MARTEM
KAUGJUHTIMISSÜSTEEMID
TELECONTROL SYSTEMS

RTU digital input module TELEM-DI24-T

User Manual

Martem AS
2015

Preface

This document, User Manual for RTU (Remote Terminal Unit) Digital Input Module TELEM-DI24-T, provides a general technical description of the module, its configuration and use. Current version of this manual is applicable to the RTU versions marked as DI-D-xxx.

Although we have carefully checked the contents of this publication for conformity with the hardware and software described, we cannot guarantee complete conformity since errors cannot be excluded**.** The information provided in this manual is checked at regular intervals and any corrections that might become necessary are included in the next releases. Any suggestions for improvement are welcome.

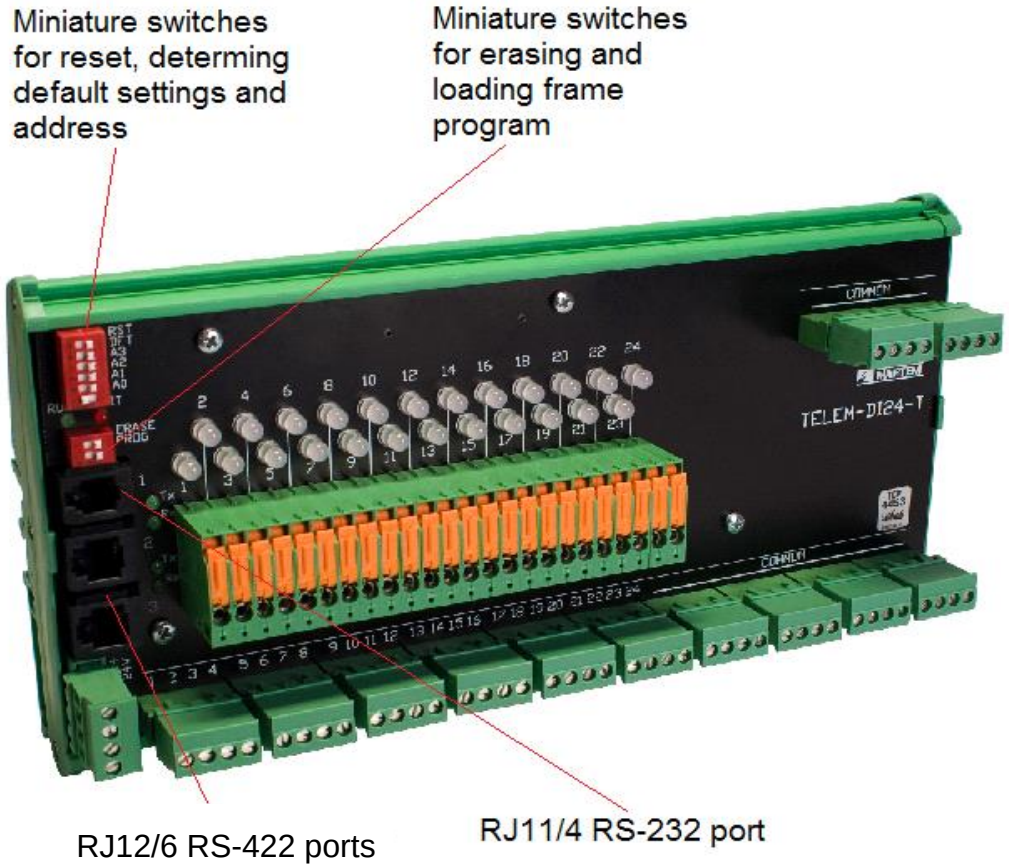
The RTU Digital Input Module TELEM-DI24-T has been designed and manufactured according to the quality principles of ISO 9001.

1. Application

TELEM-DI24-T digital input module is used for digital contact info acquisition, pulse counting and data exchange with higher level devices or systems. Its functionality allows it to be flexibly used for distributed process automation in systems to determine statuses of different objects or as a pulse counter where reliable information acquisition and excellent noise immunity with respect to environmental and electromagnetic influences are important. It may be used as a standalone device or in a daisy chain connection with other modules.

