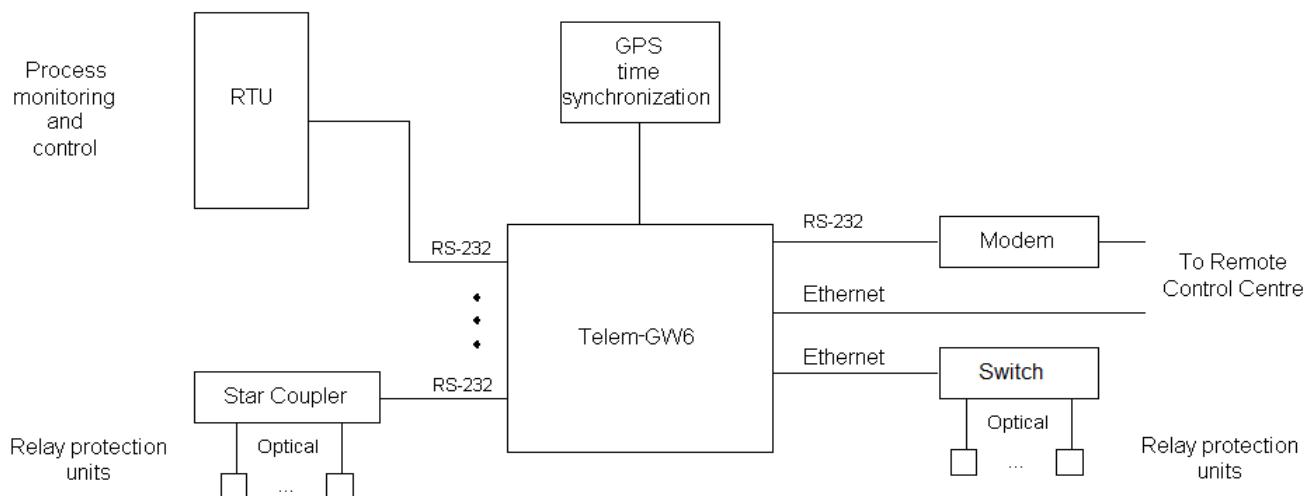
Radio frequency compatibility

- RF emission IEC 55022 Class A
- Immunity to RF fields IEC 61000-4-3, 61000-4-6

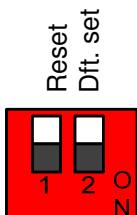
Power supply

- Supply voltage range 10 to 72 V DC
- Power consumption < 8 VA

6. Typical Application for Electric Power Station



7. Switches



1 – Reset: Switch RESET to ON state and then back to OFF state for Reset operation

2 – Dft. Set: To apply default setup:

1. Switch DFT. SET to ON state
 - *Alert indication LED starts blinking within 5 seconds
 - *Alert indication LED will blink for 2 seconds
2. Switch DFT. SET back to OFF state when the alert indication LED is **blinking** to apply default setup
 - *If DFT. SET is switched back to OFF state when the alert indication LED is not blinking, default setup will NOT be applied

For operation

Green LED – Blinking green indicates that the program is running

Red LED – Failure

For communication

Green LED at GPS port – blinking indicates the existence of GPS time synchronization.

9. Remote monitoring of operation

The status and operation of the device can be examined from log files.

The log files can be accessed via built in Web interface or can be downloaded via SSH connection.

The status information is recorded in status log files and the events archive is retained in events log files.

9.1 Status log

Detected status changes and errors are stored in text files and are physically saved to device's flash memory.

The following information is recorded:

- The communication breaks and recoveries with substation equipment
- Starts
- Watchdog operations
- Software error messages
- Communication ports failures
- TCP/IP channels open and close operations, failures

9.2 Events archiving

Console log files, events and errors are collected and archived in the form of text files and are physically saved to device's flash memory. By default, each log file have size at 5 MB. Events log will be updated only if any events occur. If no events are detected, nothing will be written to events text file.

Device have 3 opportunity to download data files to your personal computer.

- a) Use Web browser. Logs are opened and viewable in text format on the screen.
- b) In case with Martem's software GWS, under  button in opened window use button "Get Logs". Saved data is compressed archive in .tar.gz format.
- c) Use a command prompt.

10. GW6e Configuration Tool

10.1 Getting Started

Configuration program works on Windows operating systems. When starting the GW6e configuration program, user interface window with the main menu is opened:

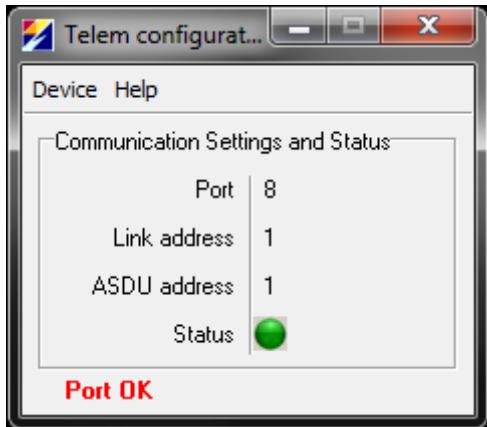


Figure 10. 1.1 User interface window

The following parameters are shown for information:

- **Port** – PC port which is used to communicate with GW6e
- **Link address** – Link address of GW6e
- **ASDU address** – ASDU address of GW6e
- **Status** – Status of the connection. RED – no connection, GREEN – connection OK

Device menu

- **Device** – For selecting the device type
- **Communication Setup** - For changing communication parameters (figure 10.1.2)
- **GW6/RTA-A conf redirection** – see 10.5 Configuration of connected I/O modules remotely through the GW6e

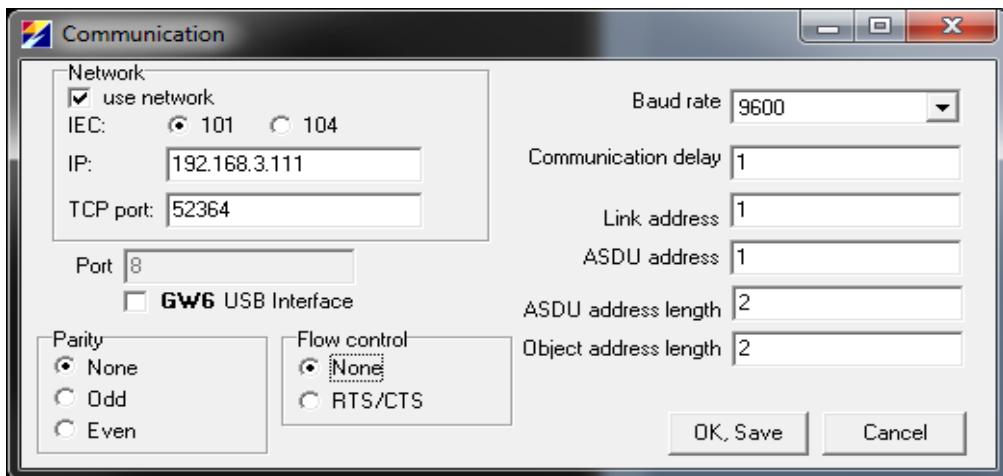


Figure 10.1.2. Communication parameters window

Fields in the communication parameters window

- **Network** – use protocols IEC 60870-5-101 or IEC 60870-5-104, IP address and TCP port for communication with device
- **Port** – PC communication port which is used to communicate with GW6e
- **GW6 USB Interface** – Check if USB port is used for communication
- **Parity** – Use of parity control bit
- **Baud rate** – Data communication rate
- **Communication delay** – Delay between reception of data and the next query in milliseconds
- **Link address** – Link address of GW6e
- **ASDU address** – ASDU address of GW6e
- **ASDU address length** – The length of the ASDU address in bytes: typically 2, possible values are 1 or 2.
- **Object address length** – Length in bytes. Typically 2, possible values are 1, 2 or 3.

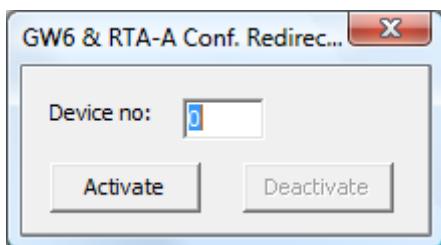


Figure 10.1.3. GW6e/RTA-A conf redirection window

- **Device no** – Number of the device which is configured (see 10.3.2 Devices Tab Card)
- **Activate/Deactivate** – Activate to configure the desired device; Deactivate to configure GW6e

10.2 GW6e Configuration Window

To open the GW6e configuration window, select **Device > GW6e** from the user interface main menu.

Shortcut icons below the menu bar:

	Open a new configuration
	Open a configuration file
	Save the configuration to a file
	Add or Delete ports, devices, objects etc
	Programming formulas with PLC function blocks
	Load XML file (IEC 61850)
	Reload all XML files attached to devices (IEC 61850)
	SSH setup GW6e
	Read the configuration from GW6e
	Write the configuration to GW6e
	Cancel SSH Read/Write process
	SSH setup
	Firmware Update over SSH
	Save configuration data in .csv file format
	Import configuration data from .csv files about ports, devices, objects, formulas etc

* Possible Reset codes:

- 1 – Simple Reset
- 2 – Reset that also clears memory buffers
- 3 – Reset that also restores the default setup

Saving, editing and opening configuration data

Configuration data is saved to the hard disk in the form of comma separated files *.csv files when the **Save** or **Save As** command is chosen from the File menu. Correspondingly, the **Open** command from the File menu opens this type of file. **Open** and **Save** can also be accessed via shortcut icons.

*.csv files can be conveniently edited with Excel software or even with any text editor program (like as Notepad++). When editing the configuration with Microsoft® Office Excel®, the file has to be saved as a comma separated (CSV) file.

Table of configuration window menu items

Main menu	File	Common		Help
Submenu (Shortcut key)	New (Ctrl+N)	SSH	SSH	Help (F1)
	Open(Ctrl+O)	TCP/IP Settings	Read	About
	Save (Ctrl+S)	Time Settings	Write	
	Save As ...	Time Zone Customization	Cancel	
	Exit	Redundant Connections	Setup	
		Direct IEC-101 to IEC-104 Translation	Updates	
		OpenVPN		
		IPSec		
		L2TP		
		Options		

10.3 Tab Cards in the Configuration Window

Configuration and setting parameters can be utilized by using topic tab cards:
Ports, Devices, Objects, Formulas, Conf, Status.
A click on a tab card button switches between tab cards.

Using the grid area

Parameters can be selected or changed in the grid area cells. Values of some cells can be changed directly and those of others via a list box or a popup window.

Values of the same column can be copied to clipboard. Use a left mouse click together with the Shift key to *Copy* and a left mouse click together with the Ctrl key for *Paste* operation.

Status message in the bottom left corner of the window shows the result of the last data modification action (OK, Error, etc).

10.3.1 Ports Tab Card

Ports tab card is active when the GW6e configuration window is opened.

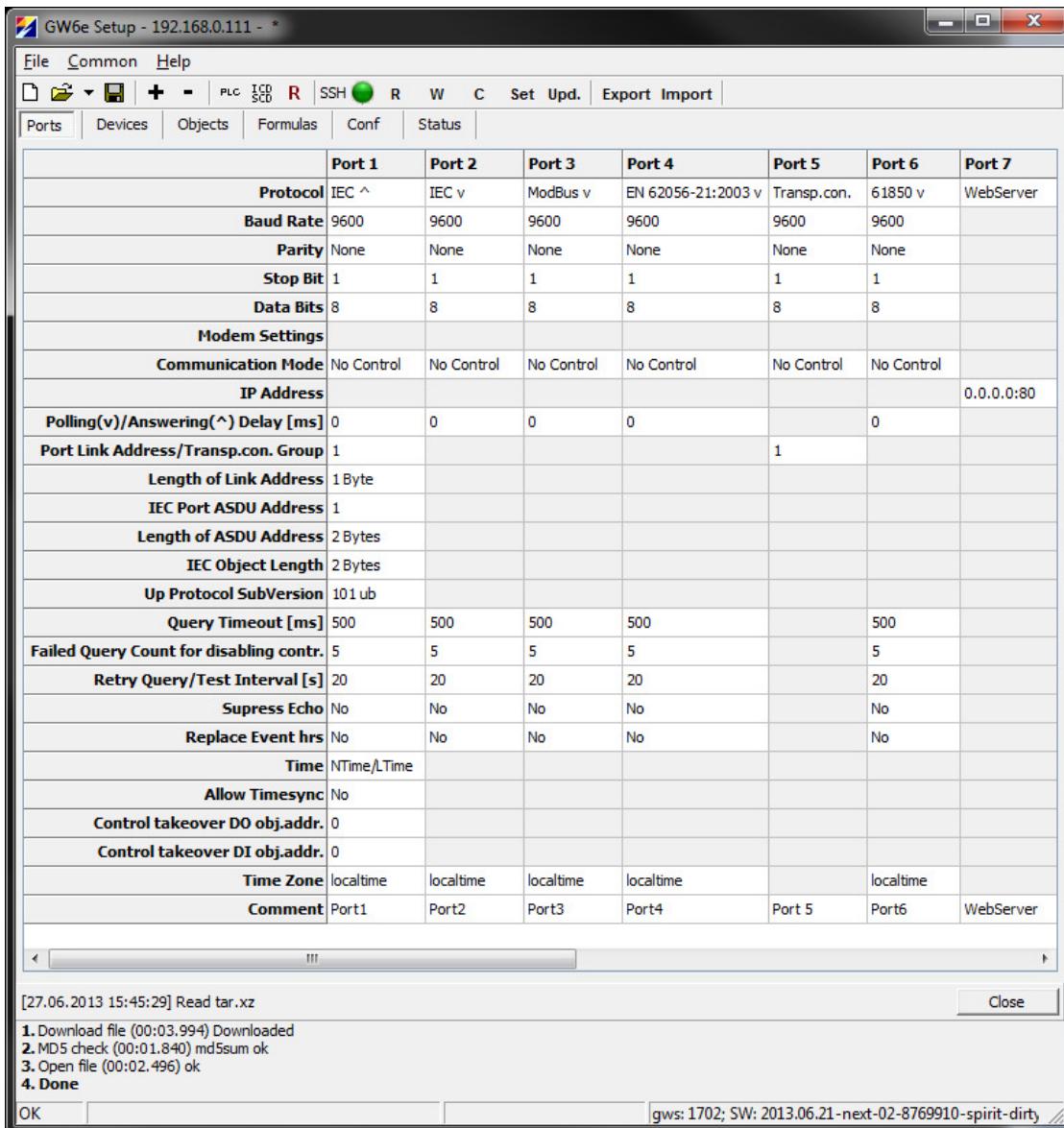
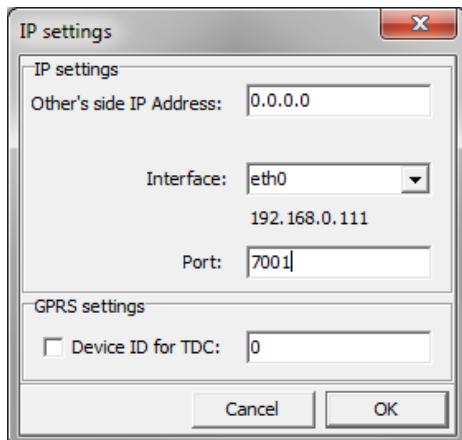


Figure 10.3 .1 Configuration window with Ports configuration tab card.

Configuration parameters of a port:

- **Protocol** – Communication protocol used by all the devices of this port.
Each protocol name is accompanied with a symbol "^" or "v" which indicates whether the port is used for an uplink or a downlink channel. For example, "Modbus v" means that this port is used for downlink with Modbus protocol.
- **Baud rate** – Data communication rate
- **Parity** – Use of parity bit for all the devices on this channel
- **Stop Bit** – possible values are 1, 2
- **Data Bits** – possible values are 7, 8
- **Modem Settings** – GPRS modem connection check period
- **Communication Mode** – Makes it possible to choose between the following handshaking options:
 - No control
 - TCP/IP Legacy
 - TCP/IP Client
 - TCP/IP Server
- **IP address** – communication IP address (used if Communication Mode is set to TCP/IP)
 - a) **61850 v**



IED IP Address – an IP address of the 61850 device (server)

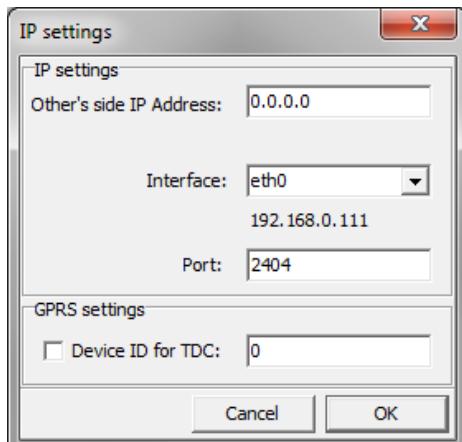
102 – (RFC 1006) IEC 61850 port of ISO Transport on top of TCP

Interface – eth0 or eth1 or eth2 Ethernet port

Provider Port – TCP port of IEC 61850 provider, port 7001 is recommended

GPRS settings – for GPRS modem ID detection from TDC/IEC software

b) IEC ^ or IEC v



Other's side IP Address – an address of the device which can connect with GW6e using corresponding port (if set to 0.0.0.0 – all devices can connect)

Interface – Any or eth0 or eth1 or eth2 Ethernet port

Port – available network communication port (in case of IEC 60870-5-104 protocol, port 2404 is recommended)

- **Polling(v)/Answering(^) Delay [ms]** – Delay between reception and the next query
- **Port Link Address/Transp.con.Group** – Link address of the device on uplink channels
- **Length of Link Address** - Length of the link address in bytes on uplink channels. Possible values are 1 or 2
- **IEC Port ASDU Address** – ASDU address on uplink channels
- **Length of ASDU Address** – Length of the ASDU address in bytes on uplink channels. Typically 2, possible values are 1 or 2
- **IEC Object Length** – Length of the IEC object address in bytes on uplink channels. Typically 2, possible values are 1, 2 and 3
- **Up Protocol SubVersion** – Number of protocol subversion on uplink channels
- **Query Timeout [ms]** – Query timeout for devices on downlink channels
- **Failed Query Count for disabling contr.** – Count of timeouts after which the error flag is raised and the query of this device temporarily suspended
- **Retry Query/Test Interval [s]** – Time period after which the suspended device is queried again
- **Suppress Echo** – If the sent messages are echoed back by the connected devices then they need to be suppressed
- **Replace Event hrs** – Yes/No. If Yes, events are sent to control centre with UCT time (the time correction value is set in Common Menu, Timing Settings)
- **Time** – Determines the time tag of events
- **Allow Timesync** – Yes or No
- **Control takeover DO obj.addr.** – The address of an object that determines control takeover of that device
- **Control takeover DI obj.addr.** – The address of an object that shows which channel has taken over the control rights
- **Time Zone** – Determines time zone, localtime or Tallinn, Estonia, or UTC
- **Comment** – useful field for comments of port property

