Epson WF-2530 LCD initialisation sequence

v1.5 06 Feb 2021

This printer was manufactured about 2012.

LCD controller similar to ST7567, but some extra instruction codes that are not in preliminary datasheet.

LCD 8 pin interface : CSB, RSTB, A0, SCLK, SDA, VDD, GND, VG

CSB	Chip select. active low, going low before the clock becomes active, and staying low for the whole period while a sequence of bytes is sent.
RSTB	Reset, hardware reset LCD, pulsed low for 85uS once after power on..
A0	Register select, asserted low to write commands, high to write data.
SCLK	Clock, 3MHz during CSB period for LCD controller.
SDA	Data, write bits clocked on rising edge of SCLK. Sent most-significant-bit first, 8 bit words, 420nS delay between bytes (clock stretched).
VDD	3.3V, logic power supply.
GND	0V
VG	LCD generated power.

From the instruction codes sent, it appears to have a Sitronix controller, like ST7567, but some extra commands. A lot of sequences are padded with no-operation (NOP) commands (code 'E3'), maybe this is because the printer uses a 32bit processor and writes out 4 bytes at a time, so pads commands to 32bits with bytes of NOP.

The control lines are also used on other parts of the front panel for controlling the front panel LEDs and scanning for key-presses.

LCD initialisation:

RS low for the whole sequence, CS low during each 4 byte word, then high for 3.25uS between words.

```
A2 A1 C0 22 E3 81 1F E5 E3 89 02 82 32 3A D3 00 E3 E3 84 2F
```

```
A2      Bias Select
A1      Horizontal display direction - reverse
C0      Vertical display direction - normal
22      Regulation Ratio – 4.0

E3      NOP
811F    Set EV, adjusts V0 – 0x1F
E5

E3      NOP
89
02      Set Column Address - 02
82
```

32 Set Page Address - 02
3A Set Page Address - 0A
D3
00 Set Column Address of RAM low byte – 0

E3 NOP
E3 NOP
84
2F Control power - Booster ON, Regulator ON, Follower ON

100uS delay

Sends 4 'pages' of 128 bytes, but display not turned on (unlike later 4 lines that are displayed), so I don't know what this material is.

E3 E3 40 00 B0 10 00 E3
E3 NOP
E3 NOP
40 Set display start line – 0
00 Set Column Address of RAM low byte – 0

B0 Set Page Address - 0
10 Set Column Address of RAM hi nibble - 0
00 Set Column Address of RAM low nibble - 0
E3 NOP

1uS delay, then CS low and RS high for the next 128 bytes of data.

```
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 02 08 20 09 24 0D 00
00 00 05 D0 00 06 88 0C 02 54 46 03 78 01 01 04
02 01 00 00 04 C8 21 02 64 01 00 7C 06 00 00 00
01 9C D2 02 04 51 01 00 00 01 30 13 01 00 00 01
40 0D 0A 28 0D 02 24 00 01 28 0D 05 3C 5E 04 28
0D 00 00 00 00 6C 00 03 28 0D 00 00 00 09 90 00
00 00 00 0D 90 00 00 00 00 01 18 1A 03 38 41 03
```

CS high, RS low
1uS delay, then 4 byte word with CS low

B1 10 00 E3
B1 Set Page Address - 1
10 Set Column Address of RAM hi nibble - 0
00 Set Column Address of RAM low nibble - 0
E3 NOP

1uS delay, then CS low and RS high for the next 128 bytes of data.

```
74 20 10 28 0D 00 00 00 0D A0 00 02 B8 09 00 FC
07 04 74 07 00 00 00 01 30 8A 02 98 05 00 00 00
02 98 4C 0D 28 0D 00 00 00 05 04 0D 00 00 00 01
24 00 00 00 00 01 20 03 06 28 0D 00 00 00 05 2C
03 02 28 0D 00 00 00 05 24 00 00 00 00 05 48 00
00 00 00 05 48 00 0A 4C 4B 02 88 1B 0A 6C 0B 00
00 00 01 9C 46 1A 28 0D 00 00 00 05 3C 47 00 00
00 01 1C 1D 00 00 00 05 84 0C 0A 28 0D 00 00 00
```

