SUNRISE SYSTEMS
QUALITY LED DISPLAY SYSTEMS

LED NEXT STOP ANNOUNCEMENT SIGNS
MODEL NXTP7X962M/J1587 SPECIFICATIONS

Firmware Version 040520

Dimensions:	26.68" x 4.00" x 2.16"
Weight:	5 lbs.
Matrix:	7 x 96 single line
LED type:	5mm (T1-3/4) fully diffused wide angle cylindrical
Color:	AlInGaP red 632 nm. peak wavelength or AlInGaP amber 590 nm. peak wavelength
Brightness level:	50 millicandelas std. Other levels available.
Readable viewing angle:	150 degrees
Chars/line:	16 in the default 5x7 font
Char fonts:	5x7 norm, 6x7 bold, 4x7 compact, graphics
Pixel dimensions:	.2" diam on .275" square grid
Nominal char. height:	2"
Stroke width/height:	10% meets ADA minimum
Char. width/height:	70% is within ADA 60% - 100% range
Viewing distance 20/20:	90 feet with 20/20 vision
Operating voltage:	+10 to +30 VDC. 100V load dump protected.
Input power:	30 watts maximum
Operating temp. range:	-30 to +50 degrees Celsius
Storage temp. range:	-40 to +70 degrees Celsius
Humidity range:	10% to 95% noncondensing
Enclosure:	.093 extruded aluminum with stainless security screws. Black anodized finish.
Fascia:	3mm acrylic tinted to match LED color
Data input:	SAE J1708/J1587 compliant serial ASCII asynchronous 9600 baud, 8 data bits, no parity, one stop bit. Receive and transmit capabilities implemented. Inputs are ESD protected. Sign unit ID can be set with DIP switch without any disassembly. Unit ID is reported by power up self test message displayed.
Aux input/output	Auxiliary pin can be used as a digital I/O line. As an output it can sink a 1 amp load to within 1 volt of ground. The load may return any positive voltage up to the power input voltage. The state of the pin can be read and reported by a J1708 status packet.

The program memory holds up to 180 characters coming in 1-15 J1587 packets. The program is erased after execution. Unformatted messages can be sent with J1587 protocol, using J1587 techniques to control presentation methods. Formatted programs can also be sent which override J1587 parameters, allowing more precise control of presentation, including speed, delays, and looping. Busy/Ready status is pollable on a sign by sign basis. Forced reset capability exists. These devices have no requirement for scheduled maintenance. They are built to withstand the vehicular environment and are expected to have a service life of ten to twenty years if not abused. Three year limited warrantee. Minor spec changes may occur as a result of product enhancements.

INSTALLATION

The sign is normally mounted to the plastic or metal vanity shield behind the bus driver. There are four captive 10-32 threaded inserts in the back of the package on a 16" x 3" pattern. Tolerance on this hole pattern is +/- .060". Do not use screws that will penetrate into the sign chassis more than 1/2". Screws should be of high quality. Alloy cap screws are best. We recommend that the vanity shield be protected by putting two rubber grommets or other bushings on either side of it. Use a washer under the head of the fixing bolt before passing it through the bushings and vanity shield. The sign will be spaced off the vanity shield by the second rubber bushing. Attachment of the unit to the vanity shield must be made after the electrical connections and DIP switch setting have been made and checked.

ELECTRICAL CONNECTIONS MUST BE MADE WITH THE VEHICLE POWER OFF TO AVOID SHORTING WIRES TO POINTS WHERE DAMAGE COULD RESULT!

1) Connect the ground wire first using at least 18 AWG and preferably heavier wire. Use a crimp ring or fork terminal to connect to the screw post marked GND on the back of the sign. A black or green wire is best for ground.

2) Next connect a red 18 AWG or heavier wire from the vehicle's switched +12 or +24 supply line (via an approved circuit breaker if required by the transit authority) to the screw post on the back of the sign marked +12/24V, again using a ring or fork type crimp terminal.

3) Verify that the power terminal screws are tight.

4) Next connect the J1708 data wires using ring or fork type crimp terminals to the screw posts on the back of the sign marked DATA A and DATA B. DATA A is the one closest to the +12/24 pin. Use wire colors different than the ones used for power and ground. Wire size does not matter. Reversal of these lines will cause no harm but the unit will not receive in that condition. YOU MUST NOT APPLY +12V or +24V TO ANY TERMINAL OTHER THAN +12/24V, OR DAMAGE WILL RESULT!

