Remote Terminal Annunciator TELEM-RTA

User Manual

Martem AS 2010

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1. General

The combined Remote Terminal Annunciator TELEM-RTA 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 device is similar to the data concentrator TELEM GW 5 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
- Analog outputs for control
- Digital contact and acquisition of pulse counting info
- On/Off control functions
- Online (leased line) or offline exchange operation over Ethernet, GPRS, GSM or PSTN requested by an event or by the remote control centre
- Concentrated data acquisition and control using different communication protocols
- Protocol cross-referencing
- Logical operations between digital and analog signals can be described
- Local or remote programmable configuration
- Local event reporting and acknowledgment
- Time synchronization using GPS

4. View



outs	•	1 DI		•	1 DI
Int	:	2 DI		•	2 DI
Big		1.0N		•	3 DI
Indin		1.055		•	4 DI
0	•	1 OFF		•	5D1
				••	6 DI
				•	2 DI
			puts	•••	8 134
	Y2		tal In	•	0.04
study		1 AO	Digit	•	9 DI
no		2 AO		•	10 DI
en.	•	1.AI		•	11 DI
Vnalo	:	2 AI		•	12 DI
	:	3 AI		•	13 DI
1	•	4 AI			14 DI
Inpu	•	5 41		•	15 DI
	•			•	16 D1
	•	6 AI		•	10 2.1



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 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) 5 (1x2 open collector and Number of ON/OFF operations 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 optional by request SSP port for TELEM DO/DI device optional by request 145 x 145 x 93 • Dimensions (W x H x D): Mounting onto panel or DIN35 rail Weight 0,6 kg Dimensions of panel cut-out • 138x138 Data communication protocols • To higher level system IEC 60870-5-101, IEC 60870-5-104, DNP 3. Modbus To lower level devices IEC 60870-5-103,

Data communication parameters

- Start bits
- Parity
- Communication rates
- Communication modes

IEC 60870-5-103, IEC 60870-5-101, DNP 3, Modbus, SPA-Bus, Telem, EN 62056-21

1

odd, even or no parity from 300 to 38400 bit/sec asynchronous RTS/CTS Control, No Control

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 (optional)
- SSP for connecting the TELEM DO/DI device and LED indication panel (optional)
- EXT for connecting an external expansion device

COM port's pin layout

Pin	1	2	3	4	5	6	7	8
COM 1	RD*	-	GND	RX	Тх	-	-	
COM 2	DSR	CTS	GND	RX	ТХ	DCD	RTS	DTR
COM 3,4	-	CTS	GND	RX	ТХ	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. Digital Input Processing

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

9.1 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.



9.2 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



10. TELEM RTA Configuration Tool

10.1 Getting Started

Same configuration tool is used for configuration of RTA and GW5. The difference is in using the RTA IO tab card.

When starting the TELEM GW5/RTA configuration program, user interface window with the main menu is opened:

💋 Telem configurator 📃 🔲 🗙									
Device Help									
Communication Settings and Status									
Port	2								
Link address	1								
ASDU address	1								
Status	 								
L									

Warning **Check communication** – If there is no connection with the RTA device then the warning message is displayed together with an alarm beep. Button "Stop sound" – Stops the alarm sound.

The following parameters are shown for information:

- Port PC port which is used to communicate with GW5/RTA
- Link address Link address of the GW5/RTA port
- ASDU address ASDU address of the GW5/RTA port
- Status Status of the connection. RED no connection, GREEN connection OK

Main menu

Device – For selecting the device type

Communication - To change communication parameters, open the following window:



Fields in the communication parameters window

- Port PC communication port which is used for communication with GW5/RTA
- 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 GW5/RTA
- ASDU address ASDUI address of GW5/RTA
- **ASDU address length** 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

10.2 GW5/RTA Configuration Window

To open the GW5/RTA configuration window, select **Device > GW5/RTA Setup** 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
- **R** Read the configuration from GW5/RTA
- W Write the configuration to GW5/RTA

RS - Reset GW5/RTA. 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 the Note Pad program. When editing the configuration with Excel, the file has to be saved as a comma separated CSV file.

Table of menu items in the GW5/RTA configuration window

File	Common	View	Help
New (Ctr+N)	Read Config (CTRL+R)	Basic	Help F1
Open (Ctr+O)	Write Config (CTRL+W)	Advanced	About
Save (Ctr+S)	Cancel Active Transfer		
Save As	Send Reset		
Exit	Interval Groups		
	TCP/IP Settings		
	Timing Settings		
	Modem Settings		
	Port Mirroring		
	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, RTA IO, 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 in 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.

