# Remote Terminal Annunciator TELEM-RTA-A

# User Manual

**Martem AS**
**2012**

## Contents

## 1. General

The combined Remote Terminal Annunciator TELEM-RTA-A is a master remote terminal unit for coordinated substation control. TELEM-RTA provides control operations, data collection, protocol cross-referencing and data exchange with the remote control center. At the same time it announces events on the front panel. If required, the units can be cascaded to obtain the desired capacity of the system. The TELEM RTA-A device is similar to the data concentrator TELEM GW6 with the same configuration software and main possibilities. It has a reduced quantity of communication ports but it has additional data collection and event indication possibilities.
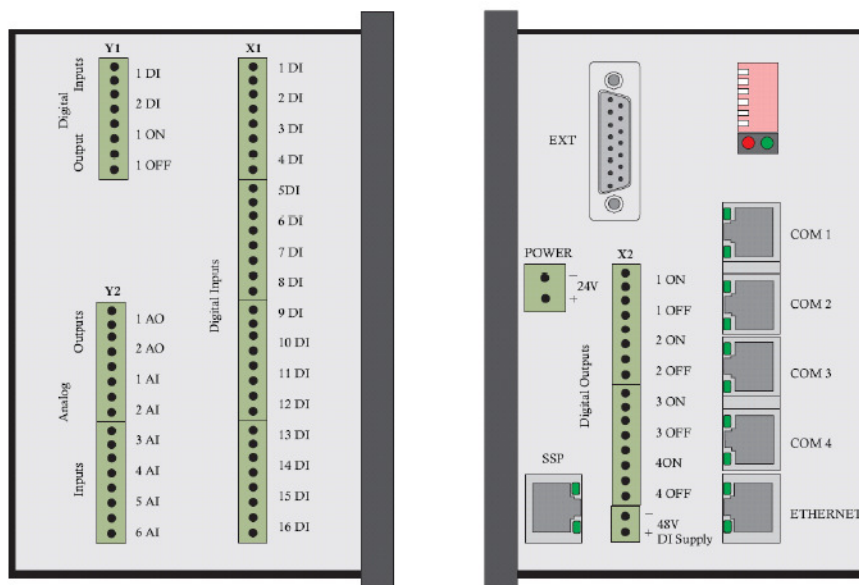
## 2. Possible Applications

Data acquisition and control of regional and national electricity utilities in SCADA systems. In other supply networks also of regional public utilities (gas, water, sewage, district heating, power plants).

## 3. Features

- Analog signal measurements
- Digital contact and acquisition of pulse counting info
- On/Off control functions
- Concentrated data acquisition and control using different communication protocols (see 5. Technical Data)
- Protocol cross-referencing
- Logical operations between digital and analog signals can be described
- Local or remote programmable configuration
- Local event reporting and acknowledgment
- 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
- Telem-RTA-A is 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 via serial or ethernet port
- 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
- Telem RTA-A is provided with control input for clock synchronizing purposes using GPS

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- RTA-A time synchronization by communication protocol (IEC 6870-5-101, IEC 6870-5-104) from control center's channels (time synchronization is possible from multiple control centers)
- Time synchronization of substation devices by communication protocol (IEC 6870-5-101, IEC 6870-5-103)
- Time synchronization by SNTP protocol (on Ethernet connection)
- Logical operations between digital and analog signals can be described
- TELEM RTU devices can be remotely configured across Telem-RTA-A
- Configuration export to ASCII, CSV format files
- A user-friendly user interface similar to MS
- Collects and transfers the sequence of events (SOE) with 1 ms accuracy
- Data sending with time and quality stamp

## 4. View

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## 5. Technical Data

- Number of differential analog inputs        6
- Analog input range (hardware specified)     0… 5 mA; -5…+5 mA;

  0…20 mA; -20…+20mA

- Number of analog outputs                    2 (optional)
- Analog output range                         0…20 mA, 30 V max
- Number of isolated digital inputs           18 (16 dry contacts with an internal supply, 2  with an external supply)

- Number of ON/OFF operations                 5 (1x2 open collector and 4x2 open drain outputs), 30 V max, 0,1A max

- Number of event indicators LED              16
- Number of acknowledge buttons               16
- Number of RS 232 communication ports        4
- Ethernet port                               1
- SSP port for TELEM DO/DI device             optional by request
- Dimensions (WxHxD):                         145x145x93 mm (without screw terminals)
- Mounting                                    onto panel or DIN35 rail
- Weight                                      0,6 kg
- Dimensions of panel cut-out                 138x138

**Data communication protocols**
- To higher level systems IEC 60870-5-101 Unbalanced and Balanced, IEC 60870-5-104
- To lower level devices IEC 60870-5-101 Unbalanced, IEC 60870-5-103, IEC 60870-5-104, SPA-bus, IEC 62056-21 (IEC 1107), Modbus-RTU, Modbus-TCP

**Data communication parameters**
- Start bits                                  1
- Parity                                      odd, even or no parity
- Communication rates                         from 300 to 38400 bit/sec asynchronous
- Communication modes                         RTS/CTS Control, No Control

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**Power supply:**
- Supply voltage                                        24 V DC
- Supply voltage for dry contact input        48 V DC
- Power consumption                              < 5 VA

**EMC**
- Emission                                               EN-55022
- Immunity
  - Static discharge                               EN-61000-4-2
  - Conducted HF field                           EN-61000-4-6
  - RF field                                            EN-61000-4-3

- Power and signal inputs
  - Dielectric withstand                         IEC 60255-5
  - Fast transients                                 EN-61000-4-4
  - Surge                                              EN-61000-4-5

## 6. Switches

- 1 – not in use
- 2 – not in use
- 3 – ON – force COM1: Addr.1, /9600/8 NI
- 4 – ON – restore default setup*
- 5 – OFF – oper mode, ON – Firmware update mode
- 6 – ON - Reset

* To restore the default setup, follow this sequence:
    Sw 4 ON -> Reset -> Sw 4 OFF within 5 sec.