5) Finally connect the lamp or chime or other auxiliary load, if any, to the AUX screw post on the back of the sign, using a crimp ring or fork terminal. Use 18 AWG wire of a different color than all the rest in use. This load must return to a positive voltage equal to or less than voltage which supplies the +12/24V screw post on the sign. The AUX post load must not pull more than one ampere when the line which connects to the AUX post is connected directly to ground. Excessive current will overheat and destroy the sink transistor inside the sign.

6) Verify that all screw terminals are tight. Verify that the fuse holder contains a 5 ampere fast blow cartridge fuse, type 3AG or similar, that is intact. There is no reason that this fuse should ever blow during normal operation.

7) Set the DIP switches on the back of the sign to match the pattern designated by the systems integrator, so that the unit will have the correct unit ID. This setting is displayed on the sign as a two digit hexadecimal number at the end of the power on self test message.

8) Log the serial number of the unit in a database or on paper along with the number of the vehicle, the date and time of installation, the name of the installer, and any notes required to fully document any problems or unusual occurrences.

9) Power on the vehicle and observe the self test message. Verify that the unit ID number at the end of the message is correct for that installation.

10) Test the unit in actual operation using the announcement system as it will normally be used.

11) Record satisfactory final test results in the installation log record. If the unit fails test and is determined to be defective, log the event in the installation log, make a clear note describing the problem including the vehicle number, the

date and location where the failure occurred, the name of the installer and how to contact them. Attach the note to the defective unit. Wrap the unit carefully and prepare it to be returned to the factory for service. Replace the defective unit with another one if available.

12) Physically secure the unit to the vanity shield. Clean it if necessary.

COMMUNICATIONS

J1708 INTERFACE

The J1708 bus uses 9600 baud ascii serial packets of 21 characters maximum. The first character of a packet is the transmitter's MID or Message Identification Character. The last character is the checksum byte which is simply the two's complement of the 8 bit sum of the MID and all the data characters. All characters in the packet added together give 0. J1708 specifies an electrical interface that is similar to RS-485 with passive resistors pulling to the lines to the idle state. It also specifies packet procedures and timing relationships that are designed to manage collision detection and recovery. It does not specify any software protocol that governs the format of the data bytes between the MID and the checksum byte. The J1587 standard is a newer software protocol that is compatible with the J1708 physical layer standard.

J1587 PROTOCOL

The signs utilize the direct character message entry facility supported by J1587 packet types M, F, and T only. Other packet types are ignored. The procedure to send a program to a sign is to first send one or more type 'M' packets. The first of these may be a special reset type 'M' packet, if it is desired to terminate display operations immediately. Next, an optional type 'F' packet may be sent to program parameters to values other than defaults. Finally a type 'T' packet is sent to trigger display of the message that was setup by the prior 'M' and 'F' packets. The M,[M..M],[F..F],T series forms a complete J1587 programming sequence. The first M packet in a sequence sets the transmitter MID for the entire sequence. Subsequent M, F, and T packets of the sequence must have a matching transmitter ID to be accepted.

When a vehicle contains more than one of these signs, and they are being programmed separately (not in broadcast mode), a full set of M..M,[F],T packets should be sent to the first sign and then a full set to the

second sign, etc. Do not intersperse packets targeted at different signs. If it is desired to send packets redundantly, send them in order aabbcc, etc. rather than abcabc. In particular, if multiple 'T' packets are sent, they should be consecutive.

Once the sign begins displaying a message, its program memory buffer is full with that program and it will not accept more programming packets until it completes its display cycle. Special packets to reset the sign, select a sign for polling, and polling status are accepted at all times. If sufficient time elapses between transmissions to guarantee that the sign will be done showing one message before the next is sent, then it may be permissible in some applications, where transmission performance is verified to be reliable, to dispense with polling the signs for status.

In high reliability applications, or where it is desired to send another message as soon as the sign is done with the previous one, it will be necessary to use the PID 384 mechanism to get the status back from each sign. This can be done just before sending a 'T' packet to verify that all previously sent 'M' and 'F' packets were received. It can be done again after sending the 'T' packet to verify that the trigger was received and at intervals thereafter to determine when the sign is done display a message.

In all of the transmissions shown below from the annunciator to the sign, the MID of the transmitter is not checked by the sign. The annunciator will typically have an MID of 195, but this could differ in some systems, and it is even be possible to have multiple controllers for the signs.