The 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/configuration tab card is active when the GW5/RTA configuration window is opened.

] 😂 🔛 R W RS + -						
orts Devices Objects Formulas	RTA IO	Status				
	Port 1	Port 2	Port 3	Port 4	SSP	
Protocol	IEC ^	IEC v	ModBus v	IEC v		
Baud Rate	9600	9600	9600	9600		
Parity	None	None	None	None		
Stop Bit	1	1	1	1		
Data Bits	8	8	8	8		
Communication Mode	No Control	No Control	No Control	No Control		
Polling(v)/Answering(^) Delay [ms]	0	0	0	0		
Port Link Address	1					
IEC Port ASDU Address	1					
Length Of ASDU Address	2 Bytes					
IEC Object Length	2 Bytes					
Up Protocol SubVersion	101 ub	0	0	0		
Allow Routing	No					
Query Timeout [ms]	500	500	500	500		
Failed Query Count for disabling contr.	5	5	5	5		
Query Interval for Retry/Bal.mode [s]	20	20	20	20		
Supress Echo	No	No	No	No		
Comment						

From the **View** menu a **Basic** or an **Advanced** view of the **Port configuration tab card** can be selected. The advanced view shows the additional query and echo suppression parameters.

Configuration parameters of a port:

- **Protocol** Communication protocol used by all the devices of this port. Each protocol name is accompanied with a symbol I"^" 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
- **Communication Mode** Makes it possible to choose between the following handshaking options:
 - No control
 - RTS/CTS Control

- RTS Callout Request– a Request by the RTS signal to the offline modem for calling out

- **Polling / Answering Delay** Delay between reception and the next query
- Port Link Address Link address of the device on uplink channels
- 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

More on the advance view:

- Up Protocol Subversion Protocol subversion number on uplink channels
- Allow Routing Allows routing of IEC 60870-5-101 protocol messages between the upper and the lower level channels
- Query Timeout in milliseconds Query timeout for the 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 is temporarily suspended
- Query Interval for Retry / Bal.mode Sec-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

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.

	eip	4054			
	(5 +				
rts Devices Ob	ojects	Formulas	RTA IO	Status	
Device nr>	1	2	3		
Objects	20	7	20		
Link addr	2	2	2		
ASDU addr	2	2	2		
ASDU addr len	2 Bytes	2 Bytes	2 Bytes		
Object addr len	2 Bytes	2 Bytes	2 Bytes		
In Use	Yes	Yes	Yes		
Port	4	3	2		
rotocol SubVersion	101UB	INT I	101UB		
Protocol	IEC v	ModBus v	IEC v		
Comment	DI24T	Integra	VAMP		
Minute Time Sync	No	No	No		
lime Sync Forward	Yes	Yes	Yes		
Replace Event hrs	No	No	No		

10.3.2 Devices Tab Card

Up to 20 downlink devices can be connected to GW5 and configured on this tab card.

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Parameters:

- Device nr Sequence number of the device
- **Objects** Number of objects in this 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 then the whole row has a grey background.
- Port Port no. of GW5 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.
- Minute 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
- **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)

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.

ſ	Add Devices	X
	Add Devices Options	
	Number of devices to add	
	New device(s) are based on	Default settings
		C Device number 1
		🔽 Copy Objects Also
		Add

Set the Add Device options:

- Number of the 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 operations are concluded:

Objects i	n danger 🔀
1	All the objects that were associtated with these devices WILL BE deleted. Are you sure you want to continue?
	Yes No

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

10.3.3 Objects Tab Card

70	∠ GW5/RTA Setup - *														
File	Hie Common view Heip														
D	ž 🔒	RW	RS -	- -											
Port	s Dev	rices 0	bjects	Formulas R	TA IO Status										
	Dev. nr.	Obj. nr.	Туре	Analog Group	SubType ^	SubType v	Invert	Fn. Code	Info nr.	Index	Obj. Addr. v	Obj. Addr. ^	Com	nent	D
Ħ	1	1	DI		SN NTime/LTime	Normal	No					200			
þ	2	1	DI		DB NTime/LTime	0	No					1000			
IH	2	2	AI	G1	FP NTime	FP					30001	1001	U1		2
IH	2	3	AI	none	FP NTime	FP					30003	1002	U2		2
IH	2	4	AI	none	FP NTime	FP					30005	1003	U3		2
IH	2	5	AI	G1	FP NTime	FP					30201	1004	U12		2
IH	2	6	AI	none	FP NTime	FP					30203	1005	U23		2
IH	2	7	AI	none	FP NTime	FP					30205	1006	U31		2
b -	3	1	DI		SN NTime/LTime	Normal	No					300			
┛															ъ
ERRO	R Right	t click to ac	cess ex	tended controls								SW	285	Controller: 1	1