10.3.2 Devices Tab Card

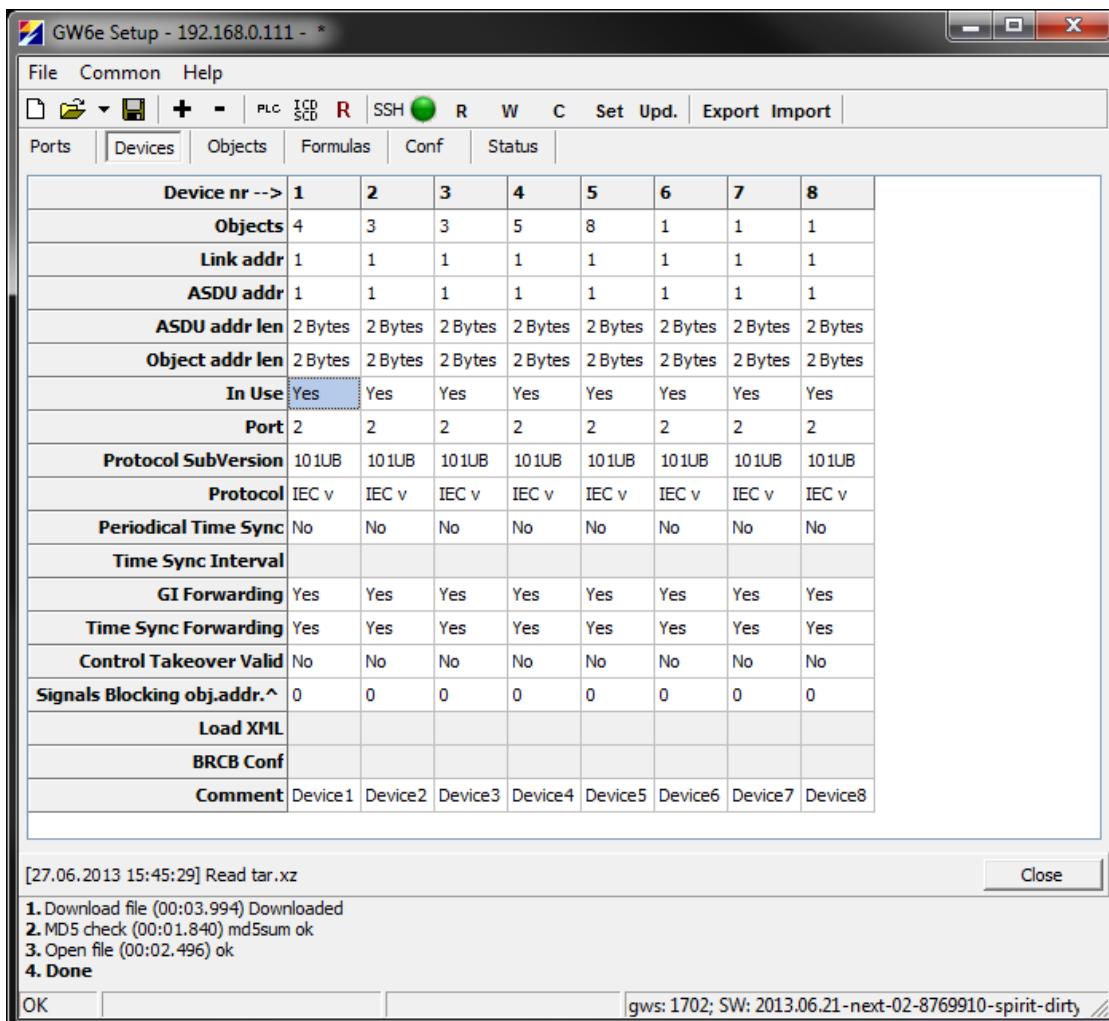


Figure 10.3.2. Devices tab card

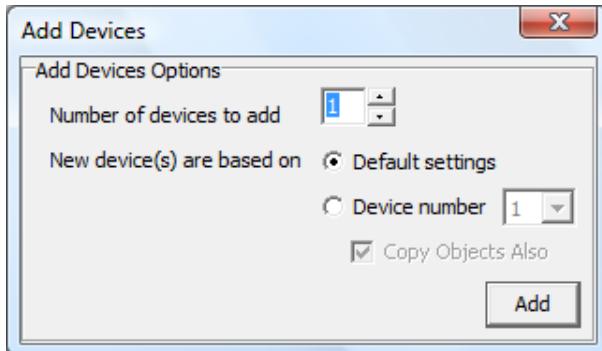
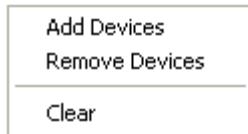
Parameters:

- **Device nr** – Sequence number of the device
- **Objects** – Number of objects in the device
- **Link address** – Link address of the connected device
- **ASDU address** – ASDU address of the connected device
- **ASDU address len** – Length in bytes, possible values are 1 or 2
- **Object address len** – Length in bytes, possible values are 1, 2 or 3
- **In use** – Indicates whether the device is in use or not. If the device is not in use, the whole row has a grey background
- **Port** – Port no. of GW6e to which the device is connected
- **Protocol SubVersion** – Number of protocol subversion
- **Protocol** – For information only. It is filled automatically according to the number of the used port.
- **Periodical Time Sync** – Yes/No. If Yes, the device is synchronized with 10 second period

- **Time Sync Interval** – under control devices time synchronization interval
- **GI Forwarding** – Yes/No. General interrogation forwarding
- **Time Sync Forwarding** – Yes/No. If Yes, the time synchronization which is received from upper channel, it is forwarded to the device
- **Control takeover valid** – Yes/No. Determines if control of the device can be taken over (see 10.3.1 Ports Tab Card)
- **Signals blocking obj.addr.^** – The address of an object which determines blocking of all signals from that device. No signals are sent to control centre from that device
*the object must be determined under a virtual device in objects table
- **Load XML** – Load XML file with object data to the device (IEC 61850)
- **BRCB Conf** – Buffered report control block configuration
- **Comment** – description of devices

Adding devices

By clicking on the  shortcut icon, a new device with default settings is added. It is also possible to add new devices with a right mouse click which makes the extended control menu to appear.



Add Devices dialog box appears.

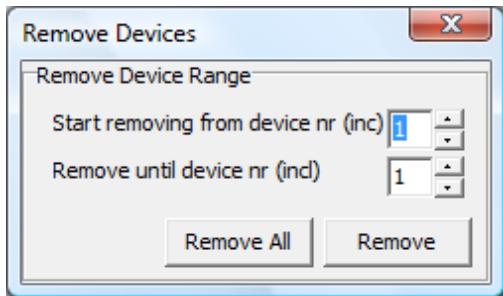
Set the Add Devices options:

- Number of devices to add
- Default settings or the device number from where the settings are derived
- Copy Object Also

Click the Add button.

Removing Devices

To remove a device, select **Remove Devices** from the extended control menu or click on the shortcut icon.



Select the range of the removed devices and click the **Remove** or **Remove All** button. The selected device is also removed after the warning dialog when is clicked.

Clearing Devices

To clear the Device Tab Card, select Clear from the extended control menu.

A warning window always appears before removing all devices.

Select **Yes** to accept or **No** to cancel the removal operation of the devices.

10.3.3 Objects Tab Card

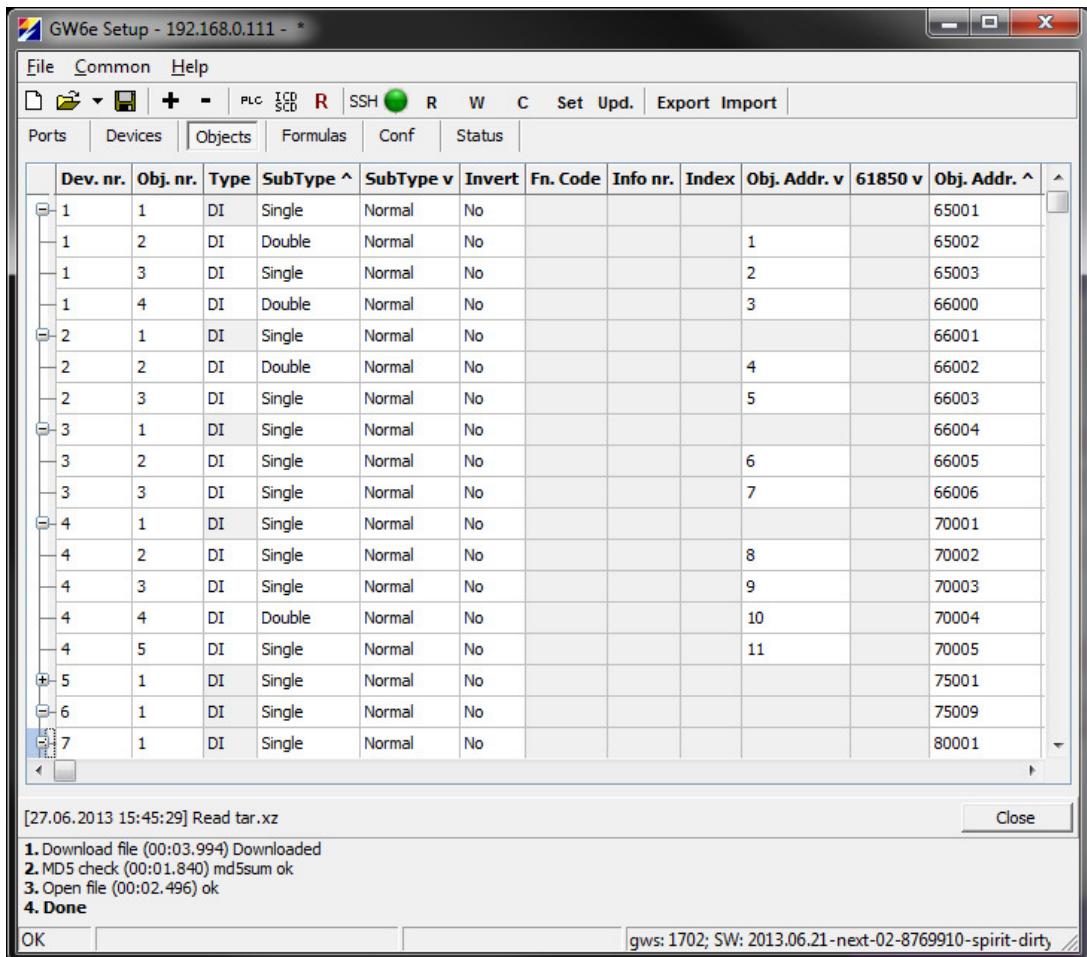


Figure 10.3.3 Objects tab card

The first object of every device is used as the communication status signal of the device. If its value is “1” then communication with this device is broken. The object (first object) of communication status signal is not counted in the **Objects** row of the **Devices Tab Card**.

Columns:

Type – Object’s type: digital input (DI), digital output (DO), analog input (AI), counter (CN)

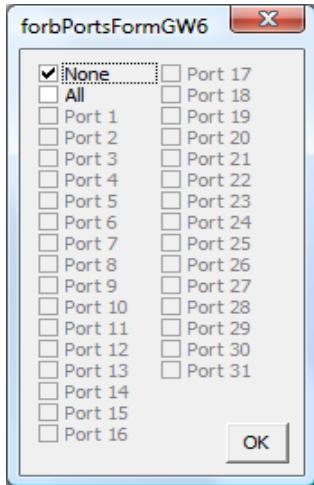
Sub Type[^] – Object’s subtype for uplink.

Sub Type v – Object’s subtype for downlink.

Subtypes of object can be selected.

Object type	Subtype ^	Subtype v
DI – Digital input	Single Double	Normal Fallback
DO – Digital output		Single Double Direct Execute Select Execute
AI – Analog input	Normalized Floating point Step position	

- **Invert** – Object’s value will be inverted
- **Fn.code** – Function code on the IEC 60870-5-103 protocol
- **Info no.** – Information number on the IEC 60870-5-103 protocol
- **Index** – Object index on the IEC 60870-5-103 protocol. It indicates the order number of the object in message types 3 and 9 of analog measurements. In IEC 60850 used to match “Integer and Enum Values” for example AutoRecSt=“Successful” index should be 3.
- **Object.Addr v** – Object’s downlink address
- **61850 v** – 61850 address (loaded from device’s XML file)
- **Object.Addr ^** – Object’s uplink address
It is possible to send the same object to control centre with different addresses by creating several object with identical downlink addresses and different uplink addresses.
- **Comment** – comments of devices
- **DB1 %Fs** – Deadband (% of full scale). If the value has changed less than the deadband then it is not spontaneously transferred.
- **Raw Min, Raw Max** – Minimum and maximum raw values of analog measurement (before scaling).
- **Scale Min, Scale Max** – Minimum and maximum scale values of analog measurement.
- **Forb. Ports ^** – Uplink port to which the object’s value transfer is blocked. To select uplink ports, which should not be used for transferring these object values, double-click on the cell of the **Forb. Ports[^]** column and select the corresponding ports from the window that has appeared.



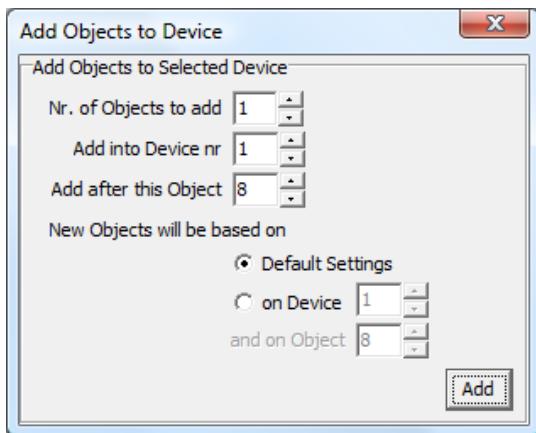
- **Crit.Min %Fs / On Ev. Nr; Crit.Max %Fs / Off Ev. Nr**
Crit.Min %Fs; Crit.Max %Fs – Minimum and maximum values in % from the full scale of analog measurements on which GW6e initializes communication (Fig. 10.5.1). If Crit. Max and Crit. Min do not have values, DB1 and DB2 are in use. If Crit. Max and Crit. Min have the value ‘zero’, only DeadB1 is in use. If the analog measurement value is between Crit. Min and Crit. Max, DB2 is in use. If the analog measurement value is out of limits, DB1 is in use.
On Ev. Nr; Off Ev. Nr – Corresponding event number used in SPA-bus
- **Ch. Nr.** – Channel nr. for SPA-bus communication protocol
- **NoFlags** – If set to Yes, removes Invalid and Not Topical flags from object status. Used for objects, which statuses are not received with General Interval time (short circuit current, etc.)

Adding Objects

By clicking on the button, a new device with default settings is added. Objects can also be added with a right click on the device tab card. After that the following extended control menu appears:

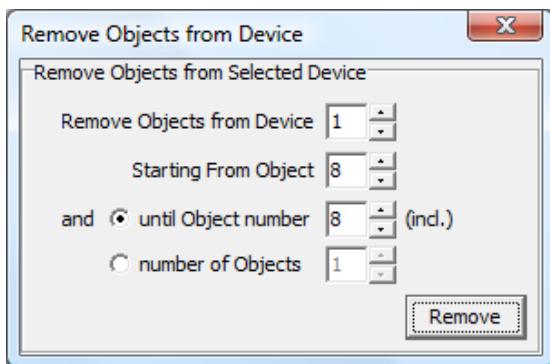


When selecting Add Objects, the following dialog box appears:



Removing Objects

To remove a device, click the button or select Remove Devices from the extended control menu. The following dialog box appears:



Hints

- Repeated object addresses are shown on yellow background.
- When leaving the Object Tab Card, all the objects are hidden. To see the objects on returning to Object Tab Card, use **Expand All** from the extended control menu that appears after a right click.

10.3.4 Formulas Tab Card

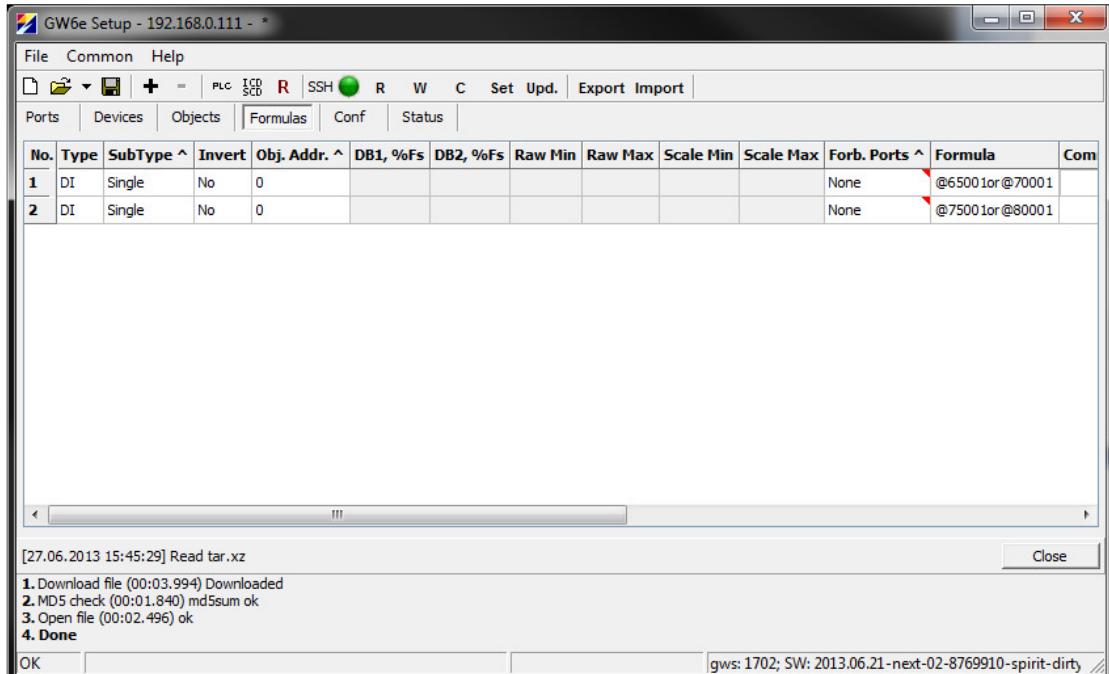


Figure 10.3.4 Formulas tab card

Columns:

- **Type**, Sub Type , Invert, Object Adr ^, DB1 %Fs, DB2 %Fs, Crit. Min %Fs, Crit. Max %Fs, Raw Min, Raw Max, Scale Min, Scale Max, Forb.Ports - as in Objects Tab Card
 - **DO addr.** – Number of the digital output (1...16) in the TLM GW-IO device controlled by the result of this formula
 - **Execution count** – The number of control operations executed, if no feedback is received from control relay. Feedback must be determined in the formula
 - **Delay** – Delay in seconds
 - **Forb. DO** – The number of DO, which control is forbidden with the result of this formula
 - **Formula** – Formula string

Editing formulas

Formulas can be created between the values of analog and/or digital objects.

