

# pixxiLCD-13P2 Series

pixxiLCD-13P2

pixxiLCD-13P2-CTP-CLB



## Datasheet

Revision 1.2

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## 1. Description

The pixxiLCD-13 is part of the new and revolutionary pixxiLCD series of embedded graphics displays designed and manufactured by 4D Systems. Developed with a low total cost of ownership in mind, this 1.3" colour IPS TFT-LCD compact Intelligent Display module offers an array of functionality and options for any designer, integrator or user.

The 1.3" display is IPS, making it have very wide viewing angles.

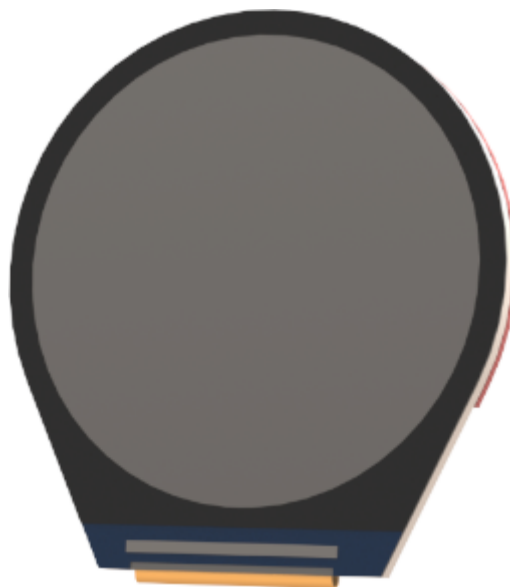
The pixxiLCD-13 is powered by the configurable PIXXI-28 graphics processor, allowing various functionalities such as touch detection, serial flash memory storage, GPIO, and ADC, along with multiple millisecond resolution timers, and UART and I2C communication.

The pixxiLCD-13 embedded graphics displays come in two variants:

- Capacitive touch (pixxiLCD-13P2-CTP-CLB)
- Non-touch (pixxiLCD-13P2)

The pixxiLCD embedded graphics displays are 100% compatible with the Workshop4 IDE, which provides users with a wealth of options for programming and controlling their system.

The pixxiLCD embedded graphics displays feature a standard 15-way, 0.5mm pitch ZIF socket interface which carries the UART, I/O, I2C, power, and reset signals to/from the display.



*The pixxiLCD-13P2*

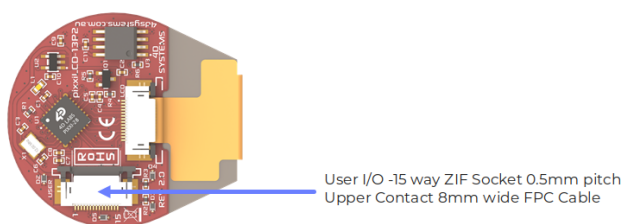
## 2. Features

- Powerful 1.3" Intelligent TFT IPS display module powered by PIXXI-28
- 240 x 240 Resolution, RGB 65K true to life colours, TFT Screen
- Capacitive Touch Panel (pixxiLCD-13P2-CTP-CLB)
- 32KB of Flash memory for user application code.
- 14KB of SRAM for user variables.
- 16MB Serial Flash memory chip for multimedia storage, data files, fonts, or for holding extra code functions (to expand the code storage of the processor).
- 3 General Purpose I/O pins for user interfacing, 2 of which are configurable as analog inputs or as I2C.
- Master I2C port (maximum supported speed is fast I2C) for user application devices.
- UART port, Asynchronous hardware serial, with 300 to 2187500 baud, for interfacing with a Host or Slave device. The Serial port is also used for device programming.
- Display full-colour images, animations, icons, and video clips.
- Supports all available Windows fonts.
- Free comprehensive Software Development Tools (Workshop4) provide drag-and-drop style and coding environments for rapid application development, upgradable to Workshop4 PRO for additional features.
- Standard 15-way, 0.5mm pitch ZIF socket interface which carries the UART, I/O, I2C, power, and reset signals to/from the display.
- Single 5.0 Volt Supply (4.0V to 5.5V range).
- Display Dimensions:
  - (pixxiLCD-13P2): 35.5 x 38.0 x 5.1 mm
  - (pixxiLCD-13P2-CTP-CLB): 49.0 x 49.0 x 5.8 mm
- Weight:
  - pixxiLCD-13P2: ~ 5g
  - pixxiLCD-13P2-CTP-CLB: ~ 10g
- RoHS, REACH and CE compliant.
- PCB is UL 94V-0 Flammability Rated

### 3. Typical Applications

- General purpose low-cost embedded graphics.
- Elevator control systems
- Point of sale terminals.
- Electronic gauges and metres.
- Test and measurement and general-purpose instrumentation.
- Industrial control and Robotics.
- Automotive system displays.
- GPS/Sat-Nav systems.
- Medical instruments and applications.
- Heart rate and Blood pressure monitors.
- Smart Home Automation display panels.
- Consumer appliance devices.
- Security and Access control panels.
- Air conditioner control panels.
- Lighting control panels.
- Vending machine panels.
- Power meter panels.
- Gaming equipment and much more.

## 4. Hardware Overview



*FPC Pinout*



### USER I/O -- 15 way FPC

Pin	Symbol	I/O	Description
1	GND	P	Device Ground.
2	+3.3V	P	3.3V Output of the internal voltage regulator.
3	+5V	P	Device Positive Supply.
4	+5V	P	Device Positive Supply.
5	GND	P	Device Ground.
6	GND	P	Device Ground.
7	TX	O	Dedicated Asynchronous Serial Port Transmit pin, TX. This pin outputs 3.3V levels.
8	RX	I	Dedicated Asynchronous Serial Port Receive pin, RX. This pin is 5.0V tolerant.
9	RESET	I	Master Reset signal. This pin is 3.3V tolerant only. Active Low.
10	--	--	Not Connected
11	--	--	Not Connected
12	IO3	I/O	This pin is available as a GPIO pin or as a Pulse Width Modulated (PWM) Audio output pin. This pin outputs 0V or 3.3V levels and is 3.3V tolerant as an input.
13	IO2	A/I/O	This pin is available as a General Purpose I/O pin with analog capability. It can also be configured as an I2C Data In/Out pin, SDA1. This pin outputs 3.3V levels and is 3.3V tolerant only.
14	IO1	A/I/O	This pin is available as a General Purpose I/O pin with analog capability. It can also be configured as an I2C clock output pin, SCL1. This pin outputs 3.3V levels and is 3.3V tolerant only.
15	GND	P	Device Ground.