CS high, RS low
1uS delay, then 4 byte word with CS low

B2 10 00 E3

B2 Set Page Address - 2
10 Set Column Address of RAM hi nibble - 0
00 Set Column Address of RAM low nibble - 0
E3 NOP

1uS delay, then CS low and RS high for the next 128 bytes of data.

```
09 CC 4D 00 00 00 01 24 06 00 00 00 01 30 0D 00
00 00 01 50 59 00 00 00 09 74 38 00 00 00 01 0C
03 16 C4 8A 00 00 00 01 10 01 07 5C 3E 00 00 00
01 58 7C 02 5D CB 01 84 09 01 00 00 01 30 04 00
00 00 00 04 00 00 C8 06 00 04 06 02 B8 00 01 00
00 05 7C 1C 05 E8 B2 03 74 4B 05 28 E4 02 4C 04
00 00 00 00 08 01 04 8C C7 01 54 01 01 B8 2C 04
6C B0 09 A0 23 02 1C 00 01 B0 15 01 00 00 03 34
```

CS high, RS low
1uS delay, then 4 byte word with CS low

B3 10 00 E3

B3 Set Page Address - 3
10 Set Column Address of RAM hi nibble - 0
00 Set Column Address of RAM low nibble - 0
E3 NOP

1uS delay, then CS low and RS high for the next 128 bytes of data

```
00 01 7C 02 00 78 06 02 50 49 07 1C 00 02 04 50
06 7C 88 02 E0 39 02 28 27 02 3C 51 02 60 E6 02
C4 01 02 64 33 06 D8 52 02 14 04 00 00 00 01 30
00 00 00 00 01 14 63 0A 24 18 01 00 00 04 58 09
```

```
00 00 00 05 48 50 02 4C 00 00 00 00 01 1C 35 00
00 00 01 A4 31 00 00 00 05 0C 03 00 00 00 02 D0
8B 02 A0 D7 01 34 00 02 AC 01 00 00 00 01 04 8C
00 00 00 02 D0 33 03 CC 05 00 4C 00 02 FC B8 04
```

CS high, RS low
500uS delay, then CS low, RS low, and 4 commands

81 22 E3 E3
8122 Set EV, adjusts V0 – 0x22
E3 NOP
E3 NOP

CS high, RS low
40mS delay, then CS low, RS low the 7 words of 4 bytes

E3 NOP
F0 Test
D5
A2 Bias Select

A1 Set scan direction of SEG - reverse
C0 Vertical display direction - normal
22 Regulation Ratio – 4.0
E3 NOP

81 22 E3 E3
8122 Set EV, adjusts V0 – 0x22
E3 NOP
E3 NOP

E3 A6 A4 EE
E3 NOP
A6 Set LCD normal/reverse - normal
A4 Display all points ON/OFF - OFF
EE Reset Modify-Read mode

AC 00 E5 89
AC00 Set Static Indicator State - OFF
E5
89

02 82 32 3A
02 Set lower nibble of RAM column address - 0x02
82
32

3A

D3 00 84 2F
D3
00 Set lower nibble of RAM column address - 0x00
84
2F Control power - Booster ON, Regulator ON, Follower ON

