

POLNET Generation 2

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Protocol Specification

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Introduction

Scope

This document specifies the POLNET G2 protocol (© POLTECH Information System AB) used for sign communication.

Revision History

Rev.	Date		
1.0 A	2011-03-18	Sara Hedfors	

Applicability

POLNET G2 Specification Rev.	POLNET G2 Protocol	POLNET G2 Firmware	Hardware
1.0 A	1.0	1.5.1 or higher	R3 or higher

Related documents

POLNET_CharacterSets	POL115-101203-2	<i>external and internal use</i>
POLNET_SymbolsAndSpecialCharacters	POL115-101203-3	<i>external and internal use</i>
POLNET_DisplayFonts	POL115-101203-4	<i>internal use only</i>
POLTECHDisplayBoardTechnicalReference		<i>internal use only</i>
POLTECHDisplayBoardImplementation		<i>internal use only</i>
POLTECHDisplayBoardHistory		<i>internal use only</i>

POLNET G2

POLNET is a protocol which makes it possible to connect signs in multidrop or point-to-point. Fixed cabling or radio modems can be used, among others.

The displays can be programmed individually, by groups or globally.

Each sign should have a unique address selected by jumpers (hard address).

The signs can also be programmed to recognise two more addresses (soft addresses). All signs recognise address #0 (global address).

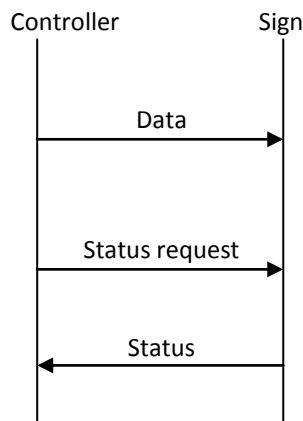
Error detection is made by the sign. If any error is detected the sign reject the block and will upon request report actual status. The previous message is not affected.

Error correction shall be made by the controller. If a status indicating an error is read from the sign a retransmission should be done.

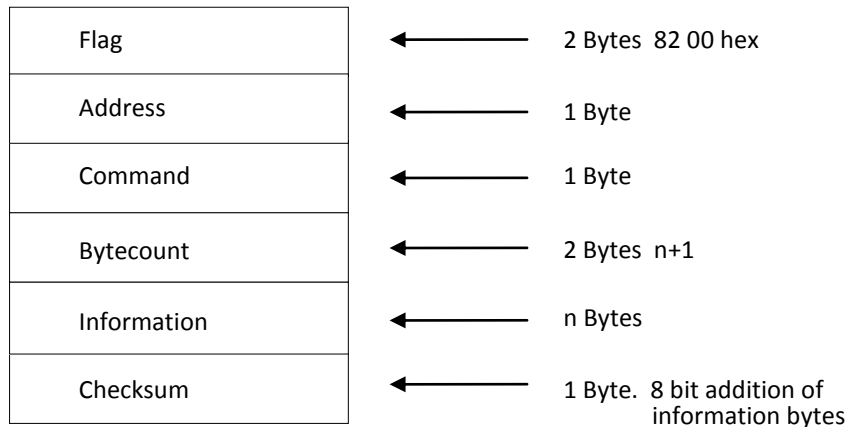
All blocks are recommended to be transmitted with less than 250 ms time between the characters.

To reduce the data sent to the sign it's possible to use a parameter update for countdown information. The sign can hold up to 64 + 64 parameters.

It's possible to activate communication monitoring. Two different timers exist in the sign, one individual timer which checks for messages addressed to the sign and one global timer which checks for messages to any sign. As default, the individual timer is set to 300 seconds, and shows "--" on the sign when activated, and the global timer is set to 180 seconds and shows "--" on when activated. The actual times and timeout messages can be reconfigured. Note that if any row is configured as clock module row it will be unaffected by timeouts.



