



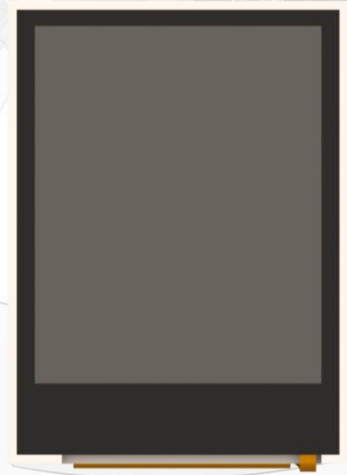
**4D SYSTEMS**  
*TURNING TECHNOLOGY INTO ART*

PIXXI DISPLAY MODULE SERIES

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# DATASHEET

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**pixxiLCD-20P2** (Non-touch)  
**pixxiLCD-20P2-CTP-CLB** (Capacitive touch)

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Please refer to the 4D Systems website for the latest  
Revision of this document

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## 1. Description

The pixxiLCD-20 is part of the new and revolutionary pixxiLCD series of embedded graphics displays designed and manufactured by 4D Systems. Developed with low total cost of ownership in mind, this 2.0" colour TFT-LCD compact Intelligent Display module offers an array of functionality and options for any designer, integrator or user.

The pixxiLCD-20 is powered by the configurable PIXXI-28 graphics processor, allowing various functionalities such as touch detection, microSD or serial flash memory storage, GPIO, and ADC, along with multiple millisecond resolution timers, and UART and I2C communication.

The pixxiLCD-20 embedded graphics displays comes in two variants:

- Non-touch (pixxiLCD-20P2)
- Capacitive touch (pixxiLCD-20P2CT-CLB)

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.



**Figure 1: The pixxiLCD-20P2-CTP-CLB**

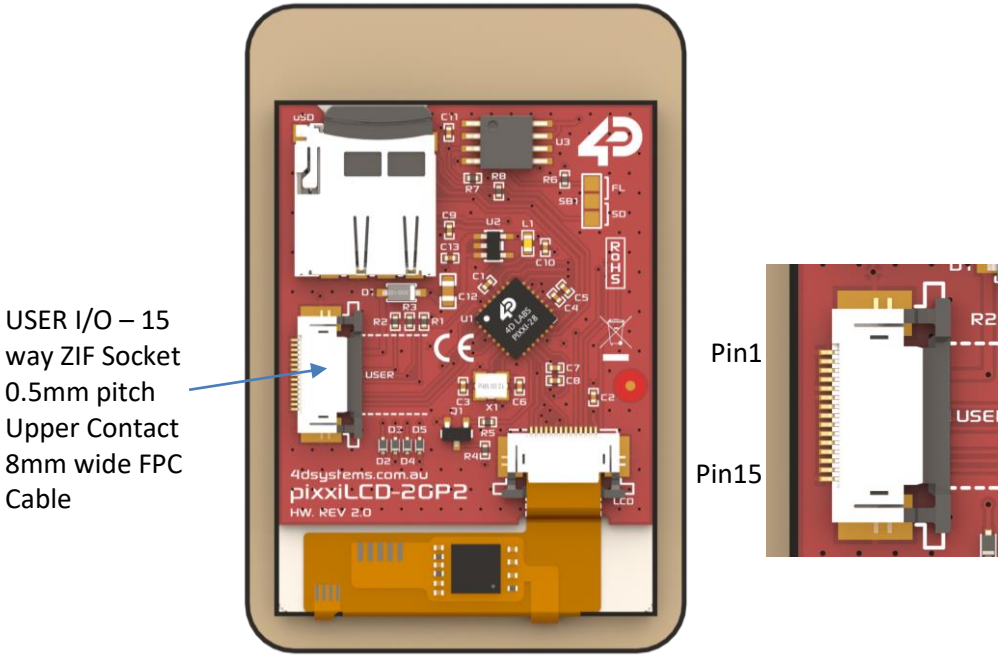
## 2. Features

- Powerful 2.0" Intelligent LCD-TFT display module powered by PIXXI-28
- 176 x 220 Resolution, RGB 65K TFT Screen
- Capacitive Touch Panel (pixxiLCD-20P2CT-CLB)
- 32KB of Flash memory for user application code.
- 14KB of SRAM for user variables.
- Selectable 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)
- Selectable on-board push type micro-SD memory card connector for multimedia storage, data files, fonts and data logging purposes.
- 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 to a Host or Slave device. The Serial port is also used for device programming.
- DOS compatible file access (FAT16 format) using uSD, as well as low-level access to card memory.
- Display full-colour images, animations, icons, and video clips.
- Supports all available Windows fonts.
- Free comprehensive Software Development Tools (Workshop4) provides 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-20P2: 37.68 x 51.33 x 5.7 mm
  - pixxiLCD-20P2CT-CLB: 44.60 x 65.80 x 7.0 mm
- Weight:
  - pixxiLCD-20P2: ~16 grams
  - pixxiLCD-20P2-CTP-CLB: ~20 grams
- 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



USER I/O – 15 way ZIF Socket  
0.5mm pitch  
Upper Contact  
8mm wide FPC Cable

Figure 2: 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-20 embedded graphics displays.

