RUTRONIK EMBEDDED

TechTalk

4D SYSTEMS
TURNING TECHNOLOGY INTO ART

Smart TFTs and Software Tools / Ready to Market

Nikolai Schnarz

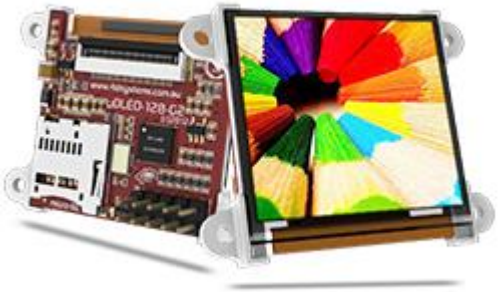
4D SYSTEMS

TURNING TECHNOLOGY INTO ART

4D Systems designs and manufactures compact and cost-effective Intelligent Display Modules using the latest state of the art OLED and LCD technology with an embedded custom graphics processor.

Mission:

We empower forward-thinking engineers, designers, and organisations with the ability to achieve their objectives using our intelligent display solutions.



© 2021 | WWW.4DSYSTEMS.COM.AU

About 4D Systems

- Established in 1990
- HQ Australia
  - R&D
  - Manufacturing ISO 9001 Certified
- Regional Offices in
  - Austria
  - Malaysia
  - New Zealand
  - Philippines
  - Turkey
  - United Kingdom

© 2021 | WWW.4DSYSTEMS.COM.AU

One Stop Shop for Embedded Display Solutions

4D SYSTEMS
MAKING HUMAN INTELLIGENCE SMARTER

Complete Hardware & Software Solution

- Quickly Develop and Integrate a GUI with Touch functionality to virtually any application.
- Reduce Development time to days or weeks instead of months or years.
- Extremely fast time to market vs. traditional approach to display and touch screen integration.

Intelligent Display Modules & Bare Displays

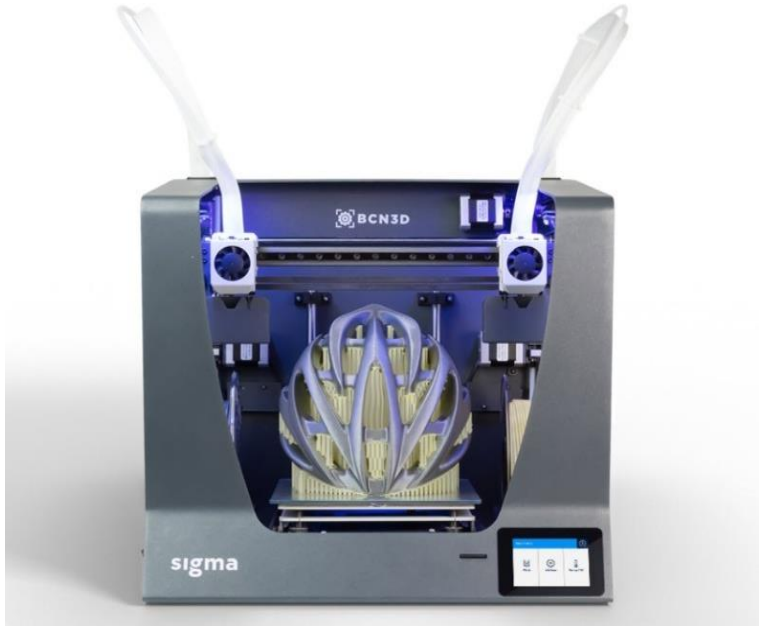
Graphics Controllers

Software Development Tools

© 2021 | WWW.4DSYSTEMS.COM.AU

Market Demand for Displays

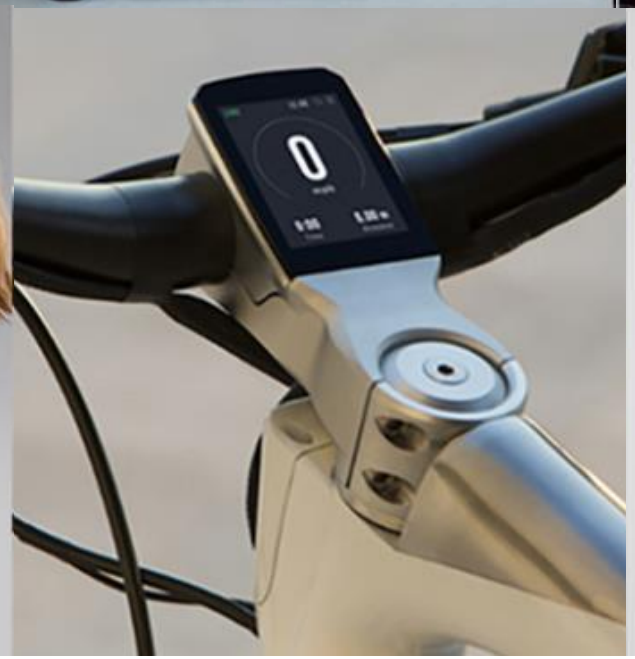
- End users have come to expect a GUI interface with touch screen in virtually any electronic application.
- As a result an ever increasing number of manufacturers are looking at integrating a full colour graphics display with touch functionality into their product.



© 2021 | WWW.4DSYSTEMS.COM.AU

Replacing Buttons with GUI and Touch

© 2021 | WWW.4DSYSTEMS.COM.AU



© 2021 | WWW.4DSYSTEMS.COM.AU

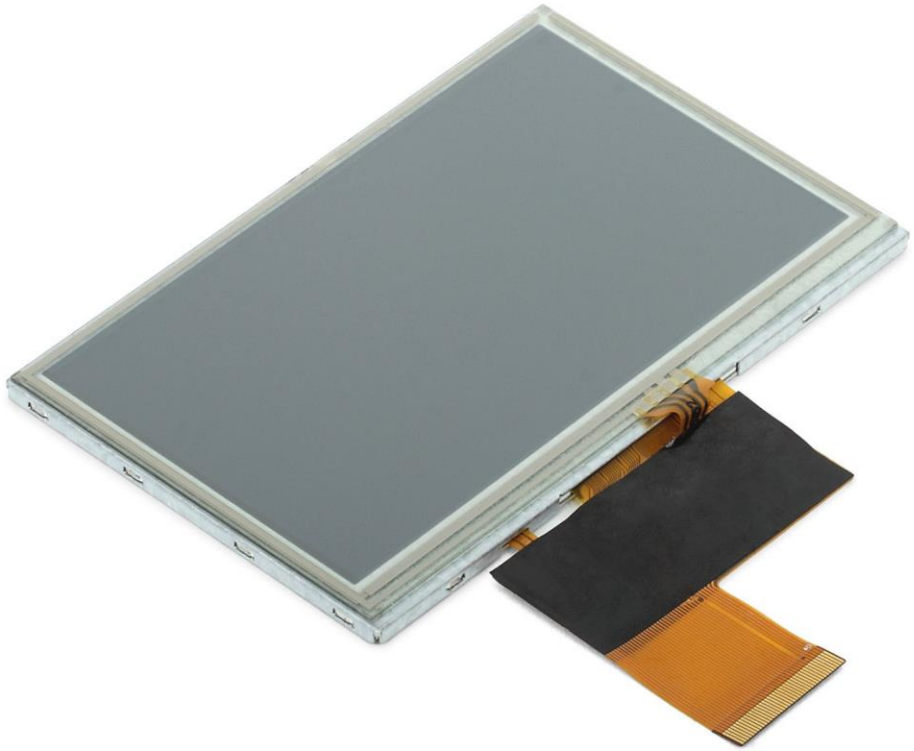
Challenges for Display Design-in

- Designing-in a graphics display with touch capability can be
  - Costly
  - Time consuming and daunting task for both Hardware & Software developers.
- Often there projects are postponed due to inflated development costs or lack of resources.
- Particularly true for specialized applications with low or medium production volumes, but also true for high volume applications.