Frame field format

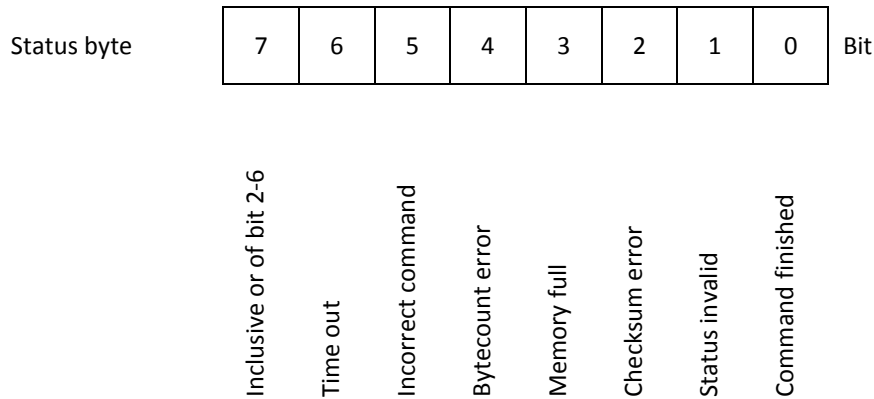


Flag:	Two bytes	82 hex 00 hex
Address:	One byte	Selects sign(s). Valid addresses are 0 - 255 (0 - FF hex). Address 0 (global) selects all signs. Programmed addresses (soft addresses) should not interfere with strapped addresses (hard addresses).
Command:	One byte	<p>81 hex Status request (only possible together with a hard address). The selected sign will return the status byte.</p> <p>84 hex Reset both timers. This command does not affect the status byte.</p> <p>3 hex Load text and start text.</p> <p>4 hex Load text and start text, with timeout (timers set).</p> <p>55 hex Load text to buffer.</p> <p>56 hex Start text from buffer.</p> <p>57 hex Start text from buffer, with timeout (timers set).</p> <p>5 hex Set up two soft addresses. 2 bytes.</p> <p>13 hex Load 2 char parameters, 2-120 bytes. See <i>Parameter Update</i>.</p> <p>23 hex Load 5 char parameters, 5-300 bytes. See <i>Parameter Update</i>.</p> <p>9 hex Set time (update RTC). 3 bytes.</p>
Bytecount:	Two bytes	The number of characters in the information block + 1. The most significant byte is transmitted first.
Information:		This is the information to the sign: soft addresses, time, parameters or text. For text formatting, see <i>Programming Specifications</i> .
Checksum:	One byte	This is an 8 bit addition of the values of all the characters in the information block.

Note that command 56 hex, 57 hex, 81 hex and 84 hex (start text, status request and reset timeout counter) has no bytecount, information bytes or checksum.

Status information

The status byte is sent to the controller upon request (command 81 hex).



- Bit 7 Error bit. One or more of bit 2-6 is set.
- Bit 6 Time out.
- Bit 5 Incorrect command.
- Bit 4 Bytecount error.
- Bit 3 Memory full.
- Bit 2 Checksum error.
- Bit 1 Status invalid. Status is only valid the first time it's read.
- Bit 0 Requested command finished.

If both bit 5 and bit 2 are set, the sign indicates that a parameter update has been sent with wrong control-checksum.

Note: All bits are active "1"

Programming specifications

The information field must always start with selection of row. The field can contain information to all or some of the rows. Positioning along the row can be done by a tabulating feature. Each row can also be separated into a number of individual segments (see chapter *Segment command*).

Moving (horizontal scroll) or alternating text can be used on part of or the whole of a row or segment. If alternating is used on only part of the row/segment the alternating part is always at the right hand side. Tab ends (sets the right hand side bound for) moving text. If no tab is used, the right hand side bound will be the end of the row or segment. Moving text can be used inside alternating, but only as one alternation of its own (the moving text will always start a new alteration, and cannot be mixed with static text on either side).

In both static and alternating display mode, part of the text can be shown flashing at 1 Hz rate.

Both time and temperature can be displayed. All signs have an internal real time clock (which can be set with command 9 hex). The sign needs an external temperature sensor in order to display the correct temperature.

Every time a block of information is successfully transmitted to the sign, all the previous information is cleared and the new appears. Note that if only one or some of the rows is programmed the other rows will be blank.

It is possible to load text to buffer in the sign, the buffered text can later be started.

There are 64 2- and 64 5-character parameters available. They can be updated separately and are used in for example countdown information. The parameters can be used in static, moving or alternating text. See chapter *Parameter update*.

Available commands

09	hex	<HT> [xx]	Selects horizontal position xx = 01 - yy hex. Position 01 is the leftmost position, yy is the rightmost position ¹ . xx is transmitted as two ASCII characters ² . This command ends (sets the right hand side bound for) moving text.
0F	hex	<SI>	Switch to bold font.
0E	hex	<SO>	Switch to normal font. This command ends bold font, and is the default setting.
11	hex	<DC1>	Start of flash.
12	hex	<DC2>	End of flash.
13	hex	<DC3>	Start of moving message (horizontal scroll). This command ends flash, bold font and selection of color plane.
14	hex	<DC4> [xx]	Start of alternating message. xx = 01 - FF hex. xx gives the display time in seconds. xx is transmitted as two ASCII characters ² . This command ends flash, bold font and selection of color plane.

¹ Note that the tab base (leftmost position value) can be reconfigured, default is 01.

The tab value's effect will vary depending on the width of the display:

Width 1 – 255 pixel: each increment is 1 column.

Width 256 – 511 pixel: each increment is 2 columns.

Width 512 – 767 pixel: each increment is 3 columns.

Width 768 – 1024 pixel: each increment is 4 columns.

² That a hexadecimal value is transmitted in ASCII characters means that, for example, value 05_{HEX} = 05_{DEC} is transmitted as "05" (30 35 hex), and value 0F_{HEX} = 16_{DEC} is transmitted as "0F" (30 46 hex).