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 **Device Tab Card**.

Columns:

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

Analog Group – G1, G2, G3. Object group for common settings.

Sub Type^ – Object's subtype for uplink. The following dialog box opens on clicking:

Object Sub Type Up	×
Input Object SubType	
Single	•
With Long Time if got with time tag	•
ОК	

Subtypes of object and time marking modes:

Object type	Format	Time marking
DI – Digital input	Single Double	Without time With Short Time With Long Time With Short Time if got with time tag With Long Time if got with time tag
DO – Digital output	Single Double Direct Execute Select Execute	
AI – Analog input	Normalized Floating point Step position	Without time With Short Time With Long Time With Short Time if got with time tag With Long Time if got with time tag
CN – Counter		

- **Sub Type v -** Object's subtype for downlink.
- 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
- **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.

Forbidden Ports 🔀	
Select FORBIDDEN Ports	
Port 1	
Port 2	
Port 3	
Port 4	
Port 5	
Port 6	
Port 7	
Port 8	
Port 9	
Port 10 OK	

- 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 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

Adding Objects

By clicking on the **b**utton, 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:

Add Objects Remove Objects
Expand All Collapse All

When selecting Add Objects, the following dialog box appears:

Add Objects to Device	×
Add Objects to Selected Device	
Nr. of Objects to add 1	
Add into Device nr 2	
Add after this Object 1	
New Objects will be based on	
Oefault Settings	
O on Device 2	
and on Object 1	
Add	

Removing Objects

To remove a device, click the _____ button or select Remove Devices from the extended control menu.

When selecting Remove Objects from the extended control menu, the following dialog box appears:

Remove Objects from Device	<								
Remove Objects from Selected Device									
Remove Objects from Device 3									
Starting From Object 2									
and 💿 until Object number 🛛 📩 (ind.)									
O number of Objects									
Remove									

Hints

- Repeated object addresses are shown on yellow background.
- When leaving the Object Tab Card, all 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

Z GW	GW5/RTA Setup - \\Phobos\d\3_Tehniline\RTUkapid\2009\Võnnu\RTA_11.09.09.csv *											
File (Commor	n View Help										
Dente		R W RS	•••		Chabus							
Ports	De		Form		Status		1	1	1	1	1	
No.	Туре	SubType ^	Invert	Obj. Addr. ^	DB1, %Fs	DB2, %Fs	Raw Min	Raw Max	Scale Min	Scale Max	Forb. Ports	Mod
1	DI	DB NTime/LTime	No	501							0000000000	Main
2	DI	DB NTime/LTime	No	502							0000000000	Main
3	AI	FP NTime/LTime		503	2	2	0	0	0	0	0000000000	Main
•												Þ
OK										SW: 0	Controller:	

Columns:

- Type, Sub Type, Sub Type, Invert, Object Adr ^, DB1, DB2, Crit.Value, Raw Min, Raw Max, Scale Min, Scale Max, Forb.Ports, Forbid Calling, obj. - as in Objects Tab Card
- **Module** Determines the RTA module (Main Module, Exp. Module 1, Exp. Module 2)
- **DO/LED no.** Number of the digital output (1...16) in the TLM GW-IO device controlled by the result of this formula or the Alarm (LED) number (1...16) on the LED Alarm panel that corresponds with the result of this formula.
- Alarm Alarm (LED) number (1...16) on the LED Alarm panel that corresponds with the result of this formula.
- Formula formula string
- **DO addr.** Number of the digital output (1...16) in the TLM GW-IO device controlled by the result of this formula

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	@201dbl@202	7
		inputs into a double 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

* 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 **b**utton, 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.