4D SYSTEMS
MAKING HUMAN INTELLIGENCE SMARTER

What is a Smart Display Module and what are its benefits?

What is a “dumb” display?



- Generic LCD TFT or OLED display.
- Needs a relatively powerful host MCU that can drive the display directly or a separate display driver IC depending on the display type.
- You have to control each and every pixel individually.
- Very Long Development Time
- Requires special expertise or knowledge to drive graphics

Working with ‘dumb’ displays

4D SYSTEMS
MAKING HUMAN INTELLIGENCE SMARTER

Low Level Design

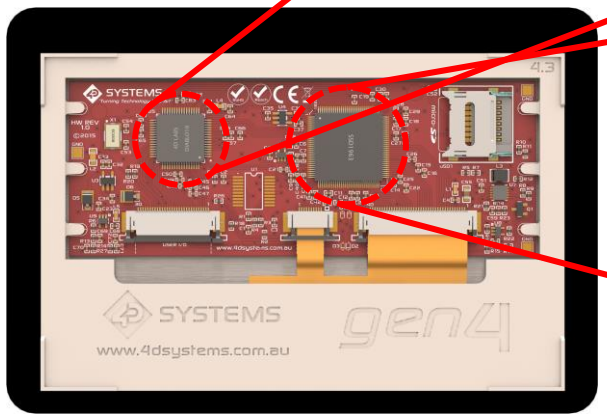
- Find a suitable supplier for display & touch screen
- Choose an appropriate MCU along with a graphics controller and driver
- Understand how the driver IC works
- Develop initialization code
- Write the driver and firmware on the selected MCU
- Write graphics primitives
- Write functions to manage image handling and other display features
- Write functions to handle touch screen mapping and calibration
- Debug… debug… debug….

Weeks / Months

Can begin designing your graphical user interface for your application

© 2021 | WWW.4DSYSTEMS.COM.AU

What is an Intelligent / Smart Display?



© 2021 | WWW.4DSYSTEMS.COM.AU

What is an Intelligent / Smart Display?

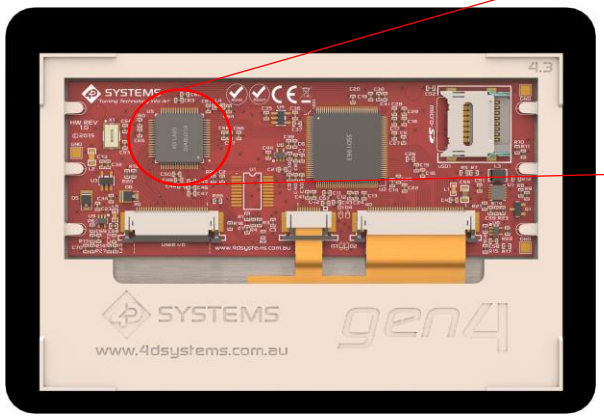
TTL Serial

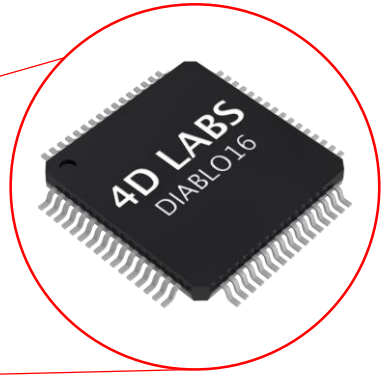
Ready-to-run Module
Takes over all graphic related processing and load

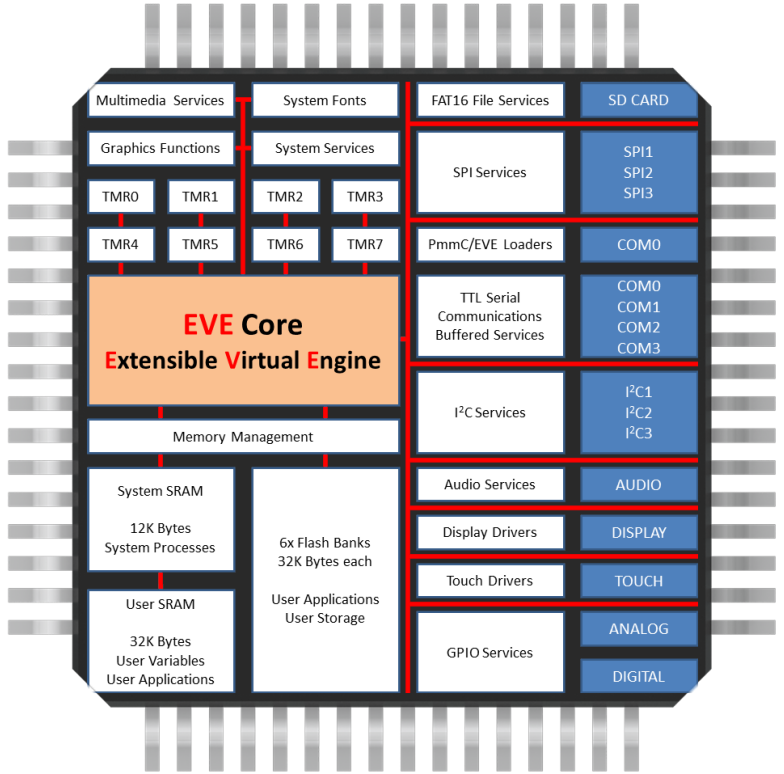
Full-colour HMI even on 8-bit micro based applications

© 2021 | WWW.4DSYSTEMS.COM.AU

What is a 4D Systems Smart Display?