15	hex	<NAK>	This code will be displayed as the actual temperature in 4 characters ($\pm TT^\circ$).
16	hex	<SYN>	This code will be displayed as the actual time in 4-8 characters (format is configurable, default is HH:MM).
17	hex	<ETB>	Switch to first color plane (normally red).
18	hex	<CAN>	Switch to second color plane (normally green).
19	hex		Switch to both color planes (normally red + green = amber). This is the default setting.
1A	hex	<SUB> [...]	Expansion mode, allowing support for images and extended formatting control. See chapter <i>Expansion control description</i> .
1B	hex	<ESC> [x]	Select row. x = 0 - F hex. 0 = top row, 1 = second row, and so on. x is transmitted as one ASCII character ² . This command ends flash font, bold font and selection of color plane. A row must always be specified.
1E	hex	<RS> [x]	This code sets the position of the 2-character parameter identified by number x. x = 30 - 6F hex (digit zero - character 'o'), where 30 hex specifies the first parameter, 31 hex specifies second parameter and so on. See chapter <i>Parameter update</i> .
1F	hex	<US> [x]	This code sets the position of the 5-character parameter identified by number x. x = 30 - 6F hex (digit zero - character 'o'), where 30 hex specifies the first parameter, 31 hex specifies second parameter and so on. See chapter <i>Parameter update</i> .

Parameter update

There are two types of parameters in the sign, one 2-character and one 5-character parameter. All used parameters can be updated all in once. The parameter update is matched to the last made full update by a control-checksum to avoid problem if a full update is lost or if the sign is restarted.

Full (or partial) parameter update:

CMD 13 hex (2-character)	2 - 120 character starting at the first parameter
CMD 23 hex (5-character)	5 - 300 character starting at the first parameter

The parameter string must be terminated with the checksum calculated for the last full update. As an alternative a wildcard '*' (2A hex) can be used.

The sign reports *checksum error + incorrect command* if the control-checksum doesn't match.

Parameter data can be any printable characters (20 - 7F hex) or any of the following control codes: bold (0F hex), normal (0E hex), flash on (11 hex), flash off (12 hex), display temperature (15 hex), display time (16 hex), first color plane (17 hex), second color plane (18 hex) and both color planes (19 hex).

Segment command (double-tab)

A new segment ends all formats, inclusive moving and alternating texts.

Each row is possible to divide into two or more segments. This is done with the segment command, consisting of two identical tab commands (09 hex) directly after each other. Note that also the horizontal position value must be identical.

As default, each row is identical to one segment. When using the segment command the row is divided into a number of segments. The first segment starts at the beginning of the row and reaches up to the horizontal

position specified by the first double-tab. The second segment starts at this position and reaches up to the next double-tab (or the end of the row if no more double-tabs are specified). Any text that does not fit into a segment (i.e. is longer than the segment itself) is cut.

Expansion control description

The following expansion codes can be used anywhere in text blocks, including alternating and moving text.

Numeric fields are encoded as a variable number of hexadecimal ASCII characters, followed by the separator ‘*’ (2A hex) or terminator ‘;’ (3B hex).

Summary of expansion codes

1A 49	hex	<SUB> I	Define (and optionally display) a bitmapped image.
1A 69	hex	<SUB> i	Recall and display an already defined image.
1A 53	hex	<SUB> S	Display a symbol/special character.

Inlined images

Specifies an image that may appear anywhere in a text block (including moving and alternating text).

Syntax: 1A 49 [width] 2A [height] 2A [color] 2A [attrib] 2A [scanline 1] { ... [scanline n] } 3B hex
 <SUB> I [width] * [height] * [color] * [attrib] * [scanline 1] { ... [scanline n] } ;

Note that all numeric parameters are decimal values transmitted as ASCII characters³.

width		The width of the image in pixels. Allowed range is 1 – 500.
height		The height of the image in pixels. Allowed range is 1 – 32. Images higher than the display height will be displayed top-aligned. Images lower than the display height will be displayed centered.
color		Specifies which color plane(s) that are defined for the image. The addition of 8 to the color field means that the image should be displayed without regard to the current color setting for any surrounding text. See also illustration below.
30 hex	0	Only a single color plane is defined. The image will be visible in all specified color planes, and the color of the image will adjust to the surrounding color specification.
31 hex	1	Only the first color plane (normally red) is specified. The image will only be visible when this color plane (17 hex) or both color planes (19 hex) are selected.
32 hex	2	Only the second color plane (normally green) is specified. The image will only be visible when this color plane (18 hex) or both color planes (19 hex) are selected.
33 hex	3	Both color planes are specified (normally red + green). Two complete image bitmaps should be sent directly after each other, with the first scanline of the second color plane sent directly after the last scanline of the first color plane. The first bitmap will only be visible when the first color plane (17 hex) or both color

³ That a decimal value is transmitted in ASCII characters means that, for example, value 2_{DEC} is transmitted as “2” (32 hex), and value 100_{DEC} is transmitted as “100” (31 30 30 hex).

planes (19 hex) are selected. The second bitmap will only be visible when the second color plane (17 hex) or both color planes (19 hex) are selected.

- 38 hex 8 Same as 0, but the color of the image will always be the third color (normally amber), regardless of the surrounding color specification.
- 39 hex 9 Same as 1, but the image will be visible in all specified color planes, and the color of the image will always be the first color (normally red), regardless of the surrounding color specification.
- 31 30 hex 10 Same as 2, but the image will be visible in all specified color planes, and the color of the image will always be the second color (normally green), regardless of the surrounding color specification.
- 31 31 hex 11 Same as 3, but the image will be visible in all specified color planes, and the image will always be tri-color, regardless of the surrounding color specification.

attrib Additional attributes for processing of the image. The sum of several individual bit fields is applied, which means that multiple attributes can be chosen by adding their values.