Referencing to object values

To use the measurement object in the formula, insert an @ sign together with the **object address** up.

Example: @101 points to the value of the object with an address to uplink 101.

Constants

Constants can be used in formulas.

Example: 1.1+2.2+3 consists of 3 floating point constants

Brackets

Brackets can be used in formulas to change the priority of the operation.
Example: `sqrt(@101/2+@102); (@201+@202+@203)/3`

Operators

Oper.	Obj. type	Description	Sample	*Priority
+	DI/AI	Addition	@101+3,2	3
-	DI/AI	Subtraction	@101-0,49	3
*	DI/AI	Multiplication	@101*2	2
/	DI/AI	Division	@101/2	2
^	DI/AI	Exponentiation	@101^2	1
<	DI	Greater than	@101<0,499	4
>	DI	Less than	@101>0,5	4
sqr	DI/AI	Square	sqr(@101*10)	0
sqrt	DI/AI	Square route	sqr(@101*10)	0
and	DI	Logical conjunction	@201and@202	5
or	DI	Logical disjunction	@201or@202	6
xor	DI	Exclusive disjunction	@201xor@202	6
not	DI	Logical negation	not@201	0
dbl	DI	Converts 2 single digital inputs into a double signal	@202dbl@201, where @202 – ON state signal @201 – OFF state signal	7
sin	DI/AI		sin@301	0
cos	DI/AI		cos@301	0
tan	DI/AI		tan@301	0
arcsin	DI/AI		arcsin@301	0
arccos	DI/AI		arccos@301	0
arctan	DI/AI		arctan@301	0

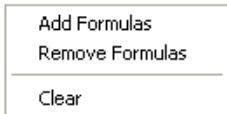
* priority determines the order of operations in the formula (the highest priority is 0)

Notes

- All analog values should be scaled before making calculations; therefore, it is very important to fill the **Raw Min**, **Raw Max**, **Scale Min**, **Scale Max** fields with Normalized values that are used in calculations.
- After editing the formula, the program automatically validates this formula and shows the result in the status area. If the formula is incorrect, the background of the edited formula is changed to pink and an error message is displayed in the status area.
- By clicking on the  button, a new formula row with default settings is added.

By clicking on the  button, the selected formula row is removed.

- Formula rows can also be added, removed or cleared by using the extended control menu like in the Object Tab Card. It appears with a right mouse click on the Formula Tab Card.



To add a Formula, select **Add Formulas**, to remove a Formula, select **Remove Formula** and to clear all formulas, select **Clear**.

- The formulas of DI type of objects can contain AI values and floating point constants. If the result of the formula is greater than 0, the value of the DI object is "1"; if the result of the formula is less than or equal to 0, the value of the DI object is "0".
- < or > statement: if the statement is true, the value of the DI object is 1; if the statement is false, the value of the DI object is 0.

10.3.5 Conf tab card

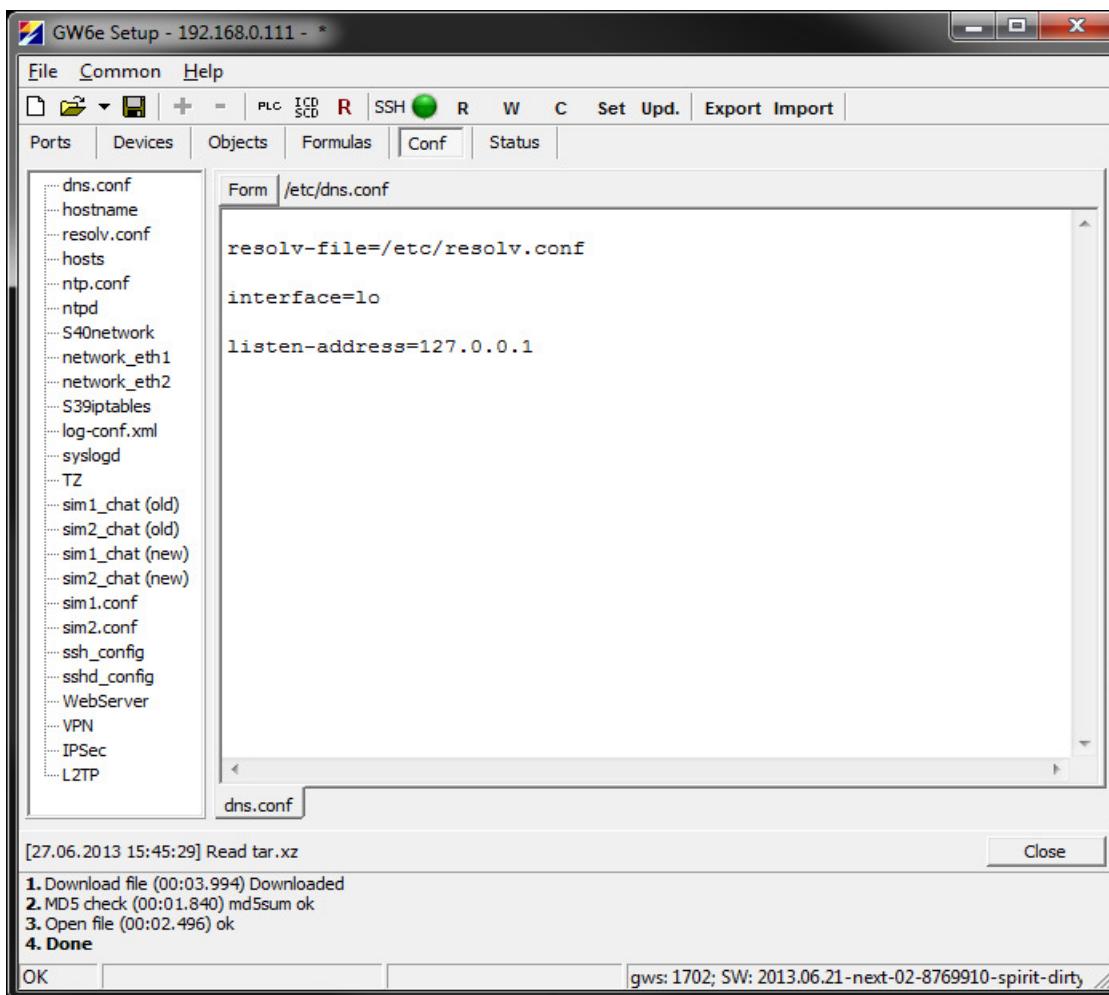


Figure 10.3.5 Conf tab card

NB! The contents inside this tab should be modified only by advanced Linux users.

10.3.5.1 dns.conf

Synopsis: `/etc/dns.conf` – file contains host Domain Name System (DNS) settings configuration information

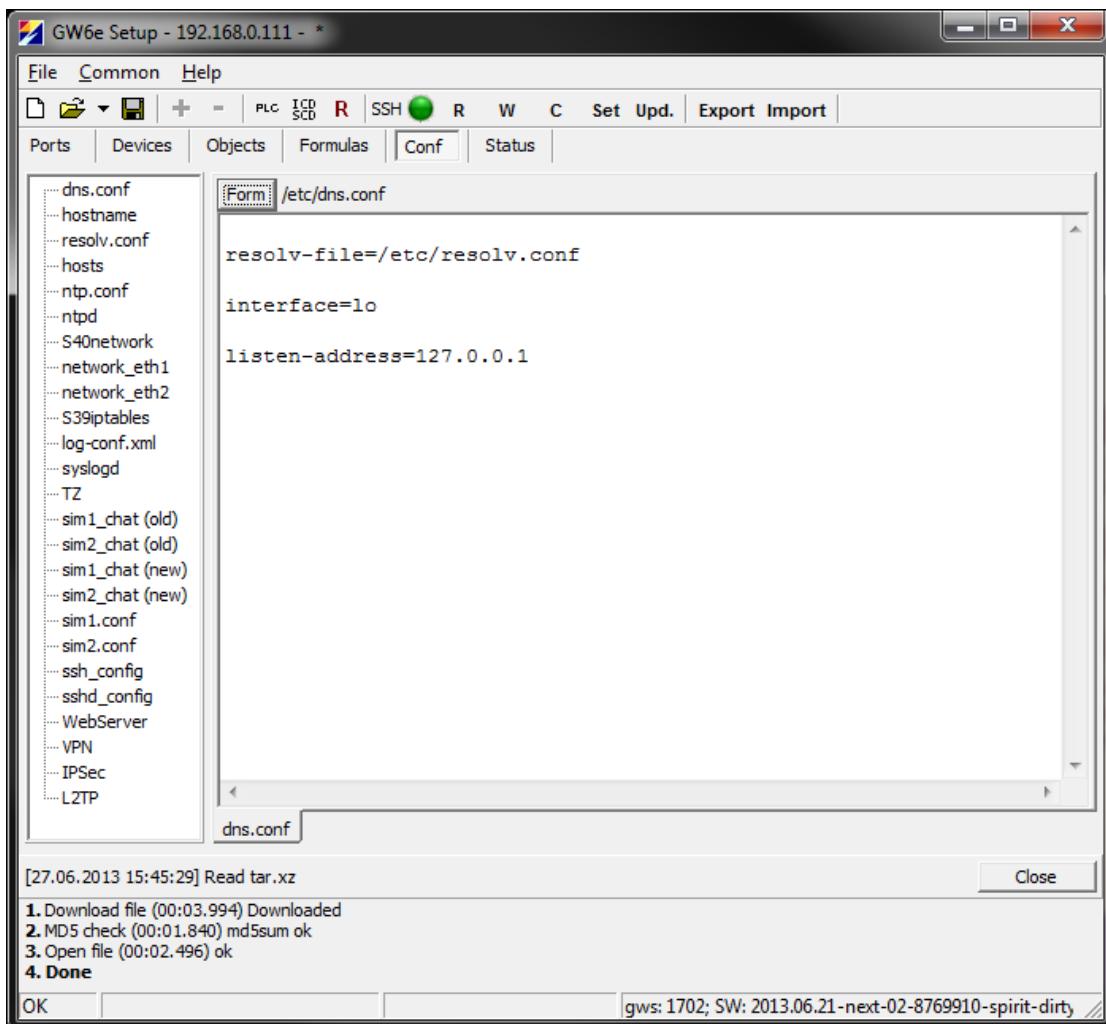


Figure 10.3.5.1 *dns.conf* file

10.3.5.2 hostname

Synopsis: */etc/hostname* – node name

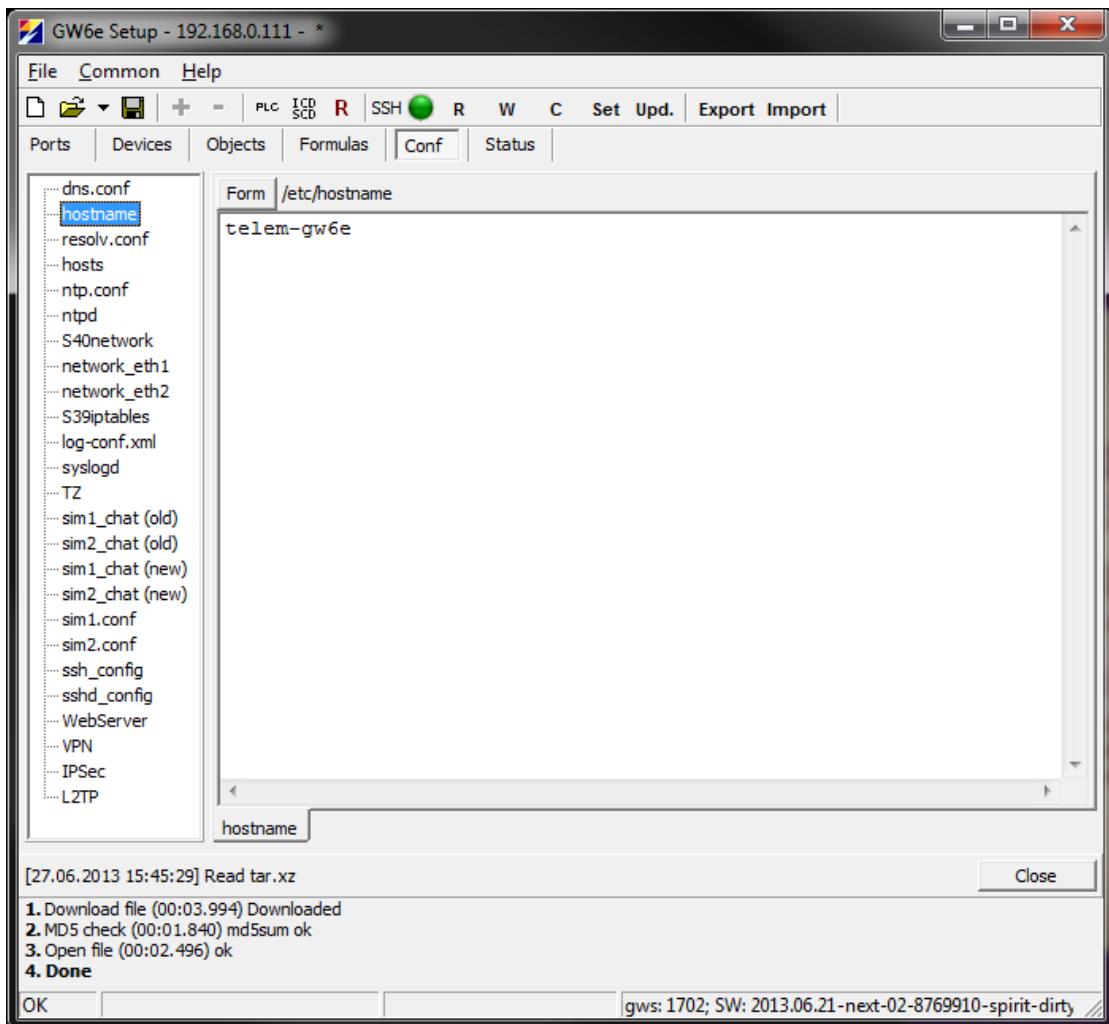


Figure 10.3.5.2. *hostname* file

10.3.5.3 resolv.conf

Synopsis: */etc/resolv.conf* – the DNS servers to be used are indicated in the file, one per line, with the nameserver keyword preceding an IP address, as in the following example:

```
nameserver 127.0.0.1  
nameserver 212.27.32.177  
nameserver 8.8.8.8
```

DNS (Domain Name Service) is a distributed and hierachal service mapping names to IP addresses, and vice-versa

10.3.5.4 hosts

- Synopsis: /etc/hosts – this file is a simple text file that associates IP addresses with hostnames, one line per IP address. For each host a single line should be present with the following information:
`IP_address canonical_hostname [aliases...]`
 Fields of the entry are separated by any number of blanks and/or tab characters. Text from a "#" character until the end of the line is a comment, and is ignored. Host names may contain only alphanumeric characters, minus signs ("-"), and periods ("."). They must begin with an alphabetic character and end with an alphanumeric character. Optional aliases provide for name changes, alternate spellings, shorter hostnames, or generic hostnames (for example, localhost).
 For additional information, use this source:
<http://linux.die.net/man/5/hosts>

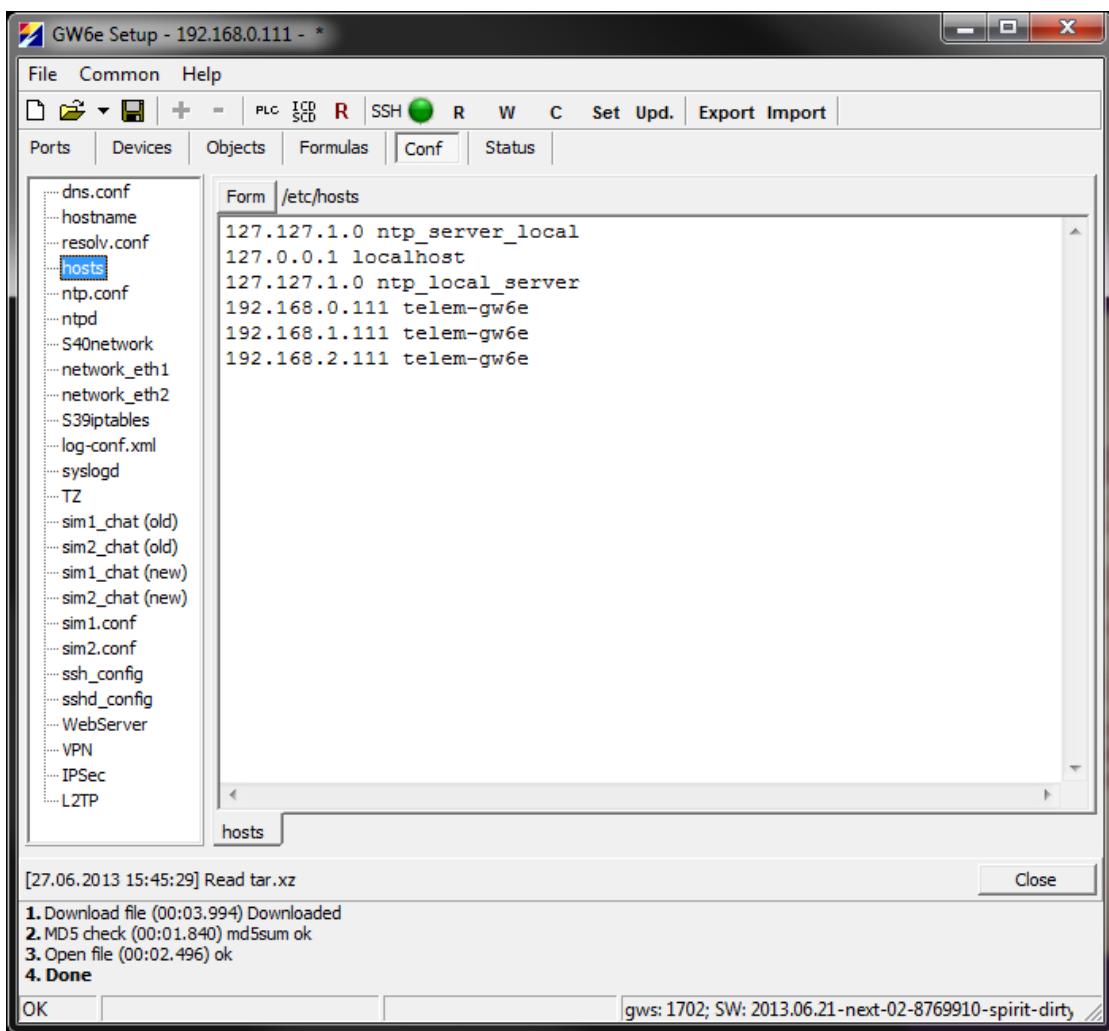


Figure 10.3.5.4 hosts file

10.3.5.5 ntp.conf

Synopsis: `/etc/ntp.conf` – Network Time Protocol (NTP) is a networking protocol for clock synchronization between computer systems over packet-switched, variable-latency data networks. User have rights to change time server names or servers IP-s. NTP provides Coordinated Universal Time (UTC) including scheduled leap second adjustments. No information about time zones or daylight saving time is transmitted; this information is outside its scope and must be obtained separately.