MESSAGE TYPE M (Annunciator to sign)

The 'M' packet specifies a specific sign (or all signs) and a line number. It also delivers the message text for that sign and line number. Multiple 'M' commands can be used to send message text that exceeds one packet in length. Special forms of the 'M' command are provided that will cause a reset or that will set the sign number without loading any text.

BYTE	DATA	DESCRIPTION
0	MID	Transmitter's MID (Annunciator MID=195)
1	255	Extension PID
2	245	PID for signage message = 501 MOD 256
3	n	Byte count of following data up to but not incl cksm
4	'M'	Packet type == character message
5	SIGN#	Must match switch on back of sign 1-254 to target

		that sign. 0 to broadcast to all signs. 255 is not legal. Signs must not be assigned switch value 0.
6	0,1	Specifies line number. Line number 1 must be specified when sending text to a single line sign. Future adaptation of this protocol to serve two line signs will accept a value of 2 for the second line or 4 for double high characters. A line number of 0 is ignored as far as text acceptance is concerned. Its only action is to allow the sign number in byte 5 to be received. Internally, there are two variables which hold target sign numbers. One holds the last target sign number associated with the most recently accepted ordinary text bearing type 'M' packet. The second holds the sign number associated with the most recently received special type 'M' packet with byte 6 equal to zero. The second is used exclusively to specify the sign number which will respond to subsequent PID 384 request parameter packets. Separation of these two variables is necessary in a multiple host installation, so that asynchronous status polling sequences from a second controller do not upset the target sign number which a first controller may have already defined and which must remain stable across an entire programming sequence. Consequently, in a multiple host system, all PID 384 request parameter packets must be preceded by a type 'M' packet that specifies a 0 line number in byte 6, and the requesting controller must check that the sign switch number returned within the sign's response matches the one expected. The variable which holds the target sign number for subsequent PID 384 requests is undefined at power up and after a reset. If it is undefined when a PID 384 request comes in, a sign will respond to the PID 384 request if the sign number that was associated with the last ordinary text bearing type 'M' packet matches its switch setting. It will also respond if the sign number associated with the last ordinary text bearing type 'M' packet was zero for broadcast mode and its ID switch setting is 1. In single host systems, there is no need to send a separate type 'M' packet with a 0 line number in byte 6 prior to each PID 384 request.
7	POS'N	Bits 8-5 carry horizontal position in the assembled message. Only values 1-15 are allowed by the J1587 standard. The sign's memory size limits the maximum

		value to 13 for unformatted direct text, but all 15 can be used for formatted programs. Subtract 1 from 4 bit value and multiply by 12 to obtain offset from first message character. All 'M' text packets in a sequence must be full except the first. To send large volumes of text to the sign, it should be broken up into sentences of 156 characters or less, (180 less formatting characters if using a formatted program), and delivered to the sign one sentence at a time, using status polling to determine when the next sentence can be sent. Bits 4-1 are vertical position and should be 0001 for normal text bearing type 'M' packets. If the position byte is zero, the designated sign will be reset immediately even if it is busy scrolling a previous message or executing a previous formatted program. The reset operation is the only way to gain control of a sign which is executing a formatted program that contains an infinite loop using the ^F or ^R instructions. This byte may be omitted in special type 'M' packets which have a zero in byte 6 to specify a target sign number for status polling, but if byte 7 exists and is zero, the reset action takes priority.
8 .. b<20	ASCII	1-12 ascii data characters. If horizontal position is 1 and first character of assembled message is '^' then the assembled message will be interpreted as a formatted program string. Otherwise, the message will be treated as verbatim direct character text for display on the specified line. The text may be omitted in special type M packets which have a zero in byte 6 to specify a target sign number for status polling.
b+1	CKSM	Checksum is two's complement of all preceding bytes

MESSAGE TYPE F (Annunciator to sign)

Direct character message parameters are assumed to apply to the sign number indicated in the last message type M packet received. The sign number is undefined at power up. If the message is qualified as a formatted program string, with an '^' character at the beginning, all parameters specified by message type 'F' will be ignored.

