UI2x16

Product Overview

The UI2x16 has been designed to allow SPLat controller with or without an LCD to have a remote user interface. Once set up, the LCD on the UI2x16 is seamlessly controlled by using any of the standard LCD instructions. The UI2x16 has the following features:

- Fully programmable SPLat controller with all the latest, relevant SPLat features. An entire application can run in the UI2x16 so it can be part of an intelligent distributed system
- Connects to other SPLat controllers via Xwire and allows any SPLat controller to have a remote user interface (LCD, buttons and LEDs) regardless of whether the controller has an LCD or not
- Parts or all of the LCD can be controlled by the controller connected to the UI2x16
- 8 --> 24 VDC operation, ~70mA maximum at 24 VDC
- 2 x 16 alpha numeric LCD with dimmable back light
- Connector for external rotary quadrature encoder
- 5 push buttons
- 1 bi color LEDs (red/green)
- Beeper
- RS485 Xwire interface (allows for very long cable runs of up to 1.2km, 3900 feet)
- TTL Xwire interface for short cable runs of less than 2 metres
- TTL communications interface (for program download, MODBUS or user defined comms)
- Connects to any SPLat controller with using Xwire (older boards may need to be reFlashed to the latest version of firmware)

LCD Magic

SPLat has a bunch of LCD instructions, like:

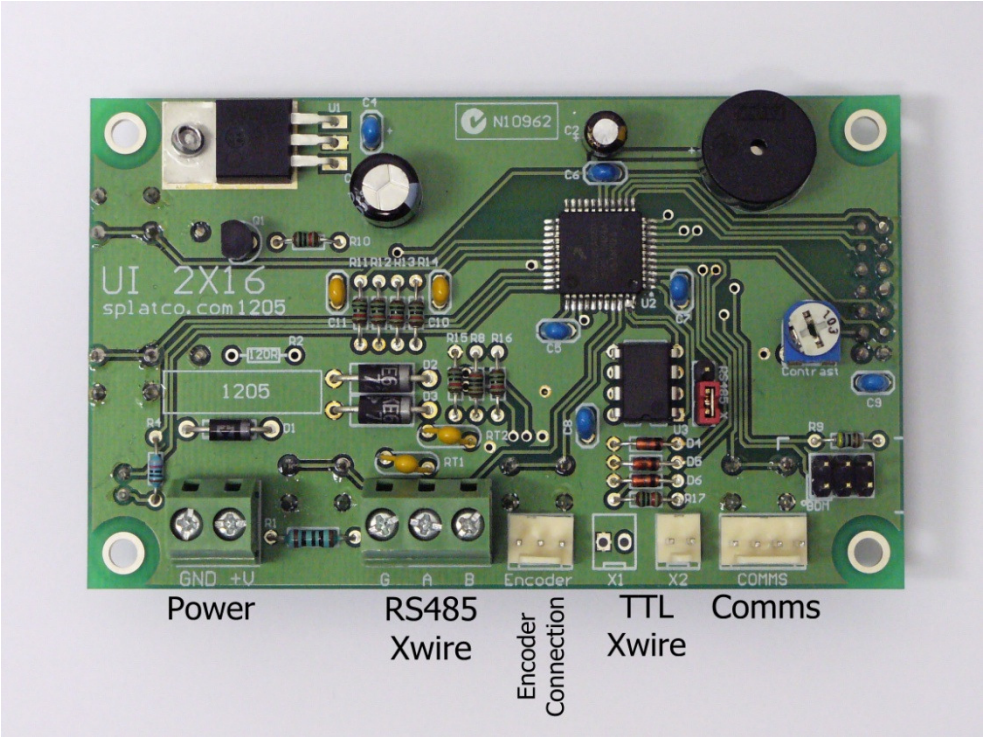
- `OBLCD_Text “Hello World.”`
  displays a text message on the screen
- `OBLCD_fDispW 3,1`
  displays W as a real number in the format ‘nnn.n’
- `OBLCD_SetCur 1,0`
  moves the cursor to the start of the second line, this is where the next characters will be displayed.

Normally these instructions are only used in controllers with a LCD, like the MMI202 and MS120, however they are actually usable on all current SPLat controllers, with or without an LCD. So for example, you can add a user interface to our inexpensive CC18 controller.

