Command protocol for MEANDR displays. RS485 control. Mode of operation - half duplex. Handshaking: yes. Involved line: RTA, RTB. The exchange rate is 9600 bps, byte format: start bit, 8 data bits, 2 stop bits. The waiting time for a response about the reception of information by the display, not more than 1000 ms (???). The interval between receiving a response from the display and sending a new command, at least 5ms (???).

When the power is turned on, the display test is performed, and upon its completion the information stored in the non-volatile memory (EEPROM) is displayed; information. EEPROM has a limited number of rewriting cycles (about 100,000 times), therefore, when developing an exchange algorithm with a scoreboard, it is necessary to choose the right commands (with or without recording in EEPROM). **General command packet format**

**Header Information packet Checksum**

**1 byte 1 byte 1 byte 1 byte 1 byte 1 byte 1 byte N bytes 1 byte**

**STB ADR ADTR Q CMD LINE COLU DATA CHS**

 Common response packet format Header Information packet Checksum 1 byte 1 byte 1 byte 1 byte 1 byte 1 byte 1 byte 1 byte N bytes 1 byte STB ADR ADTR Q CMD STATUS LINE COLU DATA CHS

STB [hex] - start bytes: 0x1B,

ADR [hex] - recipient's address;

ADTR [hex] - the sender's address (always 0x00 for MASTER);

Q [hex] - the number of bytes in the information packet, not including the checksum byte;

CMD [hex] - command;

LINE [hex] - line number of the board;

COLU [hex] - the number of the board's column;

DATA - data (the low byte is transmitted first), for some commands the data may be missing;

STATUS [hex] - command execution status byte;

CHS [hex] - checksum (low byte of the inverse of the sum of all bytes in the header and information packet

; ADR\_EE\_H [hex] - high and low bytes of the EEPROM address of the service settings area (SETINGS)

ADR\_EE\_L [hex] of the display should be addressed by the appropriate command see below;

Q\_EE [hex] - the number of bytes of the EEPROM of the display settings service area (SETINGS) to which the corresponding command should be addressed, see below;

Address allocation 0x00 - MASTER address (the device from which displays are being loaded); 0х01 ... 0хfd - address range Plays [indicated in \* .xml files]; when accessing a device with a non-existent address, the program tries to call him twice more with an interval of 500 ms (???). 0xfe - address for commands that perform operations with the serial number of the device 0hff - general address for all displays, when sending commands to the common address, the displays do not respond about receiving the package; List of commands Commands of the current display control of the board 1. 0x00 - no operation; 2. 0x02 - clearing the display (cell board) c entry in the EEPROM and with the answer; 2.1. 0x82 - clearing the display (cell board) with an entry in the EEPROM and no response; 2.2. 0x22 - clearing the display (cell board) without writing to the EEPROM and with the answer; 2.3. 0xa2 - clearing the display (cell board) without writing to the EEPROM and without response; 3. 0x01 - data input in ASCII codes with a record in the EEPROM and with the answer;

3.1. 0x81 - data input in ASCII codes with writing to EEPROM and without response; 3.2. 0x21 - data input in ASCII codes without writing to the EEPROM and with the answer; 3.3. 0xа1 - data input in ASCII codes without writing to EEPROM and without response; 4. 0x03 - data entry in seven-segment codes with writing to EEPROM and with response; 4.1. 0x83 - data entry in seven-segment codes with writing to EEPROM and without response; 4.2. 0x23 - data entry in seven-segment codes without writing to the EEPROM and with the answer; 4.3. 0xa3 - data input in seven-segment codes without writing to EEPROM and without response; 5. 0x05 - setting the brightness of the glow with writing to the EEPROM and with the answer; 5.1. 0x85 - set the brightness of the glow with writing to the EEPROM and without response; 5.2. 0x25 - setting the brightness of the glow without writing to the EEPROM and with the answer; 5.3. 0xа5 - setting the brightness of the glow without writing to the EEPROM and without answering;

 P.S. Use the necessary commands according to the selected display control algorithm in the system. If the system uses automatic brightness control, then the commands to set the brightness of the glow do not use. Service commands 6. 0x4b - display on the display (displays) of the serial number (s); 7. 0x3d - reading the device address (display) using the serial number; 8. 0x3e - record the new device address (display) using the serial number; 9. 0x3f - restoration of the initial settings (SETINGS) of the device (display) operation using the serial number; 10. 0x4c - write new device address (display) to the current address; 11. 0x4d - reading the settings (SETINGS) of the device (display) operation; 12. 0x4e - recording of new settings (SETINGS) of the device (display) operation; 13. 0x4f - restoration of the initial settings (SETINGS) of the device (display) operation to the current address.