- 30 hex 0 Flash (11 hex) will not affect image.
- 31 hex 1 Flash (11 hex) will affect the first color plane (normally red).
- 32 hex 2 Flash (11 hex) will affect the second color plane (normally green).
Note that the sum 1 + 2 = 3 (33 hex) will result in both color planes flashing.
- 38 hex 8 The image should just be defined – not displayed. The first 10 defined images can then be recalled multiple times.
Note that 8 can to be added with 1, 2 or 3 to control the flashing as described above.

Note that the *attrib* field is a multibyte number just like *width*, *height* and *color*, so in case more flag fields are later defined, this field may expand into multiple characters.

scanline The image is sent one scanline (horizontal line) at a time from top to bottom. If the image has more than one color plane, then the first scanline of the second color plane is sent directly after the last scanline of the previous color plane.

Each scanline consists of hexadecimal values which each represent 6 pixels. If the image is 1 - 6 pixels wide each scanline contains 1 value, if the image is 7 - 12 pixels wide each scanline contains 2 values, 13 - 18 pixels 3 values and so on.

The scanline data is sent as a sequence of values in the range 30 hex to 6F hex, where 30 represent no pixels set and 6F represent all 6 pixels set. The lowest bit of the value is the leftmost pixel of the image. Any unused bits in the last character for each scanline (if the width of the image isn't an even multiple of 6) are don't care, i.e. it doesn't matter what value they have. It is, however, recommended to leave them cleared.

The specified worth for each one of the 6 pixels that is represented by a value is shown in the table below. A value is calculated by adding 30 hex to the sum of the specified worths for each pixel that is set.

Pixel (from left to right):	1	2	3	4	5	6
Specified worth for each pixel:	1*1 hex	2*1 hex	4*1 hex	8*1 hex	1*10 hex	2*10 hex

































Color parameter	Defined image	Image surrounded by red text (17 hex)	Image surrounded by green text (18 hex)	Image surrounded by amber text (19 hex)
0		Red  text	Green  text	Amber  text
1		Red  text	Green  text	Amber  text
2		Red  text	Green  text	Amber  text
3		Red  text	Green  text	Amber  text
8		Red  text	Green  text	Amber  text
9		Red  text	Green  text	Amber  text
10		Red  text	Green  text	Amber  text
11		Red  text	Green  text	Amber  text

Illustration of how the color parameter will affect an image on a three-color display with red and green diodes.

Recalled images

A previously defined image may be displayed multiple times, by recalling the index of it anywhere in a displayable text block.

Syntax: 1A 69 [index] 3B hex
<SUB> i [index] ;

Note that all numeric parameters are decimal values transmitted as ASCII characters³.

index The index of the image. This corresponds to the order that the images were defined, so the first defined image has index 0, and the tenth defined image has index 9. Note that only the 10 first defined images may be recalled.

Display symbol/special character

Displays a symbol or special character.

Syntax: 1A 53 [index] 3B hex
<SUB> S [index] ;

Note that all numeric parameters are decimal values transmitted as ASCII characters³.

index The index of the symbol. See separate document for full list of symbols, but some available symbols are:

30 hex 0 Phone

31 hex 1 Bus

32 hex 2 Plane

Limitations

There are a maximum of 500 characters (including control characters) in a single string block of fixed, moving or alternating text.

There are a maximum of 20 alternating groups (each group can have any number of alternating texts), and a maximum of 80 moving texts.

There are a maximum of 64 parameters of each type.

There are a maximum of 5 levels of nested text blocks (with “nested” meaning for example time command inside a parameter).

Character sets

		Second digit															
HEX		0	1	2	3	4	5	6	7	8	9	A	B	C	D	E	F
First digit	0										TAB					NOR-MAL	BOLD
	1		FLASH ON	FLASH OFF	MOV-ING	ALTER-NATE	TEMP.	TIME	RED	GREEN	AMBER	EXPA-NSION	SEL. ROW			2 char PARAM.	5 char PARAM.
	2		!	“	#	\$	%	&	'	()	*	+	,	-	.	/
	3	0	1	2	3	4	5	6	7	8	9	:	;	<	=	>	?
	4	É	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
	5	P	Q	R	S	T	U	V	W	X	Y	Z	Ä	Ö	Å	Ü	°
	6	é	a	b	c	d	e	f	g	h	i	j	k	l	m	n	o
	7	p	q	r	s	t	u	v	w	x	y	z	ä	ö	å	ü	_

Example of character set (Swedish)

The above is an example of a character set. The control codes 00_{HEX} – 1F_{HEX} are the same for all character sets used by POLNET G2, while the character codes 20_{HEX} – 7F_{HEX} depend on which character set that are currently in use.

Note that there exists a number of character sets, the example in the figure above might not apply to your application. See separate document for character sets.

