Signal-Tech LED Count Display Protocol

Format Instructions Modular 7 Segment Version: V1 01/2023

Signal-Tech's LED Count Displays can accept data via either an RS-485 2-wire (or RS-232) network or an Ethernet Connection (TCP/IP), depending on the product being used (see ***Figure 1*** and ***Figure 2*** below).

All displays can show digits 0-9 and a specific set of alphabetic characters (see ***Figure 3*** on the next page).

Each display shall be assigned an address of 0-255. A response packet may optionally be requested when a display receives and processes a command. If this response packet is to be used by a control system for verification of data receipt, each display on the network segment must have a unique address. If no responses are required, then identical addresses may exist on a single network segment.

Figure 1:

SA Series *[RS-485/232]*
Communication Requirements

Serial Settings:
- 9600 baud
- Parity: none
- 8 data bits
- 1 stop bit

Communication Flow:
1) Create a serial port connection
2) Send data packet to the sign
3) If enabled, receive the optional response from the sign
4) Repeat steps 2-3 as needed;
   allow a delay of at least 15ms between each packet
5) Close the serial port connection

Other Notes:
For SA signs with multiple displays, each display's 7-segment controller shall be daisy-chained and pre-addressed from the factory.

Figure 2:

S-SA Series *[Ethernet]*
Communication Requirements

Default IP Address:
- None [DHCP]
- Configurable via web GUI or Telnet

Default Ports:
- :10001 [Primary Communication]
- :80 [Web GUI Configuration]
- :9999 [Telnet Configuration]

Communication Flow:
1) Create a TCP connection with the device
2) Send data packet to the sign
3) Receive the response from the sign [optional; typically requires looping while receiving into a buffer until the entire response is reveived]
4) Repeat steps 2-3 as needed;
   allow a delay of at least 30-100ms between each packet
5) Close the serial port connection

Other Notes:
For S-SA signs factory built with multiple displays, only a *single Ethernet controller* is used (i.e., only one IP address for the entire sign). Each display within the sign is identified by its "serial address" set on its 7-segment controller.

Standard Protocol Format (Four Digit Display)

Each data packet shall be formatted as follows: **SYN, SYN, STX, SA, CM, CD, X, X, X, X, CS, ETX** (12 bytes)

SYN = 0x16 (Hex)

STX = 0x02 (Hex)

SA = Sign Address (Hex); Example: 0x3C = Sign #60

CM = Command Mode (Hex);
- 0x00 = Display a number *(deprecated)*
- 0x01 = Display FULL
- 0x02 = Display OPEn
- 0x03 = Display CLSd*
- 0x04 = Blank display
- 0x06 = Display a number

*(**Note:** CLSd can display in red LEDs IF:
1) MODE switch 6 is enabled on the controller
2) The display has a set of red overlaid digits

CD = Enable or disable response packet (Hex); 0x00 = Display will not send a response packet.
0x01 = Display will generate and send a response packet.

X = An ASCII character, used with Command Modes 0x00, and 0x06. Permissible characters are shown below. Number of digits connected to display in ASCII characters must always be sent, in order to maintain the correct packet length. If 5 digits are connected the packet will be 13 (5 X's).

CS = Checksum (Hex). This is an XOR value of the data packet. Calculation of it is shown in pseudocode example shown in ***Figure 4.***

ETX = 0x03 (Hex)

Figure 3: Characters Available for Display

Digits:	0 - 9 (ASCII)
Characters:	Space,A,b,C,c,d,e,E,F,H,L,u,U,P,n,o,0,r

NOTE: If Command Types 0x01, 0x02, 0x03, or 0x04 are used, ASCII X bytes may be given any value by the system generating the packet. However, the values of the X bytes **must** still be included in the checksum calculation.

Other: ASCII "N" or "n" (0x4E) will display a tall lowercase n

Figure 4: XOR Checksum Routine Pseudocode (X4 assumes 4 digits connected)

Packet structure: **SYN, SYN, STX, SA, CM, CD, X1 , X2, X3, X4, CS, ETX**

```
temp_value = SA <XOR> CM
temp_value = temp_value <XOR> CD
temp_value = temp_value <XOR> X1
temp_value = temp_value <XOR> X2
temp_value = temp_value <XOR> X3
CS = temp_value <XOR> X4
```

The checksum must always be calculated and sent with a data packet, whether or not a response is requested. If a display receives a packet and the packet's checksum does not match the checksum value calculated by the display's processor, it will not update or change the characters being displayed. Only a properly formatted, addressed and verified data packet will cause a display update.

If the data packet's CD byte indicates that a response is requested, the display to which the packet was addressed will generate one of two responses:

If the packet's checksum matches the calculated checksum:

SYN, SYN, STX, ACK, ETX
SYN = 0x16
STX = 0x02
ACK = 0x06
ETX = 0x03
(All values are hex)

If the packet's checksum does NOT match the calculated checksum:

SYN, SYN, STX, NAK, ETX
SYN = 0x16
STX = 0x02
NAK = 0x15
ETX = 0x03
(All values are hex)

Examples based on a 4 digit display

PACKET: 0x16, 0x16, 0x02, 0x3A, 0x06, 0x01, 0x00, 0x00, 0x32, 0x33, 0x3C, 0x03
RESULT: Sign #58 displays " 23"

PACKET: 0x16, 0x16, 0x02, 0x19, 0x06, 0x01, 0x4F, 0x4F, 0x32, 0x33, 0x1F, 0x03
RESULT: Sign #25 displays "0023"

PACKET: 0x16, 0x16, 0x02, 0x01, 0x01, 0x01, 0x30, 0x31, 0x32, 0x33, 0x01, 0x03
RESULT: Sign #1 displays "FULL"

PACKET: 0x16, 0x16, 0x02, 0x0A, 0x03, 0x01, 0x30, 0x30, 0x30, 0x30, 0x08, 0x03
RESULT: Sign #10 displays "CLSd"

Other Resources:

Installation Instructions:
https://www.signal-tech.com/information-center/installation

FAQs:
https://www.signal-tech.com/information-center/faq