10.3.5 RTA IO Tab Card

RTA IO Tab Card allows you to determine input-output object parameters of Main and Expansion Modules

	R	W RS	+ +											
ts	Devices	Objects	Form	ulas	RTAIO	atus								
		woonsien Me	dulo 1	Evene	ion Modulo 7									
		хранзюнтис		LXpans	ion module z									
D Panel	ndicator	Panel	C Anr	nounciato	r Panel									
ocket X	1													
bj. nr.	Туре	SubType	Invert	DI no.	Obj. Addr	^ Comment	Forb. Ports	Forbid Calling	Tolerant ph. [ms] Intolera	nt ph. [ms]	Base per. [ms]	Change cnt.	Lock-out
	DI	DB STime	No	1	101	1	0000000000	No	5	5		500	5	1
	DI	SN STime	No	2	0		0000000000	No	5	5		500	5	1
	DI	DB STime	No	3	102		0000000000	No	5	5		500	5	1
	DI	SN STime	No	4	0		0000000000	No	5	5		500	5	1
	DI	SN STime	No	5	103		0000000000	No	5	5		500	5	1
	DI	DB STime	No	6	104		0000000000	No	5	5		500	5	1
	DI	SN STime	No	7	0		0000000000	No	5	5		500	5	1
	DI	DB STime	No	8	105		0000000000	No	5	5		500	5	1
	DI	SN STime	No	9	0		0000000000	No	5	5		500	5	1
0	DI	SN STime	No	10	106		0000000000	No	5	5		500	5	1
1	DI	SN STime	No	11	107		0000000000	No	5	5		500	5	1
2	DI	SN STime	No	12	108		0000000000	No	5	5		500	5	1
3	DI	SN STime	No	13	109		0000000000	No	5	5		500	5	1
4	DI	DB STime	No	14	110		0000000000	No	5	5		500	5	1
5	DI	SN STime	No	15	0		0000000000	No	5	5		500	5	1
.6	DI	SN STime	No	16	111		0000000000	No	F					1.1
6							0000000000		2	5		500	5	1
-					0.220			140	5	5		500	5	1
iocket X	2		10						>	5		500	5	1
ocket X)bj. nr.	2 Туре	SubType	Invert	DO no.	Obj. Addı	• Comment	Forb. Port	s Pulse len. [m	5	5		500	5	1
iocket X D bj. nr.	2 Type DO	SubType DB D.Ex	Invert No	DO no.	Obj. Add 121	• Comment	Forb. Ports	Pulse len. [m 1500	s]	5		500	5	
ocket X Ibj. nr.	2 Type DO DO	SubType DB D.Ex DB D.Ex	Invert No No	DO no. 1 2	Obj. Add 121 122	^ Comment	E Forb. Ports	 Pulse len. [m 1500 	5 5]	5		500	5	
ocket X bj. nr.	2 Type DO DO DO	SubType DB D.Ex DB D.Ex SN D.Ex	Invert No No No	DO no. 1 2 3	Obj. Addu 121 122 0	* Comment	E Forb. Ports 000000000 000000000 0000000000000000	Pulse len. [m 1500 1500 1500	s]	5		500	5	
ocket X i bj. nr.	Type DO DO DO DO DO	SubType DB D.Ex DB D.Ex SN D.Ex SN D.Ex	Invert No No No No	DO no. 1 2 3 4	Obj. Addu 121 122 0 0	* Comment	E Forb. Ports 000000000 000000000 000000000 00000000	Pulse len. [m 1500 1500 1500	s]	5		500	5	
ocket X bj. nr. ocket Y	2 Type D0 D0 D0 D0 D0	SubType DB D.Ex DB D.Ex SN D.Ex SN D.Ex	Invert No No No No	DO no. 1 2 3 4	Obj. Add 121 122 0 0	Comment	E Forb. Ports 00000000 000000000 000000000 00000000	 Pulse len. [m 1500 1500 1500 1500 	s]	5		500		
ocket X bj. nr. ocket Y bj. nr.	2 Type DO DO DO DO 1 Type	SubType DB D.Ex DB D.Ex SN D.Ex SN D.Ex SN D.Ex	Invert No No No No	DO no. 1 2 3 4 DI/DO	Obj. Addu 121 122 0 0 0	Comment ddr. ^ Comm	Forb. Ports 000000000 000000000 0000000	 Pulse len. [m 1500 1500 1500 1500 500 500 	s]	5 [ms] Into	lerant ph. [m	s] Base per. [5	nt. Lock-