The pixxiLCD-20 has the essential hardware peripherals configured for interfacing with other external devices – general purpose digital input/output, analog input, UART, and I2C.

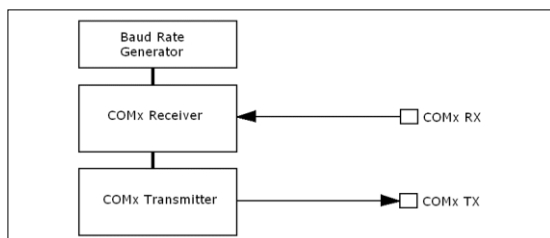
This section discusses the peripherals relevant only to the pixxiLCD embedded graphics displays. For complete information on the hardware peripherals of the PIXXI-28 graphics processor, refer to the **PIXXI-28 graphics processor datasheet**.

### 5.1. Serial Ports – TTL Level Serial

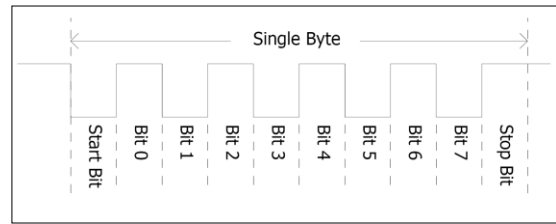
The PIXXI-28 Processor has a single hardware asynchronous serial port (COM0), with fixed pins TX/RX. The PIXXI-28's serial port can be used to communicate with external serial devices and is also used for programming the PIXXI-28 itself.

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 or 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. 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 external serial device receive (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 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-20 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
IO1	7	IO1_PIN	✓
IO2	8	IO2_PIN	✓
IO3	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-20 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
IO1	7	SCL1
IO2	8	SDA1
IO3	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. 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 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. micro SD/Flash

The pixxiLCD-20 display module has two memory devices available: microSD, and Flash Memory. The automatic hardware selection of the memory device being used is dictated by the presence of a microSD card inserted into the display module.

When using the uSD card as the memory device, simply insert the uSD card into the socket.

When using the Flash Memory as the memory device, simply eject the uSD card or yet do not insert anything in the socket.

The presence of the uSD card triggers a card detect switch inside the uSD socket, which enables or disables the Flash Memory. Only one can be enabled at once due to sharing the same bus, so your project needs to be designed with either uSD or Flash in mind.

**Note:** The correct PmmC must be loaded in the display when choosing the memory device (-u for the **SD memory** and -f for the **serial flash memory**).

The Flash Memory device is used for all multimedia file retrieval such as images, animations and movie clips, data files, fonts, or for holding extra code functions (to expand the code storage of the processor)

The SD memory card can also be used as general-purpose storage for data logging applications (RAW and FAT16 format support).

Support is available for either SD memory card (SD with up to 2GB or SDHC starting from 4GB and above) or the Serial Flash memory chip (16 MB).

The dedicated SPI port is clocked at 35 MHz



## 7. Display Features

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

### 7.1. PIXXI-28 Processor

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



The pixxiLCD-20 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-20 embedded graphics displays is 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-20.

pixxiLCD-20 Variant	PIXXI-28 Configuration
pixxiLCD-20P2	3-Wire SPI Display, Non-Touch
pixxiLCD-20P2-CTP-CLB	3-Wire SPI Display, Capacitive Touch

The data sheet for the PIXXI-28 graphics processor is available from <http://www.4dsystems.com.au>

### 7.2. SD/SDHC Memory Cards

The PIXXI-28 processor uses off the shelf standard SDHC/SD/microSD memory cards with up to 2GB capacity usable with FAT16 formatting. For any FAT file related operations, before the memory card can be used it must first be formatted to FAT16. The formatting of the card can be done on any PC system with a card reader. Select the appropriate drive and choose the FAT16 (or just FAT in some systems) option when formatting. The card is now ready to be used in the PIXXI-28 based application.

The PIXXI-28 processor also supports high capacity HC memory cards (4GB and above). The available capacity of SD-HC cards varies according to the way the card is partitioned and the commands used to access it.



The FAT partition is always first (if it exists) and can be up to the maximum size permitted by FAT16. Windows 7 will format FAT16 up to 4GB. Windows XP will format FAT16 up to 2GB and the Windows XP command prompt will format FAT16 up to 4GB.

RMPET, a 4D Systems Tool found in the Workshop4 IDE, is capable of repartitioning and formatting microSD cards to be the appropriate type and format for 4D Systems processors. This tool should be used for all cards.

