Technical Specifications and Register Map For

mLink Character LCD (HCMODU0190x)

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Specifications

Module specifications:

Module code:	HCMODU0190A (16x2 blue backlight) HCMODU0190B (20x4 blue backlight)
Supply voltage (VDD):	4.5V to 5.5V
Operating range (recommended):	0ºC to 50ºC
Display type (HCMODU0190A):	16x2 character alphanumeric LCD
Display type (HCMODU0190B):	20x4 character alphanumeric LCD
Current max (HCMODU0190A):	31mA (100% backlight, Vcc = 5V)
Current min(HCMODU0190A):	2mA (sleep)
Current max (HCMODU0190B):	46mA (100% backlight, Vcc = 5V)
Current min(HCMODU0190B):	2mA (sleep)
Interfaces:	I2C
I2C Interface speed:	400kbits/s (fast mode)
I2C default address (HEX):	0h56
Maximum number of modules:	5 with pullups fitted, 112 with pullups removed*
HCMODU0190A dimensions (inc module):	80mm x 36mm x 19mm
HCMODU0190B dimensions (inc module):	98mm x 60mm x 19mm

*Note the maximum number of connected modules will depend on cable lengths and power requirements of each module. Do not exceed 5 mLink modules connected in series with all pullups fitted.

Register Map

Register quick reference table

REGISTER	REG ADD	Reg Bit 7	Reg Bit 6	Reg Bit 5	Reg Bit 4	Reg Bit 3	Reg Bit 2	Reg Bit 1	Reg Bit 0
STATUS	0h00	RESERVED					BUSY	REGERR	I2CERR
I2C ADD (Def = 0h51)	0h01	NA	I2CADD						
MODULE TYPE	0h02	0h05							
MODULE SUBTYPE	0h03	0h00 or 0h01							
FIRMWARE VERSION	0h04	0hXX							
SLEEP	0h05	RESERVED							SLEEPEN
RESERVED	0h06 to 0h0A	RESERVED							
PRINT CHAR	0h0B	CHAR							
CURSOR COL	0h0C	COL							
CURSOR ROW	0h0D	ROW							
CONTROL REG 1	0h0E	RESERVED						DISPON	CLR
CONTROL REG 2	0h0F	RESERVED						TYPE	DIR
BACKLIGHT LEVEL	0h10	RESERVED				BL			
CONTRAST LEVEL	0h11	CONT							
PRINT CUSTOM CHAR	0h12	RESERVED					CUST[2:0]		
CUST CHAR 0 BITMAP	0h13	CC0BM							
CUST CHAR 1 BITMAP	0h14	CC1BM							
CUST CHAR 2 BITMAP	0h15	CC2BM							
CUST CHAR 3 BITMAP	0h16	CC3BM							
CUST CHAR 4 BITMAP	0h17	CC4BM							
CUST CHAR 5 BITMAP	0h18	CC5BM							
CUST CHAR 6 BITMAP	0h19	CC6BM							
CUST CHAR 7 BITMAP	0h1A	CC7BM							

Status register

Register address: 0h00
Default value: 0

7	6	5	4	3	2	1	0
RESERVED					BUSY	REGERR	I2CERR
r					r	rw	rw

Bits 7:3 Reserved
Bit 2 **BUSY**: Busy status
Not implemented for this module

Bit 1 **REGERR**: Register access error
This bit is set by hardware and reset by software
0: No register access error
1: Register access error caused by attempting to access an non-existent register, writing an illegal value to a register, or writing to a read only register

Bit 0 **I2CERR**: I2C bus access error
This bit is set by hardware and reset by software
0: No I2C error
1: An I2C bus error has occurred

Writing any value to this register will clear all bits

I2C Address Register

Register address: 0h01
Default value: 0h56

7	6	5	4	3	2	1	0
N/A	I2CADD						
r	rw						

Bit 7 N/A: Returns 0
Bits 6:0 **I2CADD**: 7 bit I2C address (default factory reset value = 0h56)
These bits are set by software
Values written to this register will be stored in non-volatile memory
Valid address range is 0h08 to 0h77. Addresses outside this range will be ignored but will set the **REGERR** bit in the status register.

