# SHIELD-LCD16×2 custom firmware note

#### 29-07-14 OLIMEX LTD

SHIELD-LCD16×2 is a two-row display compatible with the shield layout of Arduino and Arduino-like boards.

It is equipped with a PIC16 microcontroller that holds custom firmware. The firmware makes sending and receiving commands to the display easier – it implements I2C and UART communication to the display and the rest of the board's features (buttons, LEDs, etc). There are also several commands implemented and they are discussed in this document.

The sources of the firmware are also published on the product's page. You can freely use the sources as a template or a foundation to building an even more sophisticated firmware.

A good way to further comprehending the firmware and the command usage would be inspecting the examples available. These are also available at the product's web page.

# 1. I2C commands

All available i2c commands are using standard protocol format. You should use only 100kHz bus. For higher clock speed it's not guaranteed proper operation of the shield.

## 1.1 **SET\_TRIS** (0×01)

 $8 \rightarrow GPIO8$  $9 \rightarrow GPIO9$ 

 $1 \rightarrow INPUT$  $0 \rightarrow OUTPUT$ 

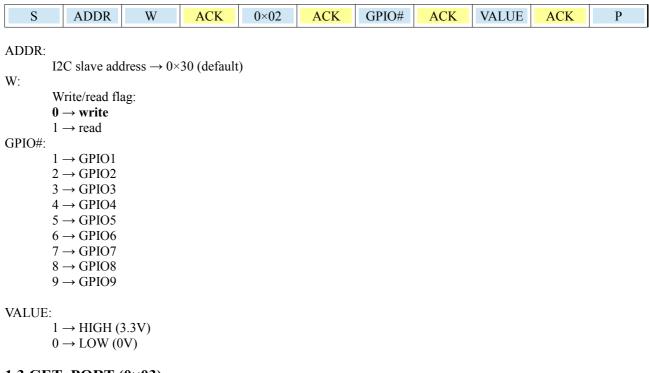
VALUE:

This command sets port direction of all available pins. These are GPIO1 to GPIO9. To make GPIO output you should write 0 as value. For input -1.

write 0 as	value. Foi i	iiput – 1.								
S	ADDR	W	ACK	0×01	ACK	GPIO#	ACK	VALUE	ACK	P
ADDR:										
	C slave add	$dress \rightarrow 0 \times$	30 (default	)						
0	rite/read fla → write → read	ag:								
GPIO#:	CDIO1									
	$\rightarrow$ GPIO1 $\rightarrow$ GPIO2									
	$\rightarrow$ GPIO3									
	$\rightarrow GPIO4$ $\rightarrow GPIO5$									
6	→ GPIO6									
7	$\rightarrow$ GPIO7									

#### 1.2 SET LAT $(0\times02)$

If a pin is configured as output you can set its level using this command. Valid values as 0 for low level and 1 - for high. They correspond to 0V and 3.3V.



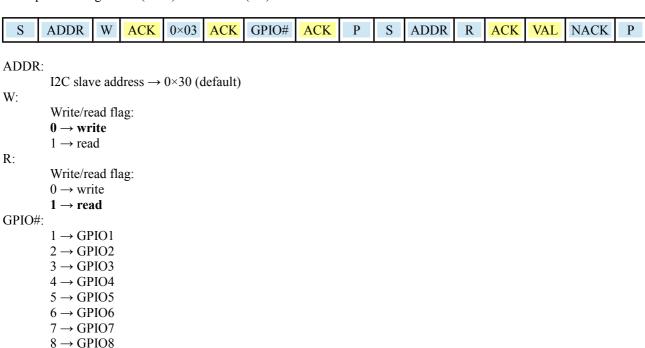
# 1.3 GET\_PORT (0×03)

 $9 \rightarrow GPIO9$ 

 $1 \rightarrow \text{HIGH (3.3V)}$  $0 \rightarrow \text{LOW (0V)}$ 

VALUE:

If GPIO is configured as input you can periodically read its state with this command. Like in the previous command 1 corresponds to high level (3.3V) and 0 - low (0V).



#### 1.4 GET BUT (0×05)

The state of the four buttons can be read all the same time using one command. The four LSB of the returned value represent the state of the buttons. For example is command return  $0\times05$  then:

 $0 \times 05 \rightarrow 0b00000101$ 

This mean:

button  $1 \rightarrow 1 \rightarrow OFF$ 

button2  $\rightarrow$  0  $\rightarrow$  ON

button3  $\rightarrow$  1  $\rightarrow$  OFF

button $4 \rightarrow 0 \rightarrow ON$ 

Notice that buttons default state is 1, so when the value is 0 the button is pressed.