**Note:** An SPI Compatible SDHC/SD/microSD card MUST be used. PIXXI-28 along with other 4D Systems Processors requires SPI mode to communicate with the SD card. If a non-SPI compatible SD card is used, then the processor will not be able to mount the card.

**Note:** Read disturb is a well-known issue with flash memory devices, such as microSD cards, where reading data from a flash cell can cause the nearby cells in the same memory block to change over time. This issue can be prevented by using industrial-grade microSD cards with read disturb protection. Industrial-grade microSD cards have a firmware that actively monitors the read operation and refreshes areas of memory which have high traffic and even move data around to prevent read disturb error from occurring. Furthermore, manufacturers may choose to implement read disturb protection on a specific part of the flash memory only, such that the beginning

part of the memory might not be protected. The RMPET utility in Workshop4 is designed to create the first partition at an offset from the start of the microSD card to account for this situation. It is therefore recommended to always partition and format an industrial microSD card using the RMPET utility before using it with 4D Systems processors.

### 7.3. FAT16

All 4D Systems displays featuring 4D Systems processors use off-the-shelf standard/micro SDHC/SD memory cards (SPI Compatible Only) with up to 4GB capacity usable with FAT16 formatting.

For any FAT file related operations, before the memory card can be used it must first be formatted correctly. Built into Workshop4 is a tool created by 4D, called RMPET. RMPET allows the User to easily partition and format microSD cards, to make their file system ready to be used with 4D Systems displays. The formatting of the card can be done on any PC system with a card reader.

The PIXXI-28 processor also supports high capacity HC memory cards (4GB and above). The available capacity of SD-HC cards varies according to the way the card is partitioned and the commands used to access it.

The FAT16 file system can utilize a maximum capacity of 4GB. The FAT partition is always first (if it exists). Any space larger than 4GB will be RAW, and can still be utilized by your 4D Systems module, using different functions. Please refer to Application Notes available from the 4D System website, [www.4dsystems.com.au](http://www.4dsystems.com.au)

## 8. Display/Module Precautions

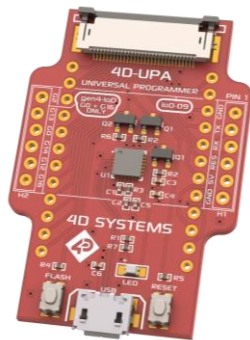
- Avoid having to display the same image/object on the screen for lengthy periods of time. This can cause a burn-in which is a common problem with all types of display technologies. Blank the screen after a while or dim it very low by adjusting the contrast. Better still; implement a screen saver feature.
- 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, damage will certainly occur. 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 temperature 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 broken backlight
- Display modules have a finite life, which is typically dictated by the display itself, more specifically the backlight. The backlight contains LED's, which fade over time. In the Specifications section is a figure for the typical life of the display, and the criteria are listed.

## 9. Hardware Tools

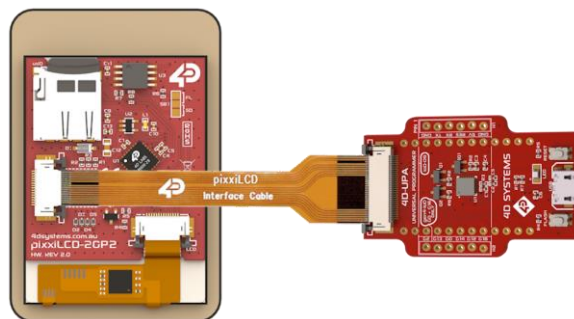
The following hardware tools are required for full control of the pixxiLCD-20 embedded graphics display.

### 9.1. 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.

The 4D-UPA is available from the 4D Systems website, [www.4dsystems.com.au](http://www.4dsystems.com.au)

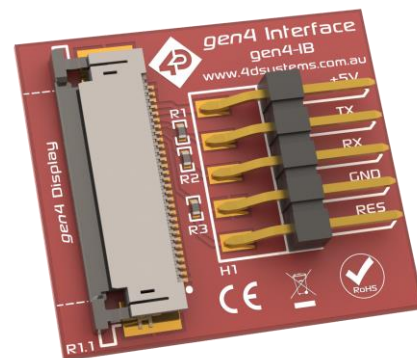
Using a non-4D programming interface could damage your processor, and **void your Warranty.**

### 9.2. Interface Board

The Interface boards (gen4-IB) ship with each pixxiLCD Display Module unless otherwise stated and is used to aid 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-to-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.

## 10. Software Overview - 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 2000's.

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 ground up for the EVE engine core. It is a high-level language which 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 pertaining to the 4DGL language, please refer to the following documents:  
**4DGL Programmers Reference Manual**  
**PIXXI-28 4DGL Internal Functions**

These are both available for download on the [Workshop4 Product Page](#) of the 4D Systems website.