2. Construction

The mechanical design is based on a plastic box that can be readily mounted on 35-mm rails. The module is based on 32-bit ARM CPU. Interfaces to other equipment are RS-232 or RS-422. Data exchange protocol IEC 60870-5-1-101. Time synchronization is possible with synchronization pulse through a GW6 device.



3. Features

- Time synchronization with 1 ms accuracy
- 2 level input filters - buffer depth for each time-tagged input is 20 Logical operations with inputs
- Leased line or a dial-up mode operation, data GSM communication request by an event in substation or by the remote control centre
- Configuration / parameterization with IEC protocol at the same line with data communication
- Daisy chain master – slave connection for up to 15 modules using RS-422 interface
- Self diagnostics and supervision simultaneously with data acquisition
- Onboard knife disconnectors for digital inputs

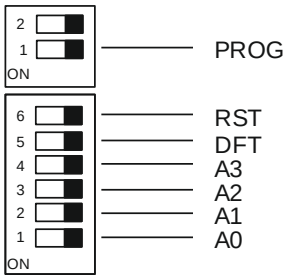
4. Technical Data

Number of digital inputs	24
Indication	1 for every input, 1 for a running indication, 1 for an alert indication
Built-in clock with a backup capacitor	Yes
Supply voltage	9-72 V DC, 1 W
Isolated input circuit voltage for signal circuits	20-135V VDC, (8W @48VDC, 20W @110VDC)
Isolation voltage	2,5 kV RMS

Weight	495 g
Mounting	DIN 35
Dimensions (WxHxD)	250 x 120 x 60
Cross section of wires for signal	Max. 2,5 mm2
Cross section of wires for power	Max. 2,5 mm2
Terminal for communication	RJ11/4 (RS232); RJ12/6 (RS422)
Over voltage protection	IEC-61000-4-4, 1 kV pulse protection
Electromagnetic Compatibility	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…+70°C

5. Mode Switches and Indication Led

5.1. Mode Switches



PROG – ON – load a new frame program
RST – ON – reset the device
DFT – ON – restores default setup
A0 – A3 – determines the address of the module

5.2. Indication LED

Indication LEDs display the state of the device:
ALERT – fired, error state or no connection with upper level device
RUN – blinking fire/unfired 1/1, normal operation and synchronized by an internal clock,
RUN – blinking fired/unfired 1/9, normal operation and synchronized by a gateway.
SIGNAL STATE – green fired, signal is activated, internal power supply
SIGNAL STATE – red fired, signal is activated, external power supply

5.3. Setting an address

A0	A1	A2	A3	Address
on	off	off	off	1
off	on	off	off	2
on	on	off	off	3
off	off	on	off	4
on	off	on	off	5
off	on	on	off	6
on	on	on	off	7
off	off	off	on	8
on	off	off	on	9
off	on	off	on	10
on	on	off	on	11
off	off	on	on	12
on	off	on	on	13
off	on	on	on	14
on	on	on	on	15
off	off	off	off	16

6. Loading Frame program

For loading new frame program two files:

- DI_SerialDownload_Firmware.bat
- di_xxx.bin

and a program:

- sflash

are needed.

Place those files in a folder
All of those files are provided by Martem AS, when needed.

Step 1
Modify contents of DI_SerialDownload_Firmware.bat

@echo off

*sflash.exe di_**xxx**.bin -s 16 -p 0x2800 -**c 8** -b 115200 -d*

pause

Define **di_xxx**.bin file to be used in the new progrem and set **com port** used by PC.

Step 2
Create connection between PC and Telem DI-24T

Step 3
Make neccesary dip switch changes and run **DI_SerialDownload_Firmware.bat** in following order:

1. PROG on
2. RST on
3. RST off
4. run DI_SerialDownload_Firmware.bat
5. wait until firmware update is finished
6. RST on
7. PROG off
8. RST off

7. Configuration

TELEM-DI24-T is configured using **configuration tool TELEM-GWS**. All 24 digital inputs are configured independently.