### Note

**I** = Input, **O** = Output, **P** = Power, **A** = Analog

## 5. Hardware Interface - Pins

This section describes the hardware interface pins of the pixxiLCD-13 embedded graphics displays.

The pixxiLCD-13 has the essential hardware peripherals configured for interfacing with other external devices -- general-purpose digital input/output, analog input, UART, and I2C.

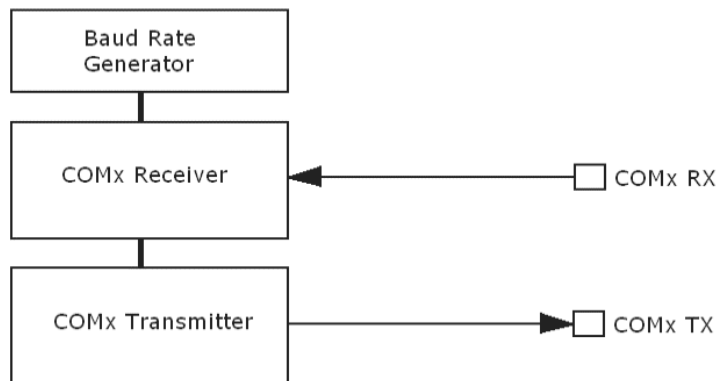
This section discusses the peripherals relevant only to the pixxiLCD embedded graphics displays. For complete information on the hardware peripherals of the PIXXI-28 graphics processor, refer to the [PIXXI-28 graphics processor datasheet](#)

### 5.1. Serial Ports -- TTL Level

The PIXXI-28 Processor has a single hardware asynchronous serial port (COM0), with fixed pins TX/RX. The PIXXI-28's serial ports can be used to communicate with external serial devices and are also used for programming the PIXXI-28 itself.

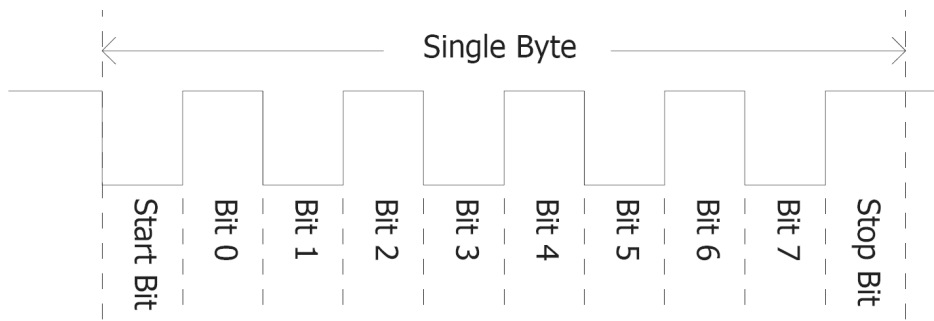
The primary features are:

- Full-Duplex 8-bit data transmission and reception.
- Data format: 8 bits, No Parity, 1 Stop bit.
- Independent Baud rates from 300 baud up to 2187500 baud.
- Single byte transmits and receives a fully buffered service. The buffered service feature runs in the background capturing and buffering serial data without the user application having to constantly poll any of the serial ports. This frees up the application to service other tasks.



A single-byte serial transmission consists of the start bit, 8 bits of data followed by the stop bit. The start bit is always 0, while a stop bit is always 1. The LSB (Least Significant Bit, Bit 0) is sent out first following the start bit.

The figure below shows a single-byte transmission timing diagram.



COM0 is the programming interface for User program downloads and PmmC programming. Once the compiled 4DGL application program (EVE byte-code) is downloaded and the user code starts executing, the serial port is then available to the user application.

**TX pin (Serial Transmit COM0):**

Dedicated Asynchronous Serial port COM0 transmit pin, TX. Connect this pin to the external serial device receiving (RX) signal. This pin outputs at 3.3V levels.

**RX pin (Serial Receive COM0):**

Dedicated Asynchronous Serial port COM0 receive pin, RX. Connect this pin to an external serial device transmit (TX) signal. This pin is 5.0V tolerant.

UART Pin	pixxiLCD FPC Pin
TX	7
RX	8

**Note**

Serial port outputs at the level of TTL 3.3V, however, are 5V tolerant, so can accept communications from 5V devices.



## 5.2. General Purpose I/O

The pixxiLCD-13 has three general-purpose input/output (GPIO) pins available. The table below shows the allocation of the GPIO pins on the pixxiLCD flex interface.

GPIO Pin	pixxiLCD FPC Pin	Pin Name	Analog Capable
<b>IO1</b>	7	IO1_PIN	✓
<b>IO2</b>	8	IO2_PIN	✓
<b>IO3</b>	9	IO3_PIN	-

GPIO pins IO1, IO2 and IO3 can be individually set as a digital input or output. The pin mode of all the pins at power-up or reset is input by default. When set as digital inputs, the pins are 3.3V tolerant. Digital GPIO pins can only source/sink 15 mA.

GPIO pins IO1 and IO2 can also serve as analog input pins. The pin mode of all the pins at power-up or reset is input by default. The analog input pins have a range of 0 to 3.3V, each having a maximum 12-bit resolution.