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 the Workshop 4 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 which runs, and that is written in 4DGL. ViSi-Genie automatically generates 4DGL itself based on what is configured in the GUI.

## 11. 4D Systems - Workshop 4 IDE

Workshop 4 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 Workshop 4 IDE.



The Workshop 4 IDE supports multiple development environments for the user, to cater for 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 PRO version of WS4. Further details explained in [section 11.3](#).
- 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.

The Workshop 4 IDE is available from the 4D Systems website. [www.4dsystems.com.au](http://www.4dsystems.com.au)

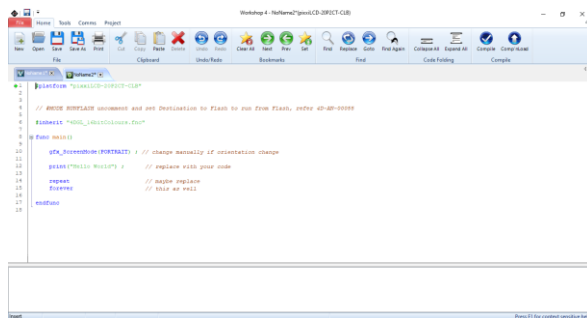
For comprehensive manuals on the Workshop 4 IDE Software, the language, and its environments, refer to

the documentation from the 4D Systems website, on the [Workshop 4 Product Page](#).

### 11.1. Workshop4 - Designer

Choose the Designer environment to write 4DGL code in its raw form.

The Designer environment provides the user with a simple yet effective programming environment where pure 4DGL code can be written, compiled and downloaded to the range of 4D Systems intelligent display modules.

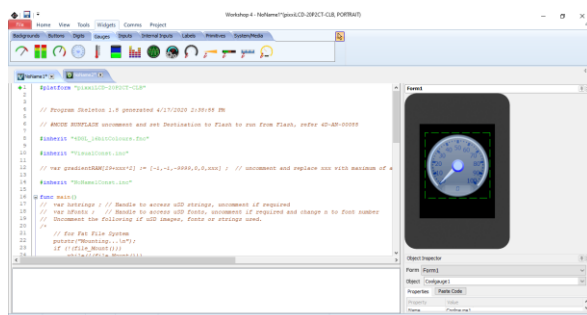


Designer is a very powerful environment, for those use to developing without any form of GUI aid, or for those developing complex systems where no aid is required.

### 11.2. Workshop4 – ViSi

ViSi was designed to make the creation of graphical displays a more visual experience.

ViSi is a great software tool that allows the user to see the instant results of their desired graphical layout. Additionally, there is a selection of inbuilt dials, gauges and meters that can simply be placed onto the simulated module display. From here each object can have its properties edited, and at the click of a button all relevant 4DGL code associated with that object is produced in the user program. The user can then write 4DGL code around these objects to utilise them in the way they choose.



### 11.3. Workshop4 – ViSi Genie

ViSi-Genie is a breakthrough in the way 4D Systems' graphic display modules are programmed. It is an environment like no other, a code-less programming environment that provides the user with a rapid visual experience, enabling a simple GUI application to be 'written' from scratch in literally seconds.

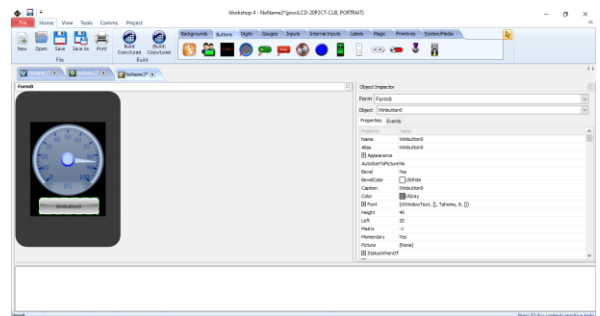
ViSi-Genie does all the background coding, no 4DGL to learn, it does it all for you.

Pick and choose the relevant objects to place on the display, much like the ViSi Environment yet without having to write a single line of code. Each object has parameters which can be set, and configurable events to animate and drive other objects or communicate with external devices.

Simply place an object on the screen, position and size it to suit, set the parameters such as colour, range, text, and finally select the event you wish the object to be associated with, it is that simple.

In seconds you can transform a blank display into a fully animated GUI with moving sliders, animated press and release buttons, and much more. All without writing a single line of code!

ViSi-Genie provides the user with a feature rich rapid development environment, second to none.



ViSi-Genie's functionality can be extended with the purchase of a Workshop4 PRO License.

Workshop4 PRO adds a professional set of features to the ViSi-Genie environment called Genie-Magic. The added features allow the user to add in 4DGL scripts, which can be activated from the display itself, from an interfacing Host, or from an external sensor or device.