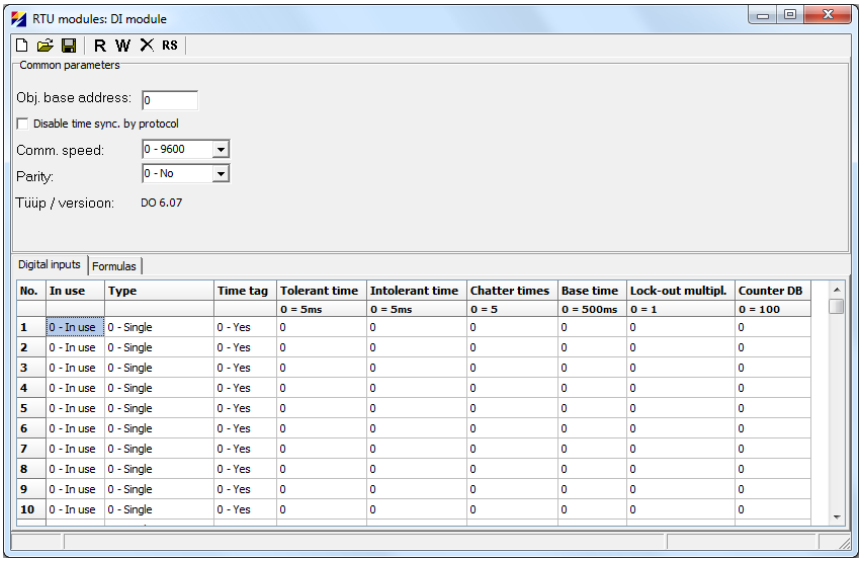
7.1. Configurable Parameters and General Settings of Communication Ports

• Transmission rate	200…38400 bit/s (default 9600 bit/s)
• Communication mode	asynchronous data bits 8, parity N, stop bits 1
• Communication interface	RS232, selectable RS422
• Communication protocol	IEC60870-5-101 slave/master, unbalanced
• Link address length	1 byte
• ASDU address length	2 byte
• Object address length	2 byte
• GPS time synchronization input	9600 bps (RS422 RX)
• Time synchronization	IEC60870-5-101 protocol,
• 1 second synchronization pulse	
• Communication interface isolation	optically to 2,5kV RMS

7.2. Configuration Parameters for Digital Inputs

TELEM DI24T module is configurable by **configuration tool TELEM-GWS** or by other configuration software using the data exchange protocol IEC60870-5-101. Telem-2000 RTU configuration software runs under Windows 95 or later operating systems on any standard PC, communicates via COM interface and performs the following principal functions:

