



# **RTU module Telem-AP**

## **User Manual**

**Martem AS**  
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CONTENTS.....**ERROR! BOOKMARK NOT DEFINED.**

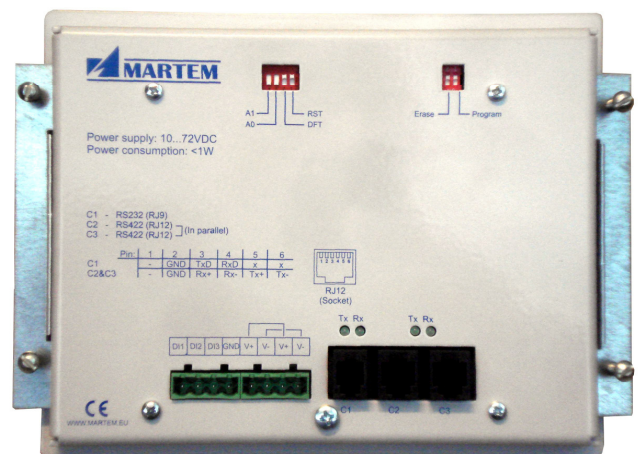
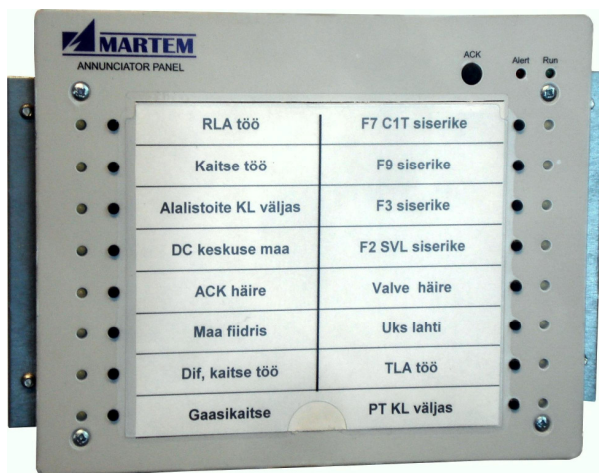
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## 1. Application

TELEM-AP annunciator panel module is used for indication of substation alarms/states provided by RTU or by physical DI-s (3xDI available on the rear panel).

## 2. Construction

- The mechanical design is based on aluminum box suitable for panel-mounting.
- The module is based on 32-bit ARM CPU.
- Interfaces to other equipment are RS-232 or RS-422.
- Data exchange protocol is IEC 60870-5-1-101, unbalanced.



Refer to Chapter 10 for technical drawings regarding panel-mounting.

### 3. Features

- Time synchronization over IEC60870-5-101 unbalanced
- Daisy chain master – slave connection using RS-422 interface
- Self diagnostics and supervision simultaneously with data acquisition
- 3 physical DI-s that can be linked to indication LED-s (14,15,16)
- LEDs controllable as latched/unlatched (blinking/no blinking)
- Dedicated acknowledgement switches for every LED, corresponding acknowledgement events with timestamps available.
- Master ACK switch to acknowledge all signals at once, corresponding acknowledgement event with timestamp available.
- States of LED-s are stored in ROM and are therefore also available after loss of power supply.

## 4. Technical Data

Number of digital inputs	3
Number of LED-s	16
Additional indication LED-s	1 for „running“ indication, 1 for „alert“ indication
Supply voltage	10-72 VDC, <1W
Internal circuit voltage for DI signals	Equal to supply voltage
Optional external voltage for DI signals	110 VDC, 3 VA
Isolation voltage	3,75 kV RMS
Weight	600 g
Mounting	Panel-mounting
Dimensions (WxHxD)	185x148x30 mm
Cross section of wires for DI signals	Max 2,5 mm <sup>2</sup>
Cross section of wires for power	Max 2,5 mm <sup>2</sup>
Terminal for communication	RJ11/4 (RS232); RJ12/6 (RS422)
Over voltage protection	IEC 61000-4-4, 1 kV pulse protection
Electromagnetic compability	EN 61000-6-2/4, EN 61000-4-4, EN 6100-4-5, EN 61000-4-6, EN 61000-4-11, EN 50147-2
Ambient temperature in operation	-30 ... +55 °C