150mS delay, then CS low, RS low

40 E3 E3 E3
40 Set display start line – 0
E3 NOP
E3 NOP
E3 NOP

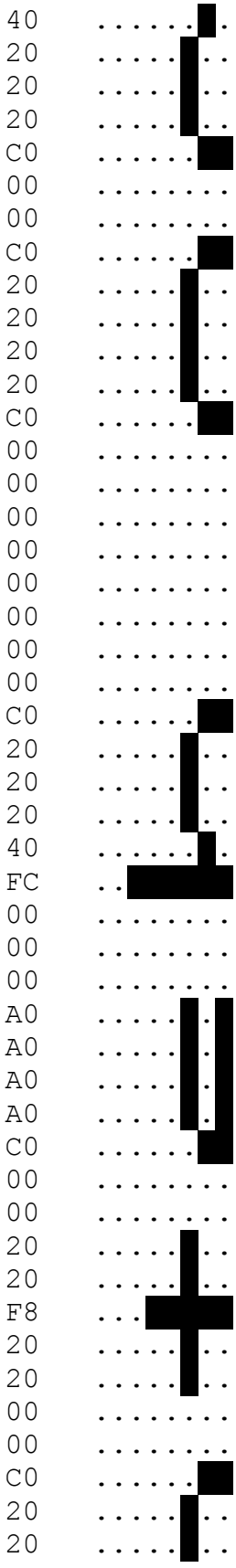
CS high, RS low
95uS delay, CS low, RS low

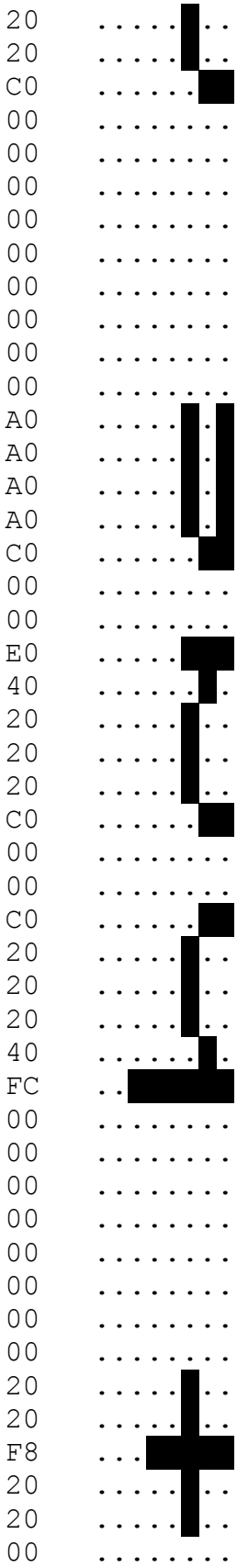
Display "The date and time " on line 1, takes two pages of 128 bytes.
B0 10 00 E3
B0 Set Page Address - 0
10 Set Column Address of RAM hi nibble - 0
00 Set Column Address of RAM low nibble - 0
E3 NOP

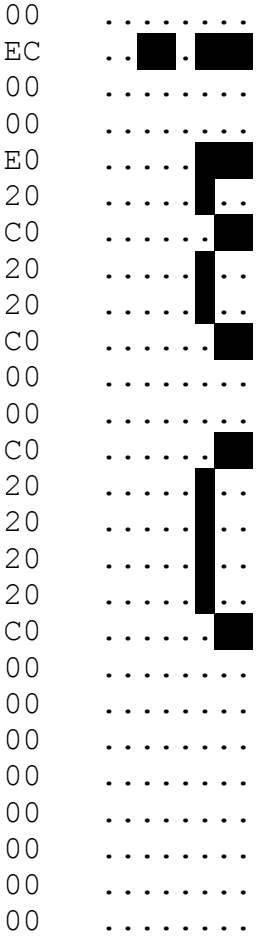
CS high, RS low
95uS delay, then CS low RS high

```
04 04 FC 04 04 00 00 FC 40 20 20 20 C0 00 00 C0
20 20 20 20 C0 00 00 00 00 00 00 00 00 C0 20 20
20 40 FC 00 00 00 A0 A0 A0 A0 C0 00 00 20 20 F8
20 20 00 00 C0 20 20 20 20 C0 00 00 00 00 00 00
00 00 00 A0 A0 A0 A0 C0 00 00 E0 40 20 20 20 C0
00 00 C0 20 20 20 40 FC 00 00 00 00 00 00 00 00
20 20 F8 20 20 00 00 EC 00 00 E0 20 C0 20 20 C0
00 00 C0 20 20 20 20 C0 00 00 00 00 00 00 00 00
```

```
04   ..#.....
04   ..#.....
FC   ..######
04   ..#.....
04   ..#.....
00   ........
00   ........
FC   ..######
```