© 2021 | WWW.4DSYSTEMS.COM.AU

Benefits of Smart Displays

- Everything is included in a convenient single package
  - Easy and reliable to source
- No low-level design required – get started out of the box
- Fast Development time – fast time to market
- Little specialized expertise required
- Focus on what matters you the most
- Suitable as a development tool and assembly component

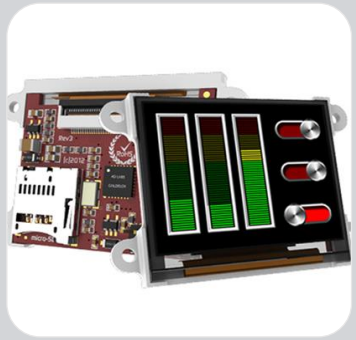
4D SYSTEMS
MAKING HUMAN INTELLIGENCE SMARTER

4D Systems Solutions
Hardware & Software

4D Systems Solutions

Graphics Processors

- GOLDELOX
- PICASO
- DIALBO16
- PIXXI-28
- PIXXI-44

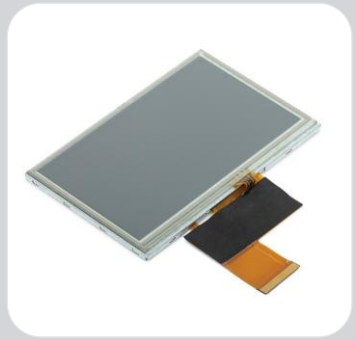


Smart Displays

- gen4 Series
- PIXXI LCD Series
- microOLED Series
- microLCD Series
- WiFi Displays
- Integrated Solutions

Software Tools

- Programming the Smart Displays
- Free Download

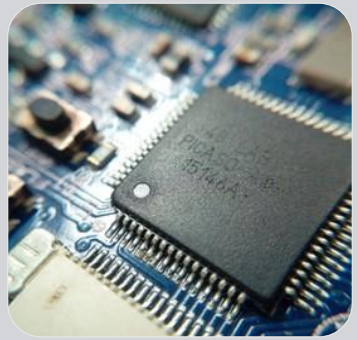


LCD TFT Displays

- LCD's available for high volume applications

Displays for SBC's

- Asus Tinkerboard
- Arduino
- Raspberry Pi
- BealgeBone Black



Custom Solutions & Manufacturing

- Design Solutions
- Manufacturing Solutions

© 2021 | WWW.4DSYSTEMS.COM.AU

Graphics Processors

4D Systems' own graphics processor, providing high quality and powerful graphics, which are available as microchips, for integrating into new products.

GOLDELOX
Embedded Graphics Controller

PICASO
Embedded Graphics Controller

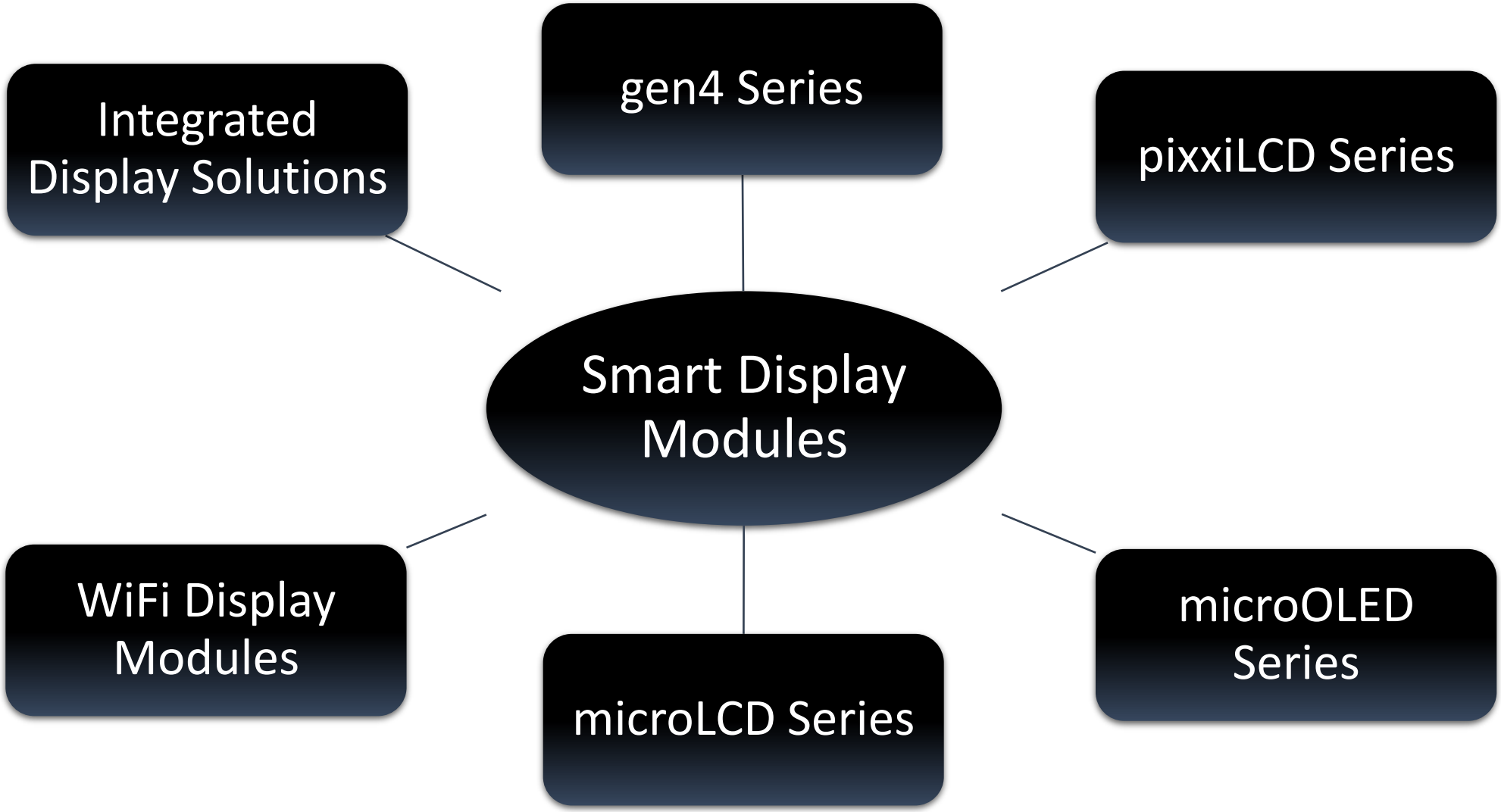
DIABLO16
Embedded Graphics Controller

PIXXI-28
Embedded Graphics Controller

PIXXI-44
Embedded Graphics Controller

© 2021 | WWW.4DSYSTEMS.COM.AU

Smart Display Modules



© 2021 | WWW.4DSYSTEMS.COM.AU

4D gen4 Series

The Embedded Display Solution

A new cosmetically sleek and low profile design for every graphical user interface application.