Workshop4 PRO also adds the ability to use SMART widgets, which are tools to assist the User to create their own Buttons, Sliders, Gauges, etc.

These PRO set of features of Genie-Magic allow the User to create an immensely powerful GUI system with a fraction of the effort required by other systems.

## 11.4. Workshop4 – Serial

The Serial environment (SPE) in the Workshop 4 IDE provides the user the ability to transform a 4D Systems Intelligent Display, into a slave serial graphics controller.

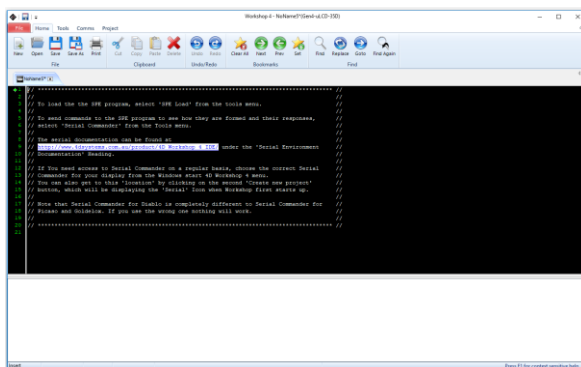
This enables the user to use their favourite microcontroller or serial device as the Host, without having to learn 4DGL or program in a separate IDE.

Once the display module is configured by the Serial Environment (by downloading what is called the SPE application to the module), commands can be sent from the users host microcontroller to display primitives, images, sound and video, and can even be used to display ViSi generated graphics and widgets.

The Serial Environment should not be taken as being basic in terms of its capabilities, as it has the full 4DGL command set behind it, but available from the Host rather than from programming the display module itself using the Workshop4 IDE.

Virtually anything created in Designer or ViSi, can be designed or controlled from the Serial Environment.

Please refer to the *“Pixxi Serial Command Set Reference Manual”* from the [Workshop 4 product page](#) on the 4D Systems website for a complete listing of all the supported Serial commands



## 11.5. PmmC Programming

The PIXXI-28 processor is a custom graphics processor. All functionality including the high level commands are 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 define 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.

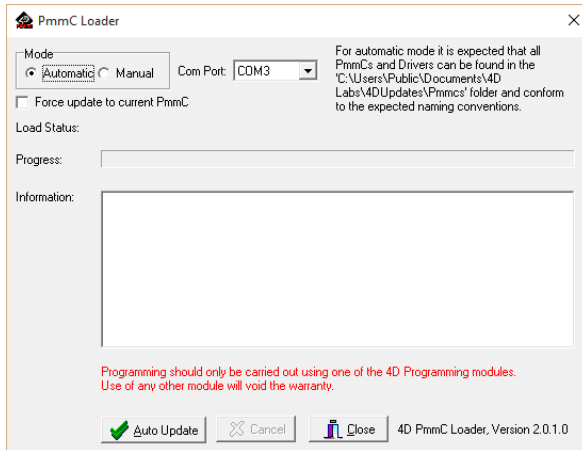
The PmmC file can only be programmed into the device with the aid of Workshop 4, the 4D Systems IDE software, or its supporting tools.

Solutions, which remove the need to use Workshop 4 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.

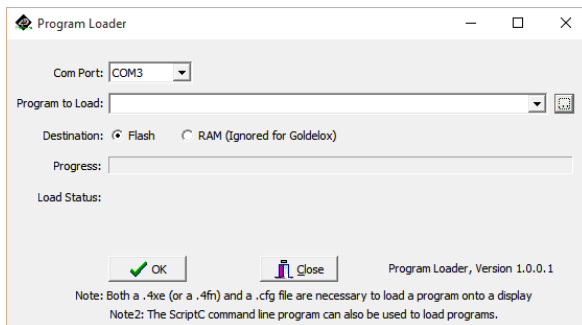
Three solutions come with the Workshop4 IDE, which can be separated out for production line computers if required, **ScriptC**, **PmmC Loader** and **Program Loader**.

**ScriptC** is a command line interface which 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.

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



**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.



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.**

## 12. Display Module Part Numbers

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

### Example:

pixxiLCD-20P2-CTP-CLB

pixxiLCD	- pixxiLCD Display Range
20	- Display size (2.0")
P2	- PIXXI-28 Processor
CTP	- Capacitive Touch Panel
CLB	- Cover Lens Bezel

- For part number which do not include CTP, this are 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.

## 13. 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 the well-known and strong 3M 300LSE adhesive.

The double sided adhesive has a thickness of 0.17mm once the backing has been removed.

More information on this adhesive can be found on the 3M website.

<http://multimedia.3m.com/mws/media/7716830/3mtm-double-coated-tapes-9474le-9495le.pdf>

## 14. 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, by 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 prior to settling with the preferred feature-set.