 P.S. The address space of the settings (SETINGS) of the device operation (display), the number of settings, the sequence and values ​​of different devices may vary. The information package of each team has some peculiarities: - for some teams only a team is included in it; - for other teams - team and status; - for third teams - team, row number, column number; - for the fourth team - the command and status, row number, column number; - for the fifth teams - the command, line number, column number and data; - for the sixth teams - the command and status, row number, column number and data. For details, see the section Command Description. Values ​​of the STATUS byte (used to analyze the correctness of the exchange): 0x00 - the package has been correctly received; 0x01 - the number of bytes in the parcel is less or more than the allowable value; 0x02 - non-existent command; 0x03 - checksums did not match; 0X04 - timeout exceeded; 0X05 - wrong MASTERa code; 0X06 is an invalid byte value.

ASCII token generator (for seven-segment indicators) Code Badge Code Badge Code Badge Code Badge Code Badge Code Sign 0x20 '' '' 0x30 '' 0 '' 0x40 '' \_ '' 0x50 '' P '' 0x60 '' '' '0x70' ' P '' 0x21 '' \_ '' 0x31 '' 1 '' 0x41 '' A '' 0x51 '' \_ '' 0x61 '' A '' 0x71 '' \_ '' 0x22 '' \_ '' 0x32 '' 2 ' '0x42' 'b' '0x52' 'R' '0x62' 'b' '0x72' 'r' '0x23' '\_' '0x33' '3' '0x43' 'C' '0x53' 'S' '0x63 '' c '' 0x73 '' S '' 0x24 '' \_ '' 0x34 '' 4 '' 0x44 '' d '' 0x54 '' t '' 0x64 '' d '' 0x74 '' t '' 0x25 '' \_ '' 0x35 '' 5 '' 0x45 '' E '' 0x55 '' U '' 0x65 '' E '' 0x75 '' u '' 0x26 '' '\_' '0x36' '6' '0x46' 'F' '0x56' '\_' '0x66' 'F' '0x76' '\_' '0x27' '\_' '0x37' '7' '0x47' '\_' '0x57' '\_' '0x67' '\_' '0x77 '' \_ '' 0x28 '' \_ '' 0x38 '' 8 '' 0x48 '' H '' 0x58 '' \_ '' 0x68 '' h '' 0x78 '' \_ '' 0x29 '' \_ '' 0x39 '' 9 '' 0x49 '' I '' 0x59 '' Y '' 0x69 '' i '' 0x79 '' Y '' 0x2A '' \_ '' 0x3A '' \_ '' 0x4A '' J '' 0x5A '' \_ ' '0x6A' 'J' '0x7A' '\_' '0x2B' '' '0x3B' '\_' '0x4B' '\_' '0x5B' '\_' '0x6B' '\_' '0x7B' '' '' 0x2C '' \_ '' 0x3C '' \_ '' 0x4C '' L '' 0x5C '' \_ '' 0x6C '' L '' 0x7C '' \_ '' 0x2D '' - '' 0x3D '' \_ '' 0x4D '' \_ '' 0x5D '' \_ '' 0x6D '' \_ '' 0x7D '' \_ '' 0x2E ''. '' 0x3E '' \_ '' 0x4E '' n '' 0x5E '' \_ '' 0x6E '' n '' 0x7E '' \_ ' '0x2F Upper line 0x3F' '\_' '0x4F' 'O' '0x5F' '\_' '0x6F' 'o' '0x7F degree