ocket X D bj. nr. ocket Y D bj. nr.	2 Type DO DO DO DO DO 1 Type DI	SubType DB D.Ex DB D.Ex SN D.Ex SN D.Ex SN D.Ex SN STime	Invert No No No No Invert No	DO no. 1 2 3 4 DI/DO 1	Obj. Addu 121 122 0 0	Comment	E Forb. Ports 000000000 000000000 000000000 00000000	5 Pulse len. [m 1500 1500 1500 1500 1500 500 500 500 50	s] ling Tolerant ph. 5	5 [ms] Into 5	lerant ph. [m	s] Base per. [500	5 Thange of 5	IIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIIII
ocket X V bj. nr. ocket Y V bj. nr.	2 Type DO DO DO DO 1 Type DI DI DI	SubType DB D.Ex DB D.Ex SN D.Ex SN D.Ex SN D.Ex SN STime SN STime	Invert No No No No Invert No No	DO no. 1 2 3 4 DI/DO 1 2	Obj. Addu 121 122 0 0 no. Obj. A 0 0	ddr. ^ Comment	Forb. Ports 000000000000000000000000000000000000	Pulse len. [m 1500 1500 1500 1500 1500 0000 No	5 5 5 5	5 [ms] Into 5 5 5	lerant ph. [m	s] Base per. [500 500 500	5 ms] Change of 5 5 5	nt. Lock- 1
iocket X Dbj. nr.	2 Type DO DO DO DO DO DO DO DO DO DO	SubType DB D.Ex DB D.Ex SN D.Ex SN D.Ex SN D.Ex SN STime SN STime SN D.Ex	Invert No No No No Invert No No	DO no. 1 2 3 4 DI/DO 1 2 1	Obj. Addu 121 122 0 0 0 0 0 0 0 0 0 0 0 0 0 0	ddr. ^ Comment	Forb. Ports 00000000 000000000 00000000	Pulse len. [m 1500 1500 1500 1500 1500 1500 1500 1500 1500 1500 1500 1500 1500 1500 1500 1500 No 1000 No 1000	5 5 5 5 5	[ms] Into 5 5 5	lerant ph. [m	s] Base per. [500 500 500	5 ms] Change of 5 5	1
iocket X Dbj. nr.	2 Type DO DO DO DO DO DO DO DO DO DO	SubType DB D.Ex DB D.Ex SN D.Ex SN D.Ex SN STime SN STime SN D.Ex	Invert No No No No No No No	DO no. 1 2 3 4 DI/DO 1 2 1	Obj. Addu 121 122 0 0 0 0 0 0 0 0 0 0 0 0	ddr. ^ Comment	Forb. Ports. 0000000000 000000000 0000000000 000000000 0000000000 000000000 000000000000000000000000000000000000	Pulse len. [m 1500 1500 1500 1500 1500 1500 0000 No 0000	s] ling Tolerant ph. 5 5	[ms] Into 5 5 5	lerant ph. [m	500 500 500 500	5 ms] Change of 5 5 5	nt. Lock- 1 1
ocket X bj. nr. ocket Y bj. nr.	2 Type DO DO DO DO 1 Type DI DI DI DI 2	SubType DB D.Ex DB D.Ex SN D.Ex SN D.Ex SN STime SN STime SN D.Ex	Invert No No No No No No No	DO no. 1 2 3 4 DI/DO 1 2 1	Obj. Addu 121 122 0 0 0 0 0 0	ddr. ^ Comment	Forb. Ports. 0000000000 000000000 0000000000 000000000 0000000000 000000000 000000000000000000000000000000000000	Fulse len. [m 1500 1500 1500 1500 1500 1500 0000 No 0000	s] ling Tolerant ph. 5 5	5 [ms] Into 5 5	lerant ph. [m	500 500 500 500 500	5 ms] Change c 5 5 5	1 mt. Lock- 1 1
ocket Y bj. nr.	2 Type DO DO DO DO DO DO DO DO DO 2 Type Type 7 Type	SubType DB D.Ex DB D.Ex SN D.Ex SN D.Ex SN STime SN STime SN D.Ex	Invert No No No No No No Mo Meas. F	DO no. 1 2 3 4 DI/DO 1 2 1 Range	Obj. Addu 121 122 0 0 0 0 Al/AO no.	ddr. ^ Comment	Forb. Ports. 0000000000 000000000 0000000000 000000000 0000000000 00000000 000000000000000000000000000000000000	Forbid Ca 0000 No 0000 No 0000 No 0000 No 0000 No	s] ling Tolerant ph. 5 5 96Fs Scale Min	[ms] Into 5 5 5 5 5 5 5	lerant ph. [m Forb. Ports	500 (s) Base per. [500 500 Crit Min, %Fs	5 ms] Change of 5 5 Crit Max, %Fs	1 mt. Lock i i i Forbid Ci