BYTE	DATA	DESCRIPTION

0	MID	Transmitter's MID (Annunciator MID=195)
1	255	Extension PID
2	245	PID for signage message = 501 MOD 256
3	n==3	Byte count of following data up to but not incl cksm
4	'F'	Packet type == Format parameter
5	p	Format parameter to be sent p='F' Font type p='R' Retention time if nonscrolling display p='S' Scroll rate. If not specified, sign defaults to static display mode if message fits on one screen, otherwise scrolls at default rate. Scrolling messages appear only once before the sign returns to the ready state. If the host controller wants to repeat a scrolling message it must send it again after it goes off screen or else send a formatted program with loops. p='O' Blink on time in tenths of seconds, if nonscrolling display. p='P' Blink off time in tenths of seconds, if nonscrolling display.
6	v	Value for parameter p is dependent on what p is. When p = 'F': v='B' Bold with 2 blank columns between v='b' Bold with 3 blank columns between v='C' Compact with 1 blank column between v='c' Compact with 2 blank columns between v='D' Default 5x7 with 1 blank column between v='d' 5x7 with 2 blank columns between When p = 'R': v = Tenths of seconds 1-254. 0 indicates indefinite duration and is the default if the p='R' parameter is not specified. Note that the sign does not enter the busy state for more than a brief moment when the value of 0 is applied. The message is merely left on the LED screen instead of being blanked, and the sign returns promptly to the ready state. In systems with multiple controllers it is necessary to use scrolling mode or specify a retention time or an equivalent formatted program to assure that a message will have adequate viewing time before a different controller can reprogram it. When p = 'S':

v = Nominal scrolling pace 1-40. 0 is not used. Values 1-20 correspond to the paces 1-20 which the interpreter assigns when exectuing a ^P instruction in a formatted text program. Paces 21-40 map onto normal paces 1-20, but they force the sign to refresh two scans between column shifts, thereby moving at half regular speed. This makes the image less sharp, but allows very slow travel rates withoug annoying flicker. The default value is 29 which gives a scan rate of 70 frames per second and a shifting rate of 35 columns per second. Research has shown that this is an optimum setting for readability by persons with impaired vision.

When p = 'O':

v = Blink on time in tenths of a second 0-15. This only has meaning if p = 'P' is also defined and if p = 'R' is nonzero. See below. Defaults to zero.

When p = 'P':

v = Blink off time in tenths of a second 0-15. This only has meaning if p = 'O' is also defined. See above. In order for a message to blink, both the p = 'O' and p = 'P' values must be specified. If one or both are unspecified or assigned a value of zero, then blinking does not occur. Blinking messages are subject to the p = 'R' retention time parameter, which must be nonzero for blinking to occur. Defaults to zero.

7	CKSM	Checksum is two's complement of all preceding bytes

MESSAGE TYPE T (Annunciator to sign)

Trigger command starts display. Applies to the sign number specified by the last message type 'M' packet received. The sign number is undefined at at power up.

BYTE	DATA	DESCRIPTION

0	MID	Transmitter's MID (Annunciator MID=195)
1	255	Extension PID
2	245	PID for signage message = 501 MOD 256
3	n==1	Byte count of following data
4	'T'	Packet type == trigger
5	CKSM	Checksum is two's complement of all preceding bytes

REQUEST PARAMETER (384)
COMPONENT SPECIFIC, EXTENDED PIDS (Annunciator to sign)

Requests sign to return status

BYTE	DATA	DESCRIPTION
0	MID	Transmitter's MID (Annunciator MID=195)
1	255	Extension PID
2	128	PID for request parameter = 384 MOD 256
3	254	PID 510 MOD 256 (Page 2 data link escape)
4	189	MID of signs
5	CKSM	Checksum is two's complement of all preceding bytes

PAGE 2 DATA LINK ESCAPE (510)
TRANSMITTER SYSTEM STATUS (Sign to Annunciator)

Response of sign to PID 384 Request Parameter message

BYTE	DATA	DESCRIPTION
0	189	Transmitter's (Sign's) MID
1	255	Extension PID
2	254	PID 510 MOD 256 (Page 2 data link escape)
3	MID	Receiving module'S MID (Annunciator typically) This is the same MID as was received in the PID 384 request parameter packet. It will typically be 195 for the annunciator but may be different in complex systems with more than one controller.
4	n==7	Byte count of following data
5	SIGN#	From switch on back of sign
6	s	State s can be 'R' for ready, 'B' for busy, or 'P' for pending. State is pending if any ordinary type 'M' message has been accepted since the last trigger. The special type 'M' message which causes a reset sets the state to ready. The special type