Code Sign Code Sign 0xa0 ''. '' 0xb0 '' 0. '' 0xa1 '' \_ '' 0xb1 '' 1. '' 0xa2 '' \_ '' 0xb2 '' 2. '' 0xa3 '' \_ '' 0xb3 '' 3. '' 0xa4 '' \_ '' 0xb4 '' 4. '' 0xa5 '' \_ '' 0xb5 '' 5. '' 0xa6 '' \_ '' 0xb6 '' 6. '' 0xa7 '' \_ ' '0xb7' '7.' '0xa8' '\_' '0xb8' '8.' '0xa9' '\_' '0xb9' '9.' '

Description of commands with examples In the proposed examples, all displays are three familiar. Examples 1 ... 7 for a display containing several displays. 1. Request the presence of the display in the display board with (address 0x01, line 0x01, column 0x02): 0x00 Example: 0x1b, 0x01, 0x00, 0x03, 0x00, 0x01, 0x02, 0xdd Answer: (if such a display is available) The format of the information packet response: Information package 1 byte 1 byte 1 byte 1 byte CMD STATUS LINE COLU Example: 0x1b, 0x00, 0x01, 0x04, 0x00, 0x00, 0x01, 0x02, 0xdc 2. Cleaning the display board: 0x02 (all displays are cleared, no answer). Example: 0x1b, 0xff, 0x00, 0x01, 0x02, 0xe2

3. Cleaning the display c with a record in the EEPROM and with the response: 0x02 Example, the display is cleared (address 0x01, line 0x01, column 0x02): 0x1b, 0x01, 0x00, 0x03, 0x02, 0x01, 0x02, 0xdb Answer: The format of the response packet information packet : Information package 1 byte 1 byte 1 byte 1 byte CMD STATUS LINE COLU

Example: 0x1b, 0x00, 0x01, 0x04, 0x02, 0x00, 0x01, 0x02, 0xda 4. Entering data in ASCII codes without writing to the EEPROM and with the answer: 0x21. Example, entering in the display of the second row of the first column of the number 056, without an entry in the EEPROM. 0x1b, 0x01, 0x00, 0x06, 0x21, 0x02, 0x01, 0x36, 0x35, 0x30, 0x1e Answer: Response information packet format: Information packet 1 byte 1 byte 1 byte 1 byte CMD STATUS LINE COLU Example: 0x1b, 0x00, 0x01, 0x04, 0x21, 0x00, 0x02, 0x01, 0xbb

5. In the data in ASCII codes without writing to the EEPROM and without an answer: 0xa1. Example, putting in the display of the second row of the first column of the number 056. 0x1b, 0x01, 0x00, 0x06, 0xa1, 0x02, 0x01, 0x36, 0x35, 0x30, 0x9e Answer: no

6. Data input in seven-segment codes with an entry in the EEPROM and with the answer: 0x03. Correspondence of the display of segments and signs to seven-segment codes: segment "A" = bit 0, "B" = bit 1, ... "G" = bit 6, segment “H” (colon or dot) - bit 7; For example: "0" - 0x3f, "1" - 0x06, "2" - 0x5b, "3" - 0x4f, "4" - 0x66, "5" - 0x6d, "6" - 0x7d, "7" - 0x07, "8" - 0x7f, "9" - 0x6f, "0." - 0xbf, "1." - 0x86, "2." - 0xdb, "3." - 0xcf, "4." - 0xe6, "5." - 0xed, "6." - 0xfd, "7." - 0x87, "8." - 0xff, "9." - 0xef, "" - 0x00, "-" - 0x40, "." - 0x80, etc .; For example, the entry in the display of the second row of the first column of the number 056 in seven-segment codes with an entry in the EEPROM and the answer. 0x1b, 0x01, 0x00, 0x06, 0x03, 0x02, 0x01, 0x7d, 0x6d, 0x3f, 0xae Answer: Response information packet format: Information packet 1 byte 1 byte 1 byte 1 byte CMD STATUS LINE COLU Example: 0x1b, 0x00, 0x01, 0x04, 0x03, 0x00, 0x02, 0x01, 0xd9 7. Entering data in seven-segment codes without recording in EEPROM and without response: 0x-3 Example, entering in the display of the second row of the first column of the number 056 in seven-segment codes without writing in EEPROM and without response 0x1b, 0x01, 0x00, 0x06, 0xa3, 0x02, 0x01, 0x7d, 0x6d, 0x3f, 0x0e

Example 8 for a display containing one display.

