

**Communication Protocol  
Description**

**Protocol ELEN UNI-TXT**

Version 1.08



# 1. Introduction

This manual provides information about controlling textual LED displays through local data network based on communication interface RS485 or Ethernet. Displays are produced by ELEN, s.r.o. company.

## 2. LAN Description

Individual displays are interconnected with a control unit into a local computer network with a bus topology. Physical layer is based on RS485 or Ethernet interface.

Transmission via **RS485** is set as **asynchronous half-duplex** communication with the following parameters: **9 600, 8, N, 1**. The bus assignment is managed as a "MASTER – SLAVE" system. The MASTER is a control unit. All SLAVE devices have unique addresses from 1 to 127. Address 0 is a global address for all devices. Communication telegrams are secured with XOR checksum. Message repeat is controlled by MASTER.

For transmission via **Ethernet** has each display assigned its IP address and operates as **device server**.

## 3. Communication Telegrams

### 3.1 Sending Frame

Sending frame has a fixed structure with variable length of information field. Sending frame is used by MASTER only. Telegram length is limited to 1024 bytes. If reply message is not used it is necessary to **wait at least 100 ms** before sending next message.

<STX><ADR><I><ETX><CSUMH><CSUML>		
<STX>	0x02	• start of telegram flag
<ADR>		• address of SLAVE device, from 1 to 127 • 0 - global address for all SLAVE devices • D7 bit is always 1 • for communication via TCP the address is 127 (or as specified)
<I>		• information message content • variable length 0 ÷ 1019 bytes
<ETX>	0x03	• end of frame flag
<CSUMH>	0x8...	• upper 4 bits of CSUM byte - bit D7 always 1
<CSUML>	0x8...	• lower 4 bits of CSUM byte - bit D7 always 1

CSUM is defined as logical (bitwise) exclusive sum of all bytes of message including STX.

### 3.2 Receiving Frame

SLAVE device, whose address has been used, can respond to sending frame in 3 ways:

<ACK>	• acknowledge of reception and execution of command
<NAK>	• refusing frame (BUSY, ...)
"nothing"	• reception of frame with global address • refusing frame (CSUM error) • reply is not required

## 4. Control Commands and Text Format

Information part of telegram contains commands which tell display what to perform with the specified text message. These commands are designated with "\$" character.

### 4.1 Commands for Writing Text

Each sending frame can contain only one command.

### 4.1.1 Direct Writing of Text

Display will show required text message directly, while its previous content is erased. Characters which cannot be displayed are replaced with empty character.

`ttttttt`

- simple writing of ASCII text characters, which can also contain commands for text formatting described in chapter 4.2

### 4.1.2 Selection of text message from display's memory (not applicable)

`$K<k1000X><k100X><k10X><k1X>`

`<k1000X><k100X><k10X><k1X>`

- position of text message in ASCII format range: memory location 0 - 8192

### 4.1.3 Clearing display

`$0`

- clearing of user display area and all text message attributes

### 4.1.4 Writing variable to a specific location

`$Z<z1X>text`

`<z1X>`

- variable location in ASCII format range: 0th to 9th position  
text - characters string, which should be displayed, 15 characters max.

## 4.2 Commands for Message Formatting

One sending frame can contain more commands of this type, commands can be nested only into command of writing text to exact position, see chapter 4.1.1.

### 4.2.1 Blinking of Message

`$F1`

- following characters will be blinking

`$F0`

- following characters will NOT be blinking

ASCII format, default 0.

Command **\$F** is valid until: The next change of value with another **\$F** command. Display is turned off. Changing settings to default parameters with command **\$R**.

### 4.2.2 Changing text message color and message background

This is valid for multi-color LED displays only. Default value is C1.

Text message color (default value is C1):

`$C0`

- black

`$C1`

- red

`$C2`

- green

`$C3`

- yellow

Background color (default value is P0):

`$P0`

- black

`$P1`

- red

`$P2`

- green

`$P3`

- yellow

The background color cannot be changed on some types of displays.

### 4.2.3 Changing font type

Selection of font from the fonts' table. Font type has its height and length. The length of all characters of FIX type is the same.

`$U<uX>`

`<uX>`

- font number from the font table in ASCII format
- range 0-9 depending on the type of display

### 4.2.4 Changing font attribute

`$W0`

- normal

`$W1`

- bold

`$W2`

- wide

### 4.2.5 Inserting time into text message

`$H0`

- basic time (hh:mm:ss)

`$H1`

- hours (hh)

`$H2`

- minutes (mm)

`$H3`

- seconds (ss)

### 4.2.6 Inserting date into text message

`$N0`

- basic date (DD:MM:YYYY)

`$N1`

- day (DD)

`$N2`

- month (MM)

`$N3`

- year (YYYY)

### 4.2.7 Displaying a simple bar-graph

`$J<j100X><j10X><j1X>`

`<j100X><j10X><j1X>`

- number of dot columns of the graph in ASCII format
- range: 0<sup>th</sup> - 999<sup>th</sup> position

### 4.2.8 Reserving location for variables

`$I<i1X>`

`<i1X>`

- position of variable in ASCII format
- range: 0<sup>th</sup> - 9<sup>th</sup> position

### 4.2.9 Inserting moving message from the right

`$M<text>$CR`

`<text>`

- moving text message which will be inserted from the right side

### 4.2.10 Inserting message from the right

`$M~R<text>`

`<text>`

- text message which will be inserted from the right side

### 4.2.11 Inserting message from the left

`$M~L<text>`

`<text>`

- text message which will be inserted from the left side

### 4.2.12 Inserting message from the top

`$M~T<text>`

`<text>`

- text message which will be inserted from the top

### 4.2.13 Inserting message from the bottom

`$M~B<text>`

`<text>`

- text message which will be inserted from the bottom

### 4.2.14 Jump to a new line

`$CR`

- immediate jump to a new line

### 4.2.15 Jump to specific line

`$I<110X><11X>`

`<110X><11X>`

- immediate jump to a specific line
- line number in a range 00 - 23 in ASCII format

### 4.2.16 Beginning of cycle

`$LBL`

The first character after this command is jumped to with the `$JMP` command, creating an endless loop of text displacement. It is used after the commands `$M~R`, `$M~L`, `$M~T` and `$M~B`.