		'M' message with line number set to zero merely allows the PID 384 request parameter message to be vectored to a specific sign and does not advance the state from ready to pending.
7	MID	This is the MID of the host controller which is currently programming the sign or which most recently loaded a message into the sign. The value is initialized to zero at power up.
8	TBMU	Text bit map, upper. This is an extension of the TBML bit map in the next byte. The LSB is set if, since the last trigger, a type 'M' packet was accepted that held text for the ninth block of 12 characters. Bit 6 is the highest bit in use. The MSB, bit 7, is always 0.
9	TBML	Text bit map, lower. The least significant bit (LSB) is set if, since the last trigger, a type 'M' packet has been accepted which contained text for the first block of 12 characters. The next bit is set if, since the last trigger, a type 'M' packet was accepted that held text for the second block of 12 characters, etc. There are a maximum of 180 bytes accepted as text, requiring up to 15 packets. This MSB of this byte is set if, since the last trigger, a type 'M' packet was accepted that held text for the eighth block of 12 characters. Corresponding bits for packets bearing text for the 9th through 15th blocks of 12 characters are held in bits 0 through 6 of the preceding TBMU byte. The 180 byte text capacity is reduced to 156, or 13 packets worth, in the case where the text delivered is pure message text rather than message text embedded in a formatted program along with control instructions. If the text delivered is pure message text, then the only presentation controls available are the limited ones provided by the J1587 type 'F' packets.
10	FBM	Format bit map: [F R S O P 0 0 0] The most significant bit indicates that a format parameter command for parameter F (font) has been accepted since the last trigger command. The bits to the right of that correspond to the other parameters: retention time, scroll rate, blink on time, and blink off time. The low 3 bits are all 0.
11	f	Flag f indicates state of sign digital I/O port. 'S' = sink and 'F' = float.
12	CKSM	Checksum is two's complement of all preceding hytes

The data body of a transmission may consist of pure printable text, in which case it is limited to 13 packets or 156 characters in length. Presentation of pure text is controlled by the formatting parameters that are carried by the type F packet. The data body may alternatively consist of a formatted sign program that begins with a caret '^' character. In this case the program size is limited to a maximum 15 packets or 180 characters in length. It should contain only printable characters and spaces, with the exception of the codes from 80-FE hex that are used by the ~G graphics encoding sequence described farther down. Each command starts with a caret (5E hex) followed by an operation code letter. A typical command series will bring some text in, wait briefly, then take it out. Loops can be setup to flash or flip-flop screens. When the command sequence is through being interpreted, the LED screen will retain its final condition indefinitely, so you must program the message exits into the command list, or else plan to perform them in a separate transmission after a short time.

^IItext	Shows "text" immediately.
^IAtext	Shows "text" coming in from above
^IBtext	Shows "text" coming in from below

The ^I commands automatically center the "text" messages on screen. If a message is too long to fit on the screen, the command will be converted automatically to an S type stream command. These commands can be used as "Out" functions by specifying no text or text containing only blanks.

^Stext	Streams "text" right to left and off screen once. No action occurs if "text" is null.

All commands which display text will accept the following special embedded sequences that begin with a tilde (7E hex):

~B	Switch to bold font for subsequent text characters
~b	Same as ~B but uses three blank columns between characters
~C	Switch to compact font for subsequent text characters
~c	Same as ~C but uses two blank columns between characters
~D	Switch to default 5x7 font for subsequent text characters
~d	Same as ~D but uses two blank columns between characters
~Gx..	Graphic patterns for successive columns of LEDs are carried by a series of characters x, each of which carries a 7 bit column pattern in bits 6543210 with bit 0 being topmost, and a 1 in bit 7. The graphic mode terminates and text mode resumes upon the first non-zero char with bit 7 clear.

Note that text characters always bear one (2 for bold font) blank column on the right but none on the left. If an embedded graphic is followed by more text, you should encode an empty column at the end of the graphic so that it doesn't touch the following text. This mechanism always adds 1 to the given value to create the column pixel pattern. The value 255 which would result in a blank column is not allowed. This is done so that the packet acquisition process can always assume that it is safe to reframe a new packet on any occurrence of a 255 byte other than in a successful checksum slot. Send 0 to encode a blank column.

^Ln Loop through subsequent code up to ^E for n repetitions. The rep count n can be one or two ASCII decimal digits expressing values from 1-99.

^E End of loop. Sends interpreter back to previous ^L to repeat commands until rep count is complete. Nesting of loop structures is not supported.

^F End of loop forever. Sends interpreter back to previous ^L in infinite loop regardless of specified ^L loop count. In this case, a reset transmission with ID 41 hex is required to stop the running program and prepare to receive another program.

^Pn Sets Pace of display refresh and motion. The parameter n is one or two ASCII decimal digits expressing a range 1-20. The default after reset is Pace 9 in combination with ^=2 described below.