## 7. Ports

- COM 1 – RS-232 (Communication or Firmware update) + GPS time synchronization
- COM 2 – RS-232 with all modem signals
- COM 3,4 – RS-232 interface
- COM  5  – Ethernet (Communication and/or Firmware update)
- SSP – for connecting the TELEM DO/DI device and LED indication panel (optional)
- EXT – for connecting an external expansion device

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COM port's pin layout

| Pin | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|
|  | - | - | GND | RX | TX | GND | - | RD* |
| COM 2 | DSR | CTS | GND | RX | TX | DCD | RTS | DTR |
| COM 3,4 | - | CTS | GND | RX | TX | GND | RTS | - |

* Time synchronization using GPS


# 8. Indication

For operation
 • Green LED – Blinking indicates operating mode
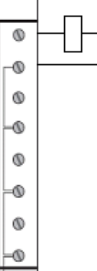 • Red LED – Failure
For communication
 • Yellow LED – RX
 • Green LED – TX

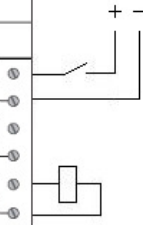Green LED at SSP port - blinking indicates GPS time synchronization


# 9. Terminal Blocks

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| Signal | Terminal | RTA X2 | |
|---|---|---|---|
| | 1 DO -on | 1 | |
| | 1 DO -on | 2 | |
| | 1 DO -off | 3 | |
| | 1 DO -off | 4 | |
| | 2 DO -on | 5 | |
| | 2 DO -on | 6 | |
| | 2 DO -off | 7 | |
| | 2 DO -off | 8 | |
| | 3 DO -on | 9 | |
| | 3 DO -on | 10 | |
| | 3 DO -off | 11 | |
| | 3 DO -off | 12 | |
| | 4 DO -on | 13 | |
| | 4 DO -on | 14 | |
| | 4 DO -off | 15 | |
| | 4 DO -off | 16 | |
| Power input for digital inputs | GND | 1 | |
| Power input for digital inputs | + 48V DC | 2 | |

| Signal | Terminal | RTA Y1 | |
|---|---|---|---|
| | 1 DI | 1 | |
| | 1 DI COM | 2 | |
| | 2 DI | 3 | |
| | 2 DI COM | 4 | |
| | 1 DO -on | 5 | |
| | 1 DO -on | 6 | |
| | 2 DO -off | 7 | |
| | 2 DO -off | 8 | |

| Signal | Terminal | RTA Y2 | |
|---|---|---|---|
| | 1 AO - | 1 | |
| | 1 AO + | 2 | |
| | 2 AO - | 3 | |
| | 2 AO + | 4 | |
| | 1 AI - | 5 | |
| | 1 AI + | 6 | |
| | 2 AI - | 7 | |
| | 2 AI + | 8 | |
| | 3 AI - | 9 | |
| | 3 AI + | 10 | |
| | 4 AI - | 11 | |
| | 4 AI + | 12 | |
| | 5 AI - | 13 | |
| | 5 AI + | 14 | |
| | 6 AI - | 15 | |
| | 6 AI + | 16 | |

# 10. Events Archiving

## 10.1 Events log

Sequence of events (SOE) are collected with 1 ms time resolution. These events are archived in the form of text files in folder ftp://<ip address>/events and are physically saved to device's flash memory. Events log will be updated only if any events occur. If no events are detected, nothing will be written to events text file.

Last events reside in file Events.txt, which can grow up to 500 kB in size (about 10 000 events). On growing over this limit the Events.txt is renamed to Events.NNN, where the NNN is file no. and the new Events.txt starts to grow from zero again. Events.NNN is also copied to Events.bak , previous Events.bak is overwritten. The contents of Events.txt and Events.bak is viewable in Web Browser.

Events.NNN files are stored in compressed form in  Events.bz2, which can grow up to 4 MB, after that the older files inside Events.bz2  will be deleted. All these files can be retrieved over FTP connection.

Archive includes:
- Events.txt          Viewable in Web Browser
- Events.bak

- Compressed container Events.bz2:

```
Events.001
.
.
.
Events.NNN
```

## 10.2 Error log

All detected errors are archived in text files in folder ftp://<ip address>/errors and are physically saved to device's flash memory.
Last errors reside in file Errors.txt, which can grow up to 500 kB in size (about 10 000 errors). On growing over this limit the Errors.txt is renamed to Errors.NNN, where the NNN is file no. and the new Errors.txt starts to grow from zero again.

All these files can be retrieved over FTP connection.

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# 11. Digital Input Processing

Digital input signals are applied to two filters, at first to "Debouncing" and then to "Chatter" filter.
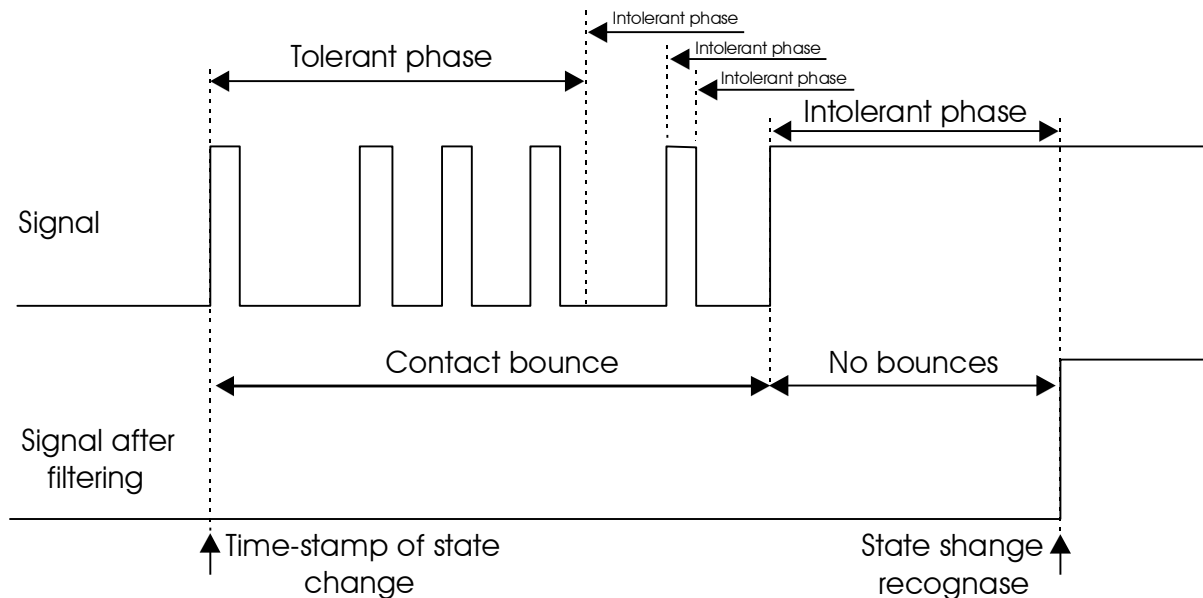
## 11.1 Debouncing Filter

The digital debouncing filter prevents switching noises.
Configuring parameters:
**Tolerant phase** - a period of time during which contact bounce is "acceptable". Having a tolerant period allows you to monitor and time-stamp the initial state of change while ignoring any subsequent contact bounces.
**Intolerant phase** - a period of time following the tolerant phase during which contact bounce is not "acceptable". It ensures that contact bounce is not mistaken for a valid change of state.