The SPLat Xwire bus allows the OBLCD instructions to work remotely. Once setup, no special handling is required. Whence saying OBLCD_Text “Hello World.” will make the message appear on the UI2x16. The Xwire chapter shows how to enable the remote LCD feature.

Connections

The connectors on the UI2x16 are shown and labeled in the picture below.



- **Power**
  This is a 2 way screw terminal block for supplying power to the UI2x16. Refer to the Power Supply section for more details.
- **RS485 Xwire**
  This is the connection for the Xwire bus using RS485 signaling. This interface should be used in preference to the TTL Xwire interface if the UI2X16 is located more than two metres from the master controller, or if the wiring is run in an electrically noisy cabinet. The RS485 interface will work over a distance of 1.2km.
- **Encoder Connection**
  This 3 pin connector allows an external rotary quadrature encoder to be connected to the UI2x16 and is very useful for navigating menu options and changing values quickly. Any encoder with two quadrature signals and a common connection may be used e.g. Digikey part number CT3002-ND. There are three connections to be made if you are using a rotary encoder: A – "A" phase of the rotary encoder, C – common connection, B – "B" phase of the rotary encoder. The pinning of the UI2x16 connector is as follows (viewed from the edge of the board:

- **TTL Xwire**
  This is the low voltage Xwire bus connection. Both X1 and X2 are the same, having two terminals simplifies multi-drop wiring. These terminals should be used only when the distance to other Xwire devices is within a couple of metres or so.
- **Comms**
  This connector is used for programming the UI2X16. The COMMS connector works at 5V CMOS/TTL levels so a PC232 or PCUSB programming cable must be used to connect to a PC. The comms connector may also be used for communicating to other serial devices, but note a level convertor may be required. This port is also capable of MODBUS RTU slave or master.

Power Supply

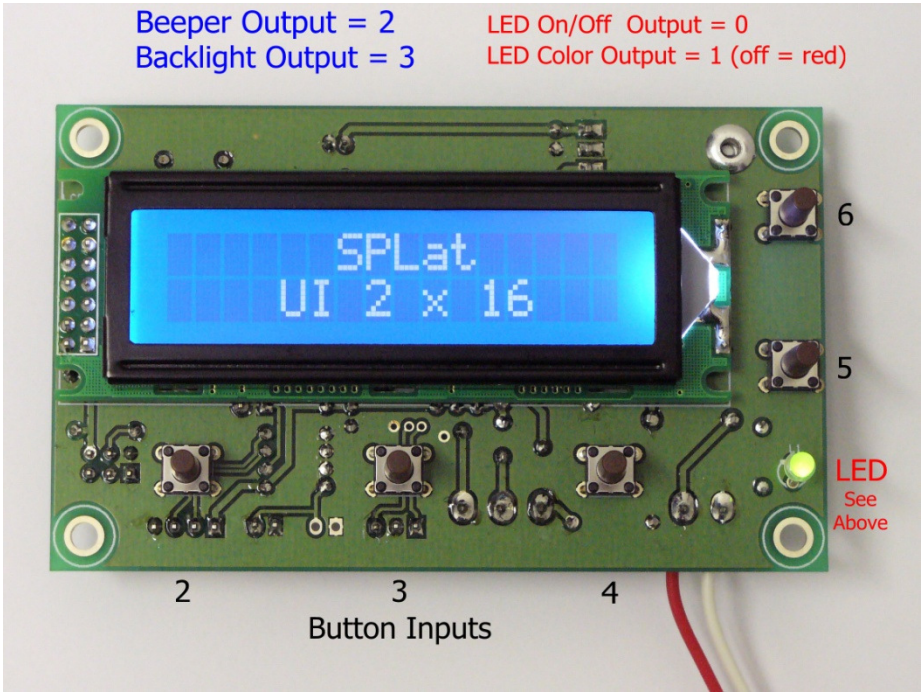
The power supply is connected to the terminals marked “GND” (circuit common or ground) and “+V” (positive supply voltage). Take care to ensure the polarity is correct. In general, the UI2X16 needs a supply voltage between 8VDC and 24VDC and will draw a maximum of 70mA, less if the LEDs, beeper or backlight are off. The voltage is must not exceed 32V.

