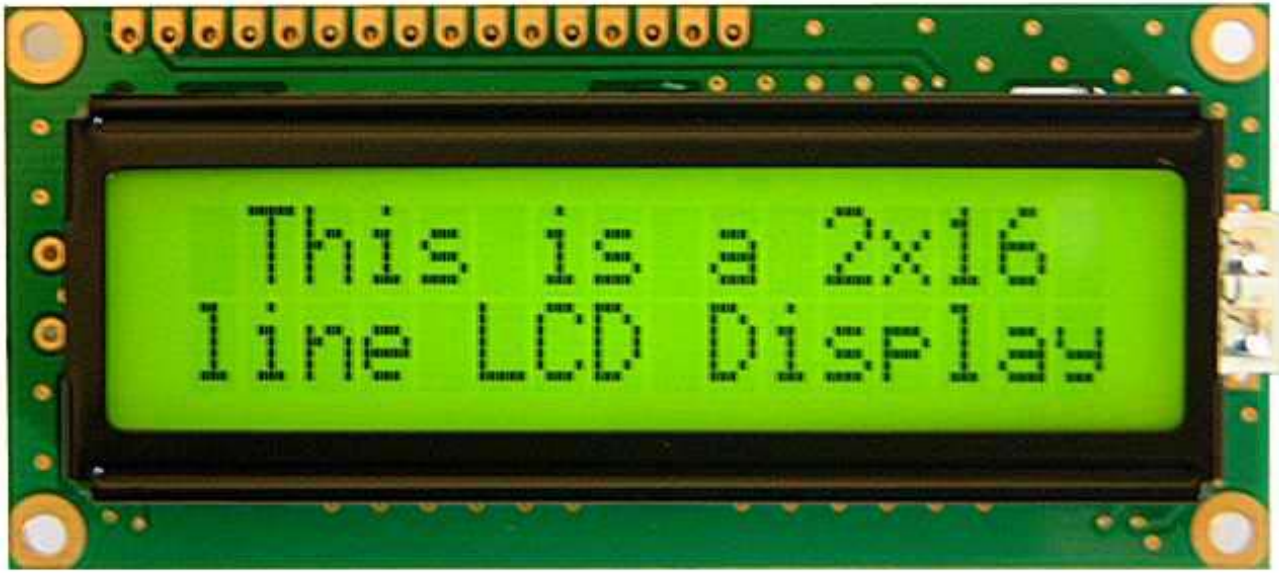
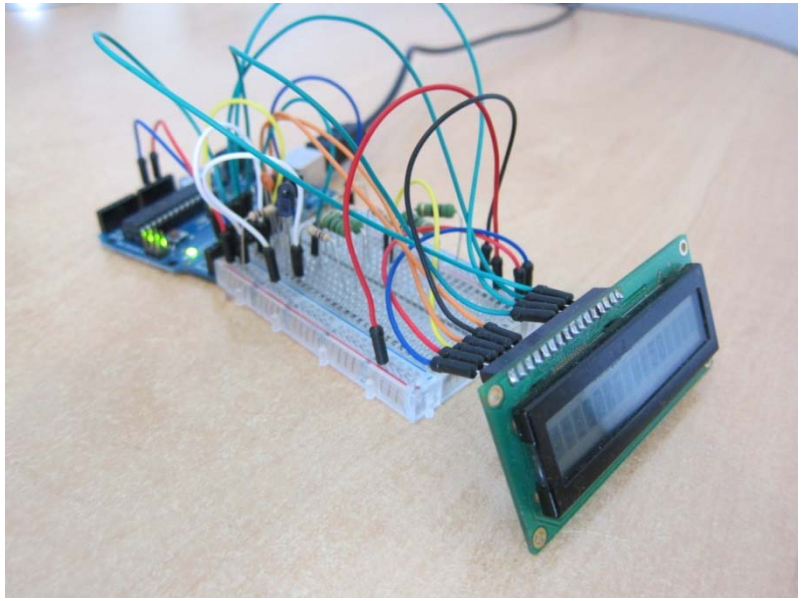