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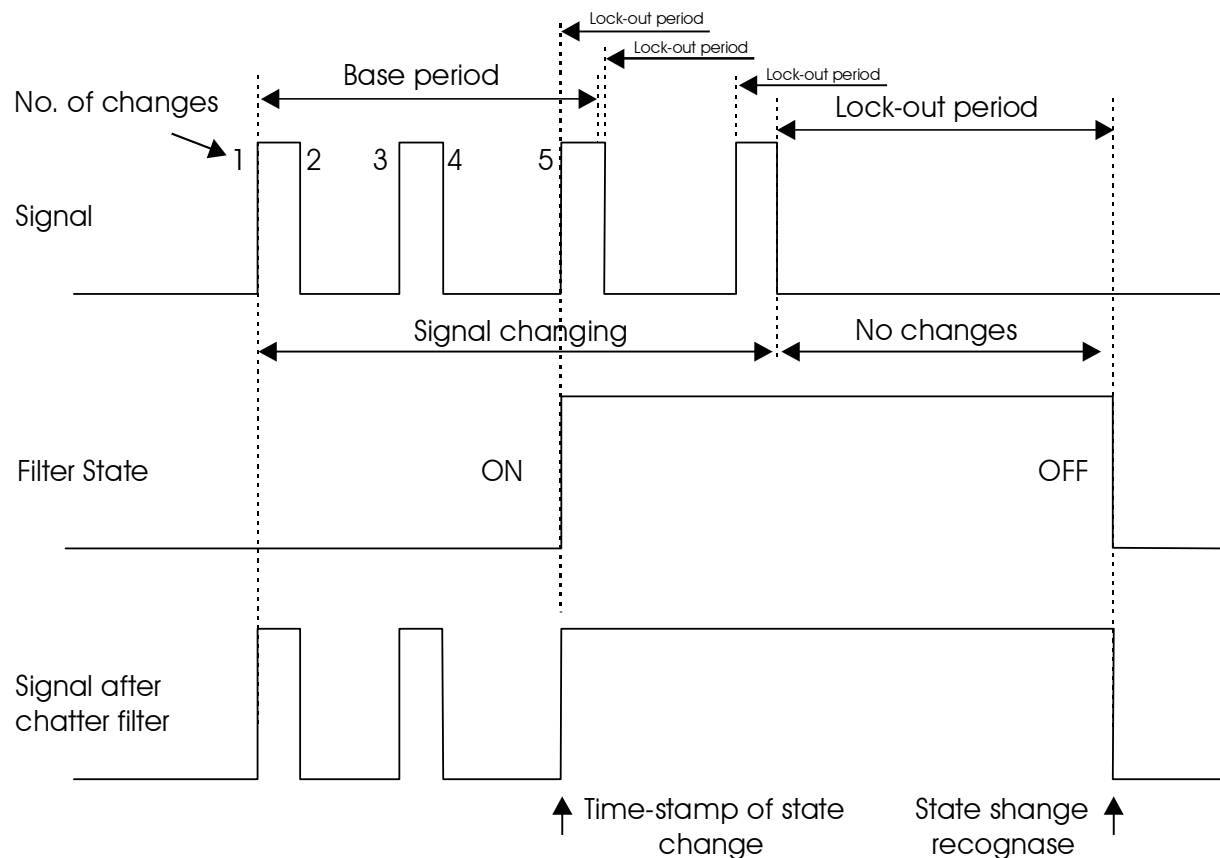
## 11.2 Chatter Filter

Chatter Filter detects input chatter preventing filling buffers.
Configuring parameters:
**Chatter times (changes) -** maximum allowed number of state transitions that can occur within a filter base period. If the number of state transitions during the filter period equals or exceeds the maximum allowed number of state transitions, chatter filter will turn ON and any further transitions will be ignored for the duration of the "lock-out" period.
Lock-out period - minimum number of filter base periods during which the chatter filter will remain ON. The chatter filter can proceed from ON to OFF only if no state transitions are detected during the entire lock-out period.
Example: Chatter times (changes) 5, Lock-out period 1

Configuration: Changes - 5, Lock-out period -1 (1x Base period)

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# 12. TELEM RTA-A Configuration Tool

## 12.1 Getting Started

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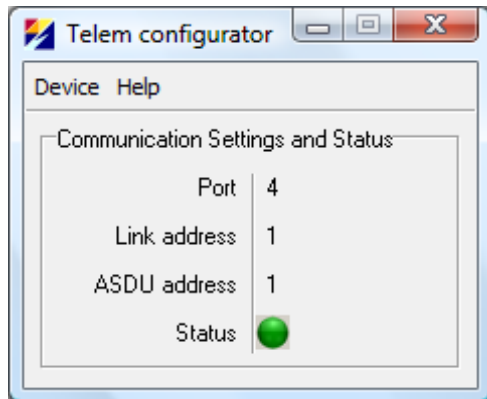


Figure 11.1.1 User interface window

The following parameters are shown for information:
* **Port** – PC port which is used to communicate with RTA-A
* **Link address** – Link address of RTA-A
* **ASDU address** – ASDU address of RTA-A
* **Status** – Status of the connection. RED – no connection, GREEN – connection OK

**Device menu**
* **Device** – For selecting the device type
* **Communication Setup** - For changing serial communication parameters to connect with RTA-A.
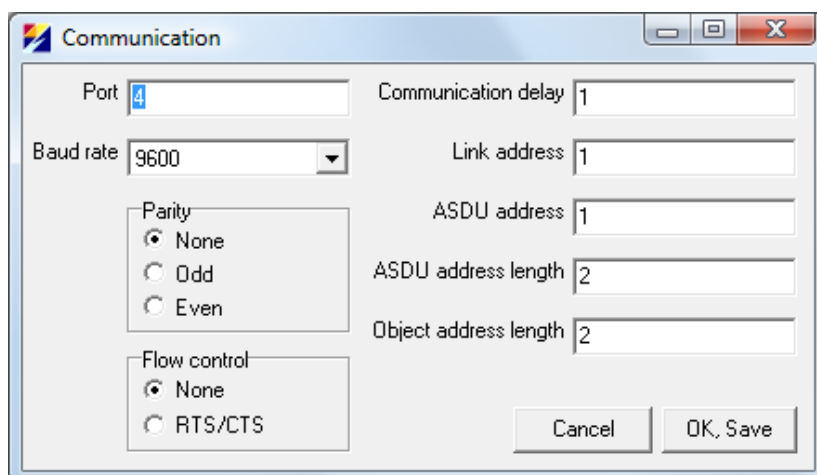


Figure 12.1.2 Communication parameters window

**Fields in the communication parameters window**
- **Port** – PC communication port which is used to communicate with RTA-A
- **Baud rate** – Data communication rate
- **Parity** – Use of parity control bit
- **Flow control** – Determines whether the RTS/CTS handshaking is used
- **Communication delay** – Delay between reception of data and the next query in milliseconds
- **Link address** – Link address of RTA-A
- **ASDU address** – ASDUI address of RTA-A
- **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.