- Configuration / parameterization of RTU
- Back up of RTU configuration data



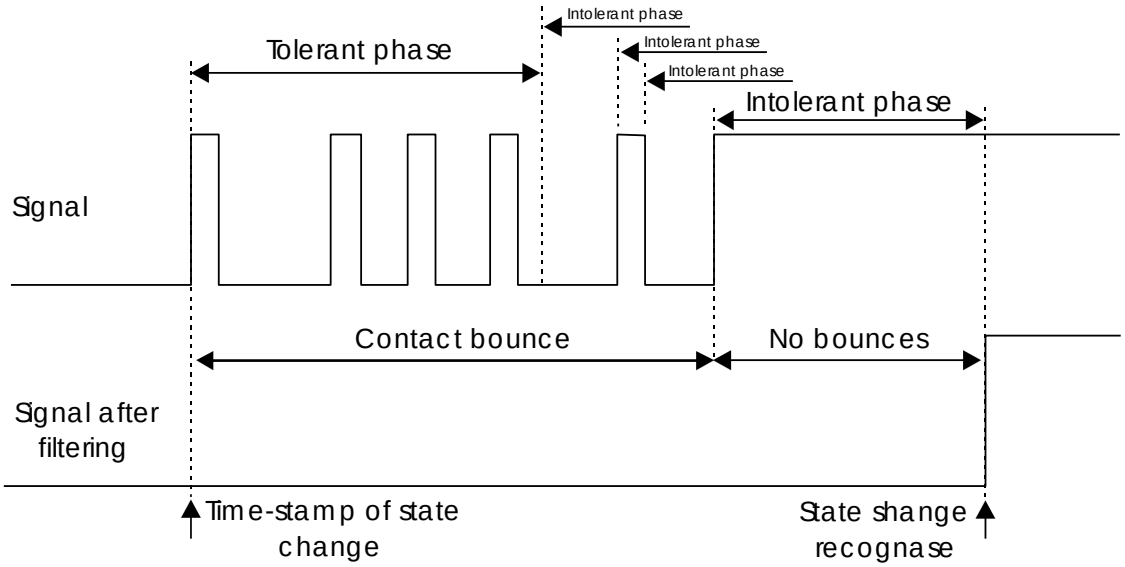
Parameter	Value	Default value

General		
1. In use	Yes No	Yes
2. Single- or double signal or counter input [In case of double signal the next input is used for second signal]	Single Double	Single
3. Time tagged	Yes No	Yes
Debouncing filter		
4. Tolerant phase [A period of time during which changes of state are permitted and ignored on a digital input signal]	1-255 ms.	5 ms (0)
5. Intolerant phase [A period of time during which the state of a digital input must remain constant]	1-255 ms.	5 ms (0)
Chatter filter [A facility that is used to disable a digital input point if the number of state changes of that point is excessively high during a defined time interval]		
6. Chatter times [changes]	1-255 times	5 (0)
7. Filter base [defined time interval]	0-32000 ms.	500 ms (0)
8. Lock-out period multiplier [Number of filter base periods when the chatter filter will be on]	1-255 periods	1
Counter		
9. Number of pulses for creating an event [Counter event is always without time tag]	1-255 pulses	100 (0)

7.2.1. Digital input processing

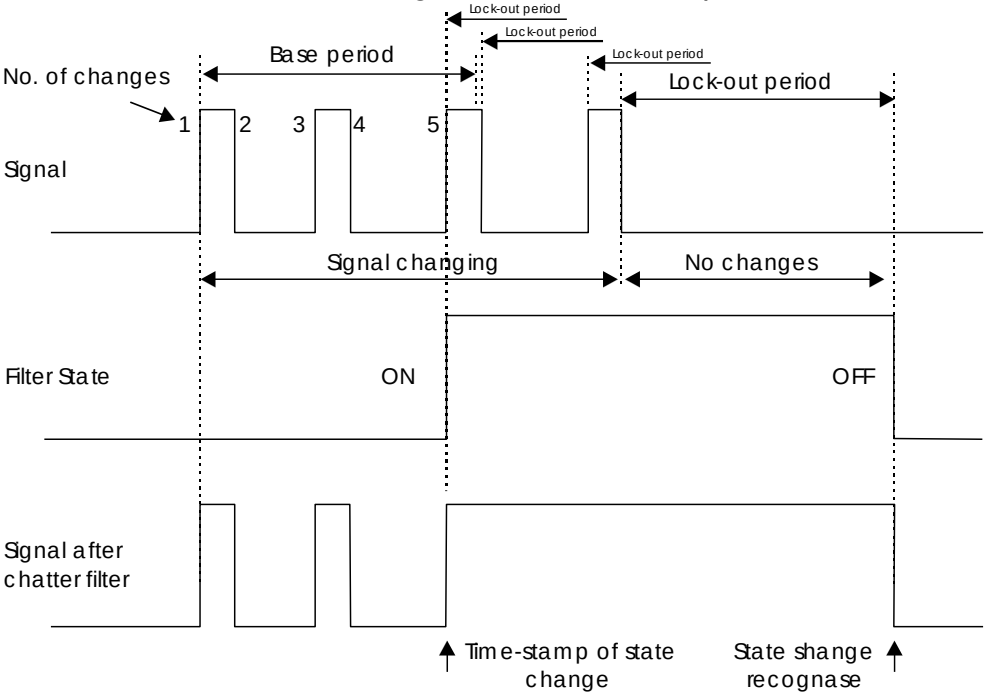
Debouncing Filter

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.