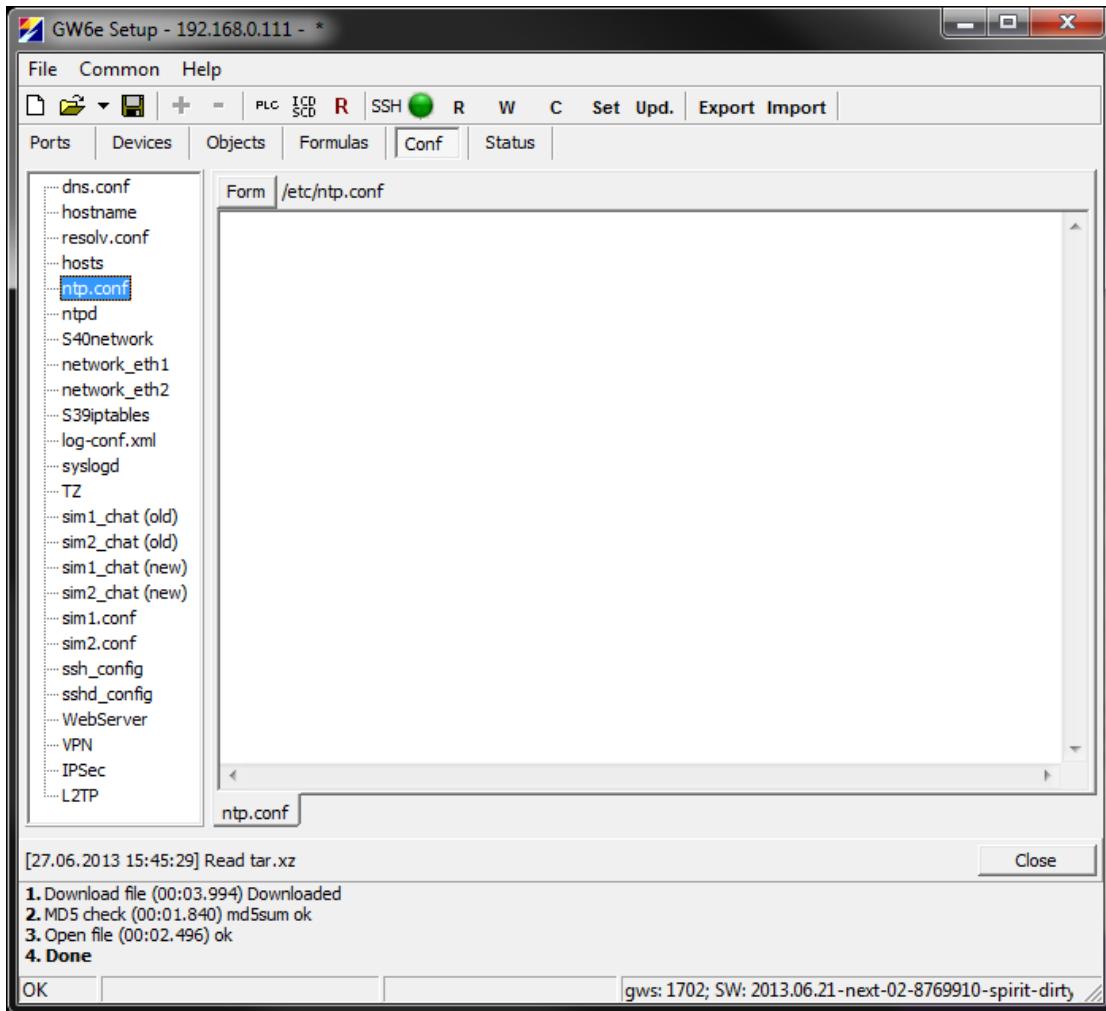


Figure 10.3.5.5 *ntp.conf* file

10.3.5.6 ntpd

Synopsis: `/etc/default/ntp` – The Network Time Protocol daemon is an operating system daemon program that maintains the system time in synchronization with time servers using the Network Time Protocol (NTP).

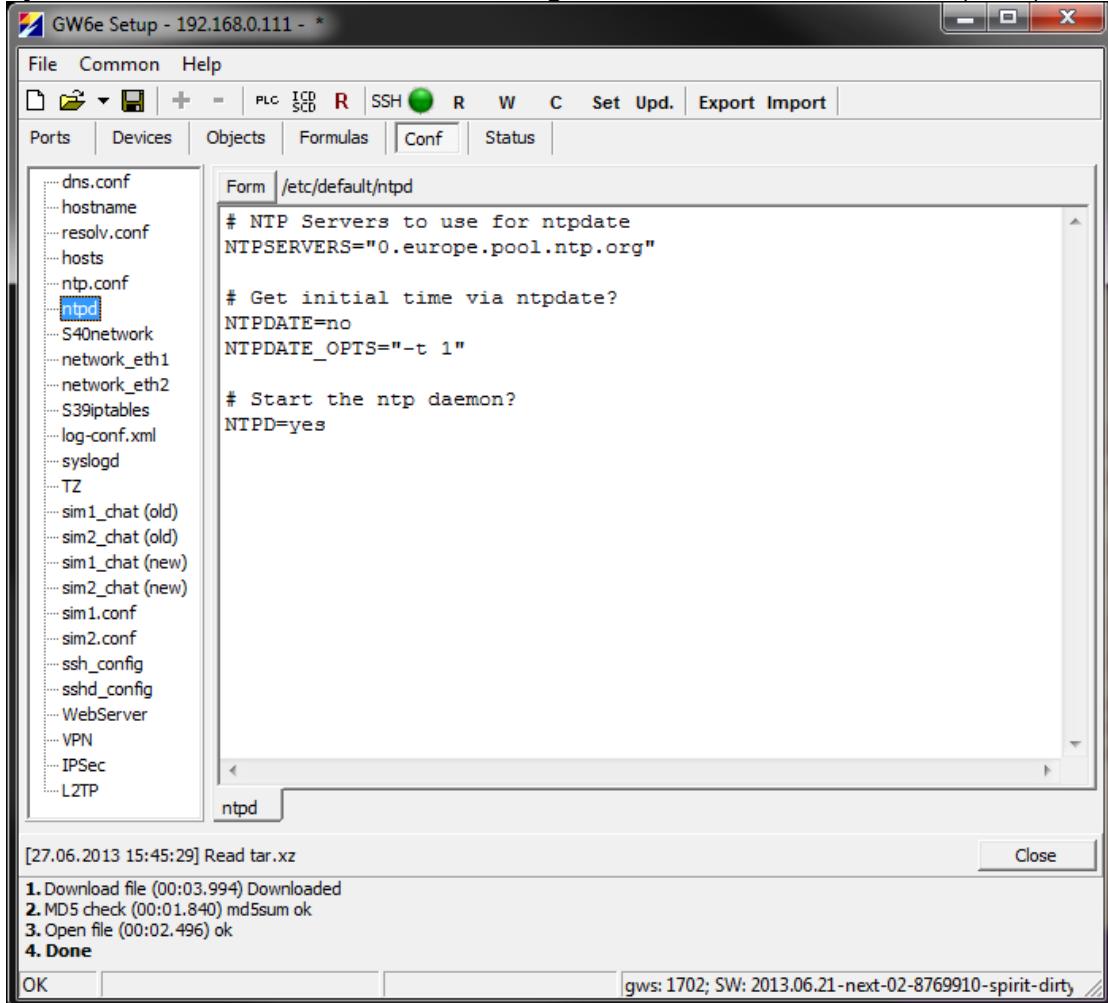
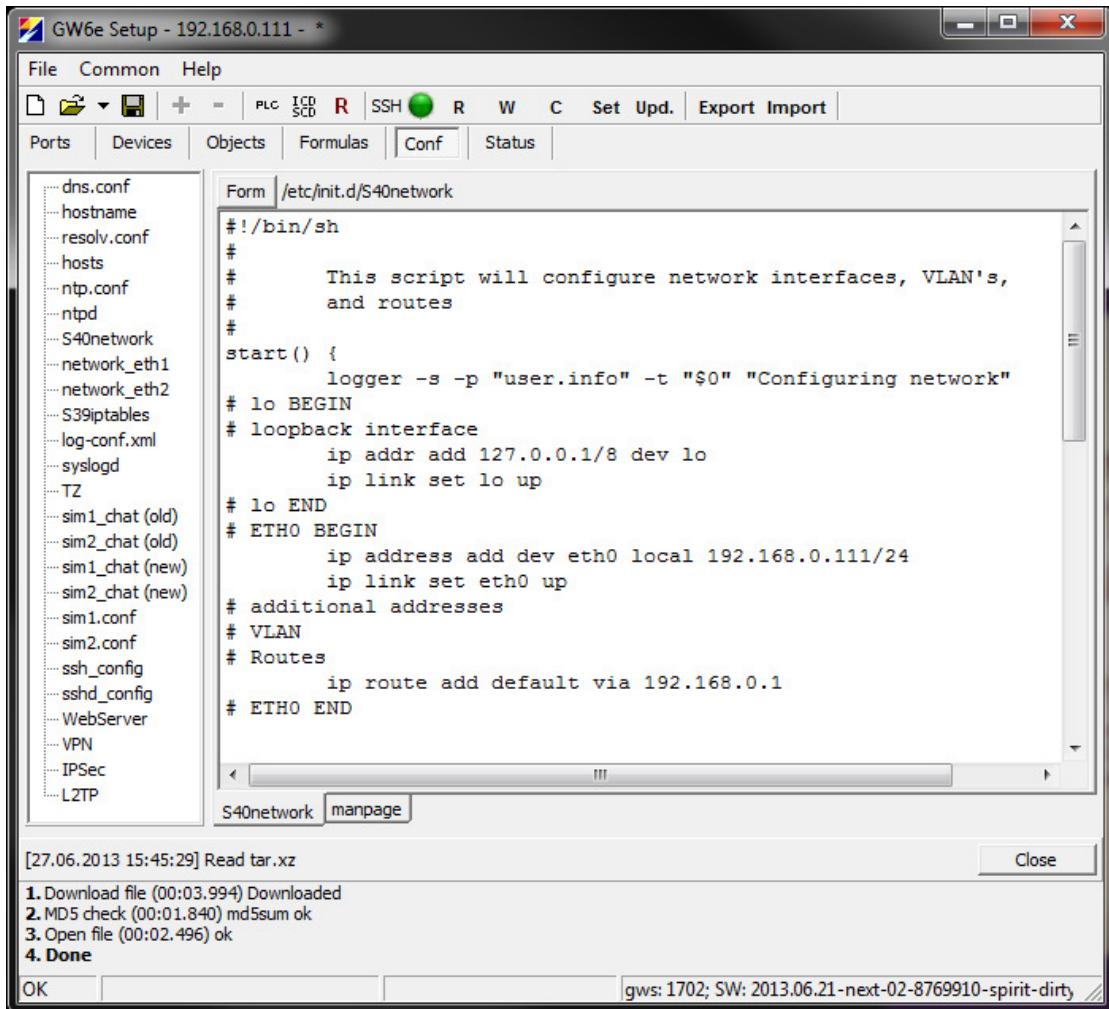


Figure 10.3.5.6 *ntp* file

10.3.5.7 S40network

Synopsis: `/etc/init.d/S40network` – script will configure network interfaces, VLAN's and routes



The screenshot shows the GW6e Setup software interface. The title bar reads "GW6e Setup - 192.168.0.111 -". The menu bar includes File, Common, Help, and tabs for PLC, ICD, SCD, R, SSH, W, C, Set, Upd., Export, and Import. Below the menu is a toolbar with icons for Ports, Devices, Objects, Formulas, Conf (selected), and Status. A sidebar on the left lists various configuration files: dns.conf, hostname, resolv.conf, hosts, ntp.conf, ntpd, S40network, network_eth1, network_eth2, S39iptables, log-conf.xml, syslogd, TZ, sim1_chat (old), sim2_chat (old), sim1_chat (new), sim2_chat (new), sim1.conf, sim2.conf, ssh_config, sshd_config, WebServer, VPN, IPSec, and L2TP. The main window displays the content of the S40network file:

```
#!/bin/sh
#
# This script will configure network interfaces, VLAN's,
# and routes
#
start() {
    logger -s -p "user.info" -t "$0" "Configuring network"
# lo BEGIN
# loopback interface
    ip addr add 127.0.0.1/8 dev lo
    ip link set lo up
# lo END
# ETH0 BEGIN
    ip address add dev eth0 local 192.168.0.111/24
    ip link set eth0 up
# additional addresses
# VLAN
# Routes
    ip route add default via 192.168.0.1
# ETH0 END
```

At the bottom of the main window, there are two buttons: S40network and manpage. A status bar at the bottom right shows [27.06.2013 15:45:29] Read tar.xz, Close, OK, and gws: 1702; SW: 2013.06.21-next-02-8769910-spirit-dirty.

Figure 10.3.5.7 *s40network* file

10.3.5.8 network_eth1 and network_eth2

Synopsis: /etc/init.d/network_eth1 and /etc/init.d/network_eth2 – script will configure network interfaces, VLAN's and routes

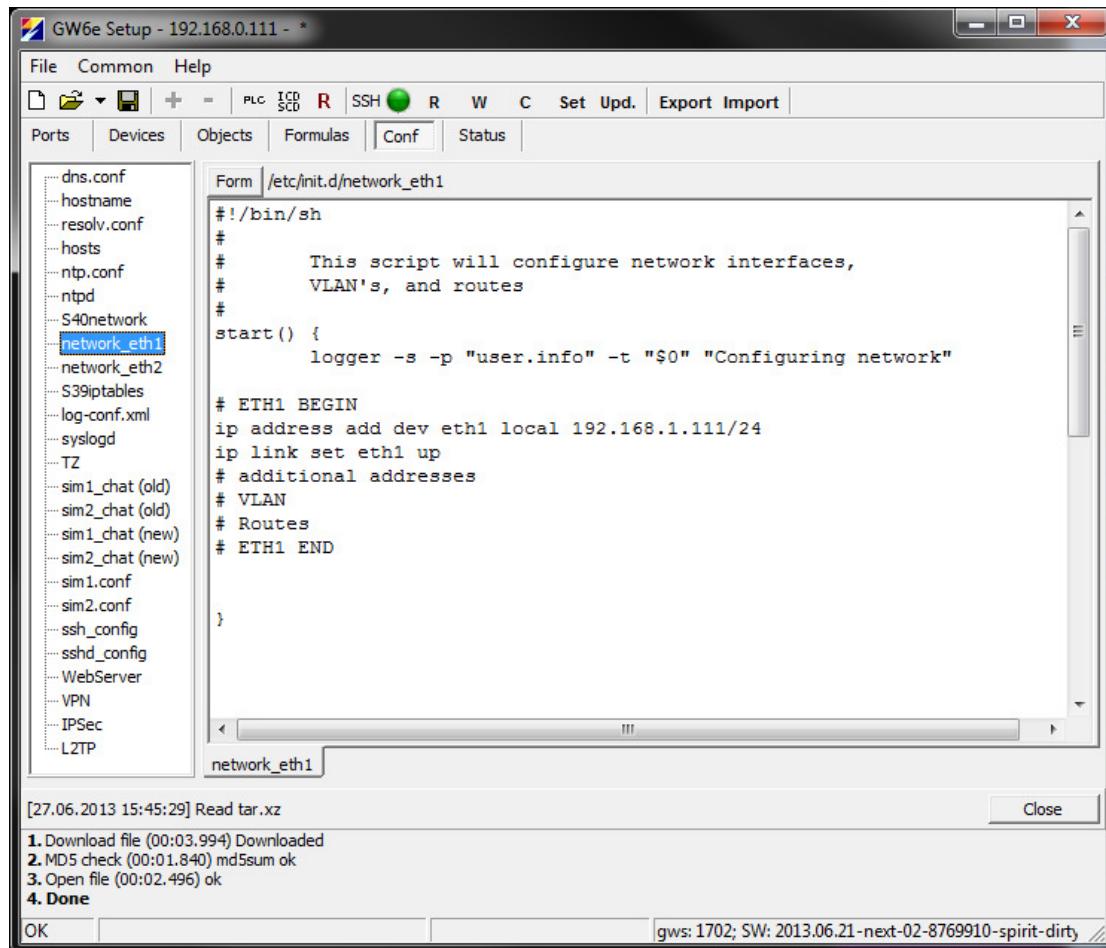


Figure 10.3.5.8 *network_eth1* file

10.3.5.9 S39iptables

Synopsis: `/etc/init.d/S39iptables` – script will configure network interfaces, VLAN's and routes