### 12.2 RTA-A Configuration Window

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

**Shortcut icons** below the menu bar:

| Icon | Description |
|------|-------------|
| 🗋 | Open a new configuration |
| 📂 | Open a configuration file |
| 💾 | Save the configuration to a file |
| R | Read the configuration from RTA-A |
| W | Write the configuration to RTA-A |
| RS | Reset RTA-A* |
| ICD SCD | Load XML file (IEC 61850) ** |
| R | Reload all XML files attached to devices (IEC 61850) ** |
| R | Read the configuration from RTA-A over SSH connection*** |
| W | Write the configuration to RTA-A over SSH connection*** |
| C | Cancel SSH connection*** |
| Set | SSH connection setup – enter correct IP address and password of device*** |
| Up | Firmware update over SSH connection*** |

  * Possible Reset codes:
   1 – Simple Reset
   2 – Reset that also clears memory buffers
   3 – Reset that also restores the default setup
  ** IEC 61850 currently available only to Telem-GW6
 *** Requires 3-rd party software "PuTTY"

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**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 the Note Pad program. When editing the configuration with 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) | Read Configuration | Help  (F1) |
| | Open(Ctrl+O) | Write Configuration | About |
| | Save (Ctrl+S) | Cancel Active Transfer | |
| | Save As | Send Reset | |
| | Exit | Analog Groups | |
| | | Tcp/Ip Settings | |
| | | Timing Settings | |
| | | Modem Settings | |
| | | Port Mirroring | |
| | | Options | |

**12.3 Tab Cards in the Configuration Window**

Configuration and setting parameters can be utilized by using topic tab cards:
**Ports, Devices, Objects, Formulas, 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.

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


### 12.3.1 Ports Tab Card

**Ports**/**configuration tab card** is active when the RTA-A configuration window is opened.

| | Port 1 | Port 2 | Port 3 | Port 4 | Port 5 |
|---|---|---|---|---|---|
| Protocol | IEC ^ | IEC v | IEC ^ | IEC ^ | IEC ^ |
| Baud Rate | 9600 | 9600 | 9600 | 9600 | |
| Parity | None | None | None | None | |
| Stop Bit | 1 | 1 | 1 | 1 | |
| Data Bits | 8 | 8 | 8 | 8 | |
| Modem Settings | | | | | |
| Communication Mode | No Control | No Control | No Control | No Control | Tcp/Ip Legacy |
| IP address | | | | | 0.0.0.0:2404 |
| Polling(v)/Answering(^) Delay [ms] | 0 | 0 | 0 | 0 | 0 |
| Port Link Address | 1 | | 1 | 1 | 1 |
| IEC Port ASDU Address | 1 | | 1 | 1 | 1 |
| Length Of ASDU Address | 2 Bytes | | 2 Bytes | 2 Bytes | 2 Bytes |
| IEC Object Length | 2 Bytes | | 2 Bytes | 2 Bytes | 3 Bytes |
| Up Protocol SubVersion | 101 ub | | 101 ub | 101 ub | 104 |
| Query Timeout [ms] | 500 | 500 | 500 | 500 | 500 |
| Failed Query Count for disabling contr. | 5 | 5 | 5 | 5 | 5 |
| Query Interval for Retry/Bal.mode [s] | 20 | 20 | 20 | 20 | 20 |
| Supress Echo | No | No | No | No | No |
| Replace Event hrs | No | No | No | No | No |
| Time | NTime/STi | | NTime/STi | NTime/STi | NTime/STime |
| Control takeover DO obj.addr. | 0 | | 0 | 0 | 0 |
| Control takeover DI obj.addr. | 0 | | 0 | 0 | 0 |
| Comment | Conf | DI24T | | | IEC 104 Ethernet |

**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
- **Communication Mode** – Makes it possible to choose between the following handshaking options:

      - No control
      - Modem Callout – Port 2
      - RTS/CTS  Control – Port 2
      - RS-422/485 – Port 5 – not in use
      - Tcp/Ip
- **IP address** – communication IP address (used if Communication Mode is set to Tcp/IP)
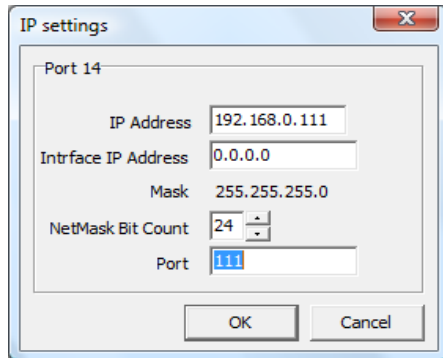
**IP Address** – an address of the device which can connect with RTA-A using corresponding port (if set to 0.0.0.0 – all devices can connect)
**Interface IP Address** – additional IP address of RTA-A
**Port** – available network communication port (in case of IEC 60870-5-104 protocol, port 2404 is recommended)

* If 2 or more different IP addresses are needed (for connecting to multiple networks [IEC 60870-5-101, IEC 60870-5-104]), then it is necessary to add equal number of ports and to define a different IP address to each port. Port 5 and higher all use the same physical Ethernet port.
- **Polling(v)/Answering(^) Delay** – Delay between reception and the next query
- **Port Link Address** – Link address of the device on uplink channels
- **IEC ASDU Address** – ASDU address on uplink channels
- **Length of the 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
- **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
- **Query Interval for Retry/Bal.mode [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
- **Control takeover DO obj.addr.** – The address of an object that determines control takeover of that device
  *the object must be determined under a virtual device in objects table
- **Control takeover DI obj.addr.** –  The address of an object that shows which channel has taken over the control rights
  *the object must be determined under a virtual device in objects table

If some parameters in the grid area have a grey background then these are not used for the chosen protocol type but you are still allowed to modify them.