*patents pending

4D SYSTEMS

TURNING TECHNOLOGY INTO ART

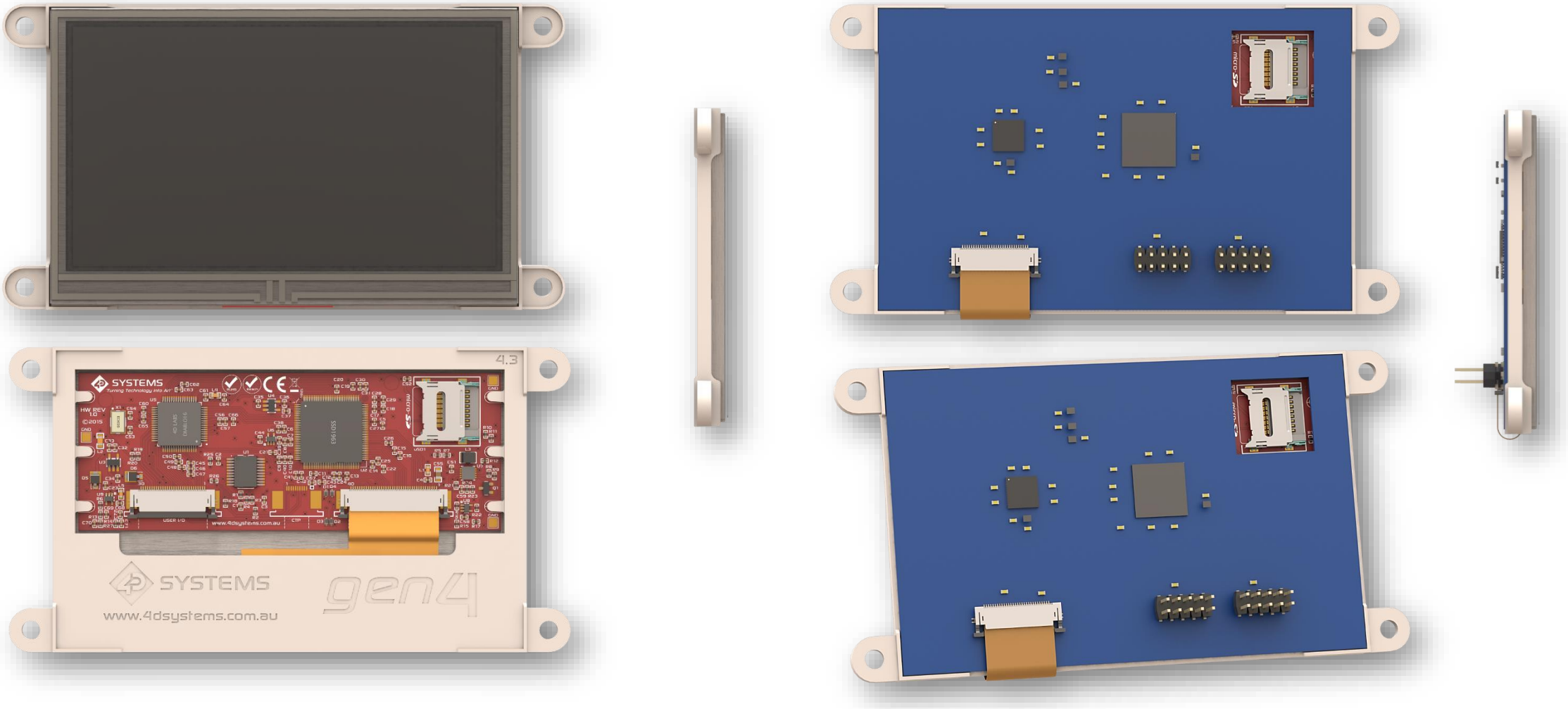
www.4dsystems.com.au

gen4 Series Display Modules

- Slim and Streamlined Design
- Seven sizes: 2.4” – 7.0”
- Touch Options
  - Non-touch
  - Resistive Touch
  - Capacitive Touch
  - Capacitive touch with Bezel
- Processors
  - DIABLO16
  - PICASO
- Programmed with Workshop4 IDE
- Starter Kits Available for all Variants
- In total: 258 part numbers to pick from

© 2021 | WWW.4DSYSTEMS.COM.AU

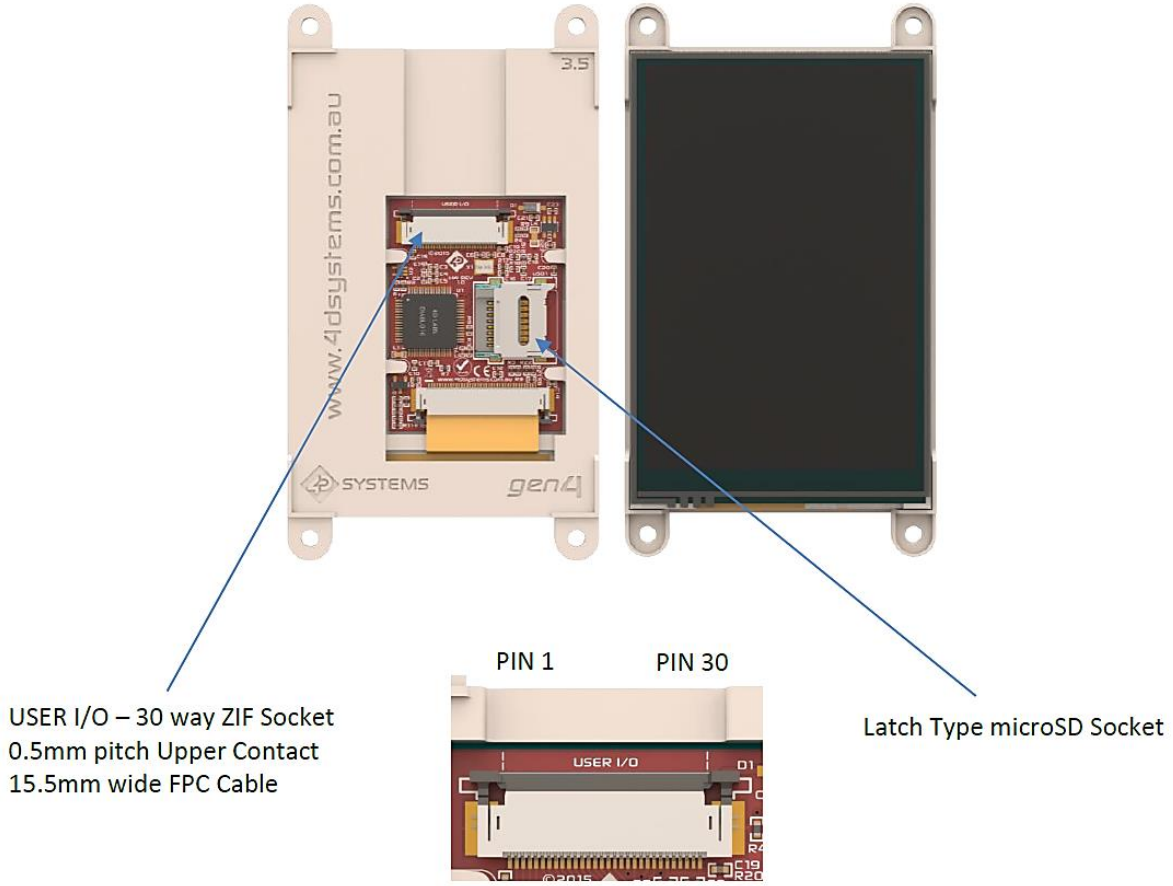
Application PCB Support



© 2021 | WWW.4DSYSTEMS.COM.AU

Stand-alone functionality – no host required

- 6 banks of 32750 bytes of Flash memory for User Application Code and data
- 32Kb of SRAM purely for the User
- 16 General Purpose I/O pins for user interfacing, which include 4 configurable Analog inputs
- GPIO variously configurable
- 3 x I2C Channels Available
- 1 x SPI dedicated for SD Card and 3 x configurable SPI channels available.
- 1 x dedicated and 3 x configurable TTL Serial com ports available
- Up to 6 GPIO can be used as Pin Counters
- Up to 6 GPIO for PWM (simple and Servo)
- Up to 10 GPIO for Pulse Output
- Up to 14 GPIO can be configured for Quadrature Encoder Inputs (2 channels)
- 30 pin FPC connection for all signals, power, communications, GPIO and programming.