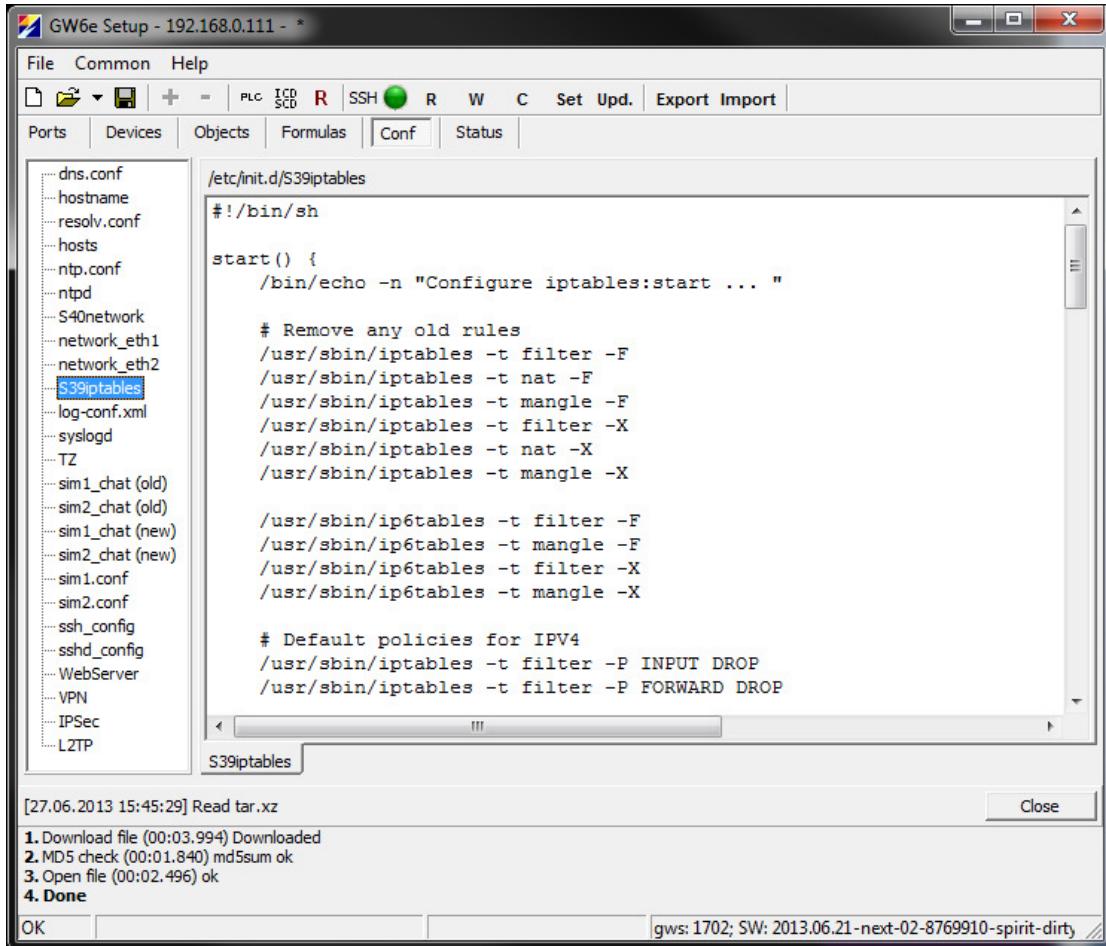


Figure 10.3.5.9 *s39network* file

10.3.5.10 log-conf.xml

Synopsis: /usr/local/etc/telem/log-conf.xml – xml-file, which contains cumulative data of configuration stages

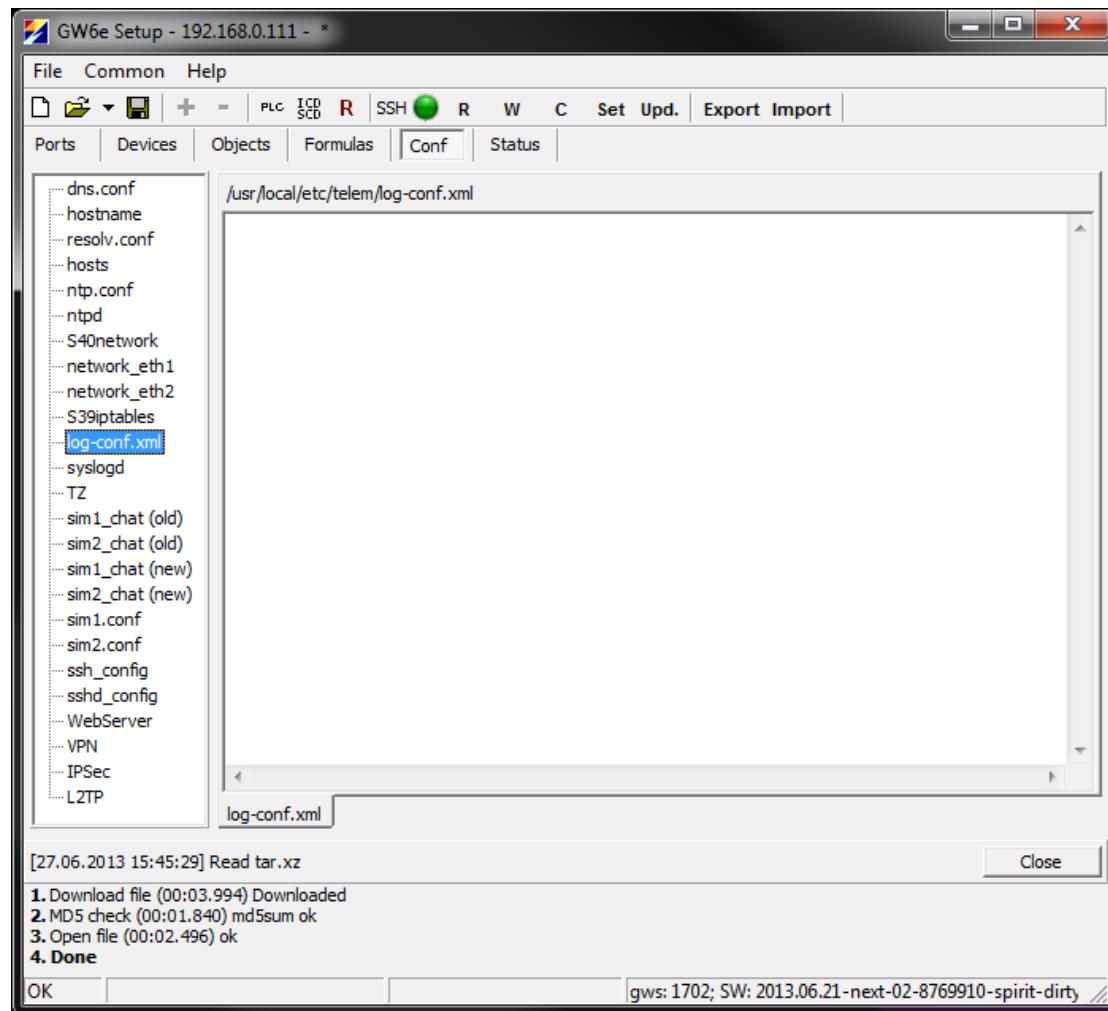


Figure 10.3.5.10 *log-conf.xml* file

10.3.5.11 syslogd

Synopsis: `/etc/default/syslogd` - file, which contains cumulative data of devices connections to the other devices

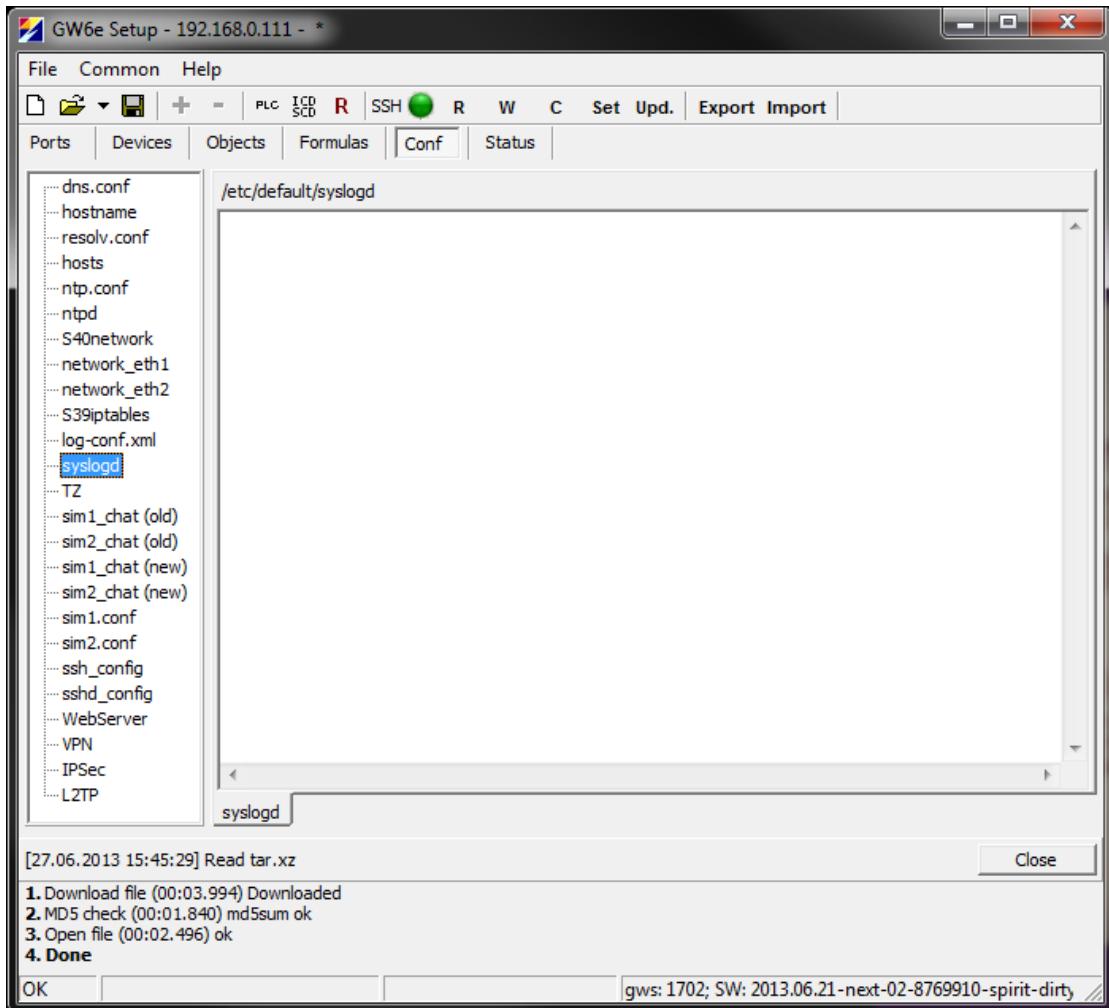


Figure 10.3.5.11 *syslog* file

10.3.5.12 TZ

Synopsis: `/etc/TZ` – to set a time zone.

Example:

```
echo "CET-1CEST-2,M3.5.0/02:00:00,M10.5.0/03:00:00" > /etc/TZ
```

NOTE: This sets the time zone for CET/CEST (Central European Time UTC+1 / Central European Summer Time UTC+2) and the start (5th week of March at 02:00) and end times (5th week of October at 03:00) of DST (Daylight Saving Time). Time zone settings for Tallinn, Estonia: EET-2EEST-3,M3.5.0/03:00:00,M10.5.0/04:00:00

More information about TZ: <http://www.sonoracomm.com/support/20-voice-support/107-uclibc-tz>

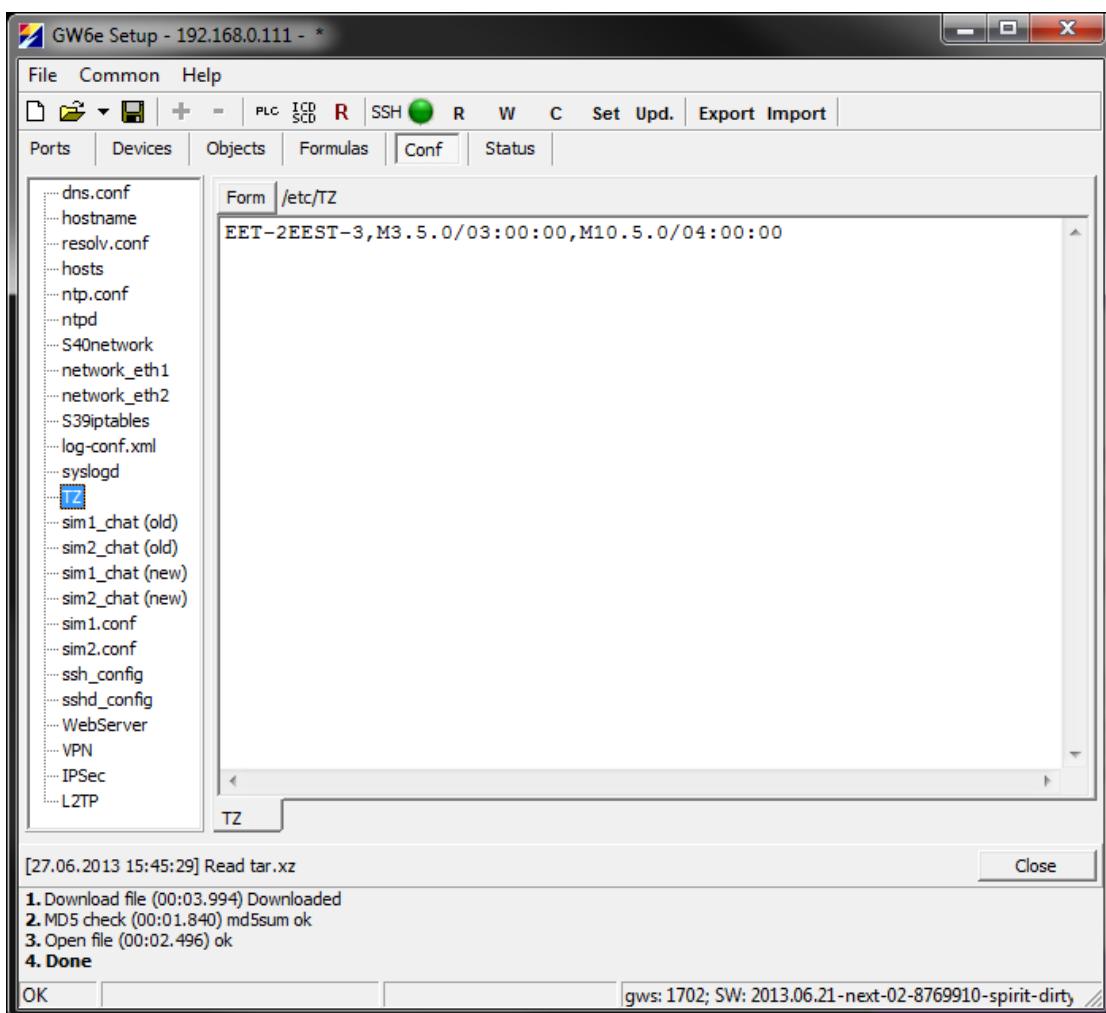


Figure 10.3.5.12 TZ file

10.3.5.13 sim1_chat

Synopsis: `/etc/ppp/peers/sim1_chat` – chat scripts are strings of text used to send commands for modem dialing, logging in to remote systems, and initializing asynchronous devices connected to an asynchronous line.
For further information use link: <http://linux.die.net/man/8/chat>

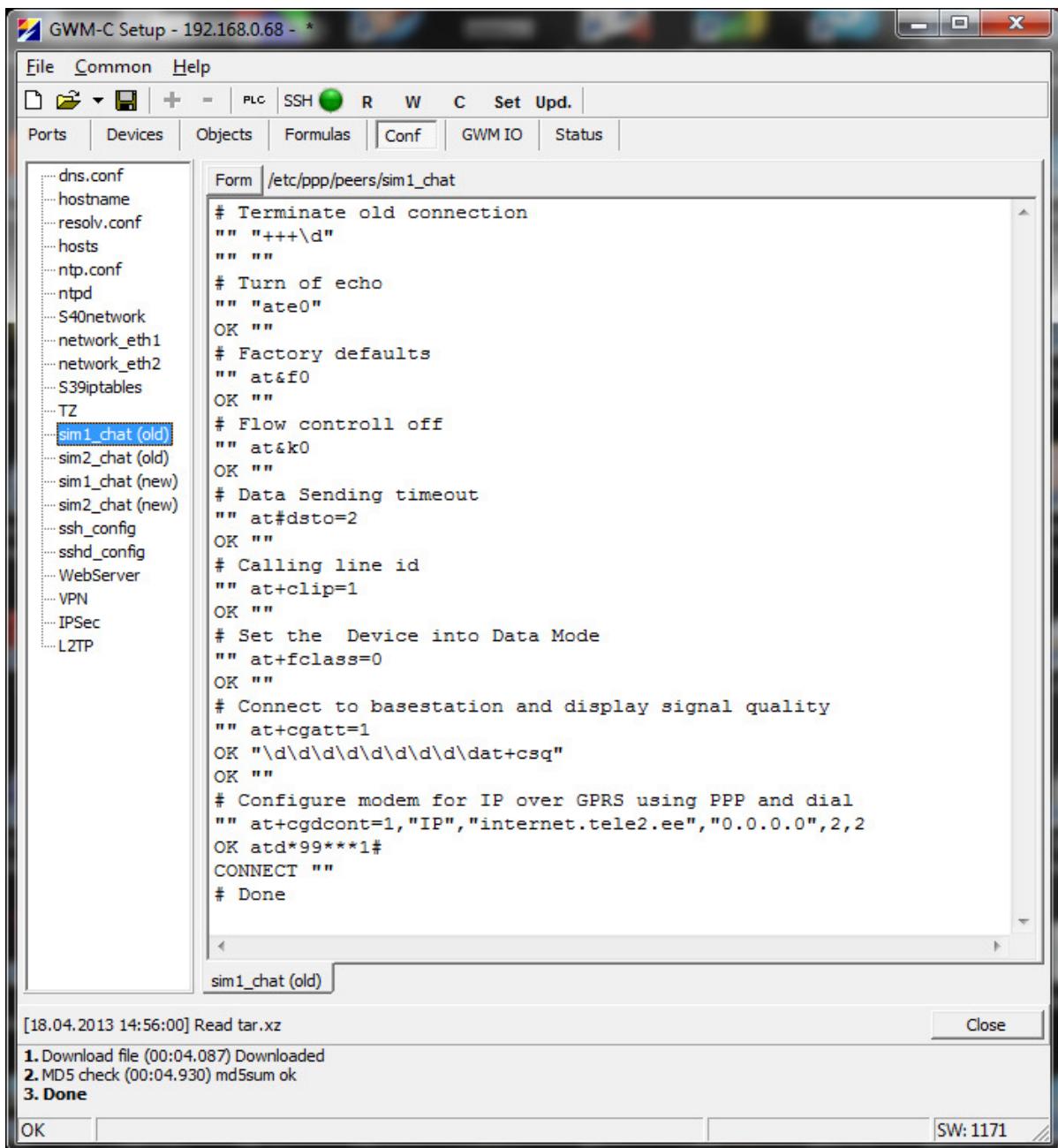


Figure 10.3.5.13 *sim1_chat (old)* file

10.3.5.14 sim1_chat (new)