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## 12.3.2 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 length** – Length in bytes, possible values are 1 or 2
- **Object address length** – 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 RTA-A 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 Forward** – 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 11.3.1 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)

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### 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
Remove Devices

Clear
```
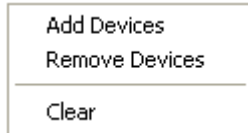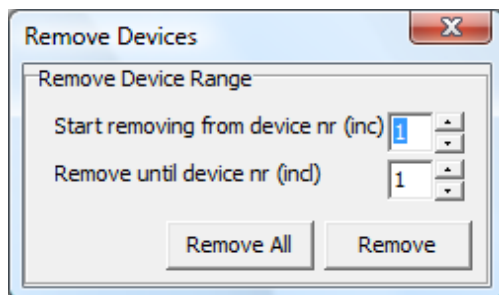
 Add Devices dialog box appears.
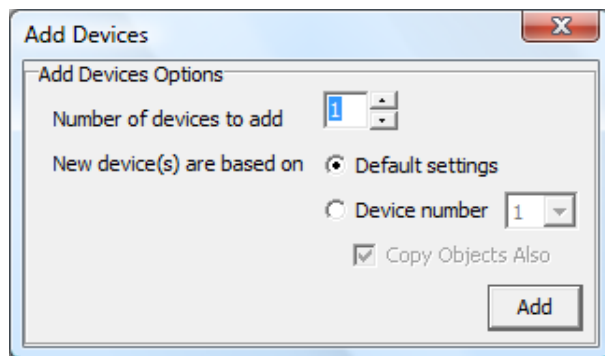
Set the Add Devices options:
- Number of devices to add
- Default settings or the device number from where the settings are derived
- Copy Object Also

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.

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**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.


## 12.3.3 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)
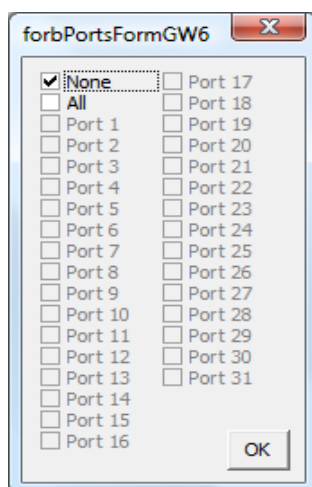**Sub Type ^** – Object's subtype for uplink.
**Sub Type v** – Object's subtype for downlink.

Subtypes of object can be selected.

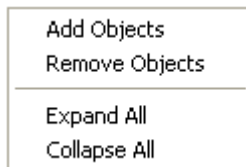| Object type | Subtype ^ | Subtype v | |
|---|---|---|---|
| DI – Digital input | Single Double | Normal Fallback | |
| DO – Digital output | | Single Double | Direct Execute Select Execute |
| AI – Analog input | Normalized Floating point Step position | | |

- **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.
- **Object.Addr v** – Object's downlink address
- **61850 v** – 61850 address (loaded from device's XML file)
- **Object.Addr ^** – Object's uplink address
- **DB1 %Fs** – Deadband (% of full scale). If the value has changed less than the deadband then it is not spontaneously transferred.
- **DB2 %Fs** – This is used instead of DB if the **Crit.Min** and **Crit.Max** fields are used and the value falls within these limits. **In case of offline** (GSM) channel, if the change in value is bigger than deadband 2 (% of full scale) then a call to SCADA system is initiated.
- **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.

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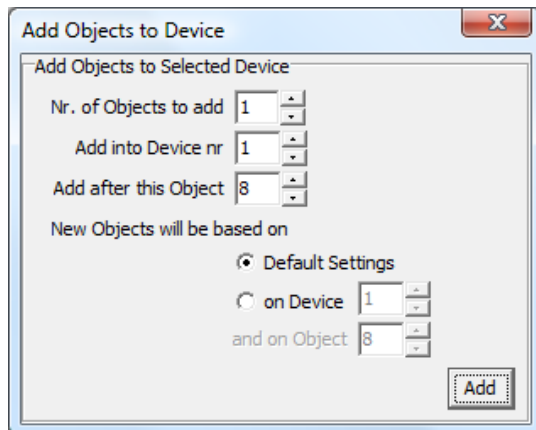12618 Tallinn              Fax: +372 639 79 80                www.martem.ee
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- **Crit.Min %Fs / On Ev. Nr; Crit.Max %Fs / Off Ev. Nr**
  **Crit.Min %Fs; Crit.Max %Fs** – Minimum and maximum values in % from the full scale of analog measurements on which RTA-A 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
- **Forb. Calling** – Block object's value transfer.
- **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:
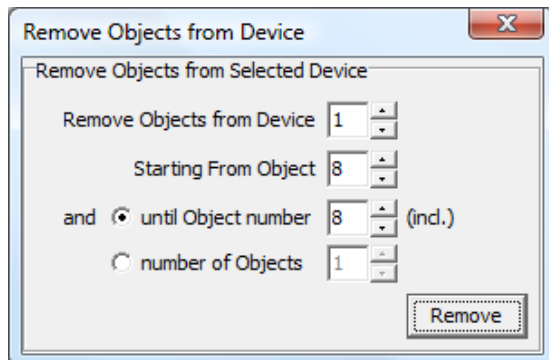


When selecting Add Objects, the following dialog box appears:

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## 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.

## 12.3.4 Formulas Tab Card



| No. | Type | SubType ^ | Invert | Obj. Addr. ^ | DB1, %Fs | DB2, %Fs | Scale Min | Scale Max | Forb. Ports ^ | LED no. | Formula | Comment | Crit Min, |
|-----|------|-----------|--------|--------------|----------|----------|-----------|-----------|---------------|---------|---------|---------|-----------|
|  | DI | Single | No | 101 |  |  |  |  | None | 1 | @1or@2 | kommentaar1 |  |
|  | DI | Single | No | 102 |  |  |  |  | None | 2 | @1and@2 | kommentaar2 |  |