Starter Kits typically include:

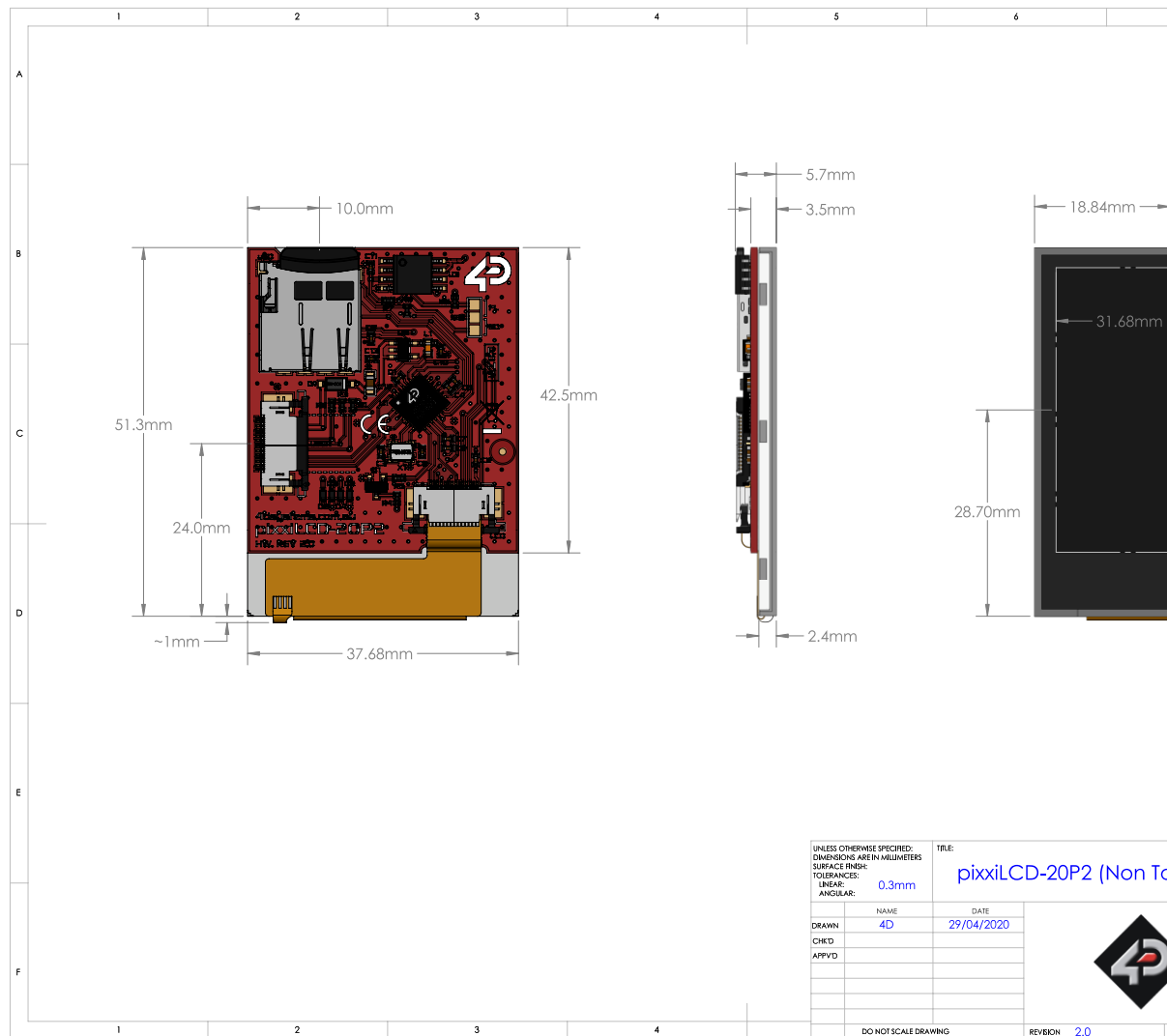
- pixxiLCD-20 Embedded Graphics Display
- 4D Universal Programming Adaptor (4D-UPA)
- 150mm 15-way-to-30-way FFC cable for connecting pixxi Adaptor Board to the 4D-UPA or gen4-IB
- gen4 Interface Module (gen4-IB)
- 5-way Female-Female ribbon cable for easy connection to a host or breadboard via the gen4-IB
- 5-way Male-Male adaptor (for converting the Female-Female cable to be Male-Female)

Please refer to the 4D Systems website for current components included in the Starter Kit.