CEiiA – Ventilator for COVID-19

Invasive Ventilators

- Getting this done was urgent
- Low Cost
- Easy to Assemble
- Used:
  - gen4-uLCD-70DT
  - gen4-BEZEL-70B
- 45 Days to get it done
- 1000 units produced
- Production time reduced from 40 minutes to 15 minutes / unit

© 2021 | WWW.4DSYSTEMS.COM.AU

Atena
CMV
Ppeak
cmH2O
19
PEEP
cmH2O
0
MV
l
232
RR
bpm
10
FIO2
%
19
TV
ml
232
P 50
0
-10
F 45
0
-45
V 800
400
0
Target
FIO2
%
50
RR
bpm
10
PEEP
cmH2O
0
TV
ml
300
HOME
MODES
ALARMS
SETUP
MORE
START
HOLD
START
STOP

4LIFE

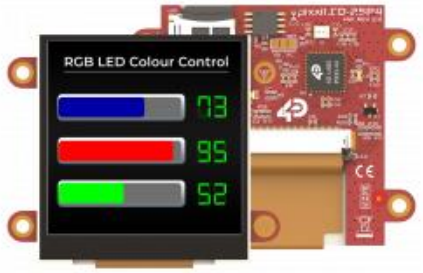
START
STOP

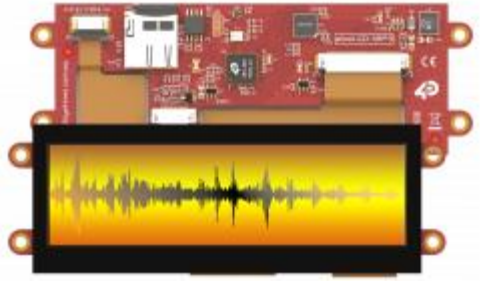
START
STOP

START
STOP

pixxiLCD Series

- Unusual sizes and shapes
- Four sizes: 1.3” – 3.9”
- Touch Options
  - Non-touch
  - Capacitive Touch
  - Capacitive touch with Bezel
- Processors
  - PIXXI-28
  - PIXXI-44
- Wide Viewing Angles
- Programmed with Workshop4 IDE
- Starter Kits Available for all Variants
- Available with 16MB Serial Flash

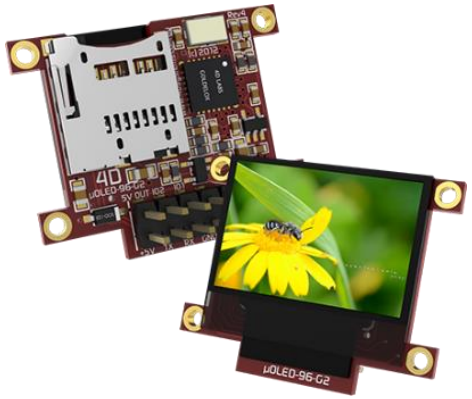




© 2021 | WWW.4DSYSTEMS.COM.AU

microOLED Series

GOLDELOX MODULES

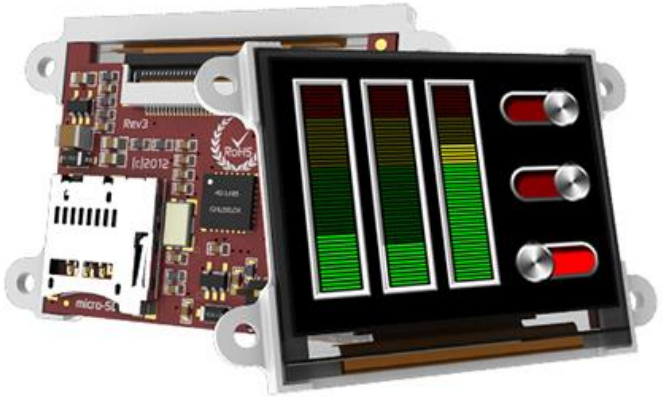


uOLED-96-G2

- PMOLED display
- 0.96” diagonal size
- 96x64 pixel resolution
- Non-touch

uOLED-128-G2

- PMOLED display
- 1.5” diagonal size
- 128x128 pixel resolution
- Non-touch



uOLED-160-G2

- PMOLED display
- 1.7” diagonal size
- 160x128 pixel resolution
- Non-touch

Keysight / IXIA - AresONE

Application:

8-port 400GE Test Solution

Product used:

uOLED-160-G2 - 1.7” Intelligent Passive Matrix OLED Display Module

Link:

https://www.ixiacom.com/products/aresone-400ge

© 2021 | WWW.4DSYSTEMS.COM.AU

TriStar Pictures

Application:

Matt Damon Back of the Head Display

(not sure what it does, but it looks cool!)

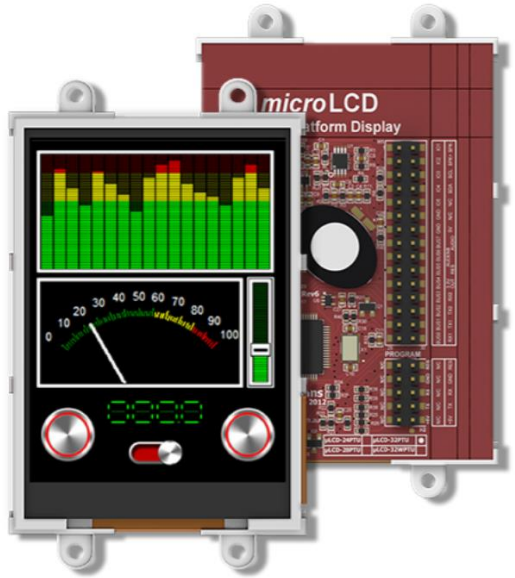
Product used:

uOLED-128-G2 – 1.5" Intelligent PMOLED display module

Link: http://www.imdb.com/title/tt1535108/

microLCD Series

- Our older range of display modules
- Eight sizes: 1.44” – 9.0”
- Slightly different form factor to gen4 Series
- Touch Options
  - Non-touch
  - Resistive Touch
  - Capacitive Touch
- Processors
  - GOLDELOX
  - PICASO
  - DIABLO16
- Programmed with Workshop4 IDE
- Starter Kits Available for all Variants