|  | DI | Single | No | 103 |  |  |  |  | None | 3 | @2401or@2414 | kommentaar3 |  |
|  | DI | Single | No | 104 |  |  |  |  | None | 4 | @2402and@2416 | kommentaar4 |  |
|  | DI | Single | No | 105 |  |  |  |  | None | 0 |  |  |  |
|  | DI | Single | No | 106 |  |  |  |  | None | 0 |  |  |  |
|  | DI | Single | No | 107 |  |  |  |  | None | 0 |  |  |  |
|  | DI | Single | No | 108 |  |  |  |  | None | 0 |  |  |  |
|  | DI | Single | No | 109 |  |  |  |  | None | 0 |  |  |  |

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**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 | 7 |

| | | | @201 – OFF state signal | |
|---|---|---|---|---|
| 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 |
| time() | DI | Time function | time>12:00:00 and time<12:01:00 | |

* 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.

  | Add Formulas |
  | Remove Formulas |
  | Clear |

  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.

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## 12.3.5 RTA IO Tab Card

RTA IO Tab Card allows you to determine input-output object parameters of RTA-A and determine whether RTA-A is used as DI indicator panel or annunciator panel.

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### 12.3.5.1 Configuration Parameters of Digital Inputs and Counters

The following data fields are configured for each input signal:
- **Type**: Digital input (DI) or counter (CN)

**Parameters for DI type:**
- **Subtype**: Single or Double and time tagging. <u>If the Double is selected then it works together with the next DI forming a pair of signals</u>.
- **Invert**: Inverts the input signal
- **Obj. addr.^**: Object address for the upper level device
- **Comment**
- **Forb.Ports**: Numbers of the ports to where this data object is not transferred (forbidden ports)
- **Forbid calling**: Possibility to forbid the callout on upper level offline channels (PSTN, GSM data)

*Debouncing filter parameters*
- **Tolerant ph.[ms]**: A period of time during which state changes are ignored. Range: 0 … 65567 ms. Default: 5 ms.
- **Intolerant ph.[ms]**: A period of time during which the state of digital input must remain unchanged. Range: 0 … 255 ms. Default: 5 ms.

*Chatter filter parameters*
- **Base per.[ms]**: Time interval for checking the number of changes
- **Change count**: Number of allowed changes during the base period
- **Lock-out multiplier**: Number of filter base periods after which the chatter filter will be reset if there are no more state changes

*Parameter for the CN type:*
- **Imp.cnt.**: Impulse counter for the counter (CN) type. If the value change exceeds it then it writes the value to output buffer (creates an event)

### 12.3.5.2 Configuration Parameters of <u>Digital Outputs</u>

The following data fields are configured for each digital output:
- **Subtype**: Single or Double, "Direct Execute" or "Select and Execute"
- **Invert**: Inverts the output signal
- **Obj. addr.^**: Object address for the upper level device
- **Comment**
- **Forb.Ports**: Numbers of the ports to where this data object is not transferred (forbidden ports)
- **Pulse len.[ms]**: Length of control pulse in milliseconds

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### 12.3.5.3 Configuration Parameters of <u>Analog Inputs</u>

The following data fields are configured for each analog input:
- **Subtype**: Normalized or floating point value and time tagging
- **Meas. Range**: Indicates the measurement range: +-Range, +Range, 0..20mA. <u>It has to mach the ordered hardware configuration!</u>