ocket X bj. nr. ocket Y bj. nr.	2 Type DO DO DO DO DO DO DO DO Type 2 Type AI	SubType DB D.Ex DB D.Ex SN D.Ex SN D.Ex SN STime SN STime SN D.Ex SN D.Ex	Invert No No No No No No Meas. J ± Range	DO no. 1 2 3 4 DI/DO 1 2 1 Range	Obj. Addu 121 122 0 0 0 0 0 0 0 0 0 122 0 0 0 0 0 0 0 0 0 1	ddr. ^ Comment	Forb. Ports. 000000000 000000000 000000000 000000000 000000000 000000000 000000000 000000000 000000000 000000000000000000000000000000000000	Forbid Call 1500 1500 1500 1500 1500 1500 0000 No 0000 No 0000 No 0000 No 0000 No	S S ling Tolerant ph. 5 5 %Fs Scale Min 0 0	[ms] Into 5 5 5 5 5 5 5	lerant ph. [m Forb. Ports 000000000	s) Base per. [500 500 500 Crit Min, %Fs 0	5 S 5 5 Crit Max, %F	I I I I Forbid Co No
ocket X bj. nr. ocket Y bj. nr.	2 Type DO DO DO DO DO DO DO DO DO DO	SubType DB D.Ex DB D.Ex SN D.Ex SN D.Ex SN D.Ex SN STime SN D.Ex SN D.Ex SN D.Ex	Invert No No No Invert No No Meas. J ± Range ± Range	D0 no. 1 2 3 4 DI/DO 1 2 1 2 1 8 Range	Obj. Addu 121 122 0 0 0 0 0 0 0 0 122 122 1 2	A Comment ddr. ^ Comm 0 0	Forb. Ports 0000000000 0000000000 00000000000 0000000000 000000000000000000000000000000000000	Forbid Ca 00000 No	S S	5 [ms] Into 5 5 5 5 5 5	lerant ph. [m Forb. Ports 000000000	s) Base per. [500 500 500 Crit Min, %FS 0 0	5 Change of 5 5 Crit Max, %Fs 0 0	1 mt. Lock- 1 1 5 Forbid C. No No
ocket X bj. nr. bj. nr. bj. nr.	2 Type DO DO DO DO DO Type DI DI DI DI DI DI DI DI DI AI AI AI	SubType DB D.Ex DB D.Ex SN D.Ex SN D.Ex SN D.Ex SN STime SN STime SN D.Ex SN D.Ex	Invert No No No Invert No No Meas. I ± Range ± Range ± Range	DO no. 1 2 3 4 DI/DO 1 2 1 2 1 2 2 2 2	Obj. Addu 121 122 0 0 0 0 0 0 0 0 12 122 1 2 3	^ Comment ddr. ^ Comm 0bj. Addr. ^ 0 0 0 0 0	Forb. Ports 0000000000 0000000000 000000000000000000000000000000000000	Forbid Ca 00000 No	S S 5 5 Solution S 5 0 0 0 0 0 0 0	5 [ms] Into 5 5 5 5 5 5 5 5 5 5 5 5 5	Forb. Ports 000000000 000000000	s) Base per. [500 500 500 Crit Min, %6Fs 0 0 0	5 Change of 5 5 Crit Max, %Fs 0 0 0	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
ocket X bbj. nr. ocket Y bj. nr.	2 Type DO DO DO DO DO Type DI DI DI DI DI DI DI AI AI AI	SubType DB D.Ex DB D.Ex SN D.Ex SN D.Ex SN D.Ex SN STime SN STime SN D.Ex SN D.Ex SN D.Ex	Invert No No No No No Meas. J ± Range ± Range ± Range	D0 no. 1 2 3 4 DI/DO 1 2 1 1 2 1 2 2 2 2 2 2	Obj. Addi 121 122 0 1 2 3 4	* Comment ddr. * Comm 0bj. Addr. * 0 0 0 0 0 0 0	Forb. Porte: 0000000000 0000000000 000000000000000000000000000000000000	Form Form <th< td=""><td>S S 5 5 5 5 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0</td><td>5 [ms] Into 5 5 5 5 5 5 5 5 5 5 5 5 5</td><td>Forb. Ports 000000000 000000000 000000000</td><td>soo soo soo soo soo crit Min, %6FS 0 0 0 0 0</td><td>5 Change of 5 5 Crit Max, %Fs 0 0 0 0</td><td>1 1 1 Forbid C: No No</td></th<>	S S 5 5 5 5 6 0 0 0 0 0 0 0 0 0 0 0 0 0 0	5 [ms] Into 5 5 5 5 5 5 5 5 5 5 5 5 5	Forb. Ports 000000000 000000000 000000000	soo soo soo soo soo crit Min, %6FS 0 0 0 0 0	5 Change of 5 5 Crit Max, %Fs 0 0 0 0	1 1 1 Forbid C: No