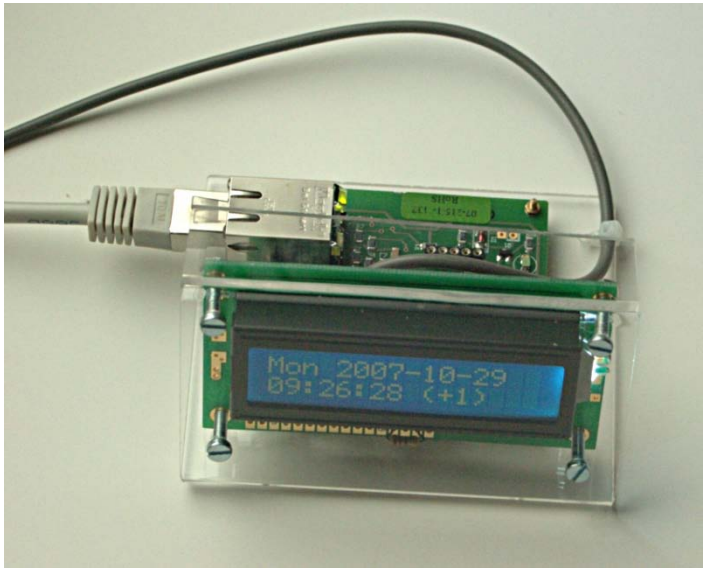
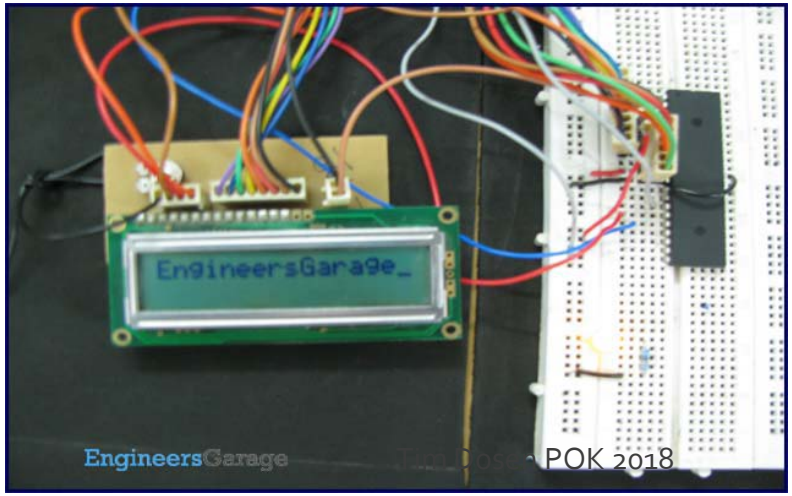
LCD