^=n Sets the number of LED refresh scans performed between image shifts during horizontal motions like streaming. The parameter n is a single decimal ASCII digit 1-6, with 2 being the default. A value of 1 results in a very sharp and crisp looking image on the LEDs. It also will produce a perceptible flicker at very low ^P pace settings. At the ^=1 setting with the very sharp image it is impossible to achieve a very slow shifting speed without flicker. Values of the ^= parameter greater than 1 will perform multiple display scans for each shift. This will allow a high ^P pace to be chosen for low flicker, while holding down the speed of travel for streaming. There is a side effect though, which is that the letters no longer look as crisp as they do with the ^=1 setting. Optimum appearance of the sign on video will result from using

^P19 in combination with an ^=4. This will refresh at at 120 frames/second and shift at 30 columns/second. This will minimize beating artifacts against the video camera's 60 frame per second rate.
The table below illustrates the interaction between the ^P and ^= settings. The =1 column is the refresh frame rate regardless of the ^= setting. It affects the amount of perceived flicker. The values in the =n columns show the rates of travel that result from various ^= settings at the given ^P pace setting.

PACE	=1	=2	=3	=4	=5	=6
20	125	62.5	41.7	31.3	25	20.8
19	120	60	40	30	24	20
18	115	57.5	38.3	28.8	23	
17	110	55	36.7	27.5	22	
16	105	52.5	35	26.3	21	
15	100	50	33.3	25	20	
14	95	47.5	31.7	23.8		
13	90	45	30	22.5		
12	85	42.5	28.3	21.3		
11	80	40	26.7	20		
10	75	37.5	25			
9	70	35	23.3			
8	65	32.5	21.7			
7	60	30	20			
6	55	27.5				
5	50	25				
4	45	22.5				
3	40	20				
2	35					
1	30					

^R Return to beginning of memory. If this instruction is placed at the end of the program, the entire program will repeat forever. In this case, a reset transmission is required to stop the running program and prepare to receive another program.

^Wn Waits n tenths of a second. The delay interval can be one or two ASCII decimal digits expressing delays from 0.1 to 9.9 seconds. Longer delays can be had by using multiple ^W commands or by putting an ^W command in a loop.

^XS Drives the Sink transistor connected to the AUX terminal

so that the output is pulled to ground. This can be used to activate a chime or LED flasher that will help to alert people. The output is a TIP120 darlington without a heatsink. Device dissipation should not exceed one watt. This will allow a continuous current of one ampere if the load will allow the transistor to pull the AUX pin all the way down to its saturation voltage. The AUX output is pulled up to +5 with a 10K ohm resistor. It may be pulled up higher to the vehicle battery voltage of 30 volts or less with no harm. The state of the AUX pin is reported by the special query transmission report. This allows the sink transistor, and possibly its load to be tested. It also allows the AUX terminal to be used as a generic digital input line.

^XF Causes the sink transistor connected to the AUX terminal to turn off, allowing the AUX terminal to Float up to +5 or higher if a load is connected to the vehicle battery voltage. This is the default state after reset.

^XDn Adjust autodimming threshold to value n which is a 1-3 digit decimal ASCII number from 1-255. The default value is 16. This value is not affected by a reset command.

^XBn Force brightness level n in range 0-31. Values 2-31 are accepted as actual brightness levels to be forced. Values above 31 are converted to 31. Values 0 and 1 are accepted as commands to disable forced brightness level mode and to return to normal sensor based brightness level mode. This mode is not affected by a reset command.

^Yn Displays test pattern n. The pattern number N can be one or two decimal ASCII digits specifying a value 0-17.

0	blank
1	row 1 lit
2	row 2 lit
3	row 3 lit
4	row 4 lit
5	row 5 lit
6	row 6 lit
7	row 7 lit
8	columns 1,5,9... lit
9	columns 2,6,10... lit
10	columns 3,7,11... lit
11	columns 4,8,12... lit

12	left half lit
13	right half lit
14	checkerboard 1
15	checkerboard 2
16	current brightness level 2-31
17	all lit

The sign is a priority 8 device, which is the lowest priority specified by J1708. The sign is guaranteed to wait for at least the J1708 specified priority 8 idle line interval before attempting to access the bus to make a status report. The typical actual idle time required before the sign will attempt transmission is in the range of 12 milliseconds, and is subject to substantial jitter cause by display refresh, timer, and UART service interrupts. Repeat collisions with devices having deterministic retry latencies are thus improbable. The sign will attempt five retries on collisions that mangle its status transmission packet MID character.