40 ......#.
20 .....#..
20 .....#..
20 .....#..
C0 ......##
00 ....
00 ....
C0 ......##
20 .....#..
20 .....#..
20 .....#..
20 .....#..
C0 ......##
00 ....
00 ....
00 ....
00 ....
00 ....
00 ....
00 ....
00 ....
C0 ......##
20 .....#..
20 .....#..
20 .....#..
40 ......#.
FC ..######
00 ....
00 ....
00 ....
A0 .....#.#
A0 .....#.#
A0 .....#.#
A0 .....#.#
C0 ......##
00 ....
00 ....
20 .....#..
20 .....#..
F8 ...#####
20 .....#..
20 .....#..
00 ....
00 ....
C0 ......##
20 .....#..
20 .....#..


20 .....#..
20 .....#..
C0 ......##
00 ....
00 ....
00 ....
00 ....
00 ....
00 ....
00 ....
00 ....
00 ....
A0 .....#.#
A0 .....#.#
A0 .....#.#
A0 .....#.#
C0 ......##
00 ....
00 ....
E0 .....###
40 ......#.
20 .....#..
20 .....#..
20 .....#..
C0 ......##
00 ....
00 ....
C0 ......##
20 .....#..
20 .....#..
20 .....#..
40 ......#.
FC ..######
00 ....
00 ....
00 ....
00 ....
00 ....
00 ....
00 ....
00 ....
20 .....#..
20 .....#..
F8 ...#####
20 .....#..
20 .....#..
00 ....



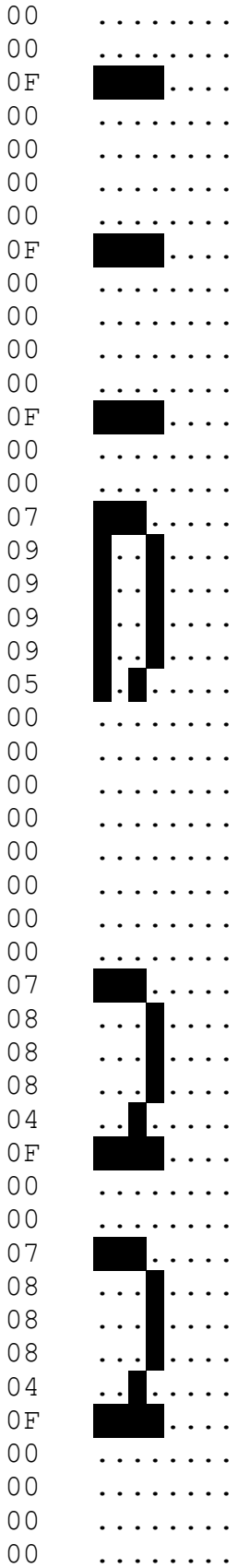
AF E3 E3 E3

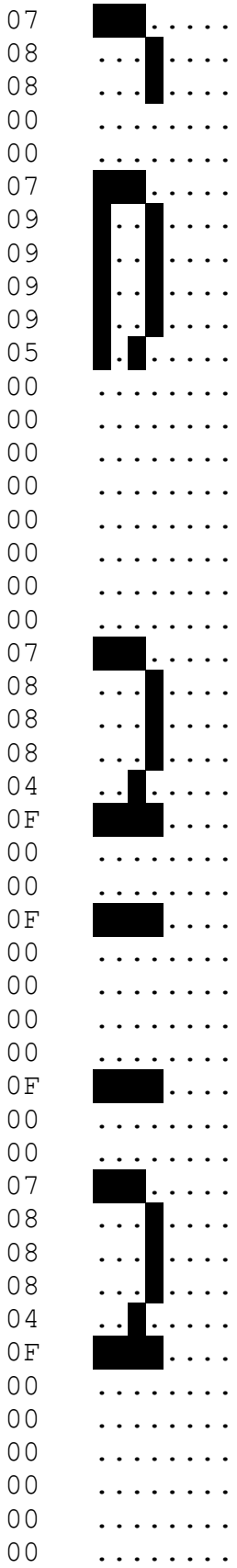
AF Display ON/OFF - ON
E3 NOP
E3 NOP
E3 NOP