Before a new address can be written to this register it must first be unlocked by writing bytes 0x55 followed by 0xAA. The new address byte must then be written within 100ms of writing the 0xAA byted otherwise the unlock process will timeout and reset.

Module Type Register

Register address: 0h02
Default value: 0h05

7	6	5	4	3	2	1	0
MTYP							
r							

Bits 7:0 **MTYP**: 8 bit value representing the module type.
This register will always return 0h05, signifying this module type is ‘Display’

Module Subtype Register

Register address: 0h03
Default value: 0h00 or 0h01

7	6	5	4	3	2	1	0
STYP							
r							

Bits 7:0 **STYP**: 8 bit value representing the module subtype.
This register will always return 0h00 for a 16x2 character display or 0h01 for a 20x4 character display

Firmware Version Register

Register address: 0h04
Default value: 0hXX

7	6	5	4	3	2	1	0
FWMAV				FWMIV			
r				r			

Bits 7:4 **FWMAV**: 4 bit value representing the modules major firmware version
Bits 3:0 **FWMAV**: 4 bit value representing the modules minor firmware version

Sleep Register

Register address: 0h05
Default value: 0h00

7	6	5	4	3	2	1	0
RESERVED							SLEEPEN
w							

Bits 7:1 Reserved
Bit 0 **SLEEPEN**: Sleep enable

This bit is set by software. Writing a 1 to this bit will place the module into low power sleep mode.
1: Enable sleep mode

Sleep mode is excited (SLEEPEN = 0) automatically on the next register read or write.
Note: After exiting sleep mode the busy bit in the status register should be polled before reading a new temperature.

Print Char Register

Register address: 0h0B
Default value: NA

7	6	5	4	3	2	1	0
CHAR							
w							

Bits 7:0 **CHAR**: ASCII value of the character to print
This register is set by software.

Writing an 8 bit ASCII character to this register will cause the character to be printed to the display at the current cursor location (see CURSOR COL and CURSOR ROW registers).

Printable ASCII characters range from ASCII codes 0h21 to 0h7F.

After writing to the register the current cursor location will be shifted to the right (DIR = 0) or to the left (DIR=1).

Additionally the module will respond to the following ASCII control codes:

0h08 (backspace): The cursor will move back by 1 character (see DIR bit)
0h09 (horizontal tab): Moves the cursor to the next tab location (max 2 characters)
0h0A (line feed): The current cursor location will move down by 1 row
0h0D (carriage return): Sets the cursor column to 0

Cursor Column Register

Register address: 0h0C
Default value: 0h00

7	6	5	4	3	2	1	0
COL							
rw							

Bit 7:0 **COL**: Cursor column position
This register is set by software.

Writing an 8 bit signed value (-128 to 127) to this register sets the current cursor column position where 0 = the left most displayable column and 15 (16x2 LCD), or 19 (20x4 LCD) is the right most displayable column. Setting this register to a value outside these ranges will cause the cursor to move to a location outside the displayable area.

Cursor Row Register

Register address: 0h0D
Default value: 0h00

7	6	5	4	3	2	1	0
ROW							
rw							

Bits 7:0 **ROW**: Cursor row position
This register is set by software.

Writing an 8 bit signed value (-128 to 127) to this register sets the current cursor row position where 0 = the top most displayable row and 1 (16x2 LCD), or 3 (20x4 LCD) is the bottom most displayable row. Setting this register to a value outside these ranges will cause the cursor to move to a location outside the displayable area.

Control Register 1

Register address: 0h0E
Default value: 0h02

7	6	5	4	3	2	1	0
RESERVED						DISPON	CLR
rw							

Bits 7:2 Reserved
Bit 1 **DISPON**: Display on/off state
This bit is set by software.

Writing to this bit will set the on/off state for the display.
1: Display on
0: Display off

Bit 0 **CLR**: Clear display
This bit is set by software and reset by hardware.

Writing a 1 to this bit clears the display and sets the current cursor position (COL & ROW) to 0.
1: Clears the display

This bit will be reset by hardware after the display is cleared.