Erdefi Rakun dan Tim dosen POK


This is a 2x16
line LCD Display

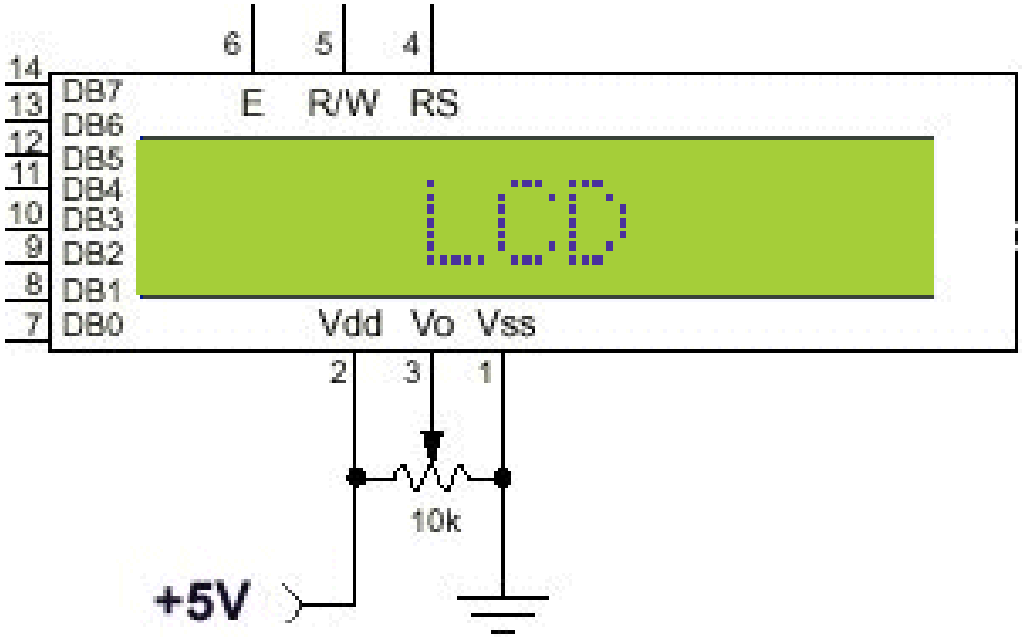



Mon 2007-10-29
09:26:28 (+1)


EngineersGarage_
EngineersGarage

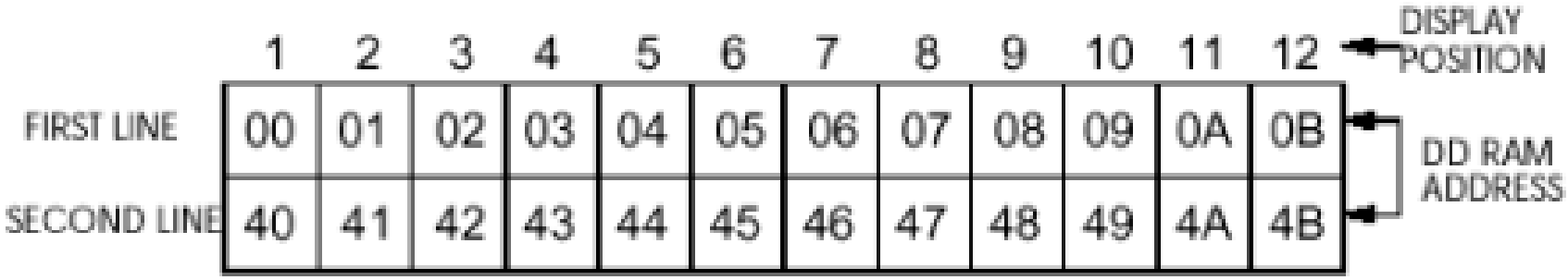

Time: 9 :36.25
Hello World!

LCD HD44780 Spec



- DB[7..0] = Data 8-bit
- E = Enable → data transfer at falling edge
- R/W = Read/Write: 0 for Write/1 for Read
- RS = Register Select: 1 for data/0 for instruction

Display Data RAM (DDRAM)

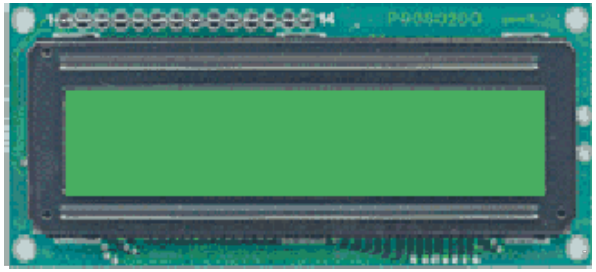


- DDRAM is the memory to store data of the character to shown at the LCD screen.
- Using **8-bit ASCII codes** to represent each character. LCD screen can fit up to 80 characters.
- DDRAM address is used as the cursor position. The cursor position is the place where the character will be displayed on LCD screen.

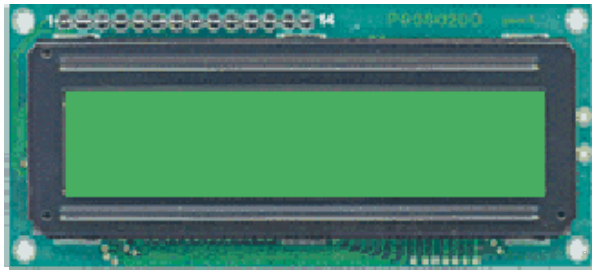
LCD Instructions

Instruction	Instruction Code										Description	Execution time (fosc= 270 kHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Clear Display	0	0	0	0	0	0	0	0	0	1	Write "20H" to DDRAM and set DDRAM address to "00H" from AC	1.53 ms
Return Home	0	0	0	0	0	0	0	0	1	-	Set DDRAM address to "00H" from AC and return cursor to its original position if shifted. The contents of DDRAM are not changed.	1.53 ms
Entry Mode Set	0	0	0	0	0	0	0	1	I/D	SH	Assign cursor moving direction and enable the shift of entire display.	39 µs
Display ON/ OFF Control	0	0	0	0	0	0	1	D	C	B	Set display(D), cursor(C), and blinking of cursor(B) on/off control bit.	39 µs