S ADDR W ACK 0×05 ACK P S ADDR R ACK VAL NACK P

ADDR:

I2C slave address  $\rightarrow 0 \times 30$  (default)

W:

Write/read flag:

 $0 \rightarrow write$ 

 $1 \rightarrow \text{read}$ 

R:

Write/read flag:

 $0 \rightarrow \text{write}$ 

 $1 \rightarrow read$ 

#### 1.5 GET ID $(0 \times 20)$

You can verify that device is present using GET\_ID command. The returned value should be compared to the default one  $(0\times65)$ .

S ADDR W ACK 0×20 ACK P S ADDR R ACK VAL NACK P

ADDR:

I2C slave address  $\rightarrow 0 \times 30$  (default)

W:

Write/read flag:

 $0 \rightarrow write$ 

 $1 \rightarrow read$ 

R:

Write/read flag:

 $0 \rightarrow \text{write}$ 

 $1 \rightarrow read$ 

# $1.6 \text{ GET\_FRM } (0 \times 21)$

Same as above to check firmware version.

S ADDR W ACK 0×21 ACK P S ADDR R ACK VAL NACK P

ADDR:

I2C slave address  $\rightarrow 0 \times 30$  (default)

W:

Write/read flag:

 $0 \rightarrow write$ 

 $1 \rightarrow \text{read}$ 

Write/read flag:

 $0 \rightarrow \text{write}$ 

 $1 \rightarrow read$ 

# 1.7 LCD CLR (0×60)

Clears everything that is displayed on the lcd.

S	ADDR	W	ACK	0×60	ACK	P

ADDR:

I2C slave address  $\rightarrow 0 \times 30$  (default)

W:

Write/read flag:

 $0 \rightarrow write$ 

 $1 \rightarrow \text{read}$ 

# 1.8 LCD WR (0×61)

Writes one character at time at position X, Y. X must be between 1 and 16. Y must be between 1 and 2.

S ADDR W ACK 0×61 ACK X ACK Y ACK CHAR ACK
--

ADDR:

I2C slave address  $\rightarrow 0 \times 30$  (default)

W:

Write/read flag:

 $0 \rightarrow write$ 

 $1 \rightarrow \text{read}$ 

X:

 $X \text{ coordinate} \rightarrow 1 - 16$ 

Y:

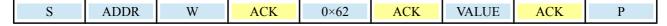
Y coordinate  $\rightarrow 1-2$ 

CHAR:

Hex code of displayed character

#### 1.9 SET BL $(0 \times 62)$

This is used to turn on and off the backlight of LCD. It can vary from 0 to 255.



ADDR:

I2C slave address  $\rightarrow 0 \times 30$  (default)

W:

Write/read flag:

 $0 \rightarrow write \\$ 

 $1 \rightarrow \text{read}$ 

VALUE:

Blacklisting level → from 0 to 255

## 1.10 UART EN (0×10)

Enables UART communication to the module.

S ADDR W ACK VALUE ACK F		S	ADDR	W	ACK	0×10	ACK	VALUE	ACK	P
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ADDR:

I2C slave address  $\rightarrow 0 \times 30$  (default)

W:

Write/read flag:

 $0 \rightarrow write \\$ 

 $1 \rightarrow \text{read}$ 

VALUE:

 $0 \rightarrow UART$  disable

 $1 \rightarrow UART$  enable

## 2. UART commands

UART needs to be enabled with UART\_EN command first!

When using UART, baud-rate should be set at 9600. All commands should end with '/r' and '/n'.

1. TRIS:g:v

Same as SET TRIS:

 $g \rightarrow GPIO$  number – 1 to 9

 $v \rightarrow value$ 

2. LAT:g:v

Same as SET\_LAT:

 $g \rightarrow \overline{GPIO}$  number – 1 to 9

 $v \to value \\$ 

3. PORT:g

Same as GET\_PORT:

 $g \rightarrow GPIO number - 1 to 9$ 

4. BUT

Same as GET\_BUT.

5. GOTOXY:x:y

Set cursor to given X and Y coordinate.

6. BLKL:v

Same as SET BL

 $v \rightarrow value - 0$  to 255

7. WR:v

Write characters to lcd.

8. CLEAR

Clear screen.