External Inputs and Outputs

The UI2X16 has no digital or analogue I/O. We made it this way to keep the cost low. If you need built in I/O with a operator interface, have a look at some of our other controllers such as the MMI202 or MS120, or use the UI2x16 with a cost effective controller such as the CC18.

Operator Interface

The digital I/O map for the buttons and LEDs is shown in the picture below.



LED

The LED has two associated outputs. Output 1 selects the colour of the LED where low (aka off) selects red and high (aka on) selects green. Outputs 0 turns the LED on and off. The colour may be selected either before or after the LED has been turned on. Here's an example that the second LED between red & green.

```
On              0       ;turn on the LED
Blink           1       ;alternate red/green
```

Beeper

The beeper may be activated via output 2. In addition, KBeep can be used to provide a brief beep. InputK instructions will provide key press beep feedback.

Backlight

The backlight may be controlled via output 3. However the OBLCD_Dim instruction provides a better automatic way to control the backlight brightness. Be aware the backlight has a limited lifespan (10,000 hours) and dimming or turning it off completely when not in use will increase its operating life.

Buttons

The 5 push button input numbers are shown in the diagram.

Rotary Dial Input

The rotary dial is very useful for navigating menu options and changing values quickly. It may be read via the Onboard Quadrature Counter, refer to the knowledge base for more information. Here's a simple application that counts up or down as the dial is turned. This example is based on the rotary encoder used on the UI4x20:

```
 OBLCD_Dim     1,3,1  ;configure LCD dimming
 OBQC_Clr      0      ;clear the OBQC count
Loop
 OBQC_fGet     0      ;get the current dial count
 fWtoQ                ;put the count in Q
 fLoadW        4.0    ;load the divisor
 fDiv                 ;now the count is 1 count per indent
 OBLCD_SetCur 0,0     ;position text at the top left of the LCD
 OBLCD_fDispW 5,0     ;display the dial count
 Goto          Loop   ;do it all again
```

In the above example, each "click" of the dial is equal to 4 counts. The dial has 24 positions so one full turn of the dial is 96 counts. However the code above changes this so each "click" is a single count, so now a full revolution is 24 counts.

The encoder signals are also available on inputs 0 and 1.

Xwire

The Xwire bus is the primary means of exchanging information between the operator of the UI2x16 and other controllers.

Selecting the Xwire or RS485 interface

The Xwire interface type for the UI2x16 is selected in software using the “Xwire_Phys” instruction. The form of this instruction is:

Xwire_Phys n

Where “n” selects the interface type:

N = 0 TTL Xwire interface selected (default setting)

N = 1 RS485 Xwire interface selected

TTL Xwire should only be used if the distance no more than a couple metres while RS485 is good for distances of up to 1.2km. RS485 is also applicable in noisy electrical environments even if the cable run is short.

Connecting to the Xwire interface

Two connectors on one long side of the board are labeled X1 and X2. These are the TTL Xwire electrical connections. The two connectors are wired in parallel on the board to facilitate daisy chaining, and are completely interchangeable. The left-hand pin of each connector is ground (0V). If you are wiring to other boards with X1/X2 connectors, simply wire like pins together. If wiring to MMi202 or SL100, see the Xwire connection instructions in their documentation. See also wiring in the Xwire documentation.

Connecting to the RS485 interface

The 3-pin screw terminal block is for RS485 connection. The A and B terminals should go to A and B on all other devices on the RS485 system.

The G terminals on all boards in a system should all be connected together. For best results, especially over long distances and/or where the devices each end are powered off different power supplies, use shielded twisted pair cable, and use the shield for the G connection.

Programming

The UI2X16 may be configured as either a Xwire master or an Xwire slave, however configuring as an Xwire slave has an advantage of allowing another controller to simply display information on the UI2X16 LCD with the normal OBLCD instructions.

The Xwire master needs some specific entries in its Xwire table to drive the UI2x16 LCD. The format is as follows:

```
NV0BYTE   249,StartCharacterOffset,NumberOfCharacters,0,0
```

Where:

- `249`: This is the special address reserved for all remote LCDs. If there are one or more UI2X16 controllers on the Xwire bus, they will all display the message.