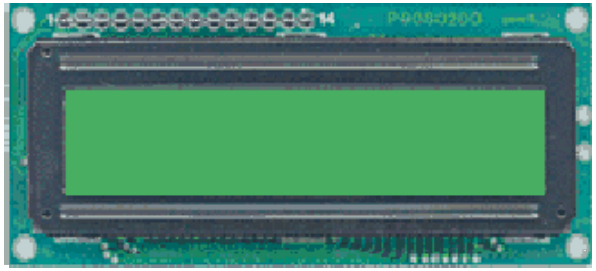
Entry Mode Set



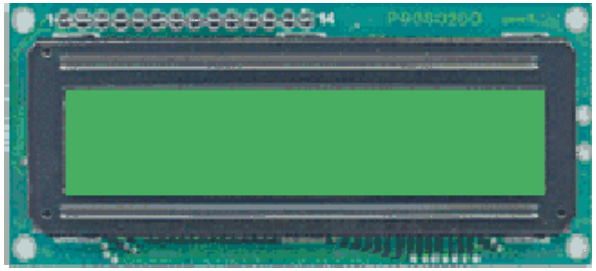
- Command : 0000 0100
- Display Shift :OFF
- Decrement Address Counter
- String :Dereli



- Command : 0000 0101
- Display Shift :ON
- Decrement Address Counter
- String :Hakan



- Command : 0000 0110
- Display Shift :OFF
- Increment Address Counter
- String:Dereli



- Command : 0000 0111
- Display Shift :ON
- Increment Address Counter
- String:Hakan

LCD Instructions (cont.)

Instruction	Instruction Code										Description	Execution time (fosc= 270 kHz)
	RS	R/W	DB7	DB6	DB5	DB4	DB3	DB2	DB1	DB0		
Cursor or Display Shift	0	0	0	0	0	1	S/C	R/L	-	-	Set cursor moving and display shift control bit, and the direction, without changing of DDRAM data.	39 μs
Function Set	0	0	0	0	1	DL	N	F	-	-	Set interface data length (DL: 8-bit/4-bit), numbers of display line (N: 2-line/1-line) and, display font type (F:5×11dots/5×8 dots)	39 μs
Set CGRAM Address	0	0	0	1	AC5	AC4	AC3	AC2	AC1	AC0	Set CGRAM address in address counter.	39 μs
Set DDRAM Address	0	0	1	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Set DDRAM address in address counter.	39 μs
Read Busy Flag and Address	0	1	BF	AC6	AC5	AC4	AC3	AC2	AC1	AC0	Whether during internal operation or not can be known by reading BF. The contents of address counter can also be read.	0 μs
Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	43 μs
Read Data from RAM	1	1	D7	D6	D5	D4	D3	D2	D1	D0	Read data from internal RAM (DDRAM/CGRAM).	43 μs

Contoh penggunaan

- Set 8-bit character in 2 lines with display font size 5 x 8

Function Set	0	0	0	0	1	DL	N	F	-	-	Set interface data length (DL: 8-bit/4-bit), numbers of display line (N: 2-line/1-line) and, display font type (F:5×11dots/5×8 dots)	39 µs