## 5.3. I2C Interface

The I2C peripheral operates up to 1 MHz, supporting standard mode, full speed, and fast mode.

The pixxiLCD-13 can only function as a Master in an I2C bus.

The following table illustrates which of the GPIO pins can be used for I2C communication.

GPIO Pin	pixxiLCD FPC Pin	I2C Pin Function
<b>IO1</b>	7	SCL1
<b>IO2</b>	8	SDA1
<b>IO3</b>	9	-

I2C clock output pin, SCL1. Connect this pin to the SCL pin of an external I2C device.

I2C data input/output pin, SDA1. Connect this pin to the SDA pin of an external I2C device.

## 5.4. System Pins

### **+5V (Device Supply Voltage):**

Display supply voltage pin. This pin should be connected to a stable supply voltage in the range of 4.0 Volts to 5.5 Volts DC. The nominal operating voltage is 5.0 Volts.

### **+3.3V (Device Output Voltage):**

3.3V Output of the internal voltage regulator. Limited to approximately 250mA, for external use.

### **GND (Module Ground):**

Device ground pin. This pin must be connected to the system ground.

### **RESET (Module Master Reset):**

Device Master Reset pin. An active low pulse of greater than 2 microseconds will reset the device. Only use open collector-type circuits to reset the device if an external reset is required. This pin is not driven low by any internal conditions.

## 6. Display Features

The pixxiLCD embedded graphics displays are designed to accommodate most applications. Some of the main features of the module are listed below.

### 6.1. PIXXI-28 Processor

The module is designed around the PIXXI-28 Graphics Controller from 4D-Labs.



The pixxiLCD-13 embedded graphics display is designed around the PIXXI-28, a configurable graphics controller from 4D Systems.

The PIXXI-28 can be configured to interface with many popular TFT-LCD and OLED displays.

The PIXXI-28 features a configurable core and hardware layer, which allows it to support LCD modules with various SPI display drivers and touch interfaces. Supported display interfaces include 3-wire serial SPI, 4-wire serial SPI and MCU 8-bit. Additionally, it has support for touch interfaces like the 4-wire resistive touch panel interface and capacitive touch panel interface through an I2C touch controller.

The pixxiLCD-13 embedded graphics displays are configured to utilize the 3-wire serial SPI configuration of the PIXXI-28 graphics processor.

The table below lists the exact PIXXI-28 configuration mode used by each variant of the pixxiLCD-13.

<b>pixxiLCD-13 Variant</b>	<b>PIXXI-28 Configuration</b>
pixxiLCD-13P2	3-Wire SPI Display, Non-touch
pixxiLCD-13P2-CTP-CLB	3-Wire SPI Display, Capacitive Touch

You can refer to the [PIXXI-28 graphics processor datasheet](#).

## 7. Display/Module Precautions

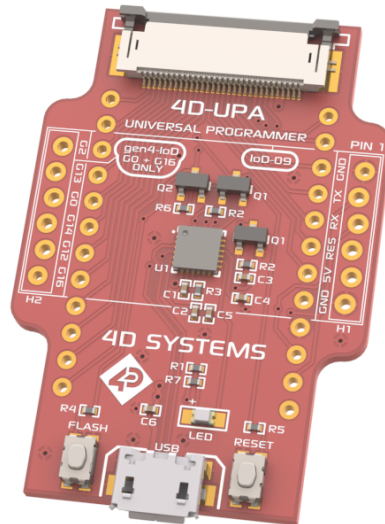
- Avoid having to display the same image/object on the screen for lengthy periods. This can cause a burn-in which is a common problem with all types of display technologies. Blank the screen after a while or dim it very low by adjusting the contrast. Better still; implement a screen saver feature.
- Moisture and water can damage the display. Moisture on the surface of a powered display should not cause any problems; however, if water is to enter the display either from the front or from the rear, and contact the electronics, it will damage. Wipe off any moisture gently or let the display dry before usage. If using this display module in an environment where it can get wet, ensure an appropriate enclosure is used.
- Dirt from fingerprint oil and fat can easily stain the surface of the display. Gently wipe off any stains with a soft lint-free cloth.
- The performance of the display will degrade under high temperatures and humidity. Avoid such conditions when storing.
- Do not tamper with the display flex cable or the components on the flex. This may affect the connection between the display and the driving circuitry and cause failure.
- Displays are susceptible to mechanical shock and any force exerted on the module may result in deformed zebra stripes, a cracked display cell and a broken backlight
- Display modules have a finite life, which is typically dictated by the display itself, more specifically the backlight. The backlight contains LEDs, which fade over time. In the Specifications section is a figure for the typical life of the display, and the criteria are listed.
- The resistive Touch model features a touch-sensitive film over the display which is sensitive to pressure. Take note when mounting the display module in an enclosure that pressure is not applied to the surface of the display by the enclosure, false touches will occur, or the touch will simply not function at all.

## 8. Hardware Tools

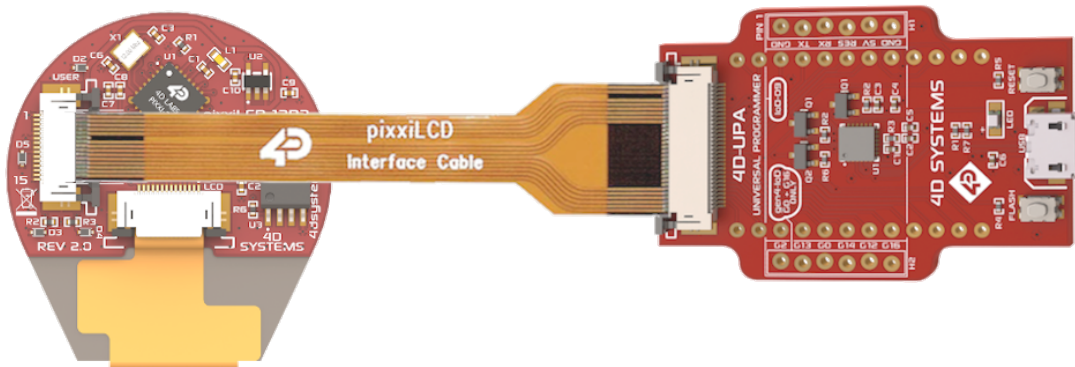
The following hardware tools are required for full control of the pixxiLCD-13 embedded graphics display.