Synopsis: `/etc/ppp/peers/VMX53/sim1_chat` – for first SIM card (based on the new CPU i.MX53)

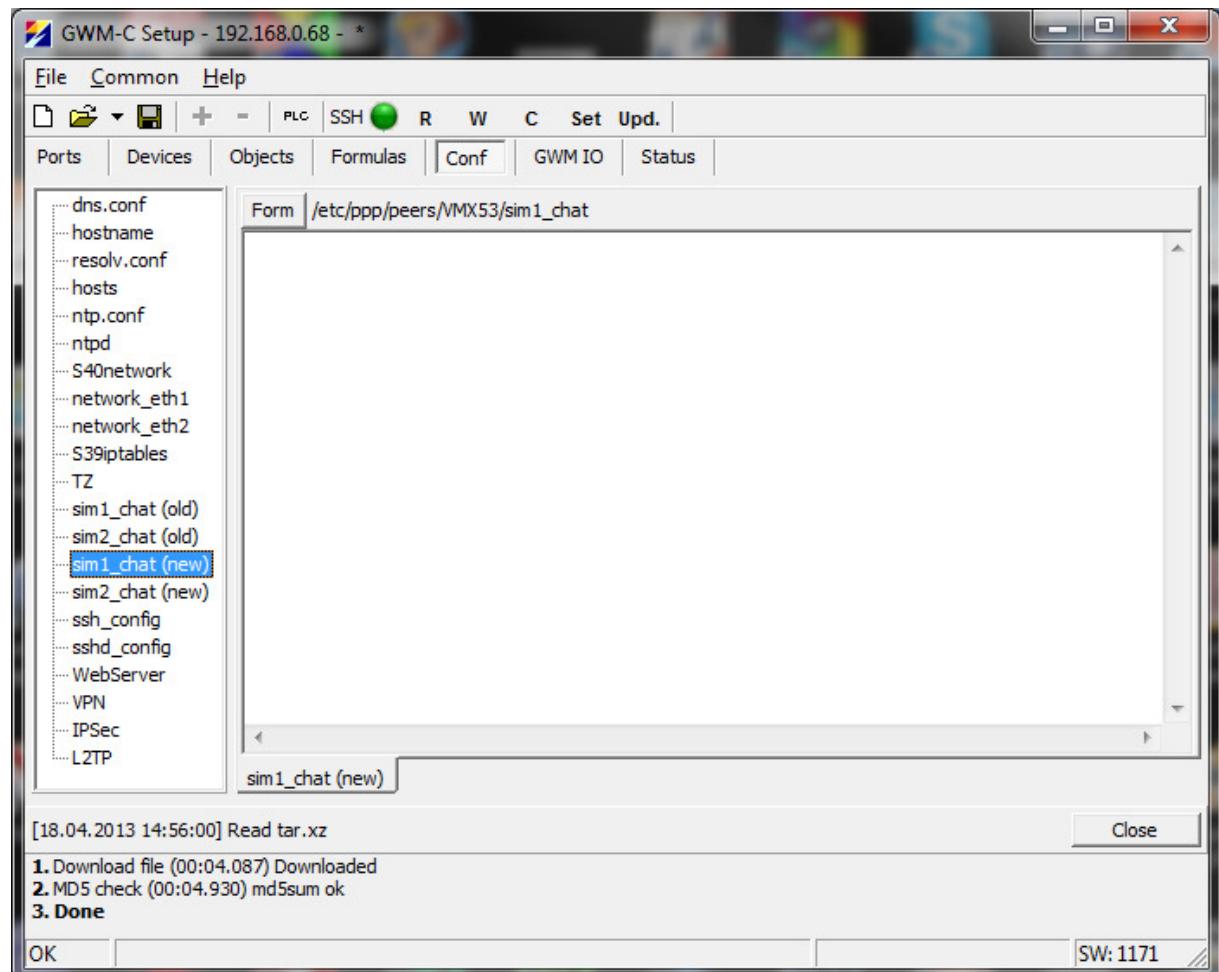


Figure 10.3.5.14 *sim1_chat (new)* file

10.3.5.15 ssh_config

Synopsis: */etc/ssh_config* - this file is the ssh client system-wide configuration file. This file provides defaults for users, and the values can be changed in per-user configuration files or on the command line.

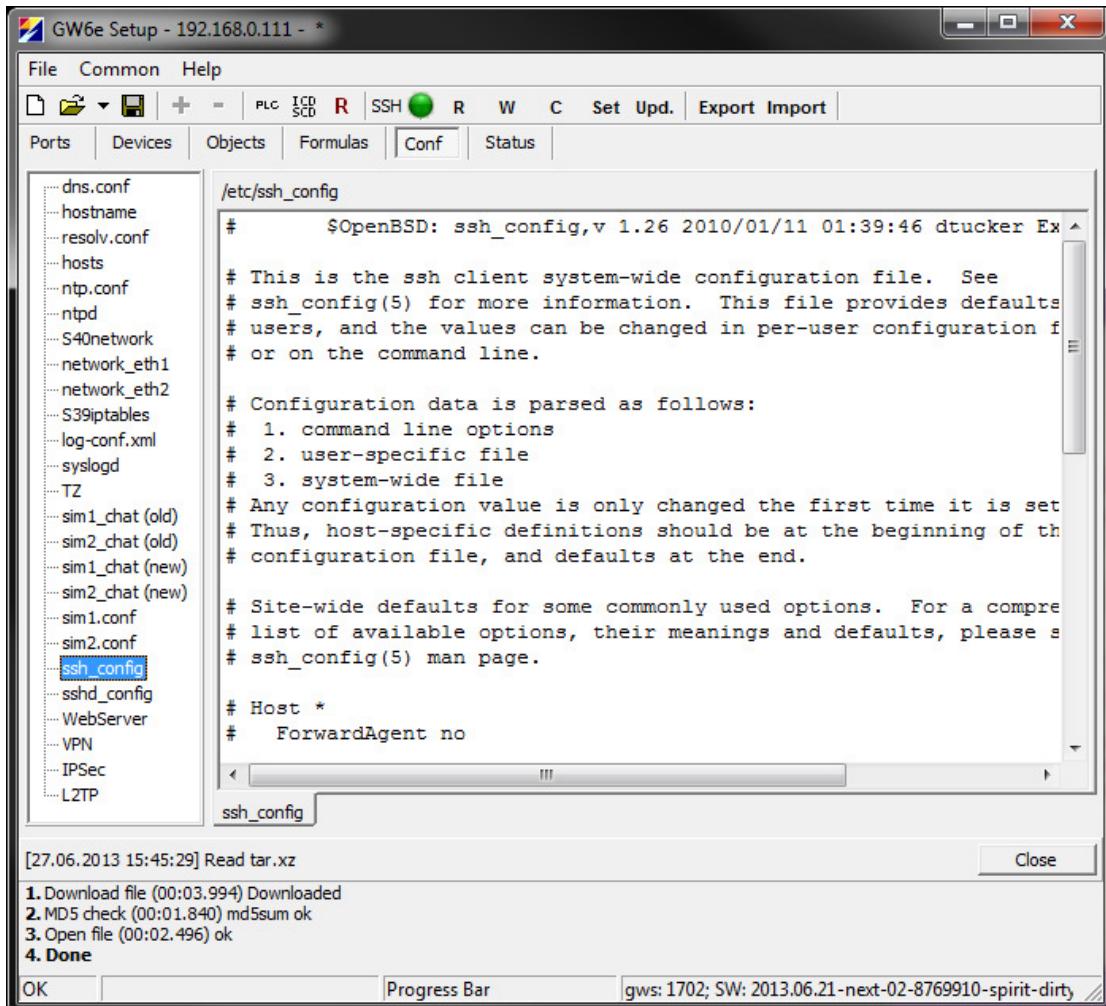


Figure 10.3.5.15 ssh_config file

10.3.5.16 sshd_config

Synopsis: `/etc/sshd_config` – OpenSSH SSH daemon configuration file. SSHD reads configuration data from `/etc/sshd_config` (or the file specified with `-f` on the command line). The file contains keyword-argument pairs, one per line. Lines starting with '#' and empty lines are interpreted as comments. Arguments may optionally be enclosed in double quotes ("") in order to represent arguments containing spaces. This file should be writable by root only, but it is recommended (though not necessary) that it be world-readable. Additional information: http://linux.die.net/man/5/sshd_config

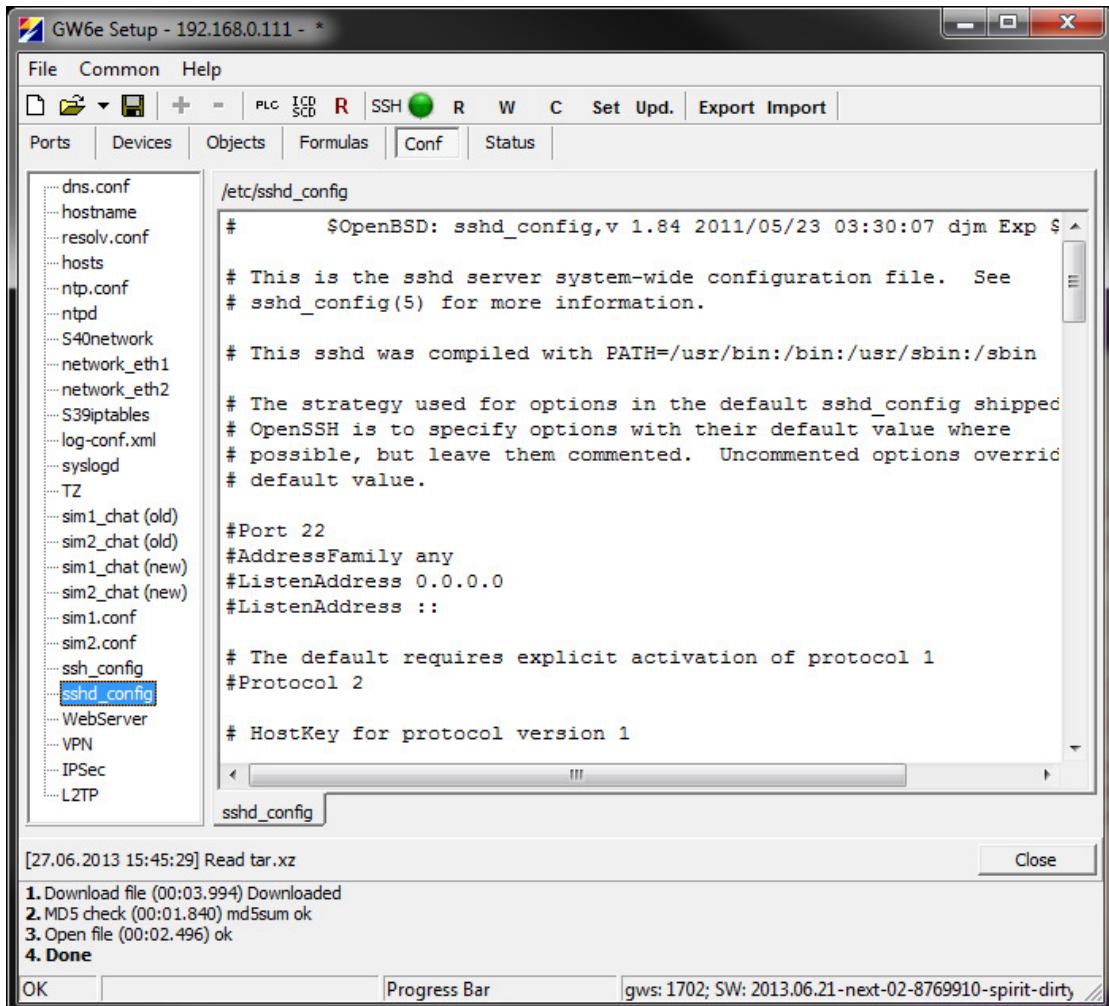


Figure 10.3.5.16 `sshd_config` file

10.3.5.17 VPN

A virtual private network (VPN) is a technology for using the Internet or another intermediate network to connect computers to isolated remote computer networks that would otherwise be inaccessible.

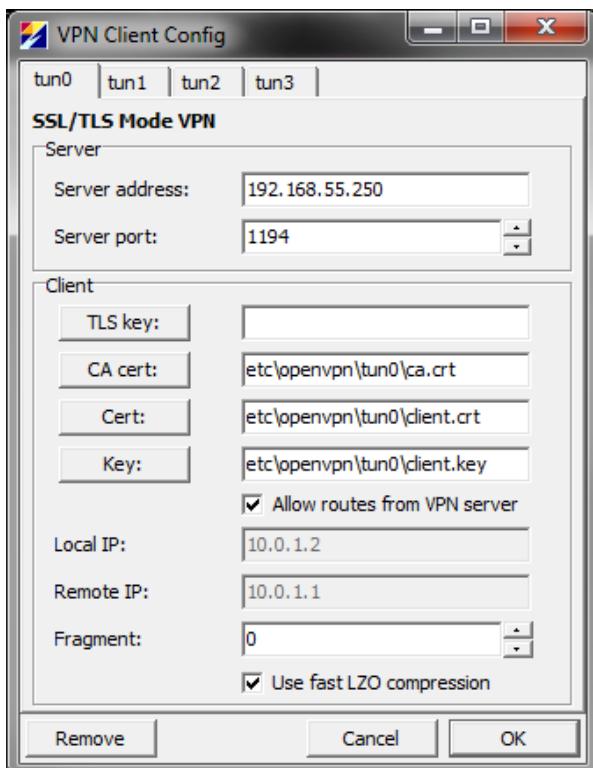


Figure 10.3.5.17 VPN client default configuration screen

Buttons:

- TLS key – SSL/TLS (Secure Socket Layer/Transport Layer Security) pre-shared key
- CA cert – SSL/TLS root certificate. Same for all clients
- Cert – client certificate
- Key – client public key

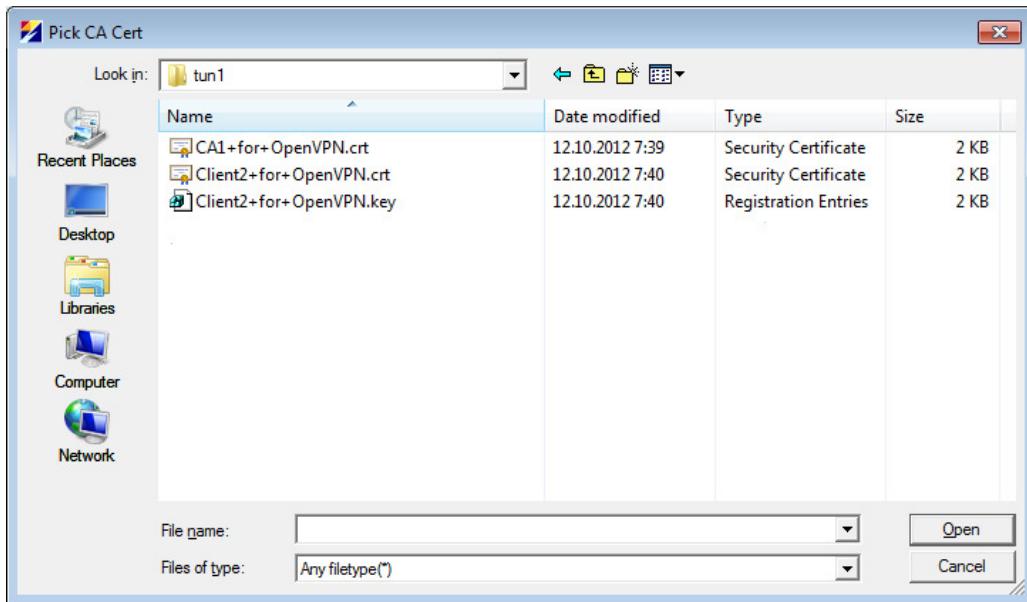


Figure 10.3.5.17a VPN client *tun1* configuration files

10.3.5.18 IPSec configuration

For IPSec configuration IKE (Internet Key Exchange) Phase 1 is available next parameters :

- Encryption algorithms: DES, 3DES, Blowfish, AES 128, AES 256
- Authentication hash functions: MD5, SHA1, SHA2 (SHA 256, SHA 384, SHA 512)
- DH Groups- Diffie-Hellman algorithm: 1(modp768), 2(modp1024), 5(modp1536), 14(modp2048), 15(modp3072), 16(modp4096)

In box of IKE Phase 2 is available:

- Authentication hash functions: DES, 3DES, HMAC MD5, HMAC SHA1, HMAC SHA256, HMAC SHA384, HMAC SHA512

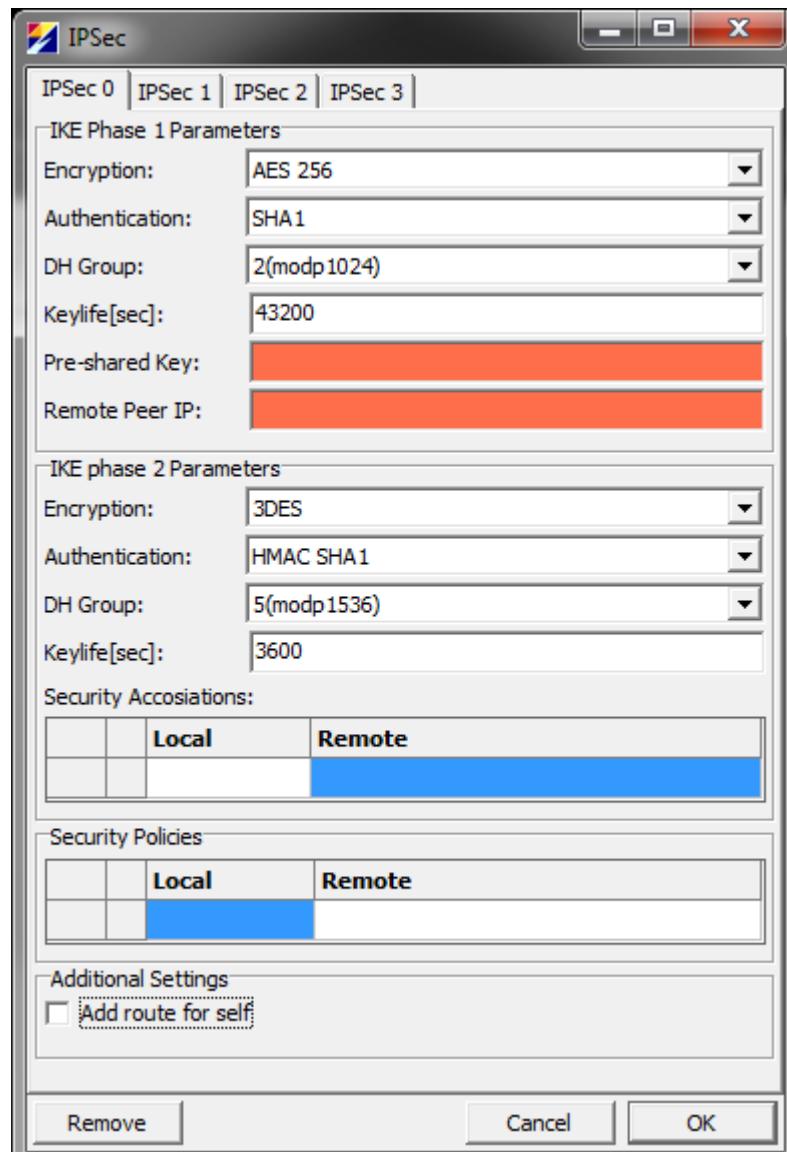


Figure 10.3.5.18 IPSec protocols configuration card

10.3.5.19 L2TP configuration

In computer networking, Layer 2 Tunneling Protocol (L2TP) is a tunneling protocol used to support virtual private networks (VPNs) or as part of the delivery of services by ISPs. It does not provide any encryption or confidentiality by itself; it relies on an encryption protocol that it passes within the tunnel to provide privacy.