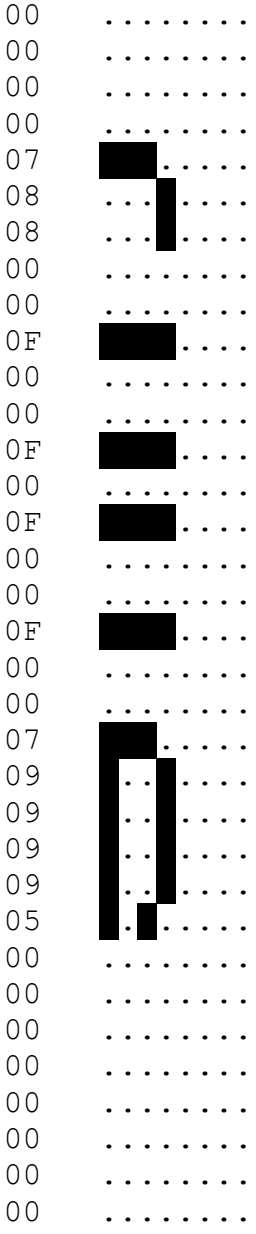
B1 10 00 E3

B1 Set Page Address - 1
10 Set Column Address of RAM hi nibble - 0
00 Set Column Address of RAM low nibble - 0
E3 NOP

```
00 00 0F 00 00 00 00 0F 00 00 00 00 0F 00 00 07 09 09 09 09 05 00 00
00 00 00 00 00 00 07 08 08 08 04 0F 00 00 07 08 08 08 04 0F 00 00 00
00 07 08 08 00 00 07 09 09 09 09 05 00 00 00 00 00 00 00 00 07 08 08
08 04 0F 00 00 0F 00 00 00 00 0F 00 00 07 08 08 08 04 0F 00 00 00 00
00 00 00 00 00 00 07 08 08 00 00 0F 00 00 0F 00 0F 00 00 0F 00 00 07
09 09 09 09 05 00 00 00 00 00 00 00 00
```


00 ....
00 ....
0F ####....
00 ....
00 ....
00 ....
00 ....
0F ####....
00 ....
00 ....
00 ....
00 ....
0F ####....
00 ....
00 ....
07 ###.....
09 #..#....
09 #..#....
09 #..#....
09 #..#....
05 #.#.....
00 ....
00 ....
00 ....
00 ....
00 ....
00 ....
00 ....
00 ....
07 ###.....
08 ...#....
08 ...#....
08 ...#....
04 ..#.....
0F ####....
00 ....
00 ....
07 ###.....
08 ...#....
08 ...#....
08 ...#....
04 ..#.....
0F ####....
00 ....
00 ....
00 ....
00 ....





AF E3 E3 E3

AF Display ON/OFF - ON
E3 NOP
E3 NOP
E3 NOP

Tag the Dog

Display "1:Yes 2:No " on line 2, takes two pages of 128 bytes.