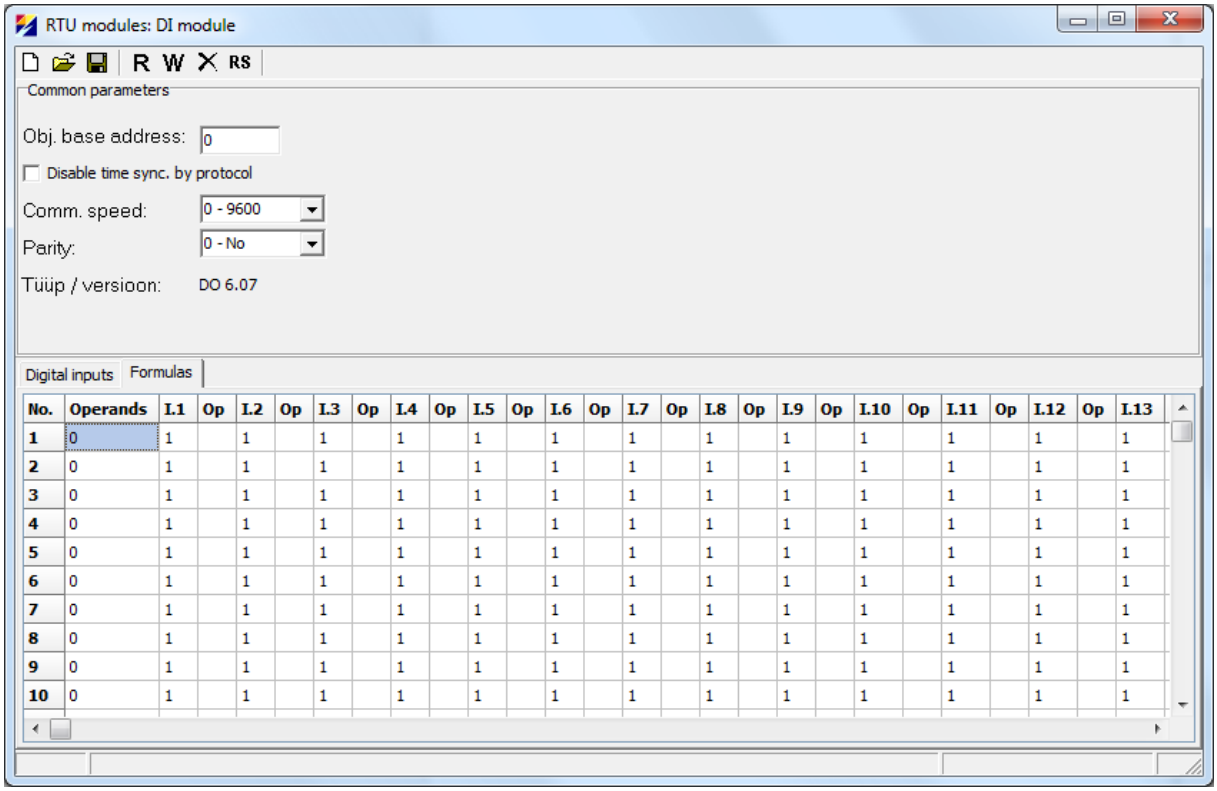
Chatter Filter

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.