## 5. Mode Switches and Indication LED-s

### 5.1 DIP switches

Mode of operation, address of the module and the default settings are determined using DIP switches on the board:

RST – ON – reset the device

DFT – ON – restores the default LED state (all LEDs off) after reset

A0 - A1 – determines the address of the module (refer to chapter 5.3)

Pogram – ON – sets module ready to download firmware (refer to chapter 7)

### 5.2 Indication LEDs

Indication LED-s display the state of the device:

ALERT – active – error state (i.e communication data link not active)

RUN – blinking – 10% on / 90% off, normal operation

LED state – ON – signal is active

blinking – signal is not active; last active signal is unacknowledged

OFF – signal is not active

### 5.3 Setting an address

A0	A1	Address
on	off	1
off	on	2
on	on	3
off	off	4

## 6. List of available Information Objects

Type	Subtype	IO1 Type	IOA	Object name	Comments
DO	Single, Dir. Exec	45	1	LED1	1=Turn on LED 1; 0=Turn off LED1 (blinking)
DO	Single, Dir. Exec	45	2	LED2	1=Turn on LED 1; 0=Turn off LED1 (blinking)
DO	Single, Dir. Exec	45	3	LED3	1=Turn on LED 1; 0=Turn off LED1 (blinking)
DO	Single, Dir. Exec	45	4	LED4	1=Turn on LED 1; 0=Turn off LED1 (blinking)
DO	Single, Dir. Exec	45	5	LED5	1=Turn on LED 1; 0=Turn off LED1 (blinking)
DO	Single, Dir. Exec	45	6	LED6	1=Turn on LED 1; 0=Turn off LED1 (blinking)
DO	Single, Dir. Exec	45	7	LED7	1=Turn on LED 1; 0=Turn off LED1 (blinking)
DO	Single, Dir. Exec	45	8	LED8	1=Turn on LED 1; 0=Turn off LED1 (blinking)
DO	Single, Dir. Exec	45	9	LED9	1=Turn on LED 1; 0=Turn off LED1 (blinking)
DO	Single, Dir. Exec	45	10	LED10	1=Turn on LED 1; 0=Turn off LED1 (blinking)
DO	Single, Dir. Exec	45	11	LED11	1=Turn on LED 1; 0=Turn off LED1 (blinking)
DO	Single, Dir. Exec	45	12	LED12	1=Turn on LED 1; 0=Turn off LED1 (blinking)
DO	Single, Dir. Exec	45	13	LED13	1=Turn on LED 1; 0=Turn off LED1 (blinking)
DO	Single, Dir. Exec	45	14	LED14	1=Turn on LED 1; 0=Turn off LED1 (blinking)
DO	Single, Dir. Exec	45	15	LED15	1=Turn on LED 1; 0=Turn off LED1 (blinking)
DO	Single, Dir. Exec	45	16	LED16	1=Turn on LED 1; 0=Turn off LED1 (blinking)
DO	Single, Dir. Exec	45	17	LED1 NO BLINK	1=Turn on LED 1; 0=Turn off LED1 (not blinking)
DO	Single, Dir. Exec	45	18	LED2 NO BLINK	1=Turn on LED 1; 0=Turn off LED1 (not blinking)
DO	Single, Dir. Exec	45	19	LED3 NO BLINK	1=Turn on LED 1; 0=Turn off LED1 (not blinking)
DO	Single, Dir. Exec	45	20	LED4 NO BLINK	1=Turn on LED 1; 0=Turn off LED1 (not blinking)
DO	Single, Dir. Exec	45	21	LED5 NO BLINK	1=Turn on LED 1; 0=Turn off LED1 (not blinking)
DO	Single, Dir. Exec	45	22	LED6 NO BLINK	1=Turn on LED 1; 0=Turn off LED1 (not blinking)
DO	Single, Dir. Exec	45	23	LED7 NO BLINK	1=Turn on LED 1; 0=Turn off LED1 (not blinking)
DO	Single, Dir. Exec	45	24	LED8 NO BLINK	1=Turn on LED 1; 0=Turn off LED1 (not blinking)
DO	Single, Dir. Exec	45	25	LED9 NO BLINK	1=Turn on LED 1; 0=Turn off LED1 (not blinking)
DO	Single, Dir. Exec	45	26	LED10 NO BLINK	1=Turn on LED 1; 0=Turn off LED1 (not blinking)
DO	Single, Dir. Exec	45	27	LED11 NO BLINK	1=Turn on LED 1; 0=Turn off LED1 (not blinking)
DO	Single, Dir. Exec	45	28	LED12 NO BLINK	1=Turn on LED 1; 0=Turn off LED1 (not blinking)