Examples

Example 1 will show how to change row, change font, use tab, use flash, the time command, temperature command and moving text.

Example 2 will show how to use the alternating command to make a sequence of pages alternate on the sign, and how to set the right hand side bound of a moving text.

Example 3 will show how to request the status byte.

Example 4 will show how to setup soft addresses.

Example 5 will show how to update the Real Time Clock.

Example 6 will show how to use parameters.

Example 7 will show how to define and recall images.

Example 8 will show how to divide a row into segments with the segment command (double-tab).

Example 1

This example will show how to change row, change font, use tab, use flash, the time command, temperature command and moving text.

Send to sign with address # 2.

Normal	BOLD	tab
123	FLASH	456
Time	15:03	Temp +21°
MOVING TEXT		

ROW 1: "Normal" is shown (static) with normal font and "BOLD" with bold font. "tab" starts at column 109 and is also shown with bold font (since tab-command does not end any formats or fonts).

ROW 2: "123" is static, "FLASH" is flashing and "456" is static.

ROW 3: "Time" will be followed by the actual time, and "Temp" will be followed by the actual temperature.

ROW 4: "MOVING TEXT" will be shown moving.

The complete telegram will be (all codes in HEX):

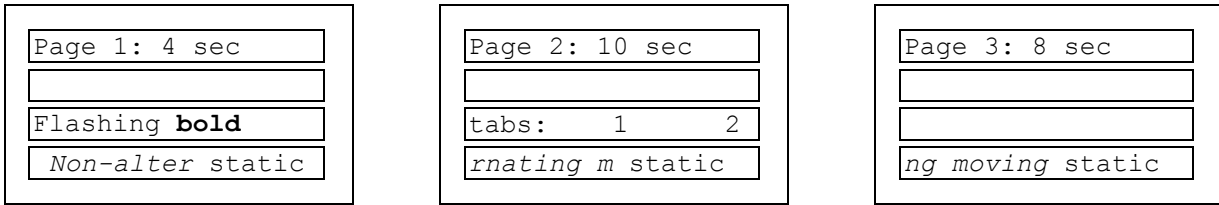
82	Flag	
00	Flag	
02	Address 2	
03	Command	
00	Bytecount HI	
43	Bytecount LO	$66 + 1 = 67_{DEC} = 43_{HEX}$
1B	Select row	INFORMATION BLOCK STARTS
30	row 1	
4E	N	
6F	o	
72	r	
6D	m	
61	a	
6C	l	
20	[space]	
0F	Switch to bold font	
42	B	

4F	O		
4C	L		
44	D		
09		Select tab	
36	6		position 109 _{DEC} = 6D _{HEX}
44	D		
74	t		
61	a		
62	b		
1B		Select row	terminates all formats
31		row 2	
31	1		
32	2		
33	3		
20	[space]		
11		Start flash	
46	F		
4C	L		
41	A		
53	S		
48	H		
12		End flash	
20	[space]		
34	4		
35	5		
36	6		
1B		Select row	terminates all formats
32		row 3	
54	T		
69	i		
6D	m		
65	e		
20	[space]		
16		Time command	
20	[space]		
54	T		
65	e		
6D	m		
70	p		
20	[space]		
15		Temperature command	
1B		Select row	
33		row 4	
13		Moving text	
4D	M		
4F	O		
56	V		
49	I		
4E	N		
47	G		
20			
54	T		
45	E		
58	X		
54	T		INFORMATION BLOCK ENDS
A3		Checksum	(actual sum 10A3)

Example 2

This example will show how to use the alternating command to make a sequence of pages alternate on the sign, and how to set the right hand side bound of a moving text.

Send to sign with address # 1.



Page 1 displayed for 4 seconds:

ROW 1: "Page 1: 4 sec"
 ROW 2: -BLANK-
 ROW 3: "Flashing" is flashing and "bold" is flashing bold
 ROW 4: "Non-alternating moving" will be shown moving

Page 2 displayed for 10 seconds:

ROW 1: "Page 2: 10 sec"
 ROW 2: -BLANK-
 ROW 3: "tabs:" is normal font, "tab 1" starts at column 55 and "tab 2" starts at column 97
 ROW 4: "Non-alternating moving" will be shown moving

Page 3 displayed for 8 seconds:

ROW 1: "Page 3: 8 sec"
 ROW 2: -BLANK-
 ROW 3: -BLANK-
 ROW 4: "Non-alternating moving" will be shown moving, and "static" starts at column 55 and is shown non-moving

After this page the sequence will start from beginning again.

Row 2 is not programmed and will be blank.