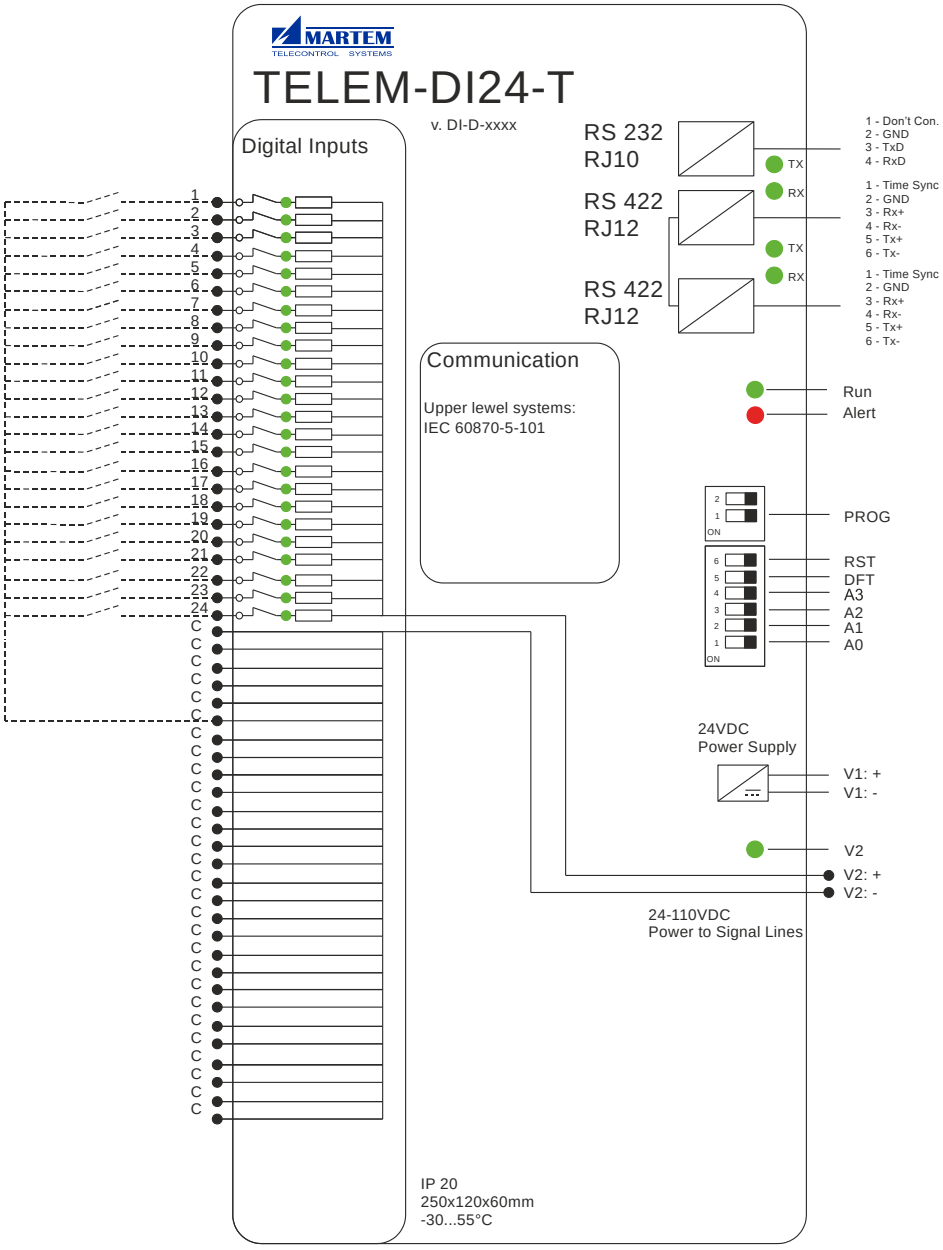
Configuration: Changes - 5, Lock-out period -1 (1x Base period)