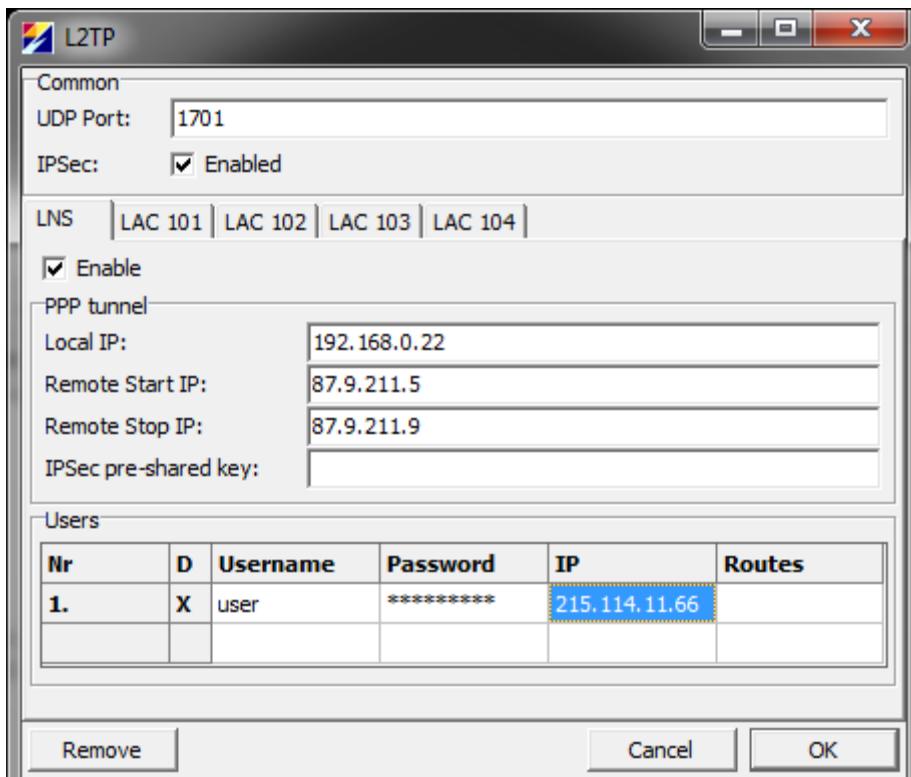


Figure 10.3.5.19 L2TP protocols configuration card

10.3.6 Status Tab Card

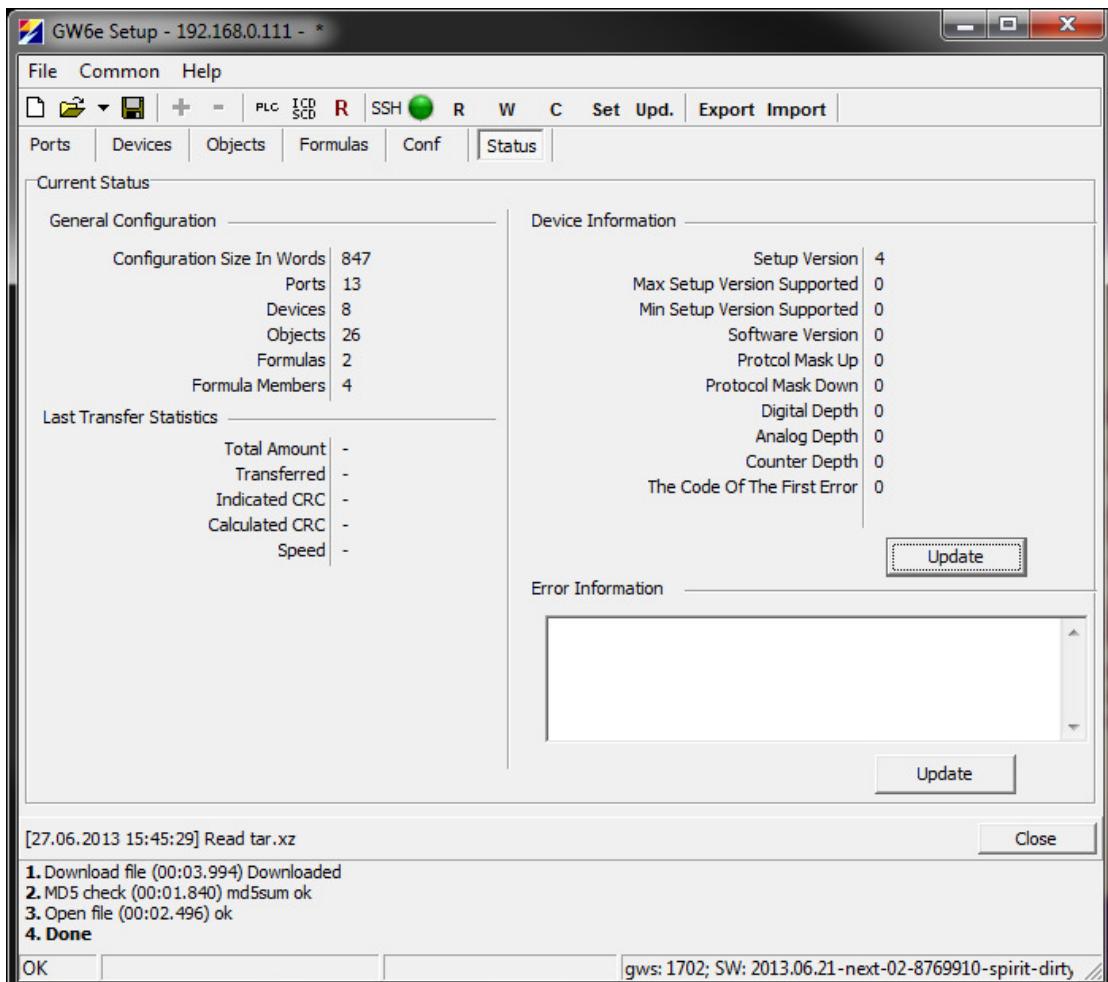


Figure 10.3.6 Status tab card

Status tab card presents the status of GW6e general configuration parameters and transfer statistics.

Update button is used to get information from the connected GW6e and it is displayed under Device Information.

10.4 Common menu item

10.4.1 TCP/IP Settings

Used for GW6e to determine IP parameters.

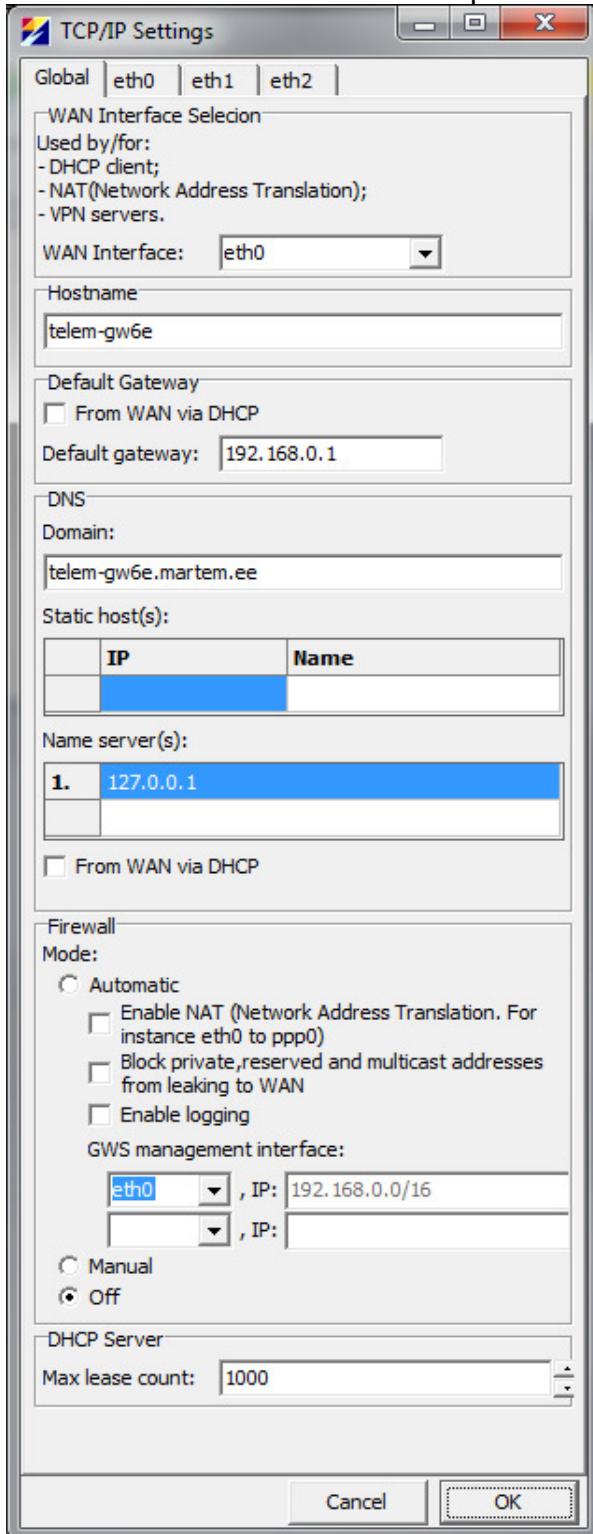


Figure 10.4.1 TCP_IP settings

10.4.2 Time Settings

To determine device initialization timeouts, time zone correction and GPS.

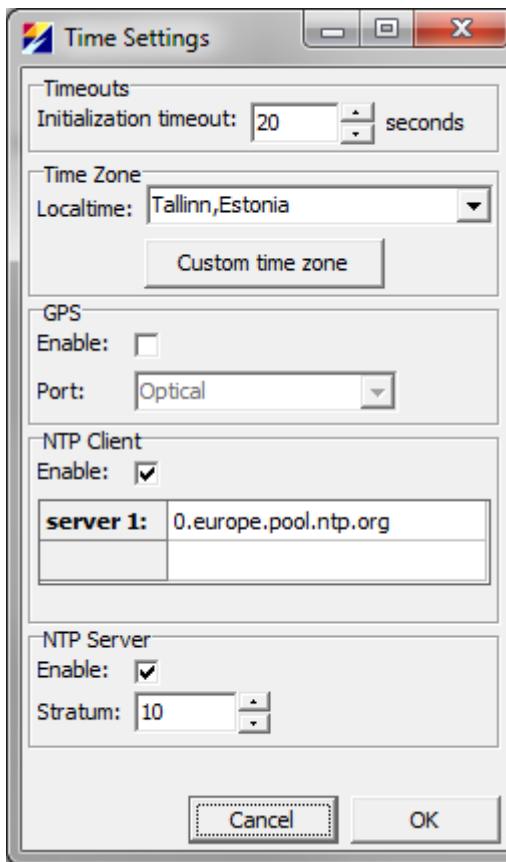


Figure 10.4.2 Time settings

10.4.3 Time zone customization

Add and configure time zones. It is possible to determine different time zone for each port.

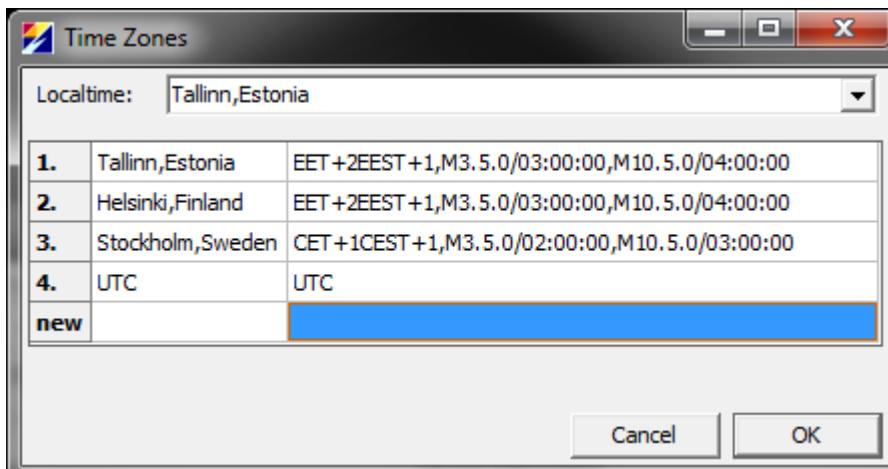


Figure 10.4.3 Time zone settings

10.4.4 Redundant connections

Determine mirror groups (up to 4 ports in each group). In case of mirrored ports, the data will be sent and received through mirrored ports, but not simultaneously. If connection with first port fails, then connection will be established immediately using the second port of corresponding mirror group, if second fails, then third etc.

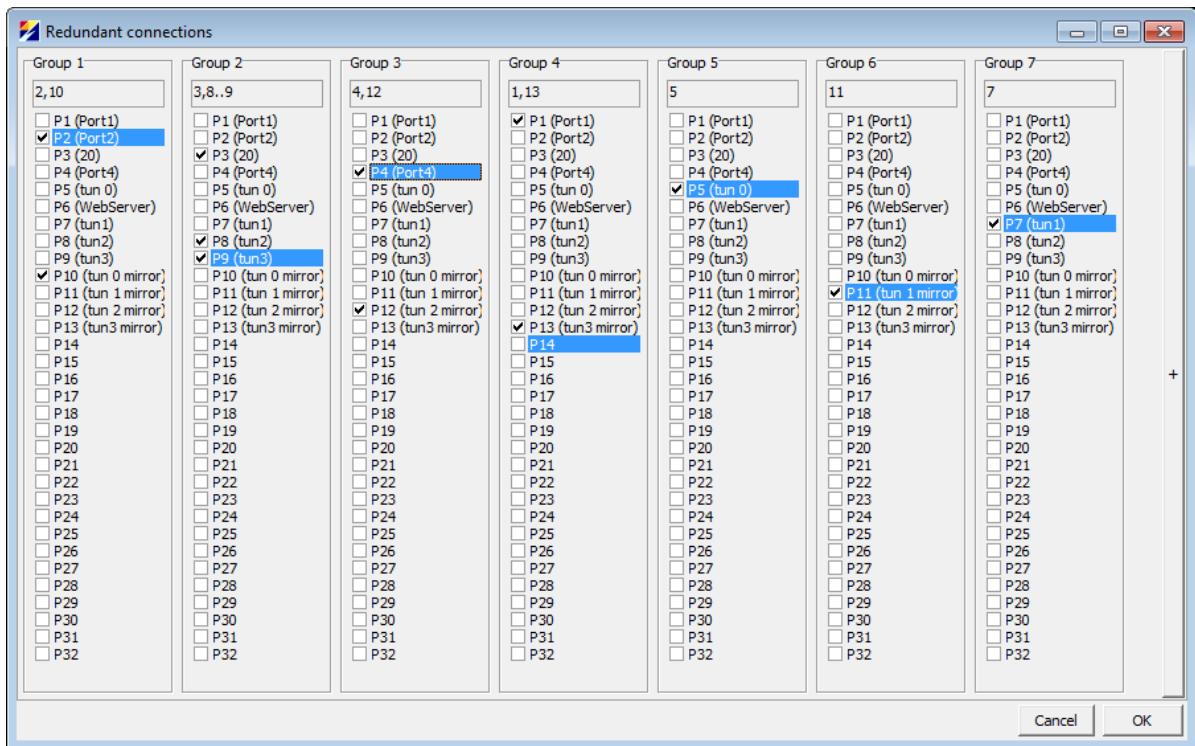


Figure 10.4.4 Redundant connections settings

10.4.5 Direct IEC-101 to IEC-104 Translation

Determine groups of ports (up to 2 ports in each group) for direct protocol translation (without intermediate database) from IEC 60870-5-101 to IEC 60870-5-104 and vice versa.