DO	Single, Dir. Exec	45	29	LED13 NO BLINK	1=Turn on LED 1; 0=Turn off LED1 (not blinking)
DO	Single, Dir. Exec	45	30	LED14 NO BLINK	1=Turn on LED 1; 0=Turn off LED1 (not blinking)
DO	Single, Dir. Exec	45	31	LED15 NO BLINK	1=Turn on LED 1; 0=Turn off LED1 (not blinking)
DO	Single, Dir. Exec	45	32	LED16 NO BLINK	1=Turn on LED 1; 0=Turn off LED1 (not blinking)
DO	Single, Dir. Exec	45	33	DI1 LED TYPE	1=Blinking; 0=not blinking
DO	Single, Dir. Exec	45	34	DI2 LED TYPE	1=Blinking; 0=not blinking
DO	Single, Dir. Exec	45	35	DI3 LED TYPE	1=Blinking; 0=not blinking
DO	Single, Dir. Exec	45	36	LED14 SOURCE	1=LED 14 linked to DI1; 0=LED 14 controlled by IOA 14 and 30
DO	Single, Dir. Exec	45	37	LED15 SOURCE	1=LED 15 linked to DI2; 0=LED 15 controlled by IOA 15 and 31
DO	Single, Dir. Exec	45	38	LED16 SOURCE	1=LED 16 linked to DI3; 0=LED 16 controlled by IOA 16 and 32
DI	Single	2	64	DI1	State of DI1
DI	Single	2	65	DI2	State of DI2
DI	Single	2	66	DI3	State of DI3
DI	Single	2	67	DI1 LED TYPE	Configured type of DI1 LED (feedback signal of IOA 33) (default=0)
DI	Single	2	68	DI2 LED TYPE	Configured type of DI2 LED (feedback signal of IOA 34) (default=0)
DI	Single	2	69	DI3 LED TYPE	Configured type of DI3 LED (feedback signal of IOA 35) (default=0)
DI	Single	2	70	LED14 SOURCE	Configured type of LED14 source (feedback signal of IOA 36) (default=0)
DI	Single	2	71	LED15 SOURCE	Configured type of LED15 source (feedback signal of IOA 37) (default=0)
DI	Single	2	72	LED16 SOURCE	Configured type of LED16 source (feedback signal of IOA 38) (default=0)
DI	Single	2	101	B1	1=LED1 acknowledged
DI	Single	2	102	B2	1=LED2 acknowledged
DI	Single	2	103	B3	1=LED3 acknowledged
DI	Single	2	104	B4	1=LED4 acknowledged
DI	Single	2	105	B5	1=LED5 acknowledged
DI	Single	2	106	B6	1=LED6 acknowledged
DI	Single	2	107	B7	1=LED7 acknowledged
DI	Single	2	108	B8	1=LED8 acknowledged
DI	Single	2	109	B9	1=LED9 acknowledged
DI	Single	2	110	B10	1=LED10 acknowledged
DI	Single	2	111	B11	1=LED11 acknowledged
DI	Single	2	112	B12	1=LED12 acknowledged
DI	Single	2	113	B13	1=LED13 acknowledged
DI	Single	2	114	B14	1=LED14 acknowledged
DI	Single	2	115	B15	1=LED15 acknowledged
DI	Single	2	116	B16	1=LED16 acknowledged
DI	Single	2	117	B17	1=All LED-s acknowledged (ACK button pressed)
DO	Single, Dir. Exec	45	2000	ENABLE DEBUG	0=Disable; 1=Enable Debug mode (activates transmission of IOA-s 2001...2006)
CN	16bit integer	16	2002	ERROR DEADLINE	Counter for task deadlines. If this value increases then TELEM-AP is not working correctly. Available if Debug enabled (IOA 2000=1)
CN	16bit integer	16	2003	ERROR QUEUE DATA1	Counter for IEC101 Data Class1 queue. If this value increases then it is an indication of communication errors. Available if Debug enabled (IOA 2000=1)
CN	16bit integer	16	2004	ERROR SPONT CNT	Counter for spontaneous events. If this value increases then it is an indication that some events are dropped. Indication of communication errors. Available if Debug enabled (IOA 2000=1)
CN	16bit integer	16	2005	SYNC COUNTER	Counter for received synchronisation packets (IEC101). Available if Debug enabled (IOA 2000=1)
CN	16bit integer	16	2006	ERROR GENERIC	Counter for generic errors. Available if Debug enabled (IOA 2000=1)