B2 10 00 E3

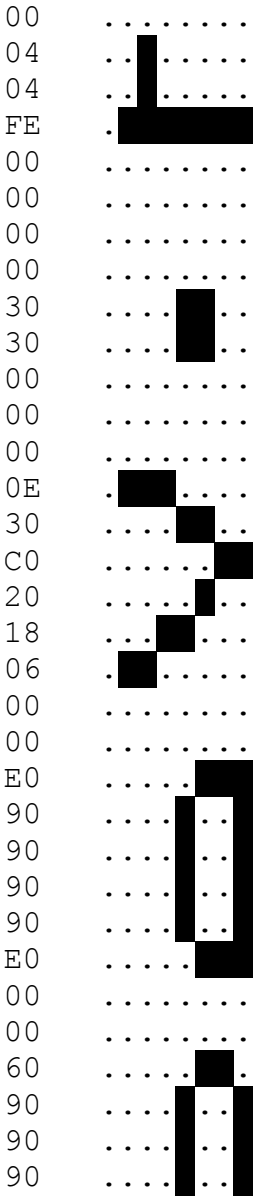
B2 Set Page Address - 2

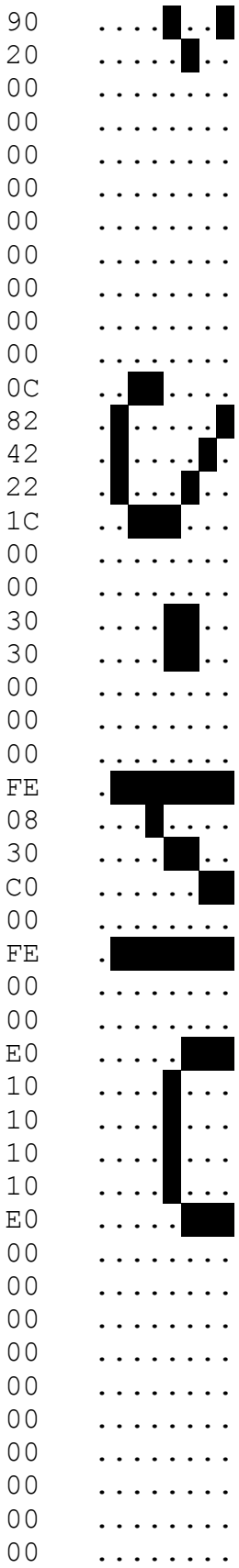
10 Set Column Address of RAM hi nibble - 0

00 Set Column Address of RAM low nibble - 0

E3 NOP

```
00 04 04 FE 00 00 00 00 30 30 00 00 00 0E 30 C0
20 18 06 00 00 E0 90 90 90 90 E0 00 00 60 90 90
90 90 20 00 00 00 00 00 00 00 00 00 0C 82 42 22
1C 00 00 30 30 00 00 00 FE 08 30 C0 00 FE 00 00
E0 10 10 10 10 E0 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 00 00 00 00 00 00 00 00 00 00
```





00 ....
00 ....
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00 ....

```
00    ........
```