- **Obj. addr.^**: Object address for the upper level device
- **Comment**
- **DB1, %Fs**: Deadband in %-s from the full scale to determine the considerable change. If the value change exceeds it then it writes the value to output buffer (creates an event)
- **DB2, %Fs**: Deadband in %-s from the full scale to cause the callout on upper level offline channels (PSTN, GSM data)
- **Scale min**.: The scaled value on the floating point value which corresponds with the minimum (zero) input value
- **Scale max**.: The scaled value on the floating point value which corresponds with the maximum measured input value
- **Forb.Ports**: Numbers of the ports to where this data object is not transferred (forbidden ports)
- **Crit.Min., %Fs**: Critical minimum in %-s from the full scale. If the value falls below this limit then the callout is initiated on upper level offline channels (PSTN, GSM data)
- **Crit.Max., %Fs**: Critical maximum in %-s from the full scale. If the value rises above this limit then the callout is initiated on upper level offline channels (PSTN, GSM data)
- **Forbid calling**: Possibility to forbid the callout on upper level offline channels (PSTN, GSM data)
- **Avg per.[ms]**: Averaging period for smoothening the measurement.
- **Zero zone**: The zone around the zero in %-s from the full scale. If the value falls into this zone then it is equalized with zero.
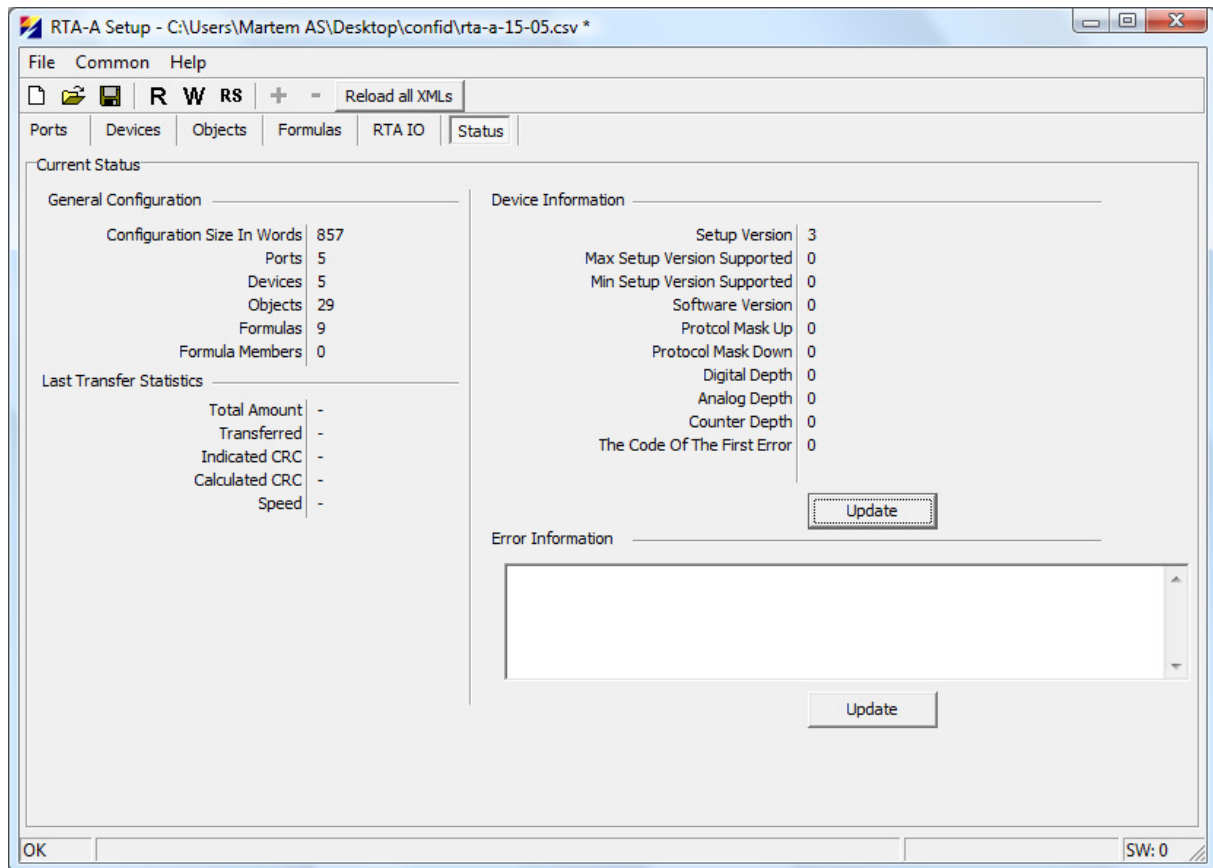
**Remark**
Ranges of analog inputs are hardware specified. If  **+ -** values are specified and range **+** is determined then negative values are presented as zero. Measurement ranges have to be determined according to the specified input values.

### 12.3.5.4 Configuration Parameters of <u>Analog Outputs</u>

The following data fields are configured for each analog output:
- **Range**: Determines the output range: 0..20mA or 4..20mA.
- **Obj. addr.^**: Object address for the upper level device
- **Comment**
- **Scale min**.: The scaled value on floating point value which corresponds with the minimum output value
- **Scale max**.: The scaled values on floating point value which corresponds with the maximum output value
- **Forb.Ports**: Numbers of the ports to where this data object is not transferred (forbidden ports)

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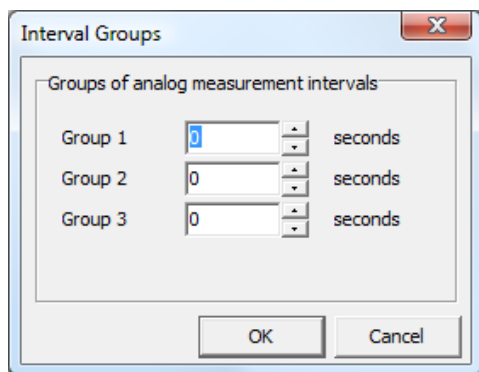Estonia

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## 12.3.6 Status Tab Card



**Status tab card** presents the status of RTA-A general configuration parameters and transfer statistics.

**Update** button is used to get information from the connected RTA-A and it is displayed under Device Information.
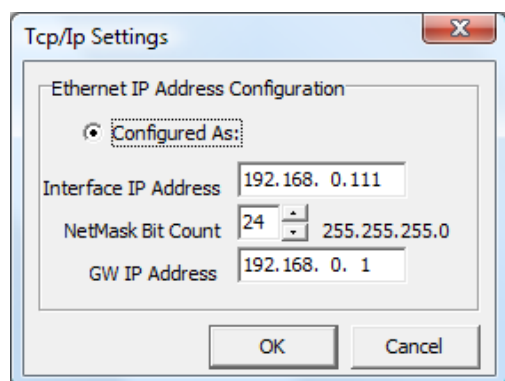
## 12.4. Common Main Menu

### 12.4.1 Analog Groups
Interval groups are used to specify the time interval of sending analog input value to the remote control center when the value has changed less than the deadband. Interval groups can be added to analog input objects in the Configuration tool in the Objects tab (Analog group).

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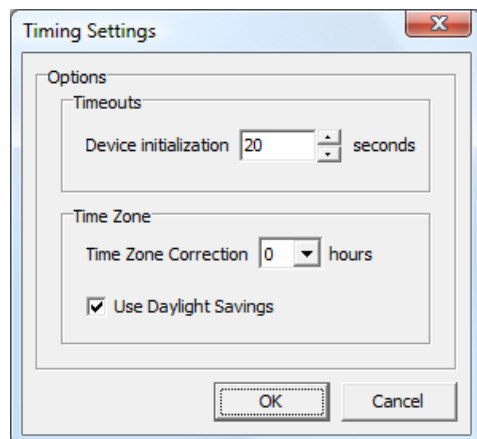Estonia

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### 12.4.2 TCP/IP Settings
Used for RTA-A to determine IP parameters.
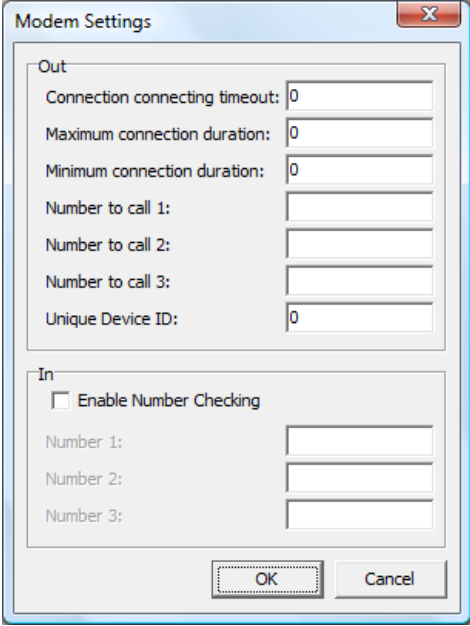
### 12.4.3 Timing Settings
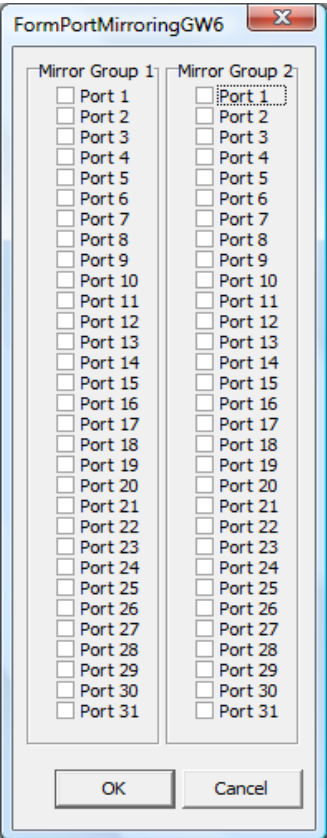To determine device initialization timeouts and time zone correction.

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### 12.4.4 Modem Settings
Configure modem settings for modem callout communication mode (Port 2).



