Character Mode Liquid Crystal Display Module
Initialization by Instruction - 4-bit data interface

Notes:

RS = 0 to select the Instruction register.
R/W = 0 so that data is written to the LCD module.

The second and third 100 µs time delays are not documented, this figure is speculation, it may be possible to check the busy flag here.

N and F must be set in the first non-special Function Set instruction and cannot be changed subsequently

All time delays specified after the Function Set are based on worst case instruction execution time (clock may be as low as 190 kHz).

The first Display ON/OFF Control instruction should probably be performed as specified (some programmers set D, C, and B here).

The device is in 8-bit mode when powered-up, and it remains in that mode until this point.

Up to this point the device reads all eight data pins each time the enable pin is pulsed.

The four bits shown in the flowchart are the relevant ones and they should be placed on the upper four data lines.

The lower four inputs are supposed to be grounded but they will be ignored in any case.

At this point the device switches to the 4-bit mode.

Beyond this point the device reads only the upper four data pins each time the enable pin is pulsed.

The device will temporarily store the first group of four data bits that it receives. After it receives the second group of four data bits it will reassemble them and execute the resulting instruction.

No time delay is required between the sending of the two groups of bits.

Power on

Wait for more than 100 ms

0 0 1 1 — Special case of 'Function Set' (lower four bits are irrelevant)

Wait for more than 4.1 ms

0 0 1 1 — Special case of 'Function Set' (lower four bits are irrelevant)

Wait for more than 100 µs

0 0 1 1 — Special case of 'Function Set' (lower four bits are irrelevant)

Wait for more than 100 µs

0 0 1 0 — Initial 'Function Set' to change interface (lower four bits are irrelevant)

Wait for more than 100 µs

0 0 1 0
N F * * — 'Function Set' (I = 1, N and F as required)

Wait for more than 53 µs or until busy flag is clear

0 0 0 0
1 0 0 0 — 'Display ON/OFF Control' (D=0, C=0, B=0)

Wait for more than 53 µs or until busy flag is clear

0 0 0 0
0 0 0 1 — 'Clear Display' (no configurable bits)

Wait for more than 3 ms or until busy flag is clear

0 0 0 0
0 1 I/D S — 'Entry Mode Set' (I/D and S as required)

Wait for more than 53 µs or until busy flag is clear

Initialization Ends

0 0 0 0
1 1 C B — 'Display ON/OFF Control' (D=1, C and B as required)

Wait for more than 53 µs or until busy flag is clear