The complete telegram will be (all codes in HEX):

82	Flag		14	Alternating	
00	Flag		30	0	
01	Address 1		41	A	10 seconds (10 _{DEC} = A _{HEX})
03	Command		50	P	
00	Bytecount HI		61	a	
7E	Bytecount LO	125+1=126 _{DEC} = 7E _{HEX}	67	g	
1B	Select row	INFORMATION BLOCK START	65	e	
30	row 1		20	[space]	all
14	Alternating	\	32	2	pages
30	0		3A	:	/ for
34	4	4 seconds (4 _{DEC} = 4 _{HEX})	20	[space]	row 1
50	P		31	1	
61	a		30	0	
67	g		20	[space]	
65	e		73	s	
20	[space]		65	e	
31	1		63	c	
3A	:		14	Alternating	
20	[space]		30	0	
34	4		38	8	8 seconds (8 _{DEC} = 8 _{HEX})
20	[space]		50	P	
73	s		61	a	
65	e		67	g	
63	c		65	e	

20	[space]			1B	Select row	
33	3			33	row 4	
3A	:			13	Moving text	
20	[space]			4E	N	
38	8			6F	o	
20	[space]			6E	n	
73	s			2D	-	
65	e			61	a	
63	c	/		6C	l	
1B	Select row			74	t	
32	row 3			65	e	
14	Alternating	\		72	r	
30	0			6E	n	
34	4	4 seconds (4 _{DEC} = 4 _{HEX})		61	a	
11	Start flash			74	t	
46	F			69	i	
6C	l			6E	n	
61	a			67	g	
73	s			20	[space]	
68	h			6D	m	
69	i			6F	o	
6E	n			76	v	
67	g			69	i	
20	[space]			67	g	
0F	Switch to bold font (still flashing)			09	Select tab	terminates moving
62	b			33	3	
6F	o			37	7	position 55 _{DEC} = 37 _{HEX}
6C	l			20	[space]	
64	d			73	s	
14	Alternating	terminates all formats		74	t	
30	0			61	a	
41	A	10 seconds (10 _{DEC} = A _{HEX})		74	t	
74	t			69	i	
61	a			63	c	INFOMATION BLOCK ENDS
62	b		all	E9	Checksum	(actual sum 22EB)
73	s		\ pages			
3A	:		/ for			
09	Select tab		row 3			
33	3					
37	7	position 55 _{DEC} = 37 _{HEX}				
31	1					
09	Select tab					
36	6					
31	1	position 97 _{DEC} = 61 _{HEX}				
32	2					
14	Alternating					
30	0					
38	8	8 seconds (8 _{DEC} = 8 _{HEX})				
20	[space]	/				

Example 3

This example will request sign with address # 4 for the status byte. The actual status will be returned immediately by the sign.

The complete telegram will be (all codes in HEX):

82	Flag
00	Flag
04	Address 4
81	Command status request

Status will be returned by the sign.

Example 4

This example will setup two soft addresses (address 24 and 34) on sign with address # 10.

The soft addresses are used to define groups of signs.

The complete telegram will be (all codes in HEX):

82	Flag
00	Flag
0A	Address 10 10 _{DEC} = A _{HEX}
05	Command load soft addresses
00	Bytecount HI
03	Bytecount LO
18	Soft address 24 24 _{DEC} = 18 _{HEX}
22	Soft address 34 34 _{DEC} = 22 _{HEX}
3A	Checksum

To reset the soft addresses, setup both addresses to 0. This will disable the soft addresses.

Example 5

This example will update the real time clock on all signs connected to POLNET since address 0 is used (global address). The time used in this example is 10:15:30.

The complete telegram will be (all codes in HEX):

82	Flag
00	Flag
00	Address 0 global address: addresses all signs
09	Command update RTC
00	Bytecount HI
04	Bytecount LO
0A	Hour 10 _{DEC} = A _{HEX} (valid inputs are 0 - 17 hex)
0F	Minutes 15 _{DEC} = F _{HEX} (valid inputs are 0 - 3B hex)
1E	Seconds 30 _{DEC} = 1A _{HEX} (valid inputs are 0 - 3B hex)
37	Checksum

Example 6

This example will show how to use parameters.

First, a full update is sent to the sign. Send to sign with address # 5.

123 Leicester 4 min
123 Derby 13 min

The complete telegram will be (all codes in HEX):

82	Flag		1B	Select row
00	Flag		31	row 2
05	Address 5		31	1
03	Command		32	2
00	Bytecount HI		33	3
30	Bytecount LO	$47 + 1 = 48_{DEC} = 30_{HEX}$	20	[space]
1B	Select row	INFORMATION BLOCK STARTS	44	D
30	row 1		65	e
31	1		72	r
32	2		62	b
33	3		79	y
20	[space]		20	[space]
4C	L		20	[space]
65	e		20	[space]
69	i		20	[space]
63	c		1E	Parameter position (2-char parameter)
65	e		31	parameter 2
73	s		31	1
74	t		33	3
65	e		20	[space]
72	r		6D	m
1E	Parameter position (2-char parameter)		69	i
30	parameter 1		6E	n
20	[space]		36	Checksum (actual sum C36)
34	4			
20	[space]			
6D	m			
69	i			
6E	n			

Second, a parameter update is sent to the sign. Send to sign with address # 5.

123 Leicester 3 min
123 Derby 12 min

The complete telegram will be (all codes in HEX):

82	Flag			
00	Flag			
05	Address 5			
13	Command			
00	Bytecount HI			
06	Bytecount LO	$5 + 1 = 6_{DEC} = 6_{HEX}$		
20	[space]	parameter 1 character 1	INFORMATION BLOCK STARTS	
33	3	parameter 1 character 2		
31	1	parameter 2 character 1		
32	2	parameter 2 character 2		
56	Checksum for last full update		INFORMATION BLOCK ENDS	
0C	Checksum (actual 10C)			

Example 7

This example will show how to define and recall images.