- `StartCharacterOffset`: This is the offset to the first character that should be displayed on the UI2X16. 0 is the very first character on the first line. 20 is the first character on the second line.
- `NumberOfCharacters`: The number of characters to display where the maximum is 32. As the LCD has 80 characters, multiple Xwire table entries will be required to send the whole screen worth of characters.
- `0,0`: Nothing is sent back, ID 249 is only used for sending LCD characters.

As Xwire messages are limited to 32 bytes, at least 3 Xwire table entries will be required for the whole LCD to be addressed in the UI2x16, for example:

```
NV0Byte        249,0,32,0,0   ;LCD chars 0 thru 31
NV0Byte        249,32,32,0,0  ;LCD chars 32 thru 63
NV0Byte        249,64,20,0,0  ;LCD chars 64 thru 79 + 4 special bytes
```

The combination of StartCharacterOffset and NumberOfCharacters means the master controller can reserve part of the LCD screen. The other part of the LCD can be written directly by the UI2X16.

So, say you only want the master controller to write to the last line of the LCD and leaving the first 3 lines under control of the UI2X16, this is what the Xwire table would contain:

```
NV0Byte        249,60,20,0,0  ;Last line of the LCD chars 60 thru 79
```

There are special bytes at the end of the 80 byte LCD buffer which map LCD features such as cursor type and control etc:

- 80 - LCD type index, sets slave LCD type to masters LCD type
- 81 - LCD cursor on/off, blinking status
- 82 - LCD cursor row address
- 83 - LCD cursor column address

These are optional and only required if you want to display a blinking cursor etc.

Example

The LEDs, buttons and rotary dial require more effort to use. They may be acted upon by a program running in the UI2X16 or simply echoed to the master controller.

For the sake of brevity, this example shows how a CC18 running as an Xwire master may use the UI2X16 as a dumb operator interface:

- The rotary dial position is reported to the CC18 which converts it to 1 count per indent and displays it back on the UI2X16.
- Each button is reported to the CC18 that then lights the LED.

Common to both boards

This is the Xwire memory used for the Xwire buffers that are sent between both boards.

```
                defBLOCK 1
bLEDs           defBYTE     ;all the LEDs are controlled by a single bit
mapped byte
sLED0On         EQU 0       ;LED on bit in the bLEDs byte
sLED0Green      EQU 1       ;LED colour bit in the bLEDs byte

                defBLOCK 5  ; 1 byte + 1 float = 5 bytes
bButtons        defBYTE     ;all the buttons are reported in a single bit
mapped byte
sButton0        EQU 0       ;button bit in the bButton byte
sButton1        EQU 1       ;button bit in the bButton byte
sButton2        EQU 2       ;button bit in the bButton byte
sButton3        EQU 3       ;button bit in the bButton byte
sButton4        EQU 4       ;button bit in the bButton byte
fCounter        defFLOAT    ;the counter is reported as a float
```