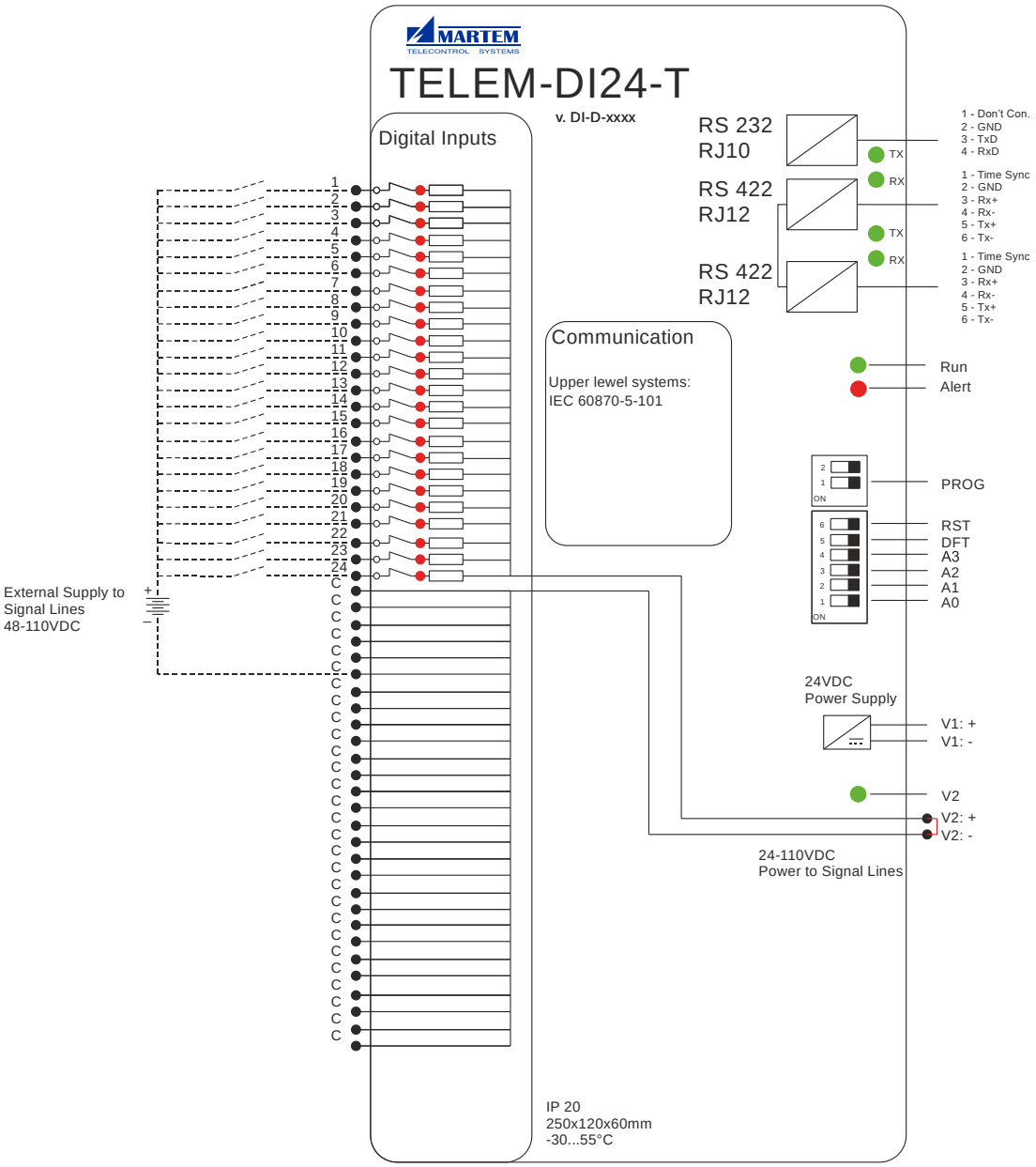
7.3. Logical Operations with Digital Inputs