### 8.1. 4D-UPA Programming Adaptor

The 4D-UPA Programming Adaptor is an essential hardware tool to program, customise and test the pixxiLCD display.



This connects to the pixxiLCD display through a 15-way-to-30-way cable.



The 4D-UPA is used to update the PmmC and to download compiled 4DGL code into the processor. It also serves as an interface for communicating serial data to the PC.

The 4D-UPA is a Universal programmer, and therefore, it may also be used for other 4D Systems products. Please refer to the [4D-UPA Datasheet](#) for more information.

You can get the 4D-UPA from the [4D Systems website](#).

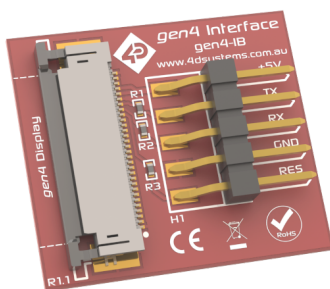
Using a non-4D programming interface could damage your processor, and **void your Warranty**.

## 8.2. Interface Board

The Interface boards (gen4-IB) ship with each pixxiLCD Display Module unless otherwise stated and are used to aid in interfacing the serial UART to other devices such as a 4D Arduino Adaptor Shield, Serial Pi Adaptor, Breadboard, etc.

It does not break out all of the signals such as the GPIO, however, it provides the basics to allow communications with an external device using the Serial UART.

Simply connect the supplied 30-way end of the 15-30 way FPC cable into the ZIF connector on the Interface Board and the 15-way end into the PixxiLCD module. The 5-way header on the Interface Board is then available to connect your external device.



Alternatively, interfacing of the pixxiLCD display module can be done using a 15-way FPC directly to your product/project, without utilising the 15-to-30 FPC or the Interface board supplied. This would be the most efficient solution for a final designed product.

## 9. Programming Language

The PIXXI-28 processor belongs to a family of processors powered by a highly optimised soft-core virtual engine called EVE (Extensible Virtual Engine). EVE was designed and created by 4D Systems in the early 2000s.

EVE is a proprietary, high-performance virtual machine with an extensive byte-code instruction set optimised to execute compiled 4DGL programs.

4DGL (4D Graphics Language) was specifically developed from the ground up for the EVE engine core. It is a high-level language that is easy to learn and simple to understand yet powerful enough to tackle many embedded graphics applications.

4DGL is a graphics-oriented language allowing rapid application development, and the syntax structure was designed using elements of popular languages such as C, Basic, Pascal and others.

Programmers familiar with these languages will feel right at home with 4DGL. It includes many familiar instructions such as `IF..ELSE..ENDIF`,

`WHILE..WEND`, `REPEAT..UNTIL`, `GOSUB..ENDSUB`, `GOTO`, `PRINT` as well as some specialised instructions `SERIN`, `SEROUT`, `GFX_LINE`, `GFX_CIRCLE` and many more.

For detailed information about the 4DGL language, please refer to the following documents:

- [4DGL Programmers Reference Manual](#)
- [Pixxi Internal Functions Manual](#)

To assist with the development of 4DGL applications, the Workshop4 IDE combines a full-featured editor, a compiler, a linker and a downloader into a single PC-based application. It's all you need to code, test and run your applications.

4DGL is available to be written in two of the four environments offered by Workshop4 IDE, Designer and ViSi. The other two environments, Serial and ViSi-Genie do not directly use 4DGL by the User (Except in Workshop4 Pro, for ViSi-Genie), however, it is present in the background. Serial is an application that runs, and that is written in 4DGL. ViSi-Genie automatically generates 4DGL itself based on what is configured in the GUI.

## 10. Workshop4 IDE

Workshop4 is a comprehensive software IDE that provides an integrated software development platform for all of the 4D family of processors and modules. The IDE combines the Editor, Compiler, Linker and Downloader to develop complete 4DGL application code. All user application code is developed within the Workshop4 IDE.



The Workshop4 IDE supports multiple development environments for the user, to cater to different user requirements and skill levels.

- The **Designer** environment enables the user to write 4DGL code in its natural form to program the range of 4D Systems' intelligent displays.
- A visual programming experience, suitably called **Visi**, enables drag-and-drop type placement of objects to assist with 4DGL code generation and allows the user to visualise how the display will look while being developed.
- An advanced environment called **Visi-Genie** doesn't require any 4DGL coding at all, it is all done automatically for you. Simply lay the display out with the objects you want, set the events to drive them and the code is written for you automatically. This can be extended with additional features when a Workshop4 PRO license is purchased from the 4D Systems website. Extended Advanced features for Visi-Genie are available in the PRO version of WS4. Further details are explained under the **Visi Genie** section of the Workshop4 documentation.
- A **Serial** environment (aka SPE 'Serial Platform Environment') is also provided to transform the display module into a slave serial module, allowing the user to control the display from any host microcontroller or device with a serial port using predefined serial commands.

For more information regarding these environments, refer to the [Workshop4 manuals](#).

The Workshop 4 IDE is available from the [4D Systems website](#).



## 10.1. PmmC Programming

The PIXXI-28 processor is a custom graphics processor. All functionality including the high-level commands is built into the chip. This chip-level configuration is available as a PmmC (Personality-module-micro-Code) file, which can be likened to traditional Firmware.