© 2021 | WWW.4DSYSTEMS.COM.AU

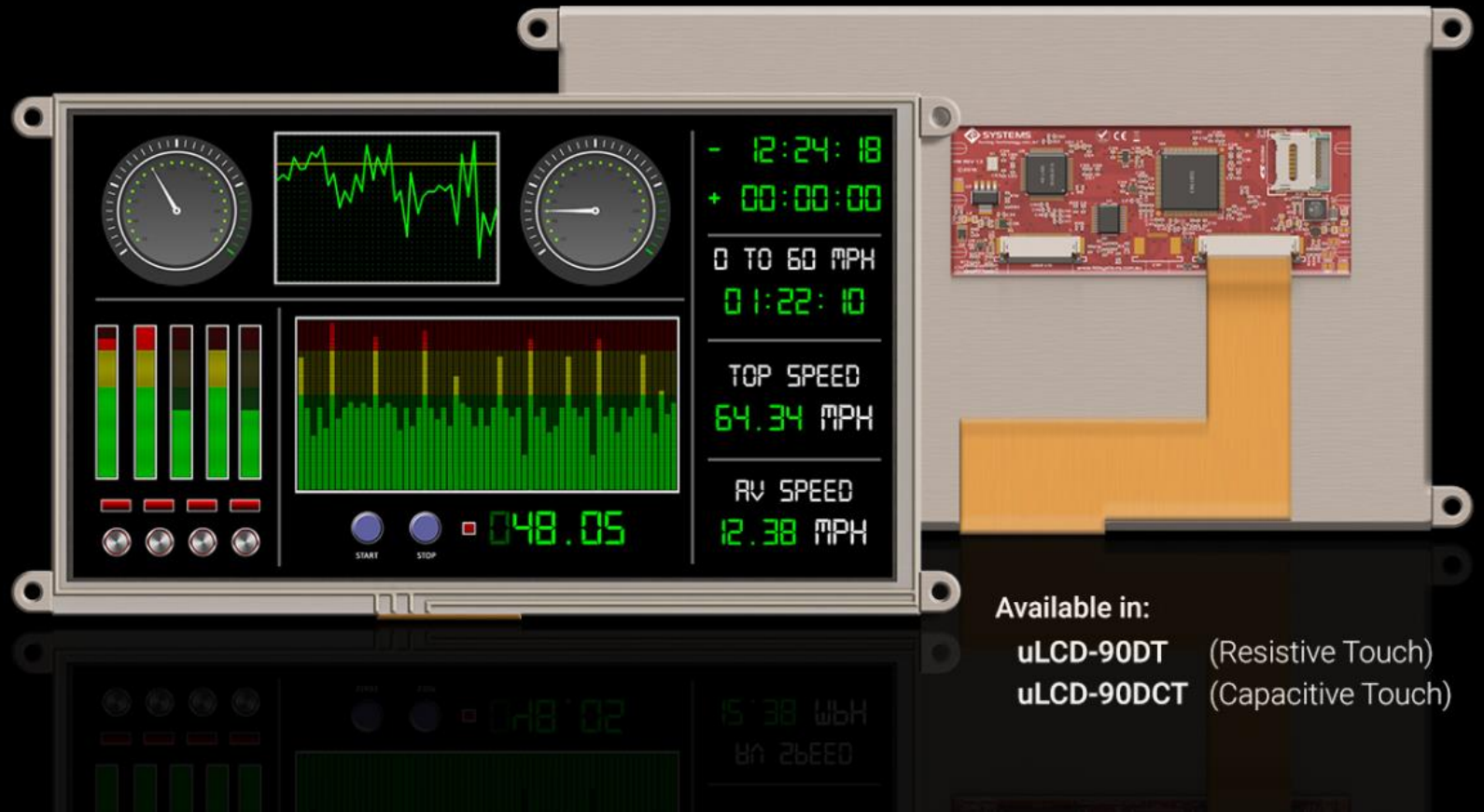
9.0” uLCD Series

4D SYSTEMS
MAKING HUMAN INTELLIGENCE SMARTER

uLCD-90DT/DCT

9.0" DIABLO16 Intelligent LCD module

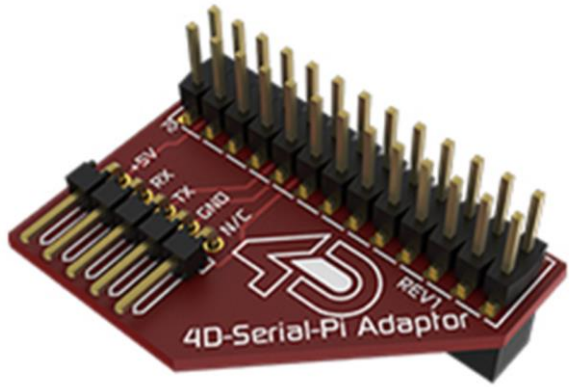
- 9.0” diagonal
- 800x480 pixels
- 65K
- **DT:** 230.7 x 126.4 x 7.9mm
  DCT: 230.7 x 126.4 x 8.15mm
- Resistive / Capacitive Touch

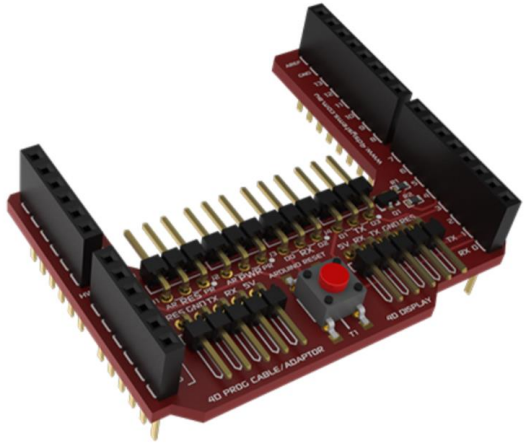


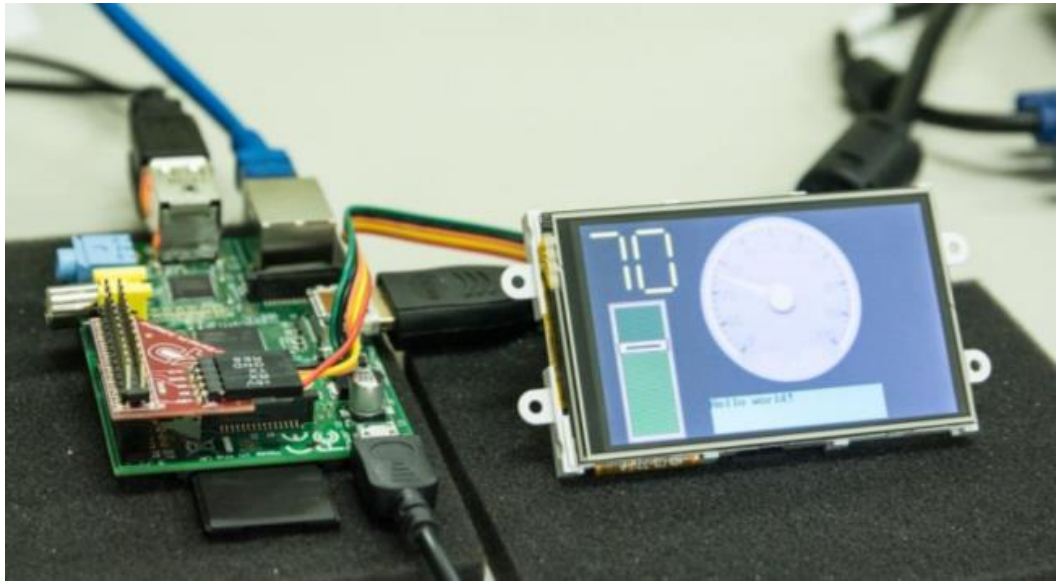
Available in:

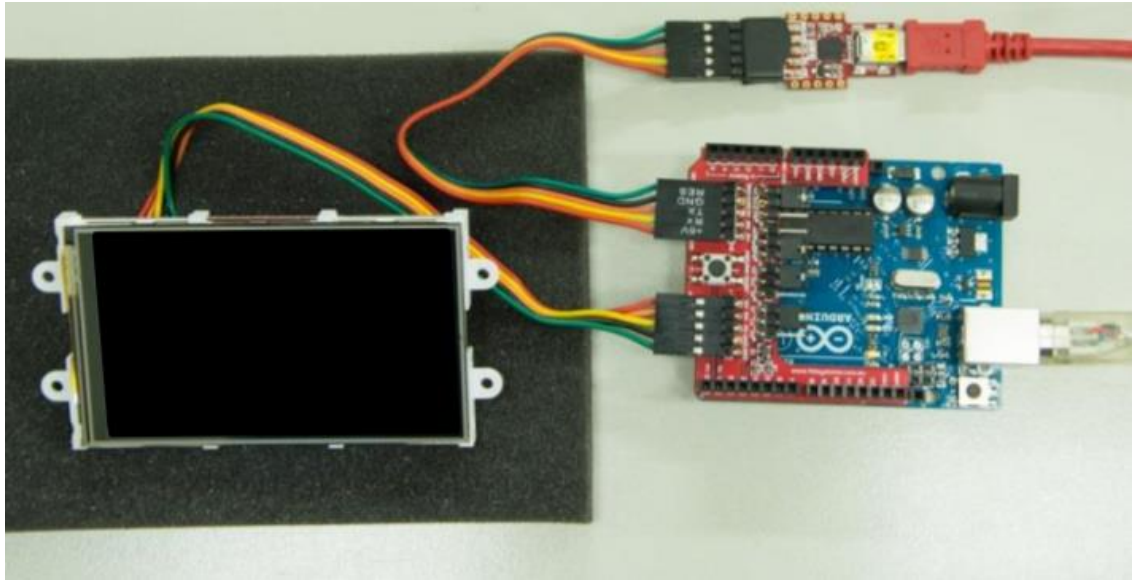
uLCD-90DT (Resistive Touch)
uLCD-90DCT (Capacitive Touch)

Interface for Arduino and Raspberry Pi



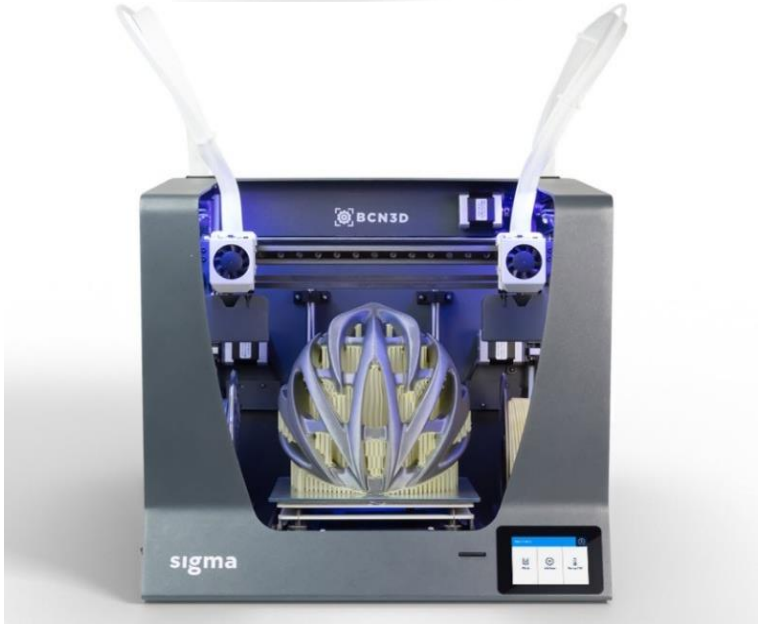






© 2021 | WWW.4DSYSTEMS.COM.AU

BCN3D Technologies – Sigma 3D Printer



Application:

3D Printer(s)

Product used:

gen4-uLCD-35DCT-CLB - 3.5" Intelligent LCD-TFT display module with Capacitive Touch and Cover Glass

Link:

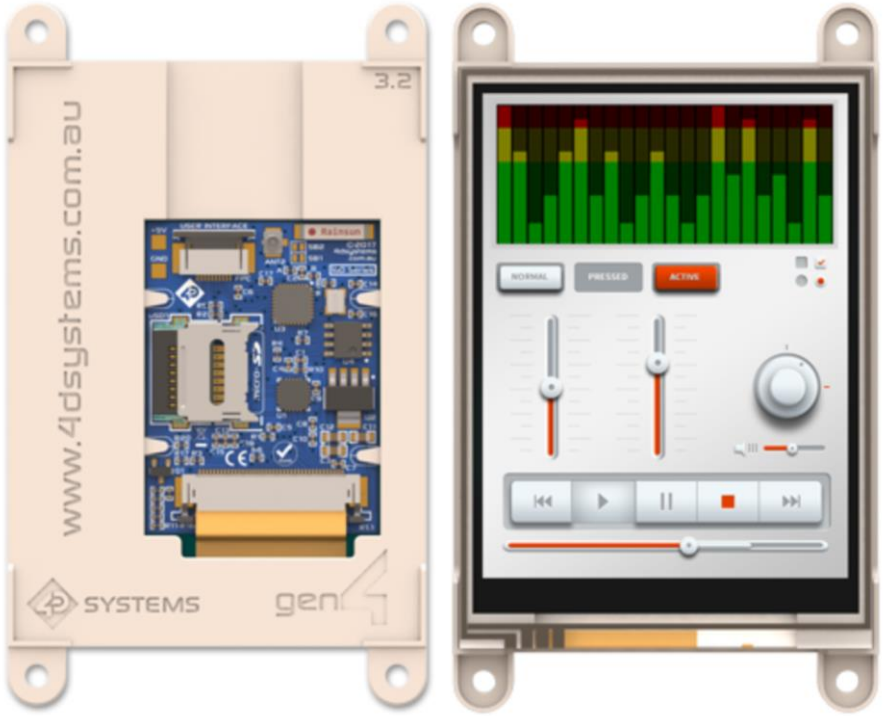
https://www.bcn3dtechnologies.com/en/catalog/bcn3d-sigma/

© 2021 | WWW.4DSYSTEMS.COM.AU

WiFi Display Modules

gen4-IoD (Internet of Displays) Series

- WiFi enabled smart display modules
- Powered by Espressif ESP8266 SoC
- Three sizes
  - 2.4”
  - 2.8”
  - 3.2”
- Resistive Touch
- Programmed using Workshop4 IDE



© 2021 | WWW.4DSYSTEMS.COM.AU

Integrated Display Solutions

Building Automation and Machine Control

- 4Discovery-35

- 4Discovery-50

© 2021 | WWW.4DSYSTEMS.COM.AU

4Discovery-35

- 3.5” TFT LCD with Resistive Touch
- DIABLO16 Processor
- RJ45 Interface with RS485 Communications
- Wall or Panel Mountable
- Programmed with Workshop4 IDE

© 2021 | WWW.4DSYSTEMS.COM.AU

Odyssey®

Every day's a breeze.