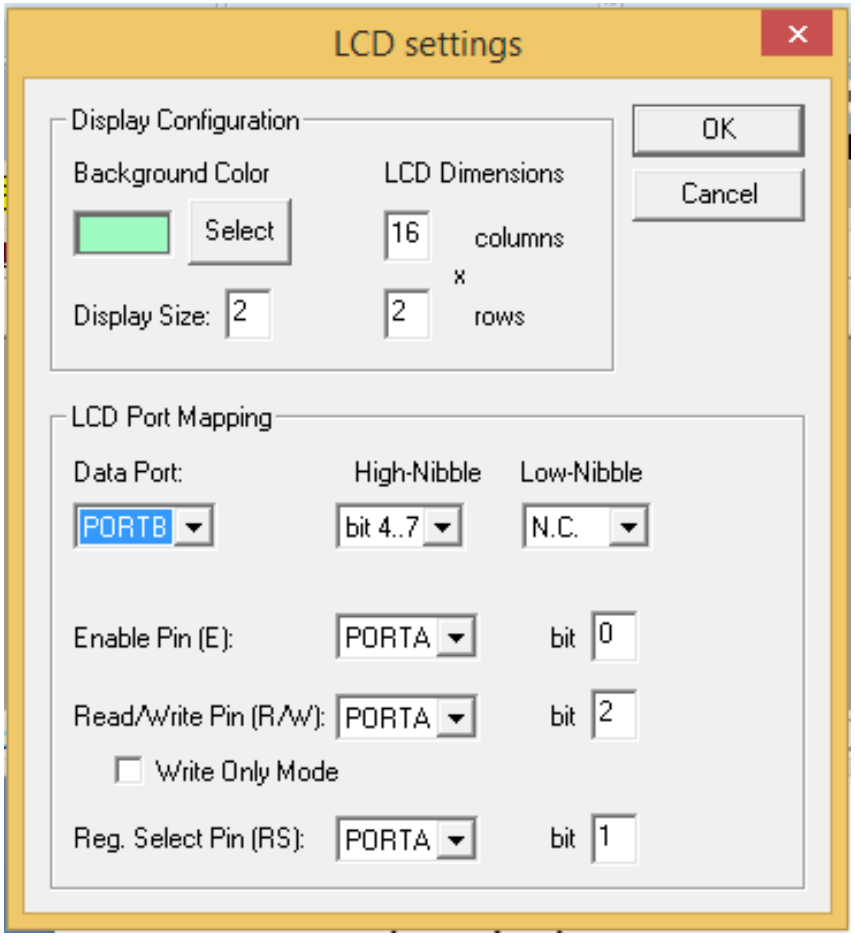
RS R/W DB7 DB6 DB5 DB4 DB3 DB2 DB1 DB0

RS = 0 R/W = 0 DB0 – DB7 = 0x38

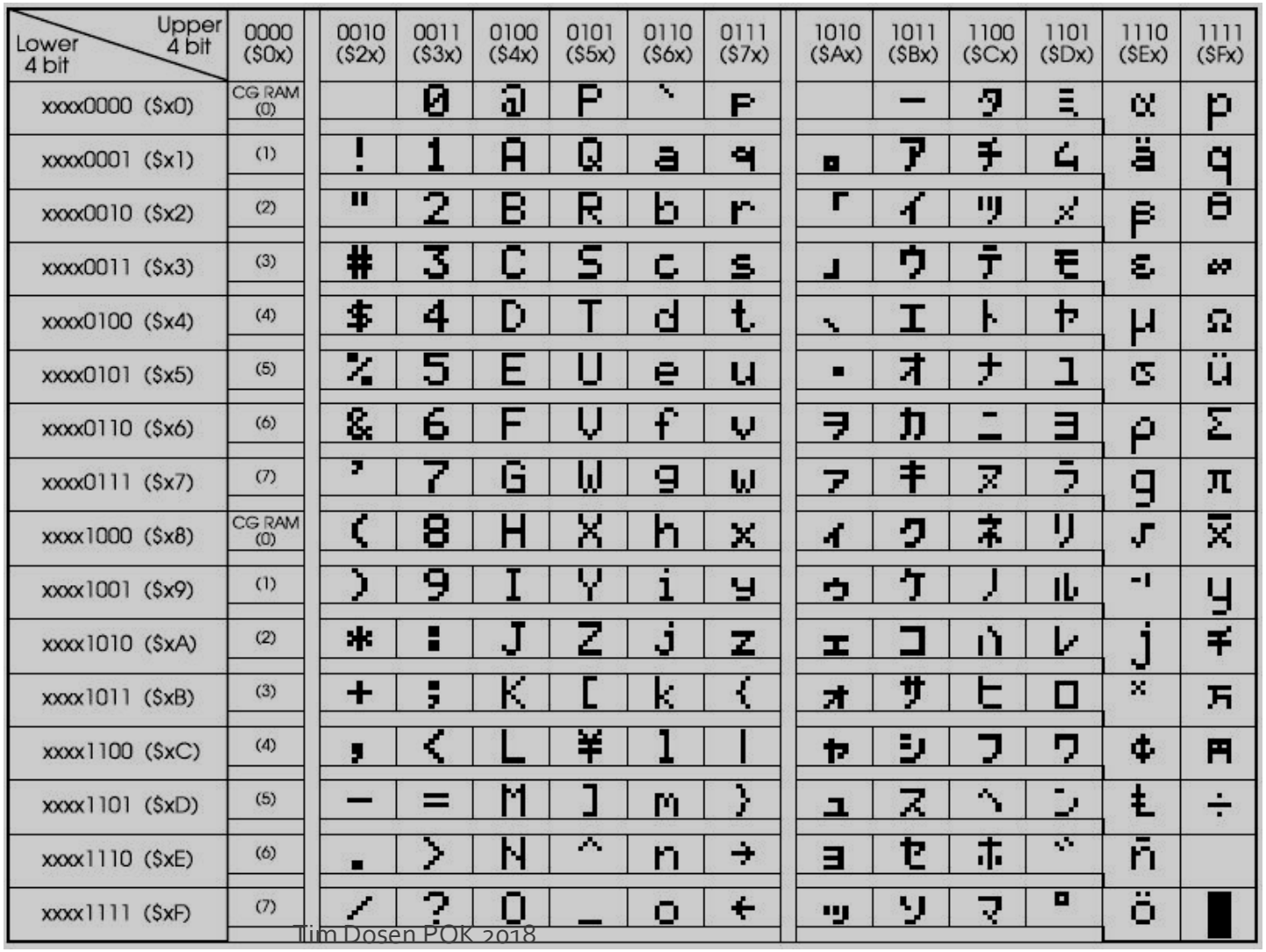
Implementasi kode

- Misal:
  - PORTA bit 0 = EN
  - PORTA bit 1 = RS
  - PORTA bit 2 = R/W
  - PORTB = DB0 – DB7

```
cbi PORTA,1 ; RS = 0
cbi PORTA,2 ; R/W = 0
ldi PB,0x38 ;
out PORTB,PB ; DB = 0x38
sbi PORTA,0 ; EN = 1
cbi PORTA,0 ; EN = 0
```



ASCII


Lower 4 bit
Upper 4 bit
0000 ($0x)
0010 ($2x)
0011 ($3x)
0100 ($4x)
0101 ($5x)
0110 ($6x)
0111 ($7x)
1010 ($Ax)
1011 ($Bx)
1100 ($Cx)
1101 ($Dx)
1110 ($Ex)
1111 ($Fx)
xxxx0000 ($x0)
xxxx0001 ($x1)
xxxx0010 ($x2)
xxxx0011 ($x3)
xxxx0100 ($x4)
xxxx0101 ($x5)
xxxx0110 ($x6)
xxxx0111 ($x7)
xxxx1000 ($x8)
xxxx1001 ($x9)
xxxx1010 ($xA)
xxxx1011 ($xB)
xxxx1100 ($xC)
xxxx1101 ($xD)
xxxx1110 ($xE)
xxxx1111 ($xF)
CG RAM (0)
(1)
(2)
(3)
(4)
(5)
(6)
(7)

Contoh penulisan karakter ke LCD

- Write the letter Y di LCD

Write Data to RAM	1	0	D7	D6	D5	D4	D3	D2	D1	D0	Write data into internal RAM (DDRAM/CGRAM).	43 µs

ASCII Y= 0x59

RS = 1 R/W = 0 DB0 – DB7 = 0x59

Implementasi kode

```
sbi PORTA,1 ; RS = 1
cbi PORTA,2 ; R/W = 0
ldi PB,0x59 ;
out PORTB,PB ; DB = 0x59
sbi PORTA,0 ; EN = 1
cbi PORTA,0 ; EN = 0
```

Simulator

http://www.dinceraydin.com/djlcdsim/djlcdsim.html