### 12.4.5 Port Mirroring
To determine 2 mirror groups (2 ports in each group). In case of mirrored ports, the data will be sent and received through both ports, but not simultaneously. If connection with first port fails, then connection will be established immediately using the second port of corresponding mirror group.

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**Notes for configuration:**

- If one RTA-A is connected to another as sub-RTU (one collects data from another), then the configuration of sub-RTU can be remotely read and written through the main RTU using the configuration program.

### 12.5 Configuration of connected I/O modules remotely through the RTA-A

For configuration of connected I/O modules through the RTA-A the configuration redirection is used. There is the menu item  "GW6/RTA-A conf redirection" in main menu for opening the corresponding sub window.
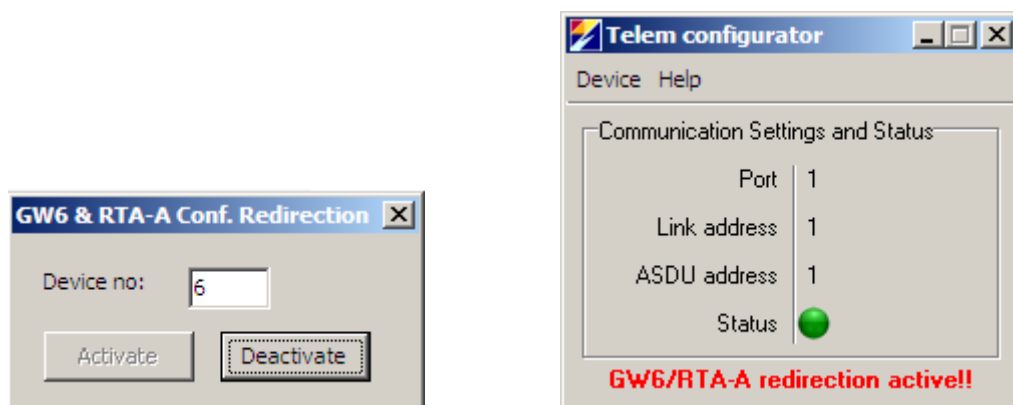
For activating the redirection of configuration data insert the device no. from Devices tab of GW6/RTA-A configuration window and press the Activate button. After that the redirection notice is shown in the main window until to deactivation of it.

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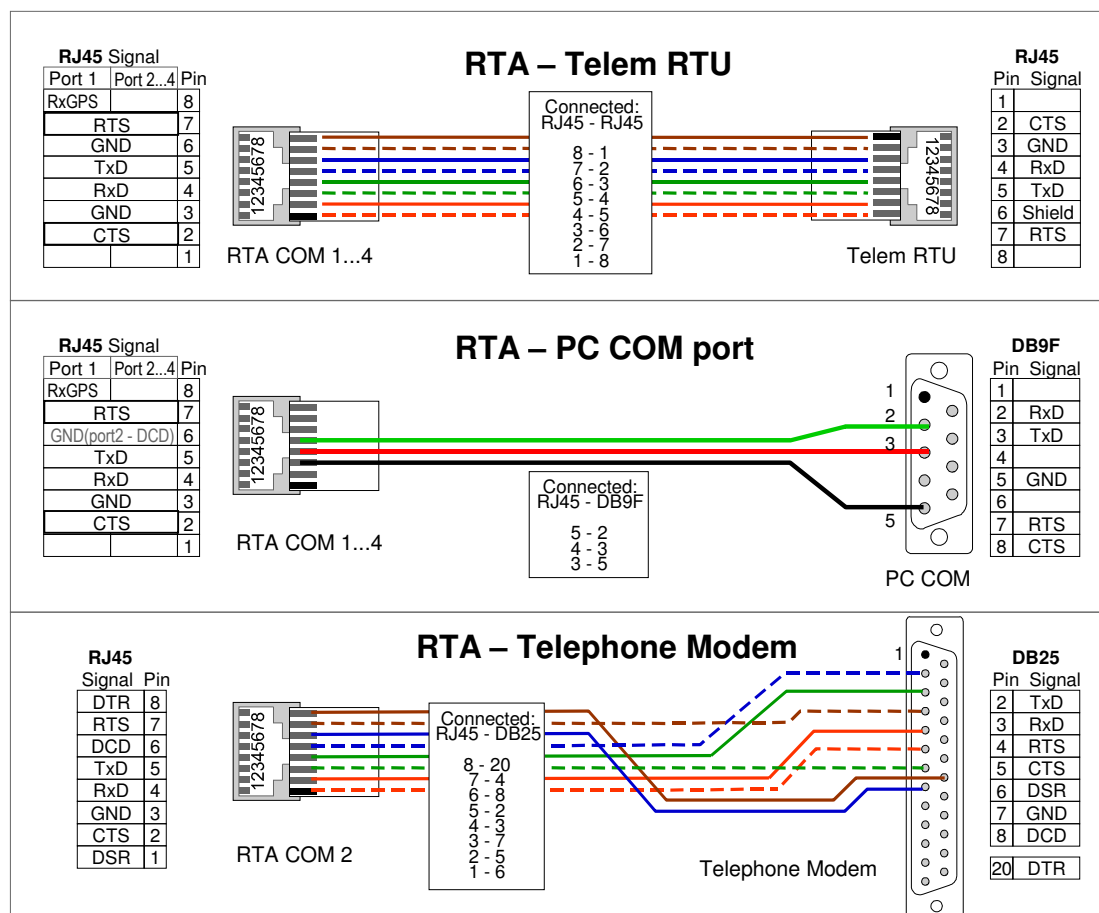Estonia

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## 13. Configuration via FTP

1. Make a configuration with GWS.exe and save it as binary file
   File > Save As > Binary file (*.bin) (gwSetup.bin)
2. Open your file browser and type in the following address:
   **ftp://root@[device's IP address]**
   For example: ftp://root@10.0.0.48
3. Open **"disk"** directory
4. Copy the binary configuration file (gwSetup.bin) to the ftp directory.
5. Wait about 1 minute (this is unnecessary if reset is sent through the configuration program)
6. Perform reset operation to Telem-RTA-A device
7. Wait until the device resumes to it's normal operation state
8. Configuration is complete

## 14. Communication Cables

TELEM RTA-A Communication Port RJ-45 pin layout.

| PIN | Port 1 RS232/Load GPS | Port 3, Port4 RS232 | Port 2 RS232 |
|-----|------------------------|---------------------|--------------|
| 1 | | | DSR |
| 2 | | CTS | CTS |
| 3 | GND | GND | GND |
| 4 | RxD | RXD | RXD |
| 5 | TxD | TXD | TXD |
| 6 | GND | GND | DCD |
| 7 | | RTS | RTS |
| 8 | RX (for GPS time synchronization) | | DTR |

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## 15.  Firmware update

Updating RTA-A firmware via ftp:

- Extract the compressed firmware update file (provided by Martem AS) to your computer.
- Connect to RTA-A via a SFTP client (for instance WinSCP). Default IP address is 192.168.0.111 if not changed by user (IP address can be seen with configuration software). Login as **"root"** (password is provided by Martem AS).
- Open **"disk"** directory in RTA-A and copy extracted files inside "disk" directory on your computer to RTA-A.
- New firmware should start automatically (you should see new firmware version number by updating configuration software status window).
- Firmware update is complete.
- If there are problems with copying files start process from beginning.
- If new firmware doesn't start automatically perform supply reset to the device (plug power supply out and then in).

## 16.  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 can not 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.
- For further information Please visit Telem-RTA-A webpage at Martem Wiki.

## 17. Revision History

Rev 11/2012            Added I/O terminal block diagrams