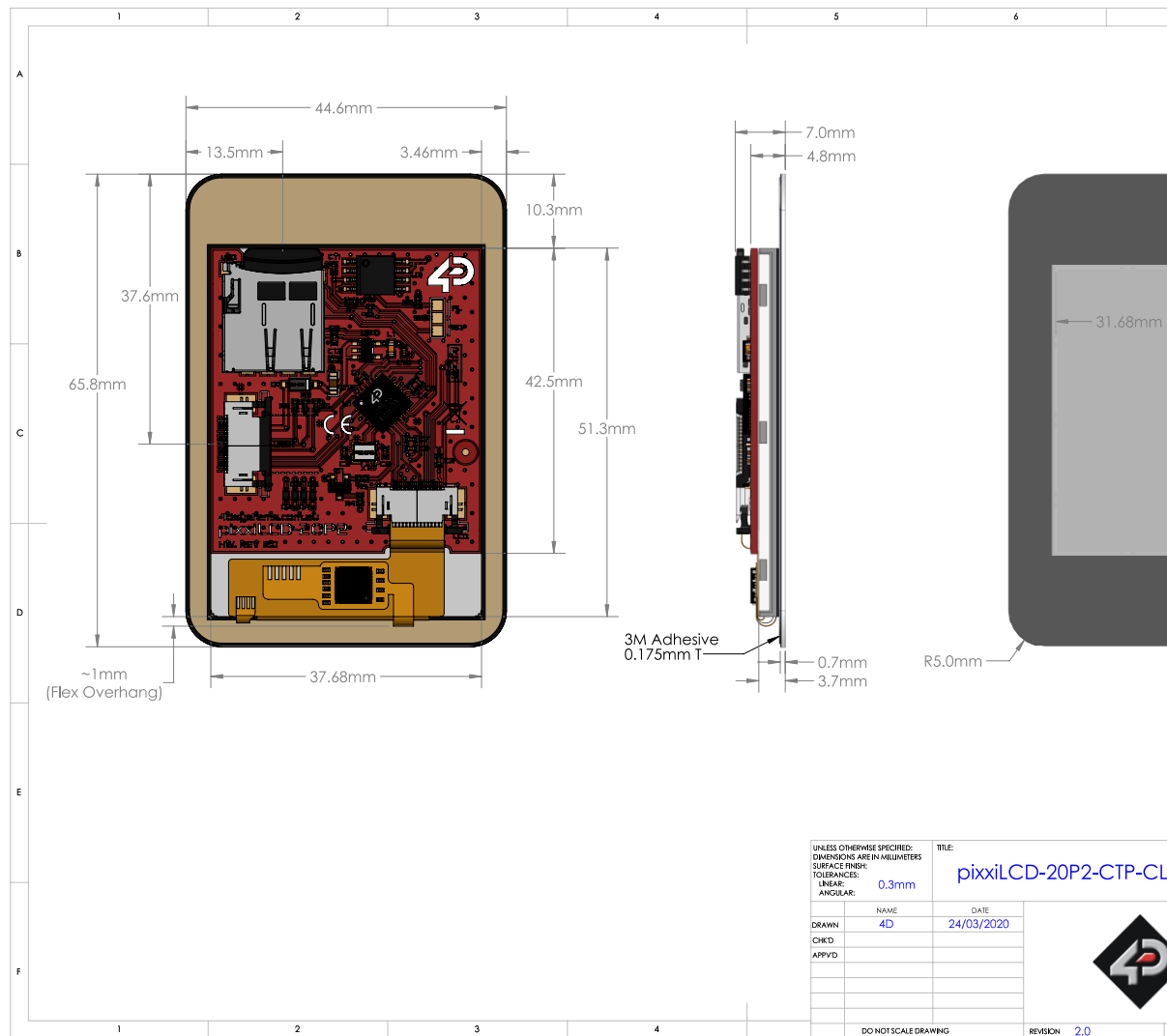
Simply select the Starter Kit option when purchasing the chosen display module on the 4D Systems shopping cart, or from your local distributor.