## 7. Loading Frame Program

1. Connect power supply to the device
2. DIP switch "Pogram" ON
3. Toggle DIP switch "RST" (ON-OFF)
4. Load programm by executing "AP\_SerialDownload\_Firmware.bat"
5. Wait until message "Press any key to continue..." appears
6. DIP switch "RST" ON
7. DIP switch "Program" OFF
8. DIP switch "RST" OFF
9. If necessary restore default setup by using DIP swich "DFT"

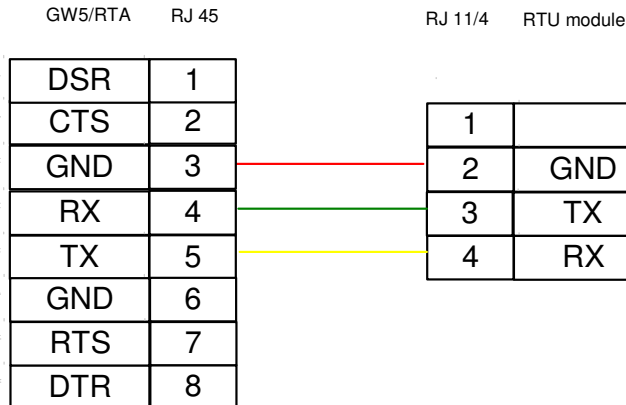
## 8. General Settings of Communication Ports

- Transmission rate 115200 bit/s
- Communication mode asynchronous data bits 8, parity N, stop bits 1
- Communication interface RS232, selectable RS422
- Communication protocol IEC60870-5-101 slave, unbalanced
- Link address length 1 byte
- ASDU address length 2 byte
- Object address length 2 byte
- Time synchronization IEC60870-5-101 protocol
- Communication interface isolation optically to 2,5kV RMS

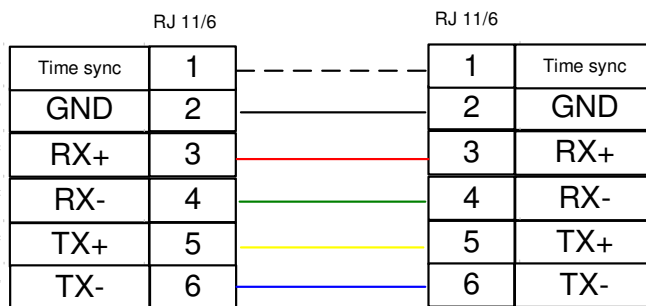


## 9. Communication Cables

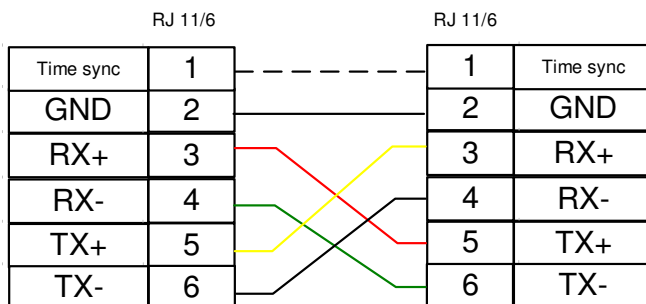
### Data concentrator-RTU module connection



### RTU module RS-422 Slave-Slave connection



### RTU module RS-422 Master-Slave connection



## 10. Panel-mounting of Telem-AP