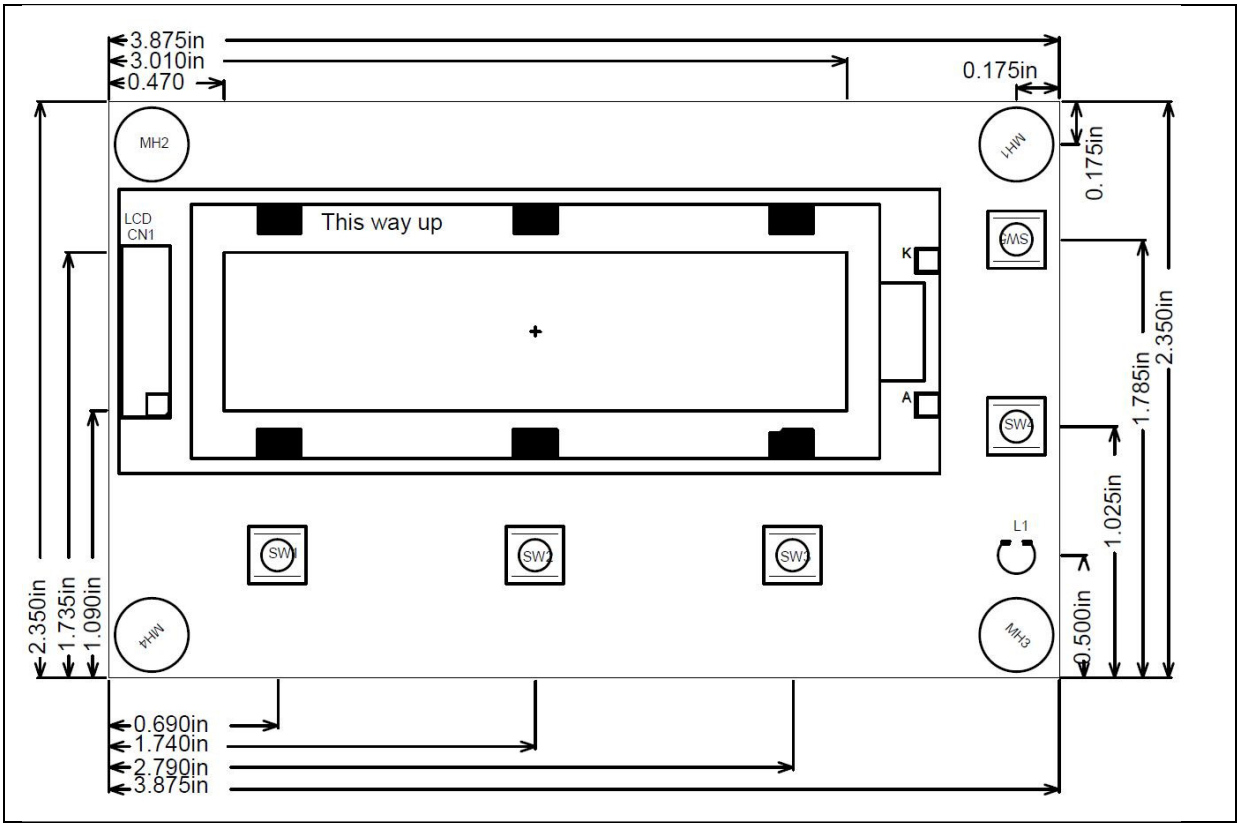
UI2X16 code

```
; Start of code, first some initialisation
 OBLCD_Dim      1,3,1       ;configure LCD dimming
 OBQC_Clr       0           ;clear the OBQC count
 LoadX          0           ;we'll use Xwire address 0 for buttons and LEDs
 XwireSetAddr               ;set our address
 XwireSlave     pXwireSlave ;start running as an Xwire slave

Loop
 Recall         bLEDs       ;get the LED values
 LoadX          %00000011   ;load the output
 OutputM        0           ;drive the LED outputs

 InputFM        2           ;read all the buttons
 Store          bButtons    ;place in the Xwire buffer

 OBQC_fGet      0           ;get the current dial count
 fStore         fCounter    ;place in the Xwire buffer
 Goto           Loop        ;do it all again

; Start of nonvolatile memory
 NVEM0
pXwireSlave     NV0Byte bButtons,5,bLEDs,1
```

CC18 example code

```
; Start of code, first some initialisation
 OBLCD_type    2            ;select 2 x 16 character display
 XwireMaster   pXwireMaster ;start running as an Xwire slave

Loop
 OBLCD_SetCur  0,0          ;position text at the top left of the LCD
 fRecallQ      fCounter     ;get the dial position
 fLoadW        4.0          ;divide by 4
 fDiv                       ;now the count is 1 count per indent
 OBLCD_fDispW  5,0          ;display the dial count

 ;light the LED when a button is pressed
 RecallS       sButton0,bButtons
 RecallS       sButton1,bButtons
 or
 RecallS       sButton2,bButtons
 RecallS       sButton3,bButtons
 or
 RecallS       sButton4,bButtons
 or
 or
 StoreS        sLED0On,bLEDs

 Goto          Loop         ;loop over and do it again

; Start of nonvolatile memory
 NVEM0
pXwireMaster
 NV0Byte       249,0,32,0,0         ;LCD chars 0 thru 31
 NV0Byte       249,80,4,0,0         ;LCD chars 80 thru 83 are control bytes
 NV0Byte       0,bLEDs,1,bButtons,5 ;buttons and LEDs
 NV0Byte       255                  ;end of table
```

Dimensions (inches)



Dimensions (mm):