No.	Operands	I.1	Op	I.2	Op	I.3	Op	I.4	Op	I.5	Op	I.6	Op	I.7	Op	I.8	Op	I.9	Op	I.10	Op	I.11	Op	I.12	Op	I.13
1	0	1		1		1		1		1		1		1		1		1		1		1		1		1
2	0	1		1		1		1		1		1		1		1		1		1		1		1		1
3	0	1		1		1		1		1		1		1		1		1		1		1		1		1
4	0	1		1		1		1		1		1		1		1		1		1		1		1		1
5	0	1		1		1		1		1		1		1		1		1		1		1		1		1
6	0	1		1		1		1		1		1		1		1		1		1		1		1		1
7	0	1		1		1		1		1		1		1		1		1		1		1		1		1
8	0	1		1		1		1		1		1		1		1		1		1		1		1		1
9	0	1		1		1		1		1		1		1		1		1		1		1		1		1
10	0	1		1		1		1		1		1		1		1		1		1		1		1		1

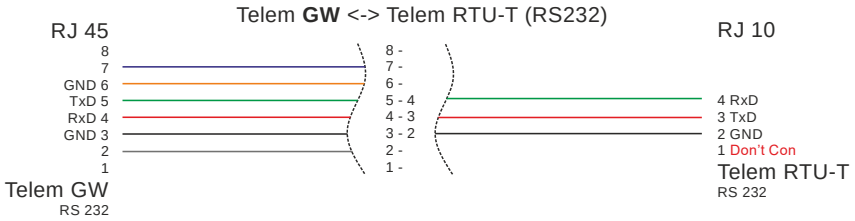
8. Connection to Signal Lines

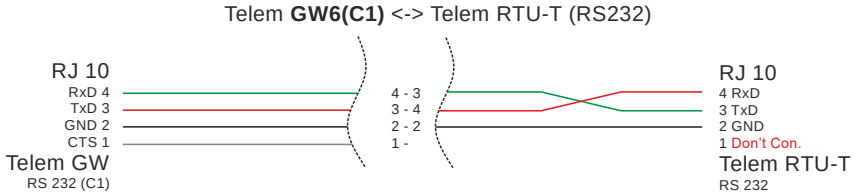


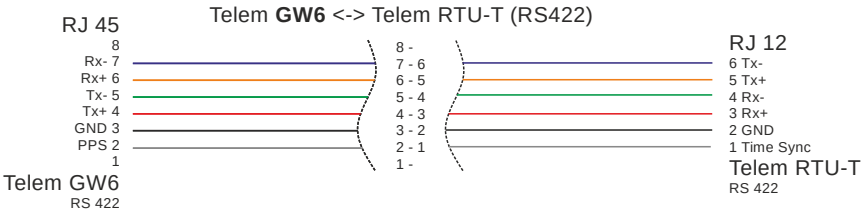


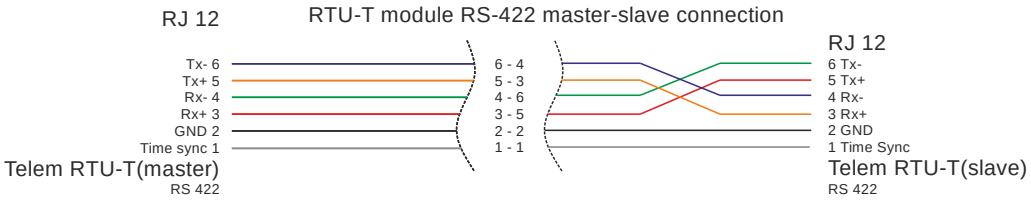
Power Input V2 has to be short-circuited when external Supply to signal lines is used

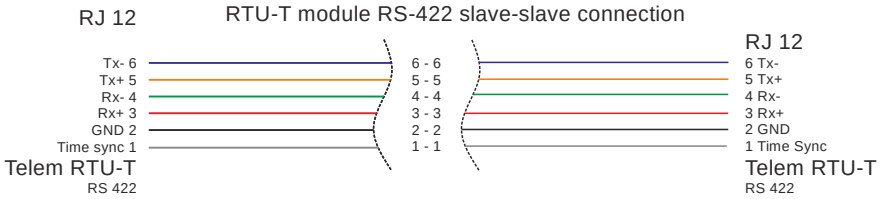
9. Communication Cables











10. Revision History

Rev 5/2015 Manual for TELEM-DI24-T (version DI-D-xxxx)