An example of a small image 9 pixel wide and 8 pixel high:

```

··#####··
·#·····#·
#·#···#·#
#······#
#·#···#·#
#··####·#
·#·····#·
··#####··
    
```

Each scanline is grouped 6 pixels at a time from left to right, with left-most pixel encoded in lowest bit:

```

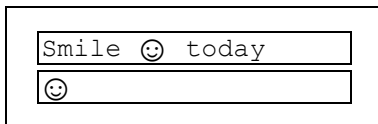
··#### #·· (0*1 + 0*2 + 1*4 + 1*8 + 1*10 + 1*20) hex (1*1 + 0*2 + 0*4) hex
·#···· #· (0*1 + 1*2 + 0*4 + 0*8 + 0*10 + 0*20) hex (0+1 + 1*2 + 0*4) hex
#·#··· #·# (1*1 + 0*2 + 1*4 + 0*8 + 0*10 + 0*20) hex (1*1 + 0*2 + 1*4) hex
#····· #· (1*1 + 0*2 + 0*4 + 0*8 + 0*10 + 0*20) hex (0+1 + 0*2 + 1*4) hex
#·#··· #·# (1*1 + 0*2 + 1*4 + 0*8 + 0*10 + 0*20) hex (1*1 + 0*2 + 1*4) hex
#··#### #· (1*1 + 0*2 + 0*4 + 1*8 + 1*10 + 1*20) hex (0+1 + 0*2 + 1*4) hex
·#···· #· (0*1 + 1*2 + 0*4 + 0*8 + 0*10 + 0*20) hex (0+1 + 1*2 + 0*4) hex
··##### #·· (0*1 + 0*2 + 1*4 + 1*8 + 1*10 + 1*20) hex (1*1 + 0*2 + 0*4) hex
    
```

```

··#### #·· 3C 01 hex
·#···· #· 02 02 hex
#·#··· #·# 05 05 hex
#····· #· 01 04 hex
#·#··· #·# 05 05 hex
#··#### #· 39 04 hex
·#···· #· 02 02 hex
··##### #·· 3C 01 hex
    
```

The above values should then be added with 30 hex before being emitted.

Send to sign with address # 2.



The full data to transmit this image as a single color plane active for both red and green will then be (all numbers in hexadecimal):

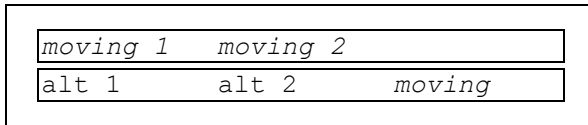
82	Flag	
00	Flag	
02	Address 2	
03	Command	
00	Bytecount HI	
30	Bytecount LO	47 + 1 = 48 _{DEC} = 30 _{HEX}
1B	Select row	INFORMATION BLOCK STARTS
30	row 1	
53	S	
6D	m	
69	i	
6C	l	
65	e	
20	[space]	
1A	EXPANSION MODE:	
49	l	define image
39	9	width of image
2A	*	field separator
38	8	height of image
2A	*	field separator
30	0	color parameter

```
2A      *   field separator
33      3   attribute parameter
2A      *   field separator
6C      1st scanline, first value
31      1st scanline, second value
32      2nd scanline, first value
32      2nd scanline, second value
35      3rd scanline, first value
35      3rd scanline, second value
31      4th scanline, first value
34      4th scanline, second value
35      5th scanline, first value
35      5th scanline, second value
69      6th scanline, first value
34      6th scanline, second value
32      7th scanline, first value
32      7th scanline, second value
6C      8th scanline, first value
31      8th scanline, second value
3B      ;   END OF EXP.MODE
20      [space]
74      t
6F      o
64      d
61      a
79      y
1B      Select row
31      row 2
1A      EXPANSION MODE:
69      i   recall and display image
30      0   recall image # 1
3B      ;   END OF EXP. MODE   INFORMATION BLOCK ENDS
D2      Checksum (actual BD2)
```

Example 8

This example will show how to divide a row into segments with the segment command (double-tab).

Send to sign with address # 2.



ROW 1: "moving 1" will be moving between start of row and column 54, and "moving 2" will be moving from column 55 to column 97.

ROW 2: "alt 1" will alternate between normal and bold font every second, "alt 2" (starting at column 55) will alternate between normal and bold font every 5th second, and "moving" will be moving from column 97 to end of row.