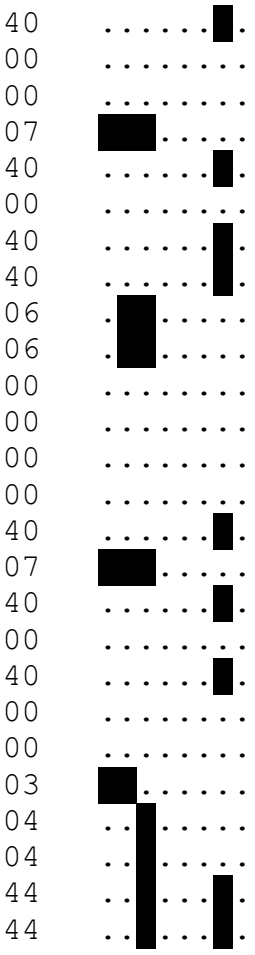
AF E3 E3 E3

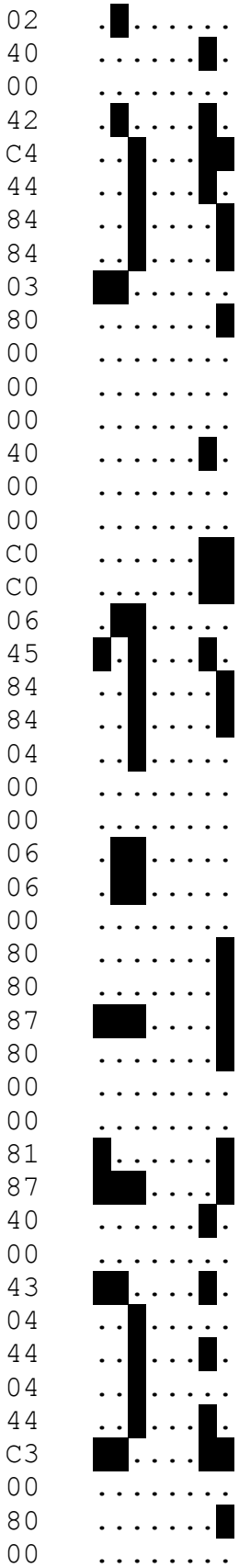
AF Display ON/OFF - ON
E3 NOP
E3 NOP
E3 NOP

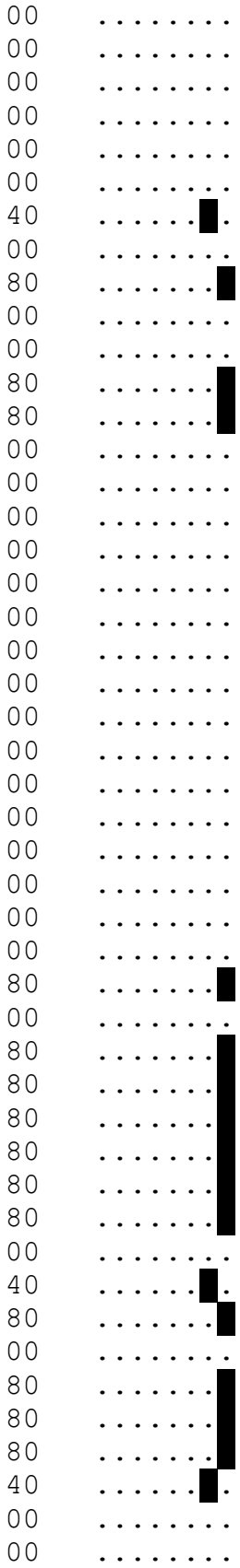
B3 10 00 E3

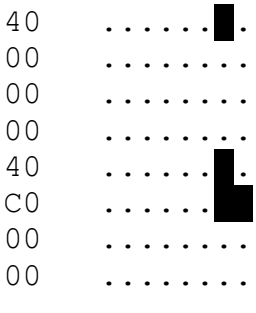
B3 Set Page Address - 3
10 Set Column Address of RAM hi nibble - 0
00 Set Column Address of RAM low nibble - 0
E3 NOP

```
40 00 00 07 40 00 40 40 06 06 00 00 00 00 40 07
40 00 40 00 00 03 04 04 44 44 02 40 00 42 C4 44
84 84 03 80 00 00 00 40 00 00 C0 C0 06 45 84 84
04 00 00 06 06 00 80 80 87 80 00 00 81 87 40 00
43 04 44 04 44 C3 00 80 00 00 00 00 00 00 00 40
00 80 00 00 80 80 00 00 00 00 00 00 00 00 00 00
00 00 00 00 00 00 80 00 80 80 80 80 80 80 00 40
80 00 80 80 80 40 00 00 40 00 00 00 40 C0 00 00
```









AF E3 E3 E3

AF Display ON/OFF - ON
E3 NOP
E3 NOP
E3 NOP

Sequence:
After a sequence of setup commands, 4 'pages' of 128 bytes, are sent but the display is not turned on and nothing is apparent visually. On character based LCD displays I might expect a sequence like this to be defining programmable character dot matrices, but I don't know the purpose here.

Lastly two lines of text are sent and displayed :
line1 - "**The date and time settings have been reset, or are incorrect. Do you want to set them again?**"
line2 - "**1:Yes 2:No**"

Line 1 starts to scroll left after about 2 second pause. Scrolls completely off the left of display then repeats. About 9 or 10 seconds for a character to scroll from one end to the other.

The characters are 14 pixels high, on the second line of data displayed there appears to be extra data in the lower 2 'unused' bits of each displayed byte.