10.3.5.1 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</u> works together with the next DI forming a pair of signals.
- **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 ... 65567 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)

10.3.5.2 Configuration Parameters of Digital Outputs

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

10.3.5.3 Configuration Parameters of Analog Inputs

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</u> has to mach the ordered hardware configuration!
- **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.

10.3.5.4 Configuration Parameters of Analog Outputs

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)

10.3.6 Status Tab Card

GW5/RTA Setup - \\Phobos\d\3_Tehniline\R File Common View Help	TUkapid\2009\Võnnu\RTA_11.09.09.csv	
🗅 😂 🔜 R W RS + -		
Ports Devices Objects Formulas RTAIC	D Status	
Current Status		
General Configuration	Device Information	
Configuration Size In Words 983 Ports 4 Devices 3 Objects 47 Formulas 0 Formula Members 0 Last Transfer Statistics Total Amount - Transferred - Indicated CRC - Calculated CRC - Speed -	Setup Version 3 Max Setup Version Supported By GW5 0 Min Setup Version Supported By GW5 0 Software Version In GW5 0 Protocl Mask Up 0 Protocol Mask Down 0 Digital Depth 0 Analog Depth 0 Counter Depth 0 The Code Of The First Error 0 Update	
		×
	Update	
Ж	SW: 0	Controller:

Status tab card presents the status of GW5/RTA general configuration parameters and transfer statistics.

Update button is used to get information from the connected GW5/RTA and it is displayed under Device Information.

11. Common Settings

Common settings are accessible from the menu of the GW5/RTA Setup window.

7 G	W5/RTA	Setup -	*		
File	Common	View H	Ielp		
D (Read	Configura	ation	Ctrl+R	
Port	Write	Configura	ation	Ctrl+W	as
	Cance	el Active 1	ransfer		
	Send	Reset			Grou
Ð	Interv	val Group	s		
L	Tcp/I	p Settings			
	Timing	g Settings			
	Mode	m Setting	s		
	Port	Mirroring			
	Optio	ns			
	2	7	AI	none	

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11.1 Interval 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 groups).

Interval Group	s			×
Groups of ana	log measu	rement in	tervals	
Group 1 Group 2 Group 3	2 4 8	•	seconds seconds seconds	
		ОК	Cancel	

11.2 TCP/IP Settings

TCP/IP Settings are only used for GW5/RTA with an Ethernet port and used to determine the IP address and number of the socket port.

Tcp/Ip Settings	×
IEC 104 Ethernet IP Ad	dress Configuration
C Not Used	
Configured As:	
IP Address	0. 0. 0. 0
NetMask Bit Count	2 255.255.255.255
Port 1	
	OK Cancel

11.3 Timing Settings

Timing Settings are used to determine RTA initialization timeout and time zone correction.

Timing Settings
Options
Device initialization 20 seconds
Time Zone Time Zone Correction Time Zone Correction
Use Daylight Savings
OK Cancel

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11.3 Telephone Modem Settings

Modem Settings are used to determine calling parameters in the dial-up mode operation.

The modem can be used only through communication port 2. Only this port has all the necessary handshaking signals for the modem.

- 1. Open **Ports** tab card in the GW5/RTA configuration window.
- 2. Set Communication Mode to port 2 Modem Callout.
- 3. From the **Common** menu open **Modem Settings**.