Control Register 2

Register address: 0h0F
Default value: 0h00 (16x2) or 0h01 (20x4)

7	6	5	4	3	2	1	0
RESERVED						TYPE	DIR
rw							

Bits 7:2 Reserved
Bit 1 **TYPE**: Display type
This bit is set by software.

Sets the display type to either a 16x2 or 20x4 character display.
1: 20x4 LCD
0: 16x2 LCD

Note: after a factory reset this bit will be set or reset depending on the display type purchased.

Bit 0 **DIR**: Cursor direction
This bit is set by software.

Sets the direction the cursor will move after printing an ASCII character or printing one of the 8 custom characters.
1: Cursor will move 1 character to the left
0: Cursor will move 1 character to the right

Note: Values written to this register will be stored on the modules non-volatile memory.

Backlight Level Register

Register address: 0h10
Default value: 0h0F

7	6	5	4	3	2	1	0
RESERVED				BL			
rw							

Bits 7:4 Reserved
Bits 3:0 **BL**: Backlight level

These bits are set by software.

Sets the brightness level of the backlight. The backlight level can be set to a value between 0 (backlight off) and 10 (backlight max). Values in between will set the brightness level in 10% increments.

Writing a value greater than 10 will set the backlight to maximum.

Contrast Level Register

Register address: 0h11
Default value: 0h10 (16x2) 0h45 (20x4)

7	6	5	4	3	2	1	0
CONT							
rw							

Bits 7:0 **CONT**: Contrast level

These bits are set by software.

Sets the display's contrast level where 0 = minimum contrast and 255 = max contrast.

Note: After factory reset this register will be set to a value depending on the display type purchased.

Values written to this register will be stored on the modules non-volatile memory.

Print Custom Character Register

Register address: 0h12
Default value: NA

7	6	5	4	3	2	1	0
RESERVED					CUST		
w							

Bits 7:3 Reserved
Bits 2:0 **CUST**: Index number of the custom character to print

This register is set by software.

Writing a value from 0 to 7 will cause one of the 8 custom characters to be printed to the display at the current cursor location.

Before printing a custom character its bitmap should be defined via the appropriate custom character bitmap register (CC0BM to CC7BM)

After writing to the register the current cursor location will be shifted to the right (DIR = 0) or to the left (DIR=1).

Custom Character Bitmap Registers

Register address: 0h13 to 0h1A
Default value: NA

7	6	5	4	3	2	1	0
CC0BM … CC7BM							
w							

Bits 7:0 **CCxBM**: Custom character bitmap registers 0 to 7

This register is set by software.

The display contains 8 user definable 5x8 pixel custom characters which can be printed to the display via the CUST bits in the Print Custom Character register.

These 8 custom characters can be defined by writing a bitmap to one of the 8 custom character bitmap registers CC0BM to CC7BM depending which characters bitmap your wish to update.

A custom character bitmap can be defined by the lower 5 bits of a set of 8 bytes as follows:

Bit Number	7	6	5	4	3	2	1	0	HEX
Byte 0	---	---	---	0	1	1	1	0	0h0E
Byte 1	---	---	---	1	1	1	1	1	0h1F
Byte 2	---	---	---	1	0	0	0	1	0h11
Byte 3	---	---	---	1	0	0	0	1	0h11
Byte 4	---	---	---	1	0	0	0	1	0h11
Byte 5	---	---	---	1	0	0	0	1	0h11
Byte 6	---	---	---	1	0	0	0	1	0h11
Byte 7	---	---	---	1	1	1	1	1	0x1F

Table 1: Custom character bitmap example

To write a bitmap to a custom character, write the 8 bytes (byte 0 to 7) containing the bitmap in sequence to the appropriate custom character bitmap register (CC0BM to CC7BM). For example, to write the above bitmap to custom character 0 write the following bytes in sequence to register CC0BM:

0h0E, 0h1F, 0h11, 0h11,0h11, 0h11, 0h11, 0h1F

Note: Each byte must be written to the custom character bitmap register in sequence and within 100ms of the previous byte otherwise the write sequence will reset.