8. Data entry in ASCII codes with an entry in the EEPROM and with the answer: 0x01. For example, entering the number 056 in ASCII codes in the display with the address 0x04, with the entry in the EEPROM and with the answer. 0x1b, 0x04, 0x00, 0x06, 0x01, 0x01, 0x01, 0x36, 0x35, 0x30, 0x3c Answer: The format of the response information packet: Information packet 1 byte 1 byte 1 byte 1 byte CMD STATUS LINE COLU

Example:

0x1b, 0x00, 0x04, 0x04, 0x01, 0x00, 0x01, 0x01, 0xd9

Description of service commands with examples In the EEPROM of the board during manufacture, the following are recorded: - the serial number of the board of 4 bytes: number, year and week of manufacture [example: 00 03 18 50 (number is 0003, where one is 18, week is 50)]. Cannot be changed during explication; - the address of the recipient ADR [example: 0x01]. It can be changed in the process of exploitation. - configuration settings (SETINGS). Can be changed in the process of explication. The full list of SETINGS with addresses in the EEPROM is specified during the development process. This list may include: - the value of the maximum value of the counter; - the value of the coefficient of the minimum time of the active state of the contact (= K \* 0.1 sec.); - the values ​​of the auxiliary registers control the brightness of the display, etc. - the number of familiarity on the display; - timeout ratio when exchanging via RS232 / RS485, etc.

9. Display on the scoreboard of the serial number of the scoreboard with a known address: 0x4b; Example, display on the scoreboard the serial number, the scoreboard with the address 0x09, the number of rows - 2 and the number of columns - 2 (serial number 00 03 18 50 is written in the EEPROM) 0x1b, 0x09, 0x00, 0x03, 0x4b, 0x01, 0x01, 0x8b Answer: Response information packet format: Information packet 1 byte 1 byte 1 byte 1 byte CMD STATUS LINE COLU Example: 0x1b, 0x00, 0x09, 0x04, 0x4b, 0x00, 0x01, 0x01, 0x8a All display boards go out in the first line of the first display columns are sequentially displayed in a circle: '' \_ '', '' 0 '', '' 0 '', '' 0 '', '' 3 '', '' 1 '', '' 8. '', ' '5' ',' '0.' ', (Where:' '\_' 'is the preamble,' '.' 'After the units of the year and week is ancillary . Nye for lichshego perception Out display board serial number - loading information boards or reset (see examples 1 ... 8.).

10. Display on the scoreboard of the serial number of the scoreboard with an unknown address or, if you need to determine the serial addresses of several scoreboards, managed by a single interface: 0x4b; Example, display on the scoreboard of the serial number of the scoreboard with an unknown address (unknown addresses). 0x1b, 0xff, 0x00, 0x03, 0x4b, 0x01, 0x01, 0x95 Answer: none All system displays their system numbers, see Example 9 of this document. 11. Reading the board address using the serial number: 0x3d; Example, reading the address of the board using the serial number (serial number 00 03 18 50 and address 0x09 is recorded in the EEPROM) 0x1b, 0xfe, 0x00, 0x07, 0x3d, 0x01, 0x01, 0x00, 0x03, 0x18, 0x50, 0x35 Answer: Information format response package: Information packet 1 byte 1 byte 1 byte 1 byte CMD STATUS LINE COLU Example: 0x1b, 0x00, 0x09, 0x04, 0x3d, 0x00, 0x01, 0x01, 0x98

 12. Record the new address of the scoreboard using the serial number: 0x3e; Example, recording the new address of the board (0x03) using the serial number (serial number 00 03 18 50 and address 0x09 is recorded in the EEPROM) 0x1b, 0xfe, 0x00, 0x08, 0x3e, 0x01, 0x01, 0x00, 0x03, 0x18, 0x50, 0x03 , 0x30 Reply: The format of the information packet of the answer: Information packet 1 byte 1 byte 1 byte 1 byte CMD STATUS LINE COLU