A PmmC file contains all of the low-level micro-code information (analogy of that of a soft silicon) which defines the characteristics and functionality of the device. The ability of programming the device with a PmmC file provides an extremely flexible method of customising as well as upgrading it with future enhancements.

The Display Driver is located inside the PmmC for pixxi-28 and contains the initialisation and parameters associated with the particular display that is to be connected to the PIXXI-28 processor, along with product-specific settings and parameters which are required over and above what is found in the PmmC.

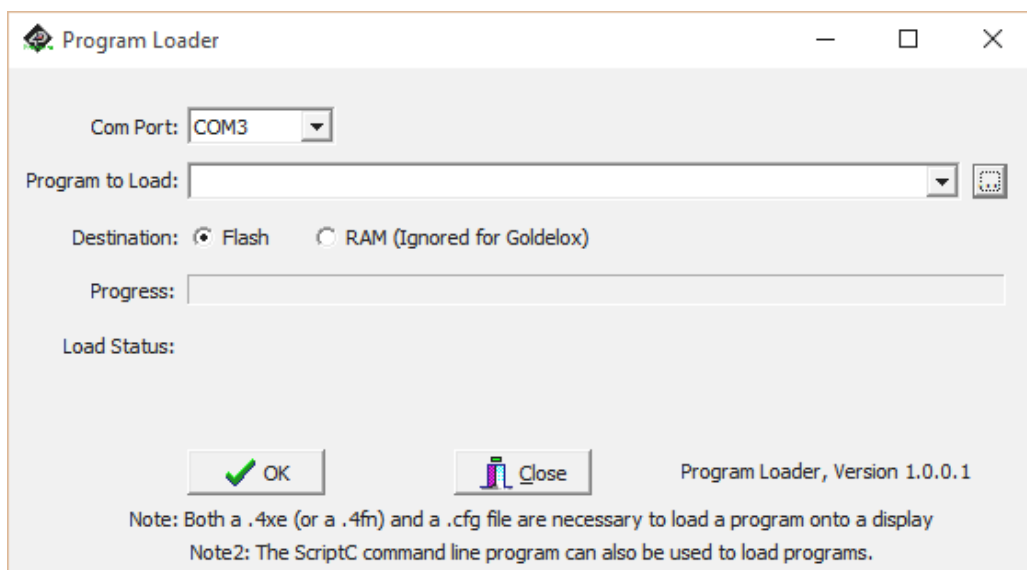
The PmmC file can only be programmed into the device with the aid of Workshop 4, the 4D Systems IDE software, or its supporting tools.

Solutions, which remove the need to use Workshop4 to program the display, are available for commercial customers requiring batch programming or production line programming. These solutions are practical for production staff to minimize the chance of unwanted or unauthorised modifications on the production line.

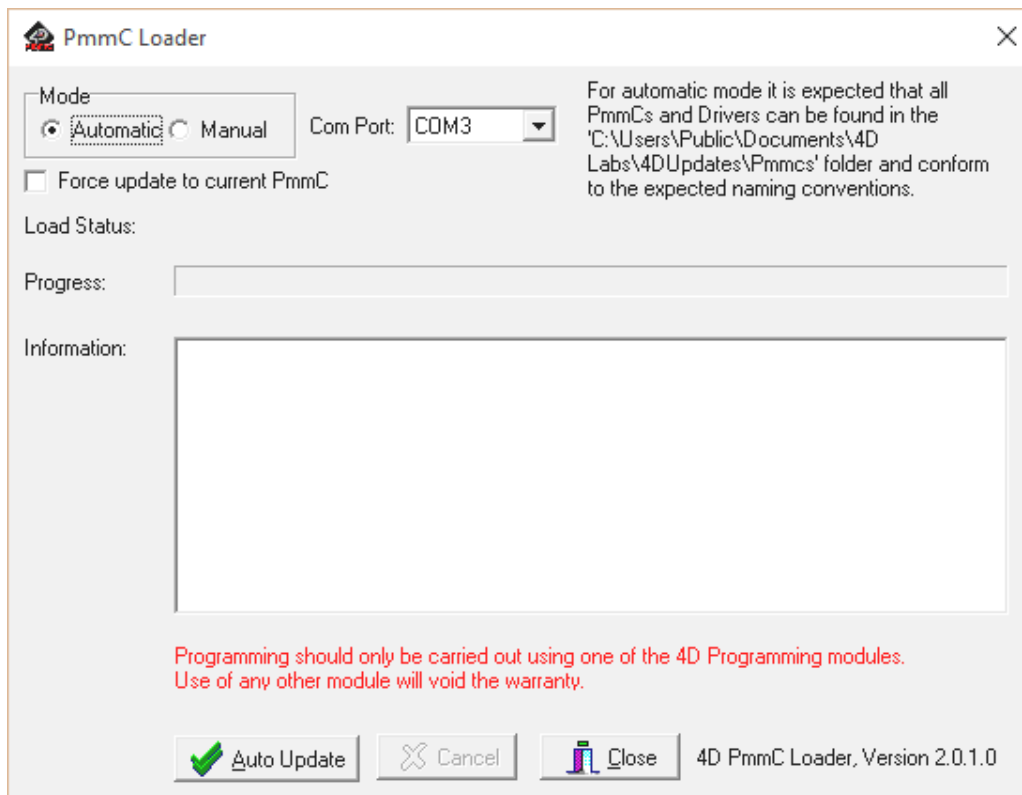
Three solutions come with the Workshop4 IDE, which can be separated for production line computers if required, **ScriptC**, **PmmC Loader** and **Program Loader**.

**ScriptC** is a command line interface that can be controlled from a Batch Script or similar, useful for repetitive loading or when controlled from an external application. Example scripts are provided, showing how to load PmmC, Display Drivers and Applications using a batch script.

**Program Loader** is a GUI interface designed to download Applications to either Flash or RAM, useful for testing or production loading, without the need for Workshop4 itself.