Modem Settings	×				
Out					
Connection connecting timeout	: 0				
Maximum connection duration:	0				
Minimum connection duration:	0				
Number to call 1:					
Number to call 2:					
Number to call 3:					
Unique Device ID:	0				
Enable Number Checking					
Number 1:					
Number 2:					
Number 3:					
OK Cancel					

Callout parameters:

- **Connection connecting timeout** if the connection was not established during this time (seconds), GW5/RTU will try to call out again.
- **Maximum connection duration** if the connection is still open after this time, it will be closed by GW5/RTA. If the value of this parameter is 0 then GW5/RTA will never close the connection.
- **Minimum connection duration** if the connection was broken during this time, GW5/RTA will try to call out again.
- **Number to call** if the first number is busy then the gateway will call the next number. If all the numbers are busy then the gateway will call around the numbers until some number answers.
- **Unique Device ID** additional identification no. used when calling out (ID number, may be used if modem cannot send its phone number).

Number Checking may be enabled for **incoming** calls. In this case, the connection may be established only from these 5 phone numbers maximum. (The phone numbers must be typed up exactly as the modem receives them)

GW5/RTA initializes a communication line when one of the digital inputs changes or when analog measurement value changes over the determined minimum and maximum ranges and the callout event is not forbidden for this input. If communication is initialized by GW5/RTA, it terminates the connection after all data is sent.



11.4 Port Mirroring for Redundant Channels

The port mirroring menu option is used for configuration of upper level redundant channels.

Port Mirroring	×
Mirror Group 1 Port 1 Port 2 Port 3 Port 4 Port 5 Port 6 Port 7 Port 8 Port 9 Port 10 Port 11 Port 12 Port 13 Port 14 Port 15 Port 16	Mirror Group 2 Port 1 Port 2 Port 3 Port 4 Port 5 Port 6 Port 7 Port 8 Port 9 Port 10 Port 11 Port 12 Port 13 Port 15 Port 15 Port 15 Port 16
ОК	Cancel

Two redundant (mirror) groups can be configured. The marked ports of one mirror group share the same event buffer. So if the upper level channel is switched over to another redundant channel then there will be no double events.

11.5 Options

The common settings of GW5/RTA configuration module are set up in this window.

Options	X					
Separator Characters	Decimal Separator					
	⊙ Character used					
C ASCII code of the d 59	C ASCII code of the c 44					
Regional's Defaults	Regional's Defaults					
ASCII's @ www.lookuptables.com						
GW5 Automatic restart Reset GW5 after every Write procedure (recommended)						
	OK Cancel					

Separator characters are related to the CSV file format of the GW5/RTA configuration file.

If the automatic restart option is marked then the program automatically sends the restart command to GW5/RTA after having downloaded the settings.

12. Specific Settings of the GPRS modem

If the GPRS modem is used for communication with the central system then the following changes in settings are recommended.

Open the **Ports** tab card in the GW5/RTA configuration window.

GW5/RTA Setup - \\Phobos\d\3_Te Common View Help	niline\RTU	kapid\200	9\Võnnu\R	TA_11.09.0	9.csv *	
😂 🔛 🛛 R W RS 🕂 -						
rts Devices Objects Formulas	RTA IO	Status				
	Port 1	Port 2	Port 3	Port 4	SSP	
Protoco	IEC ^	IEC v	ModBus v	IEC v		
Baud Rate	9600	9600	9600	9600		
Parity	None	None	None	None		
Stop Bi	1	1	1	1		
Data Bits	8	8	8	8		
Communication Mode	No Control	No Control	No Control	No Control		
Polling(v)/Answering(^) Delay [ms]	0	0	0	0		
Port Link Address	125					
IEC Port ASDU Address	125 💲					
Length Of ASDU Address	2 Bytes					
IEC Object Length	2 Bytes					
Up Protocol SubVersion	101 ub	0	0	0		
Allow Routing	No					
Query Timeout [ms	9000	500	500	500		
ailed Query Count for disabling contr	. 5	5	5	5		
uery Interval for Retry/Bal.mode [s]	20	20	20	20		
Supress Echo	No	No	No	No		

The recommended changes for the upper level GPRS channel are:

- Querry timeout: 9000 ms
- UP protocol Subversion: 101b Balanced IEC 60870-5-101
- Querry Interval for Retry: 255 sec.

For the settings of port 2 look at the example above.

13. Communication Cables

TELEM RTA 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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14. 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.