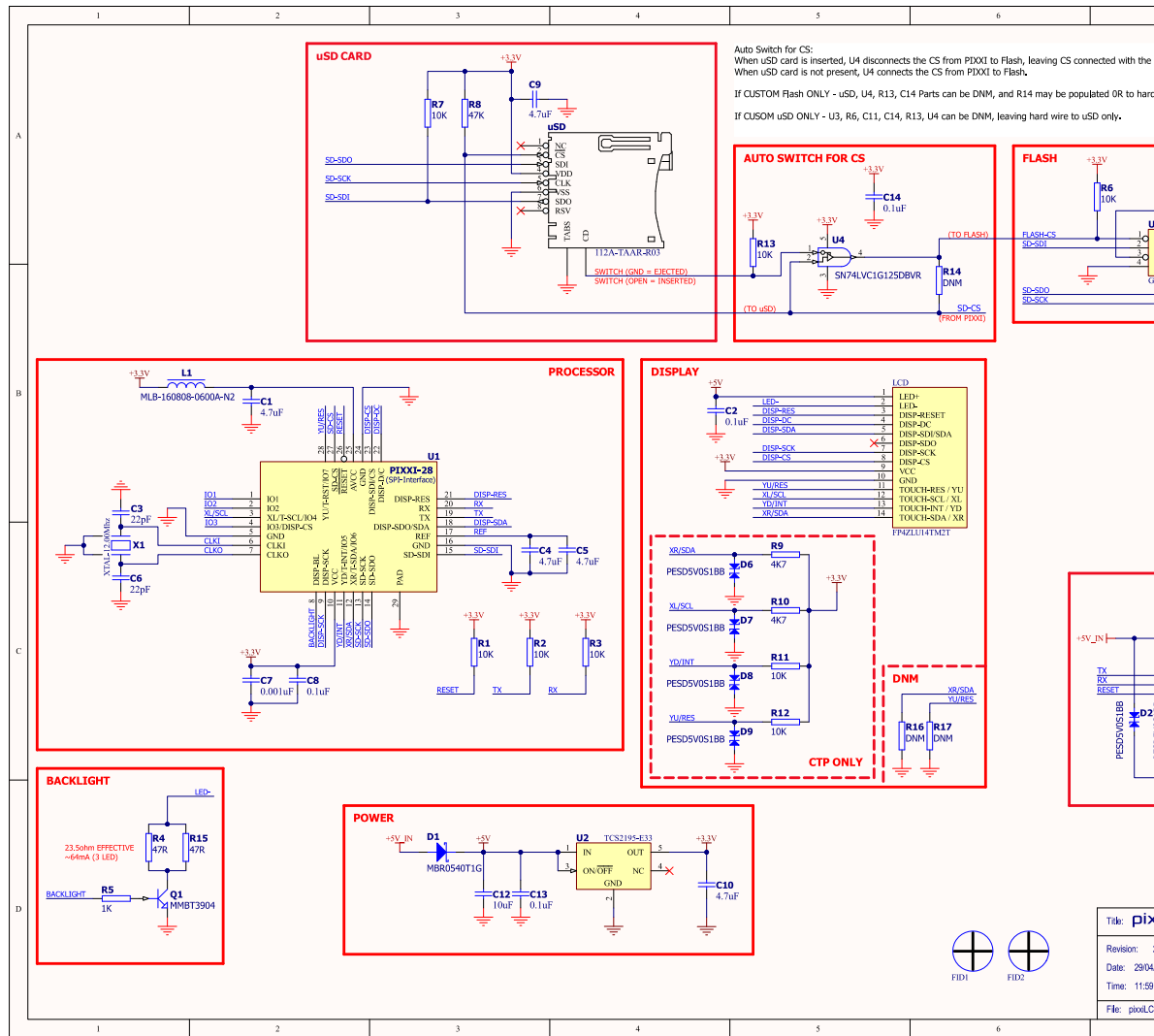
15. Mechanical Details (Non-Touch)



16. Mechanical Details (Capacitive Touch with Cover Lens Bezel)



17. Schematic Details – REV 2.1



## 18. Specifications

### ABSOLUTE MAXIMUM RATINGS

Operating ambient temperature .....	-20°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 a 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	2.0	--	--	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-20P2	--	100	--	mA
	5V Supply – pixxiLCD-20P2-CTP-CLB	--	110	--	mA
Display Endurance	Hours of operation, measured to when 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 Transmissive LCD
Display Size		2.0" Diagonal
Display Resolution		176x220 (Portrait View)
Display Brightness	5V Supply, pixxiLCD-20P2	500 cd/m <sup>2</sup> (typical)
	5V Supply, pixxiLCD-20P2-CTP-CLB	460 cd/m <sup>2</sup> (typical)
Display Contrast Ratio	Typical	300:1
Display Viewing Angles	Above Centre	45 Degrees
	Below Centre	20 Degrees
	Left of Centre	45 Degrees
	Right of Centre	45 Degrees
Display Viewing Direction		6 o'clock Display (Optimal viewing is from below when in Portrait mode)
Display Backlighting	White LED Backlighting	1x3 Parallel LED's
Pixel Pitch		0.1803 x 0.1803mm (Square pixels)
Pixel Density	Number of pixels in 1 row in 25.4mm	141 DPI/PPI

19. Hardware Revision History

Revision Number	Date	Description
2.0	24/03/2020	Initial prototype
2.1	29/04/2020	<ul style="list-style-type: none"><li>• Minor PCB fixes and improvements</li><li>• Addition of automatic Flash/uSD card hardware selection</li></ul>

20. Datasheet Revision History

Revision Number	Date	Description
1.0	10/06/2020	Initial release version
1.1	03/11/2020	Updated incorrect viewing direction for LCD

## 21. Legal Notice

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For Sales Support: [sales@4dsystems.com.au](mailto:sales@4dsystems.com.au)

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