Example: 0x1b, 0x00, 0x03, 0x04, 0x3e, 0x00, 0x01, 0x01, 0x9d 13. Restoring the original [factory] configuration settings (SETINGS) of the device (board) operation using the serial number: 0x3f; Example, install the original [factory] configuration settings (SETINGS) of operation using the serial number (address 0x03 and serial number 00 03 18 50 are written in the EEPROM): 0x1b, 0xfe, 0x00, 0x07, 0x3f, 0x01, 0x01, 0x00, 0x03, 0x18, 0x50, 0x33 Answer: The format of the information response packet is: Information packet 1 byte 1 byte 1 byte 1 byte CMD STATUS LINE COLU Example: 0x1b, 0x00, 0x03, 0x04, 0x3f, 0x00, 0x01, 0x01, 0x9c 14. Writing a new address in the scoreboard with a known address: 0x4e; Example, write to the board a new address (0x03) (address 0x09 is written in the EEPROM) 0x1b, 0x09, 0x00, 0x04, 0x4e, 0x01, 0x01, 0x03, 0x84 Answer: Format of the response information packet: Information packet 1 byte 1 byte 1 byte 1 CMD STATUS LINE COLU byte Example: 0x1b, 0x00, 0x03, 0x04, 0x4e, 0x00, 0x01, 0x01, 0x8d 15. Restoring the original [factory] configuration settings (SETINGS) of the device (scoreboard) with a known address: 0x4f; Example, install the original [factory] configuration settings (SETINGS) of the board with a known address (the address 0x03 is written in the EEPROM): 0x1b, 0x03, 0x00, 0x03, 0x4f, 0x01, 0x01, 0x8d Answer: Response information packet format: Information packet 1 byte 1 byte 1 byte 1 byte CMD STATUS LINE COLU Example: 0x1b, 0x00, 0x03, 0x04, 0x4f, 0x00, 0x01, 0x01, 0x8c 16. Reading from the EEPROM of the scoreboard with the known address of the configuration settings (SETINGS) of the board's function: 0x4d Example, read the configuration settings (SETINGS) of the functioning of the board with a known address (in the EEPROM app Sana'a: Address 0x03, ADR\_EE\_H = 0x00, ADR\_EE\_H = 0x09, Q\_EE = 0x05): The format of the information package: Information Package 1 byte 1 byte 1 byte 1 byte 1 byte 1 byte CMD LINE COLU ADR\_EE\_H ADR\_EE\_L Q\_EE

0x1b, 0x03, 0x00, 0x06, 0x4d, 0x01, 0x01, 0x00, 0x09, 0x05, 0x7e Answer: The format of the response information packet:

1 byte 1 byte 1 byte 1 byte 1 byte 1 byte 1 byte N bytes CMD STATUS LINE COLU ADR\_EE\_H ADR\_EE\_L Q\_EE DATA

0x1b, 0x03, 0x00, 0x0c, 0x4d, 0x00, 0x01, 0x01, 0x00, 0x09, 0x05, 0x04, 0x04, 0x87, 0x00, 0x0f, 0xda

17. Record in the EEPROM of the scoreboard with a known address configuration settings (SETINGS) of the function of the scoreboard: 0x4с Example, write down new configuration settings (SETINGS) of the functioning of the scoreboard with

address (in EEPROM recorded: address 0x03, ADR\_EE\_H = 0x00, ADR\_EE\_H = 0x09, Q\_EE = 0x05): Information packet format: Information packet 1 byte 1 byte 1 byte 1 byte 1 byte 1 byte N bytes CMD LINE COLU ADR\_EE\_H ADR\_EE\_EE

0x1b, 0x03, 0x00, 0x0b, 0x4c, 0x01, 0x01, 0x00, 0x09, 0x05, 0x03, 0x03, 0x68, 0x00, 0x0e, 0xfe Answer: The format of the response information packet:

1 byte 1 byte 1 byte 1 byte 1 byte 1 byte 1 byte N bytes CMD STATUS LINE COLU ADR\_EE\_H ADR\_EE\_L Q\_EE DATA

0x1b, 0x03, 0x00, 0x04, 0x4c, 0x00, 0x01, 0x01, 0x8f

Consultations: IRF MEANDR sia Alexey Nesterov mob. 26496368 t. 67627834. meandr@inbox.lv