The complete telegram will be (all codes in HEX):

<table border="0"> <tr><td>82</td><td>Flag</td><td></td></tr> <tr><td>00</td><td>Flag</td><td></td></tr> <tr><td>02</td><td>Address 2</td><td></td></tr> <tr><td>03</td><td>Command</td><td></td></tr> <tr><td>00</td><td>Bytecount HI</td><td></td></tr> <tr><td>58</td><td>Bytecount LO</td><td>87 + 1 = 88_{DEC} = 58_{HEX}</td></tr> <tr><td>1B</td><td>Select row</td><td>INFORMATION BLOCK STARTS</td></tr> <tr><td>30</td><td>row 1</td><td></td></tr> <tr><td>13</td><td>Moving text</td><td></td></tr> <tr><td>6D</td><td>m</td><td></td></tr> <tr><td>6F</td><td>o</td><td></td></tr> <tr><td>76</td><td>v</td><td></td></tr> <tr><td>69</td><td>i</td><td></td></tr> <tr><td>6E</td><td>n</td><td></td></tr> <tr><td>67</td><td>g</td><td></td></tr> <tr><td>20</td><td>[space]</td><td></td></tr> <tr><td>31</td><td>1</td><td></td></tr> <tr><td>09</td><td>Select tab</td><td></td></tr> <tr><td>33</td><td>3</td><td></td></tr> <tr><td>37</td><td>7</td><td>position 55_{DEC} = 37_{HEX}</td></tr> <tr><td>09</td><td>Select tab</td><td></td></tr> <tr><td>33</td><td>3</td><td></td></tr> <tr><td>37</td><td>7</td><td>DOUBLE-TAB</td></tr> <tr><td>13</td><td>Moving text</td><td></td></tr> <tr><td>6D</td><td>m</td><td></td></tr> <tr><td>6F</td><td>o</td><td></td></tr> <tr><td>76</td><td>v</td><td></td></tr> <tr><td>69</td><td>i</td><td></td></tr> <tr><td>6E</td><td>n</td><td></td></tr> <tr><td>67</td><td>g</td><td></td></tr> <tr><td>20</td><td>[space]</td><td></td></tr> <tr><td>32</td><td>2</td><td></td></tr> <tr><td>09</td><td>Select tab</td><td></td></tr> <tr><td>36</td><td>6</td><td></td></tr> <tr><td>31</td><td>1</td><td>position 97_{DEC} = 61_{HEX}</td></tr> <tr><td>09</td><td>Select tab</td><td></td></tr> <tr><td>36</td><td>6</td><td></td></tr> <tr><td>31</td><td>1</td><td>DOUBLE-TAB</td></tr> <tr><td>1B</td><td>Select row</td><td></td></tr> <tr><td>31</td><td>row 2</td><td></td></tr> <tr><td>14</td><td>Altenating</td><td></td></tr> <tr><td>30</td><td>0</td><td></td></tr> <tr><td>31</td><td>1</td><td>1 second (1_{DEC} = 1_{HEX})</td></tr> <tr><td>61</td><td>a</td><td></td></tr> <tr><td>6C</td><td>l</td><td></td></tr> <tr><td>74</td><td>t</td><td></td></tr> <tr><td>20</td><td>[space]</td><td></td></tr> <tr><td>31</td><td>1</td><td></td></tr> </table>	82	Flag		00	Flag		02	Address 2		03	Command		00	Bytecount HI		58	Bytecount LO	87 + 1 = 88 _{DEC} = 58 _{HEX}	1B	Select row	INFORMATION BLOCK STARTS	30	row 1		13	Moving text		6D	m		6F	o		76	v		69	i		6E	n		67	g		20	[space]		31	1		09	Select tab		33	3		37	7	position 55 _{DEC} = 37 _{HEX}	09	Select tab		33	3		37	7	DOUBLE-TAB	13	Moving text		6D	m		6F	o		76	v		69	i		6E	n		67	g		20	[space]		32	2		09	Select tab		36	6		31	1	position 97 _{DEC} = 61 _{HEX}	09	Select tab		36	6		31	1	DOUBLE-TAB	1B	Select row		31	row 2		14	Altenating		30	0		31	1	1 second (1 _{DEC} = 1 _{HEX})	61	a		6C	l		74	t		20	[space]		31	1		<table border="0"> <tr><td>14</td><td>Altenating</td><td></td></tr> <tr><td>30</td><td>0</td><td></td></tr> 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<tr><td>67</td><td>g</td><td>INFORMATION BLOCK ENDS</td></tr> <tr><td>F3</td><td></td><td>Checksum (actual 14F3)</td></tr> </table>	14	Altenating		30	0		31	1	1 second (1 _{DEC} = 1 _{HEX})	0F		Switch to bold font	61	a		6C	l		74	t		20	[space]		31	1		09	Select tab		33	3		37	7	position 55 _{DEC} = 37 _{HEX}	09	Select tab		33	3		37	7	DOUBLE-TAB	14	Altenating		30	0		35	5	5 seconds (5 _{DEC} = 5 _{HEX})	61	a		6C	l		74	t		20	[space]		32	2		14	Altenating		30	0		35	5	5 seconds (5 _{DEC} = 5 _{HEX})	0F		Switch to bold font	61	a		6C	l		74	t		20	[space]		32	2		09	Select tab		36	6		31	1	position 97 _{DEC} = 61 _{HEX}	09	Select tab		36	6		31	1	DOUBLE-TAB	13	Moving text		6D	m		6F	o		76	v		69	i		6E	n		67	g	INFORMATION BLOCK ENDS	F3		Checksum (actual 14F3)
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