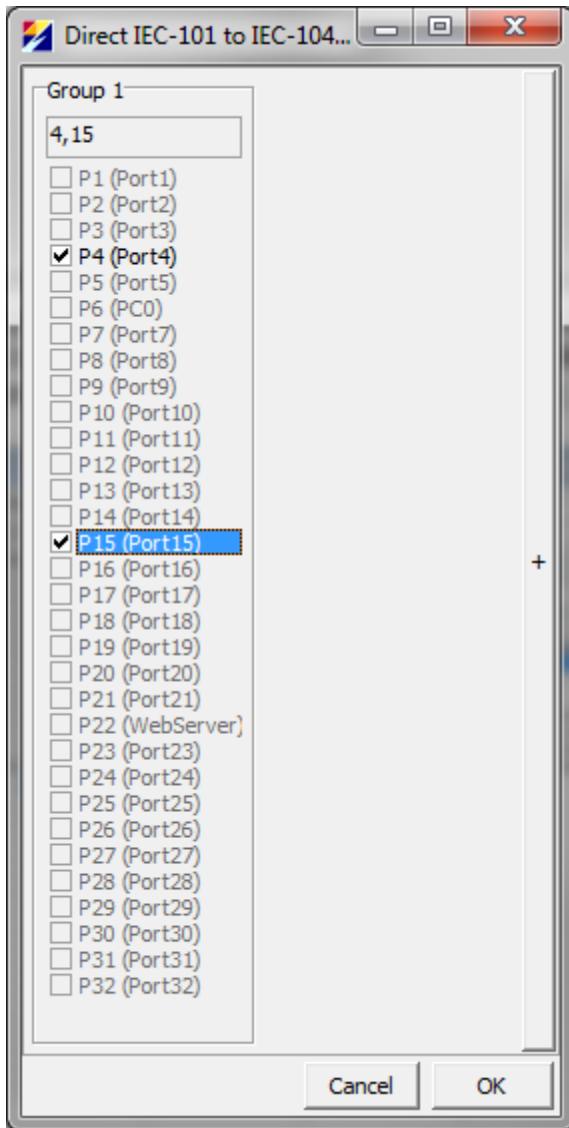


Figure 10.4.5 Direct IEC-101 to IEC-104 Translation settings

10.4.6 OpenVPN

Determine OpenVPN (virtual private networking) settings. Currently only 4 OpenVPN tunnels are supported.

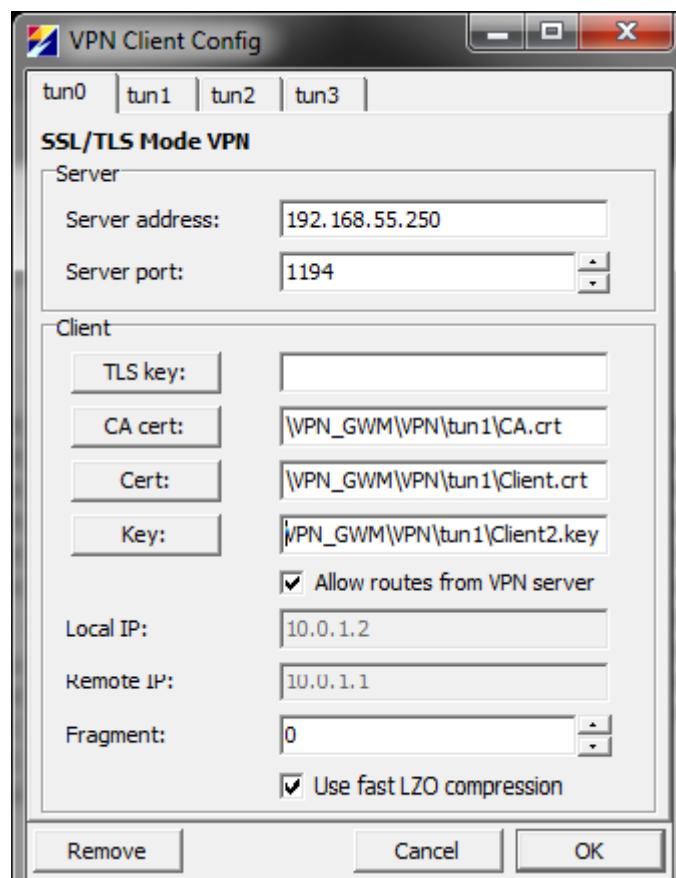


Figure 10.4.6 OpenVPN settings

10.4.7 IPSec

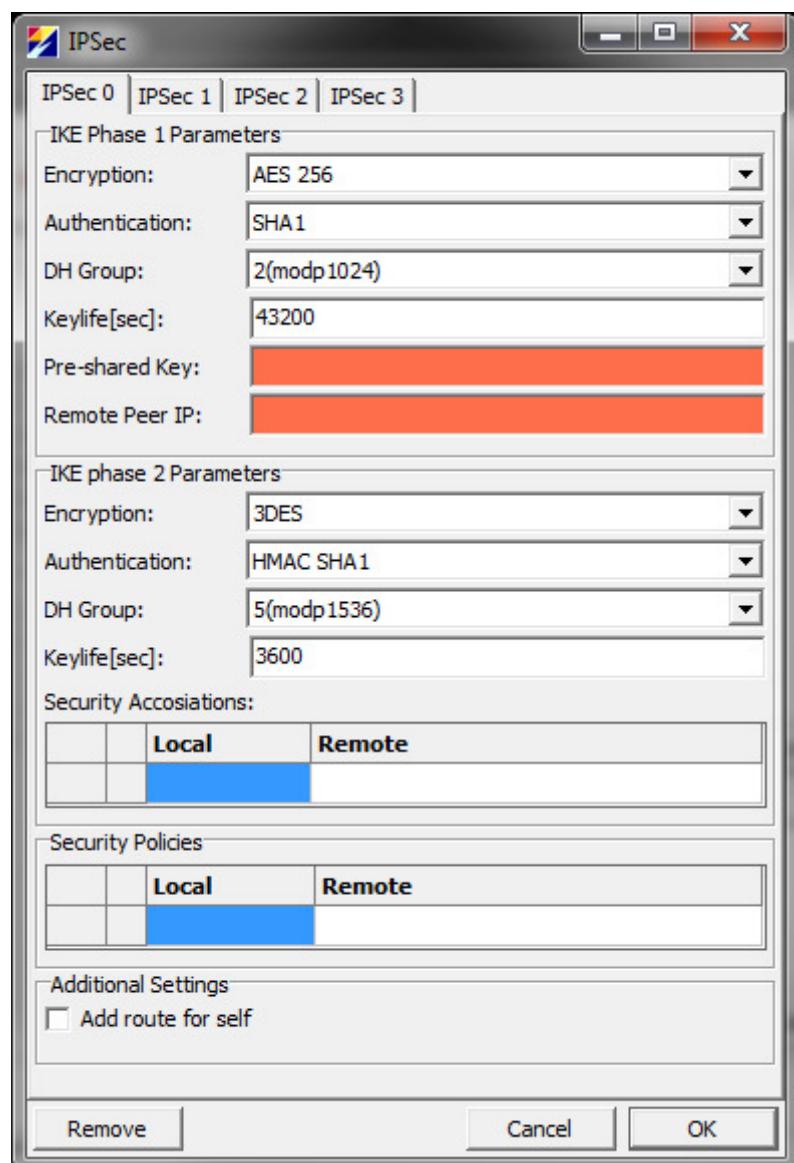


Figure 10.4.7 IPSec settings

10.4.8 L2TP

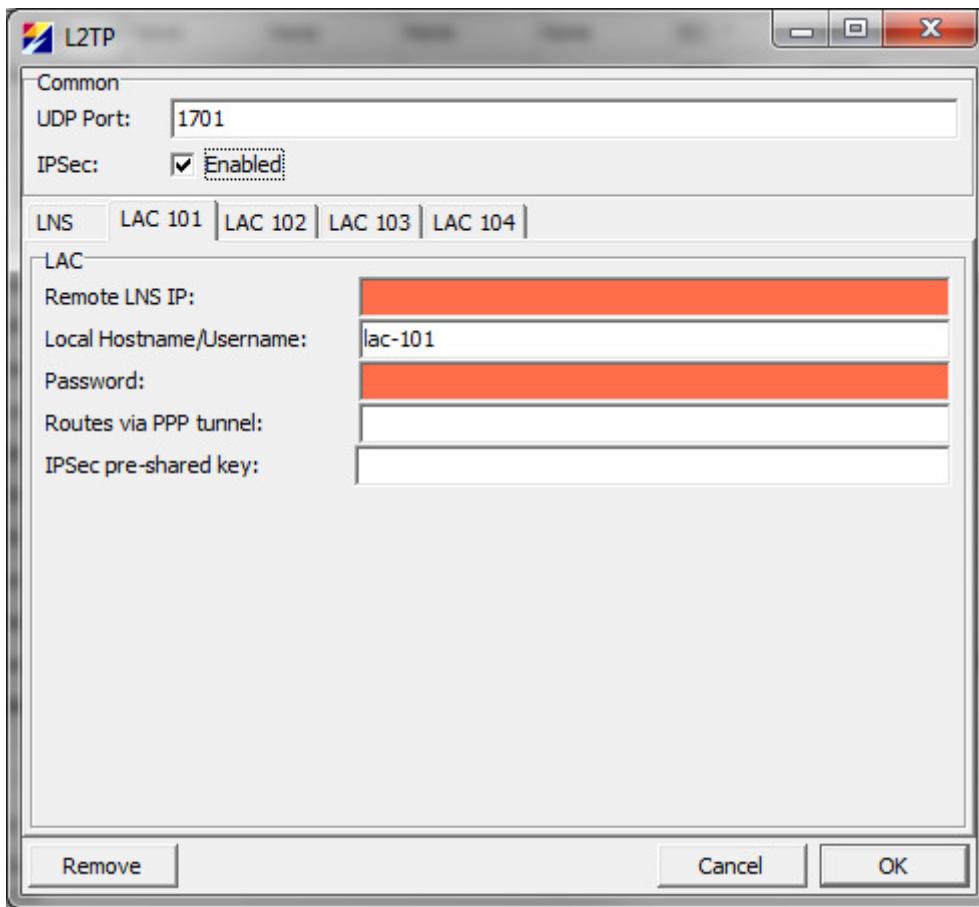


Figure 10.4.8 L2TP settings

10.4.9 Static Routing

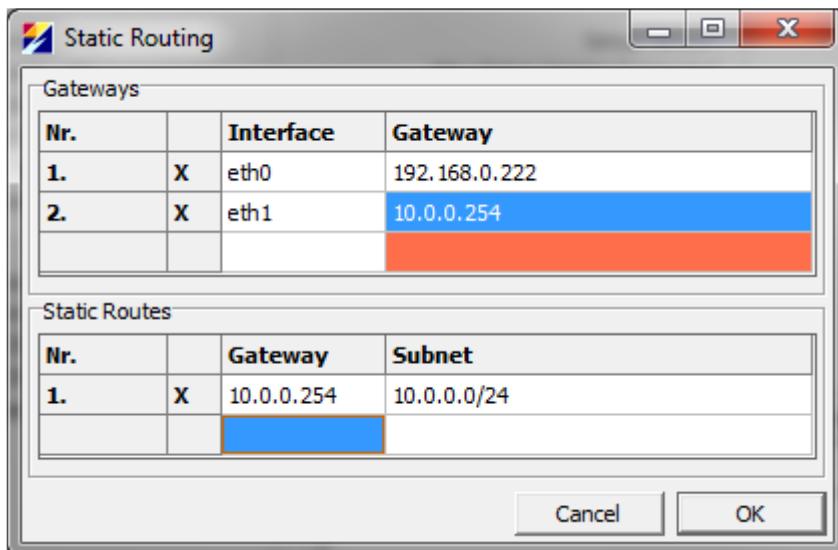


Figure 10.4.9 Static routing settings

10.4.10 Options

Used for changing general options of GWS. In general no modifications needed.

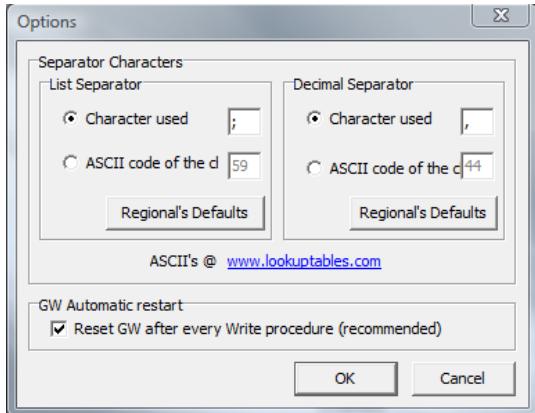


Figure 10.4.10 Options settings

11. Communication Cables

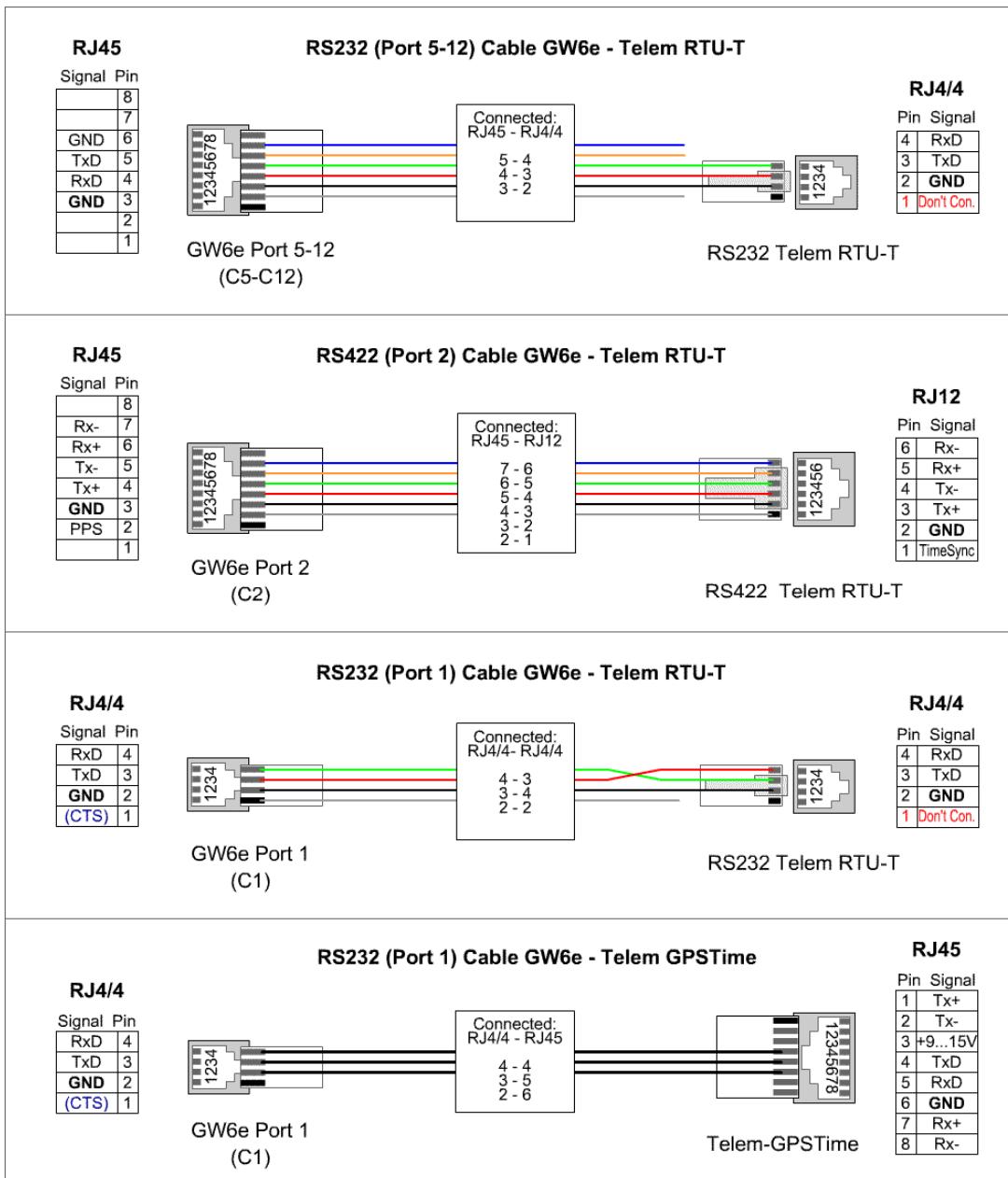


Figure 11.1 GW6e communication cables

Port RJ-45 pin layout

PIN	ETH0, ETH1, ETH2	Port 2 (C2) RS-422/ PPS**/ GPS* (isolated)	Port 5-12 (C5-C12) RS-232
1	TX+		
2	TX-	PPS* out	
3	RX+	GND	GND
4		Tx+	RxD
5		Tx-	TxD
6	RX-	Rx+	GND
7		Rx-	
8			

Port RJ-4/4 pin layout

PIN	Port 1 (C1)* RS-232/GPS
1	CTS
2	GND
3	TxD
4	RxD

* GPS for time synchronization

** PPS - pulse per second

Port 1, Port 2 and GPS Port must be configured for GPS time synchronization by software.

Port 4 pin layout (from left to right)

Port 4 (C4)
RS-485/GPS*
(isolated)
Rx/Tx-
Rx/Tx+
GND
IFR***
IFR***

*** IFR – internal fault relay

12. Firmware Update

12.1 Loading firmware through Secure Digital (SD) Memory Card slot

Updating firmware:

1. Connect Secure Digital (SD) Memory Card to your computer
2. Extract the compressed firmware update file (provided by Martem AS) to your SD Memory Card
3. Disconnect the card from your computer
4. Insert the card to TELEM-GW6e SD Memory Card slot
 - * SD Memory Card slot is located at the back of the device
5. Perform reset operation to TELEM-GW6e device
6. Wait until the device resumes to its normal operation state
7. Firmware update is complete. Remove the SD Memory Card and check if firmware update was successful

Checking results of the firmware update operation:

1. Connect the SD Memory Card to your computer
2. Open the folder you extracted earlier
3. Check if the file "res.txt" is present and open it
4. Check the state of installed files at the last part of the file
 - *If the state of update files is OK - firmware update was successful

12. Notes

- If not stated otherwise on the individual pages of this document, AS Martem reserves the right to make modifications.
- Although the contents of this publication have been checked for conformity with the hardware and software described, we cannot guarantee complete conformity since errors cannot be excluded.
- The information provided in this manual is checked at regular intervals and any corrections that might become necessary are included in the next releases.
- Any suggestions for improvement are welcome.
- The contents of this manual are subject to change without prior notice.