### 4.2.17 End of cycle

`$JMP`

It jumps to the first character after the `$LBL` command, creating an endless loop of moving text. It is used after the commands `$M~R`, `$M~L`, `$M~T` and `$M~B`.

### 4.2.18 The speed of extending the text in the horizontal direction

`$VH<X>`

`<X>`

- Sets the text moving speed. Applies to commands `$M~R`, `$M~L`.
- Speed in the range 0 - lowest to 9 - highest in ASCII format.

## 4.2.19 The speed of extending the text in the vertical direction

`$VV<X>`

`<X>`

- Sets the text moving speed. Applies to commands `$M~T`, `$M~B`.
- Speed in the range 0 - lowest to 9 - highest in ASCII format.

## 4.2.20 Deleting a row

`$CL`

- clears the row contents

## 4.2.21 Waiting

`$WT<10X><1X>`

`<10X><1X>`

- Waiting before executing the next command.
- Time in seconds in the range 01-99 in ASCII format.

## 4.2.22 Uploading image to display

`$PLD<10X><1X><image>`

`<10X><1X>`

- Sequence number of the image in the range 00-23 in ASCII format.

`<image>`

- File with Windows bitmap transferred to the display in hex format.
- The bitmap must have 16 colors with a maximum size given by the number of display lines (for example 16 x 16 or 24 x 24).

## 4.2.23 Displaying image on display

`$PIC<10X><1X>`

`<10X><1X>`

- Sequence number of the image in the range 00-23 in ASCII format.

# 4.3 Commands for Global Functions of Display

After reset, default values are set and command lasts until rewritten with a new command. Settings of these parameters will stay the same even if the display is restarted. Each sending frame can contain only one command.

## 4.3.1 Brightness Control

`$B<type of brightness control><brightness level>`

`<type of brightness control>`

- brightness control type sign
- 0 - brightness control by setting direct value of PWM without automatic control
- 1 - brightness control by setting the steepness of regulation curve in ASCII format, default 1

`<brightness level>`

- level value, while bit D7 is 1
- range 0 - 100%, default value is 80%

### 4.3.2 Setting message TIMEOUT (not applicable)

\$T<time-out value>

<time-out value>

- value of time-out period from 0 to 127, while bit D7 is 1
- range 0 - 127 seconds, default value is 0

### 4.3.3 Clearing display before writing new message

\$A<clearing method>

<clearing method>

- L - before writing of new line, will clear the entire display content
- R - before writing of new line, will keep the entire display content
- ASCII format, default R

### 4.3.4 Real Time Synchronization Packet

Display will set the internal real time according to content of the synchronization packet. Display is expecting information about time and date, in a format, which contains correction for time zone and DST (summer/winter time).

\$S<Y10X><Y1X><M10X><M1X><D10X><D1X>  
<H10X><H1X><MIN10X><MIN1X><SEC10X><SEC1X>

<Y10X>

- tens of year in ASCII format

<Y1X>

- ones of year in ASCII format

<M10X>

- tens of month in ASCII format

<M1X>

- ones of month in ASCII format

<D10X>

- tens of day in ASCII format

<D1X>

- ones of day in ASCII format

<H10X>

- tens of hours in ASCII format

<H1X>

- ones of hours in ASCII format

<MIN10X>

- tens of minutes in ASCII format

<MIN1X>

- ones of minutes in ASCII format

<SEC10X>

- tens of seconds in ASCII format

<SEC1X>

- ones of seconds in ASCII format

### 4.3.5 Controlling Checksum Verification

Enables or disables checksum verification during communication.

Factory default setup for checksum is disabled. This verification is mainly used for RS485 network. For TCP/IP it is not needed because verification of data is already performed by TCP link layer.

\$D<checksum verification control>

<checksum verification control>

- 0 - checksum is not verified
- 1 - checksum is verified
- ASCII format, default 0

### 4.3.6 Controlling Reply of Display

Allows to set whether display should acknowledge received packets during communication.

`$E<reply control>`

`<reply control>`

- 0 - display does not reply
- 1 - display replies
- ASCII format, default 0

### 4.3.7 Blinking Text Parameters

`$G<period><filling>`

`<period>`

- blinking time period x 100 ms
- range 0 - 127 (that means 0.1 - 12.7 seconds), value of bit D7 is 1
- default value is 15

`<filling>`

- what percentage of blinking period is display ON
- range 0 - 100%, value of bit D7 is 1
- default value is 66%

### 4.3.8 Setting default values

`$R`

- all display parameters will be set to default values

### 4.3.9 Reading display's settings

Allows you to read the values from the EEPROM that were set in chap. 4.3.1 to 4.3.6.

`$Q`

- it will respond with a 14-byte string which contains display's settings