**PmmC Loader** is a GUI interface designed to download PmmC's and Drivers to 4D Systems Processors. It can automatically update existing PmmC's and Drivers present on a module or manually change or force download to a blank processor or module, overwriting anything written in previously.



Please contact our Support Team for more information on what we can provide. Some solutions also exist for external processor-based loading, if there is a requirement for that. This solution is available under NDA.

Using a non-4D programming interface could damage your module, and **void your Warranty.**

## 11. Display Module Part Numbers

The following is a breakdown of the part numbers and what they mean.

### Example:

- pixxiLCD-13P2
- pixxiLCD-13P2-CTP-CLB

where:

pixxiLCD - pixxiLCD Display Range

13 - Display size (1.3")

P2 - PIXXI-28 Processor

CTP - Capacitive Touch Panel

CLB - Cover Lens Bezel

### Note

- A product without a CTP in the part number is a non-touch variant.
- Cover Lens Bezels (CLB) are glass fronts for the display module with overhanging edges, which allow the display module to be mounted directly into a panel using special adhesive on the overhanging glass. This is available for capacitive touch only.

## 12. Cover Lens Bezel -- Tape Spec

The perimeter of the CLB display modules features double-sided adhesive tape, designed to stick directly onto a panel, enclosure, box etc without the need for any mounting screws or hardware.

The tape used is 3M 9495LE tape, which uses well-known and strong 3M 300LSE adhesives.

The double-sided adhesive has a thickness of 0.175mm once the backing has been removed.

You can find more information about the adhesive on the 3M website.

## 13. Starter Kit

4D Systems highly recommends all first-time buyers of 4D Systems' displays, to purchase the Starter Kit when purchasing their first 4D Systems display solution.

The Starter Kit provides all the hardware that is required to get the User up and running.

Not all development environments and features will be needed by every User. However, purchasing the display solution in a Starter Kit allows you to take full advantage of all of the features of the 4D Systems Display Solution and try out each of the 4D Workshop4 Environments before settling with the preferred feature set.

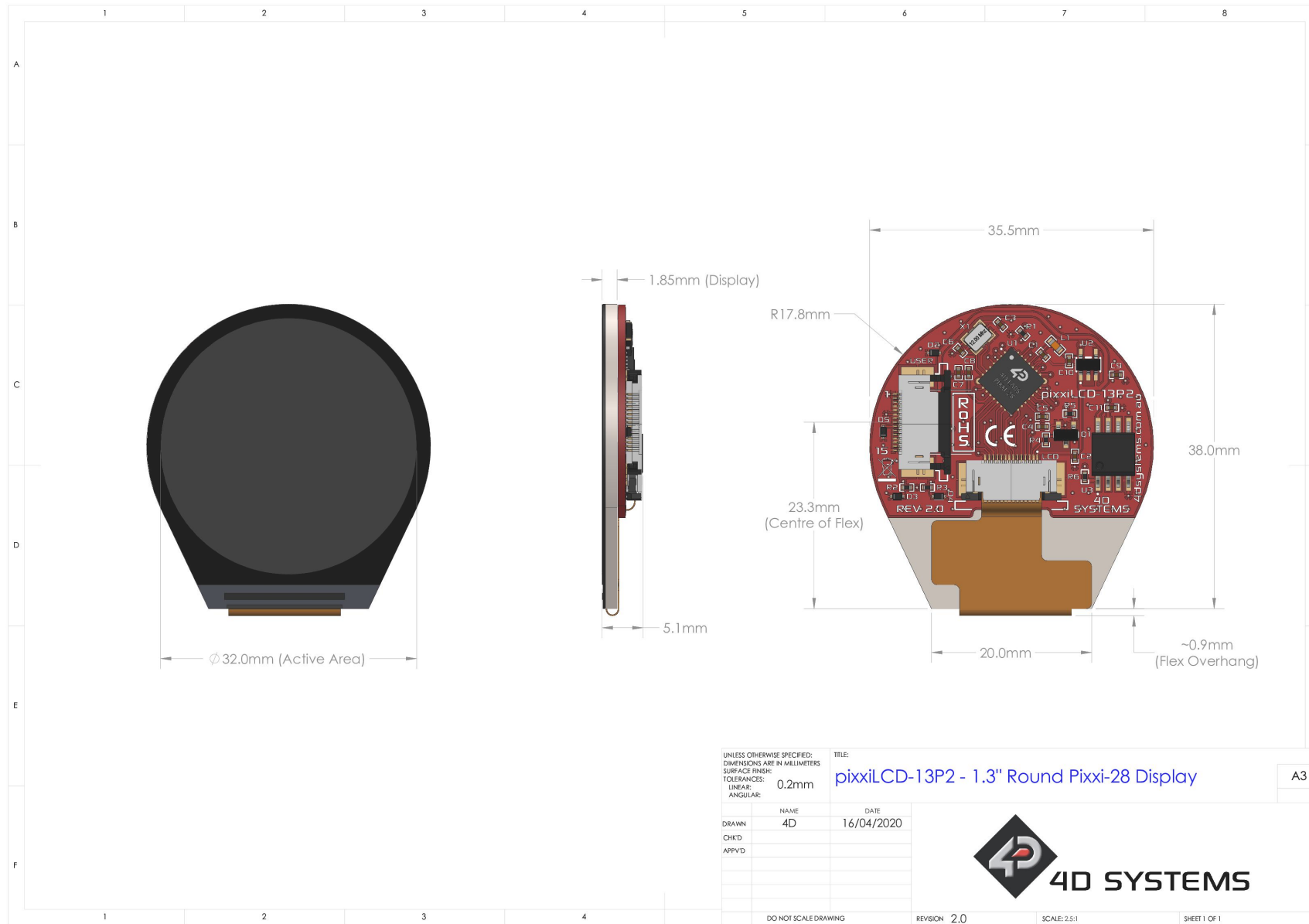
Starter Kits typically include:

- pixxiLCD-13 Embedded Graphics Display
- 4D Universal Programming Adaptor (4D-UPA)
- 150mm 15-way-to-30-way FFC cable for connecting pixxi Adaptor Board to the 4D-UPA or gen4-IB
- gen4 Interface Module (gen4-IB)
- 5-way Female-Female ribbon cable for easy connection to a host or breadboard via the gen4-IB
- 5-way Male-Male adaptor (for converting the Female-Female cable to be Male-Female)

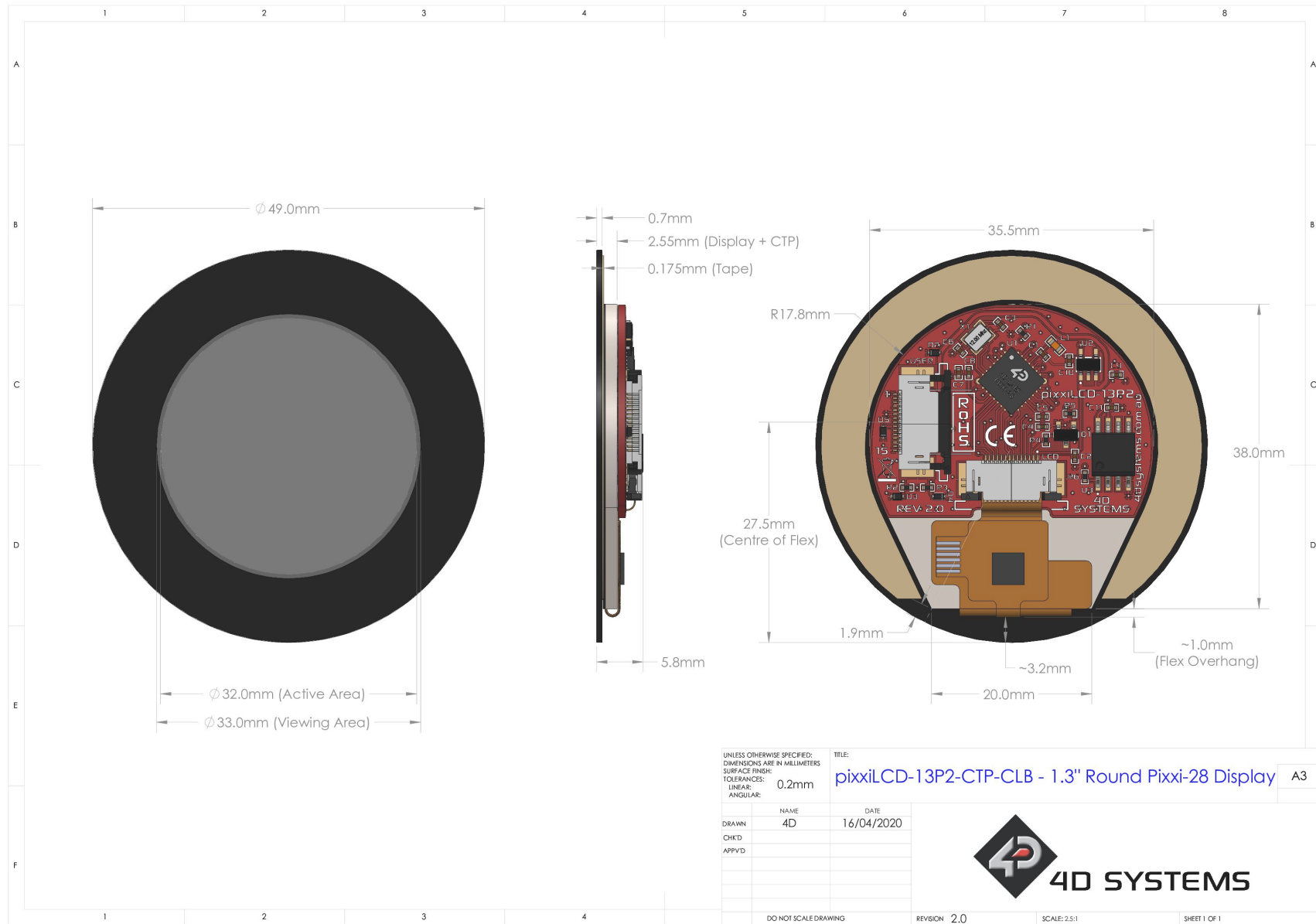
Please refer to the [4D Systems website](#) for the current components included in the Starter Kit.

Simply select the Starter Kit option when purchasing the chosen display module on the 4D Systems shopping cart, or from your local distributor.

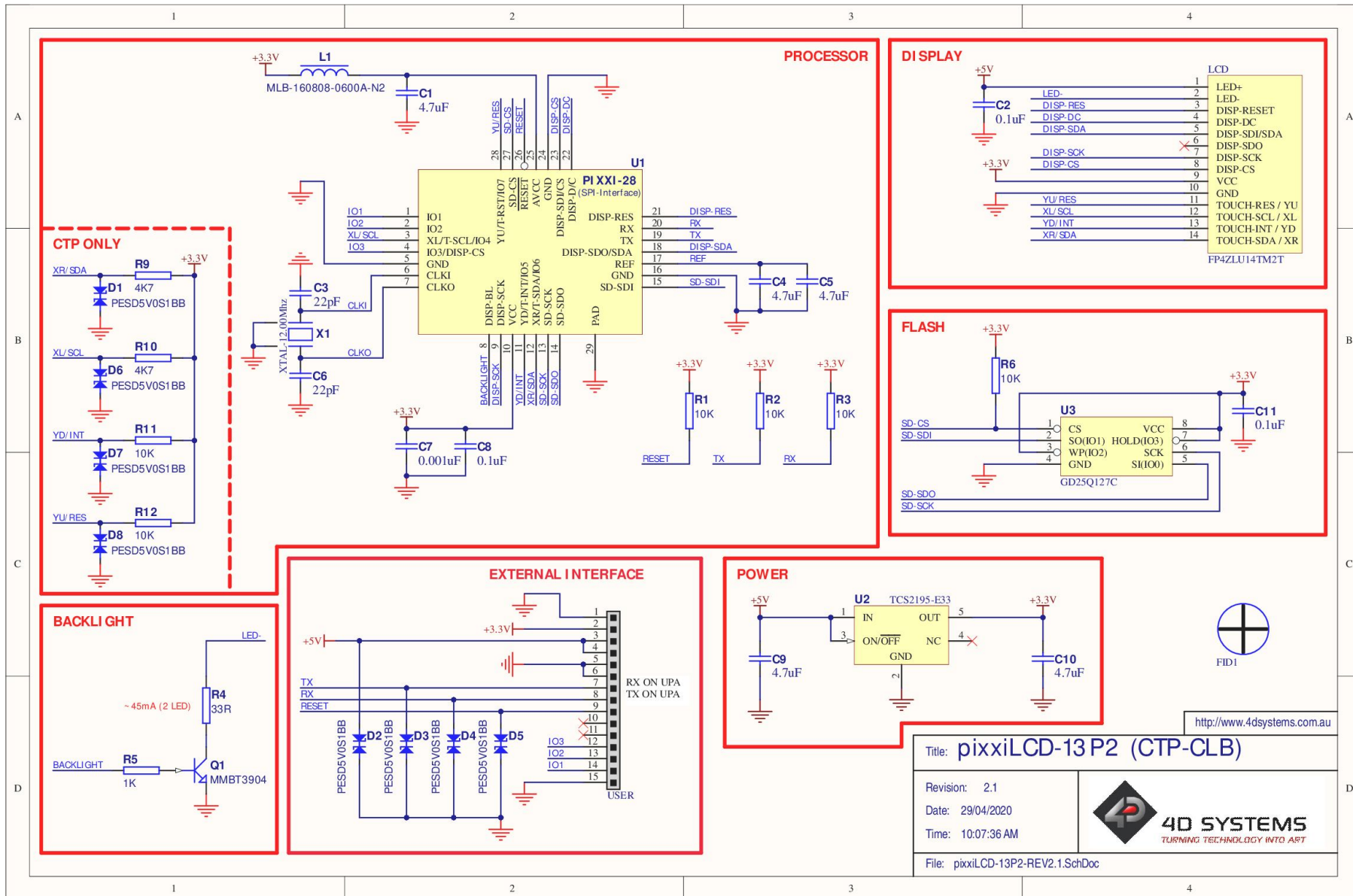
### 14. Mechanical Details (Non-Touch)



# 15. Mechanical Details (Capacitive Touch with Cover Lens Bezel)



# 16. Schematic Details - REV 2.1



## 17. Specifications

### ABSOLUTE MAXIMUM RATINGS

Operating ambient temperature	-13°C to +70°C
Storage temperature	-30°C to +80°C
Voltage on VCC with respect to GND	-0.3V to 6.0V
Maximum current sunk/sourced by any pin	15.0mA

### Note

Stresses above those listed here may cause permanent damage to the device. This is for stress rating only and functional operation of the device at those or any other conditions above those indicated in the recommended operation listings of this specification is not implied. Exposure to maximum rating conditions for extended periods may affect device reliability.

### RECOMMENDED OPERATING CONDITIONS

Parameter	Conditions	Min	Typ	Max	Units
Supply Voltage (VCC)	Stable external supply required	4.0	5.0	5.5	V
Processor voltage (VP)		--	3.3	--	V
Operating Temperature		-10	--	+60	°C
Input Low Voltage (VIL)	all pins	GND	--	0.2VP	V
Input High Voltage (VIH)	non 5V tolerant pins	0.8VP	--	3.3	V
Input High Voltage (VIH)	5V Tolerant Pins, RX pin	0.8VP	--	5.5	V
Reset Pulse	External Open Collector	1.3	--	--	µs
Operational Delay	Power-Up or External Reset	500	--	3000	ms




**GLOBAL CHARACTERISTICS BASED ON OPERATING CONDITIONS**

Parameter	Conditions	Min	Typ	Max	Units
Supply Current (ICC)	5V Supply -- pixxiLCD-13P2	--	100	--	mA
Supply Current (ICC)	5V Supply -- pixxiLCD-13P2CTP-CLB	--	105	--	mA
Display Endurance	Hours of operation, measured to when the display is 50% original brightness	30000	--	--	H
CLB Display Hardness	Hardness of the CLB Glass	--	6	--	H


**LCD DISPLAY INFORMATION**

Parameter	Conditions	Specification
Display Type		TFT IPS LCD
Display Size		1.3" Diagonal
Display Resolution		240X240 (Portrait View)
Display Brightness	5V Supply, pixxiLCD-13P2	300 cd/m2 (typical)
	5V Supply, pixxiLCD-13P2-CTP-CLB	270 cd/m2 (typical)
Display Contrast Ratio	Typical	800:1
Display Viewing Angles	Above Centre	80 Degrees
	Below Centre	80 Degrees
	Left of Centre	80 Degrees
	Right of Centre	80 Degrees
Display Viewing Direction		ALL (IPS Display)
Display Backlighting	White LED Backlighting	1x2 Parallel LED's
Pixel Pitch		0.133 x 0.133 mm (Square pixels)
Pixel Density	Number of pixels in 1 row in 25.4mm	191 DPI/PPI

## 18. Revision History



### Hardware Revision

Revision Number	Date	Description
2.0	06/04/2020	Initial prototype
2.1	29/04/2020	Minor PCB fixes and improvements



### Datasheet Revision

Revision Number	Date	Description
1.0	10/06/2020	Initial release version
1.1	13/01/2021	Updated Logo and Home page imagery
1.2	07/12/2022	Modified datasheet for web-based documentation