Live comfortably & save energy
all year round.

Bradford™ Ventilation

Visit **odyssey.com.au** or call **1800 332 332**

CSR

Easy-to-use touch screen control panel

New display screen with added features and benefits.

Set and forget

Simply set your desired temperature settings in your living or roof areas, and Odyssey will automatically provide all the comfort you need throughout your home. There's a BOOST setting, that is manually controlled, to provide an extra burst of fresh air and get rid of odours.

All year round comfort and protection

In summer, set your system to remove stifling hot air and freshen your home. In winter, draw in warmer, outside air to improve those cold, damp living areas. In addition, moisture and potentially damaging condensation can be controlled all year round. Relative humidity is displayed for the living area, roof space and external environment.

Simple operation

Temperature data can be logged and viewed in 24 hour periods, going back six months, and the settings screen displays easy to understand tiles for simple operation.

Hubbell

4D SYSTEMS
MAKING HUMAN INTELLIGENCE SMARTER

NX SimpleTouch™ Graphic Wall Station

by Hubbell Control Solutions
Collection Name: NX Distributed Intelligence

Contact Us

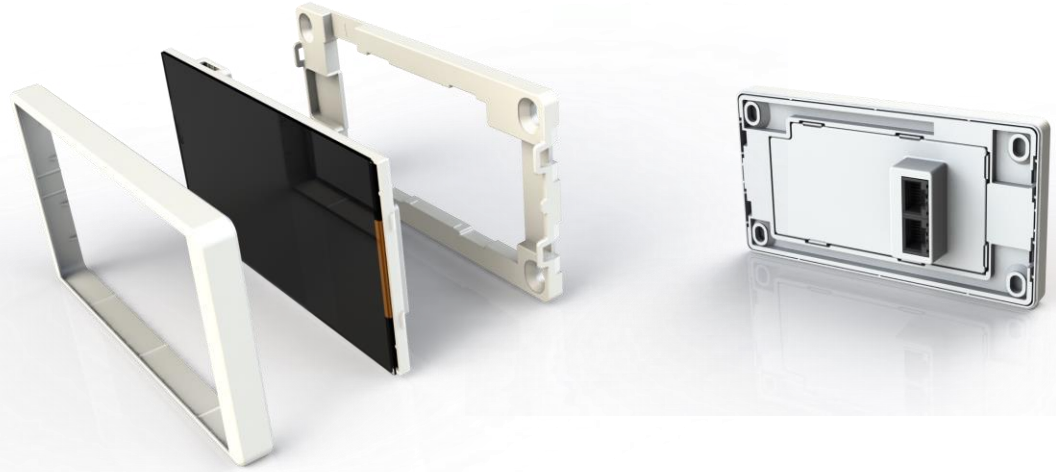
The NX SimpleTouch™ graphic wall station is an attractive and capable user interface for a NX controlled space. The 3.5" high resolution touch screen is highly visible from any angle and is simple to use. NX SimpleTouch provides users with a flexible and intuitive lighting control solution for switching, dimming, SpectraSync™ color temperature (CCT) control and preset activation. The NX SimpleTouch display is designed to be mounted to a standard single-gang rectangular wall box using the provided trim. Alternately it can be mounted into an enclosure or panel, enabling a wide range of customer applications NX SimpleTouch is a low-

Read More

Product Details | Resources / Downloads | Stocked Items

4Discovery-50

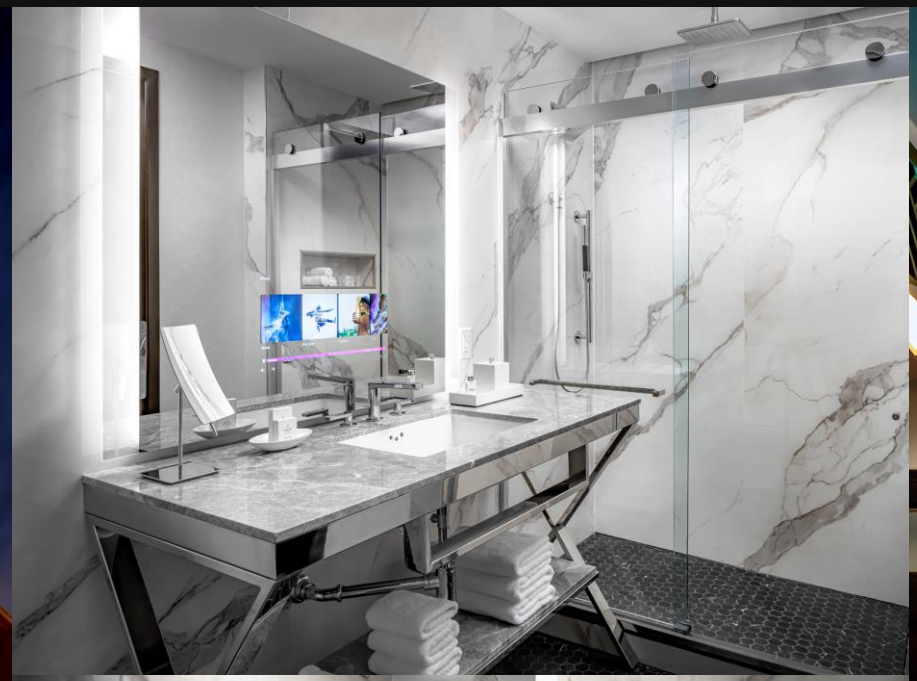
- 5.0” High Resolution IPS Display with 480x854 pixels.
- Capacitive Touch Screen
- Enclosure included
- 2 x RJ45 jacks with RS485. Can be used to daisy-chain if / when needed. Not necessary to use both jacks.
- Integrated Proximity Sensor to wake the device up from sleep mode
- Easy access to microSD card for media updates
- Slim design
- GUI Design and Programming done in 4D Workshop4 IDE
- Low power requirements
- Daughter board design allows for customisation for specific requirements
- Optional
  - Integrated WiFi and WiFi Antenna
  - Integrated Bluetooth



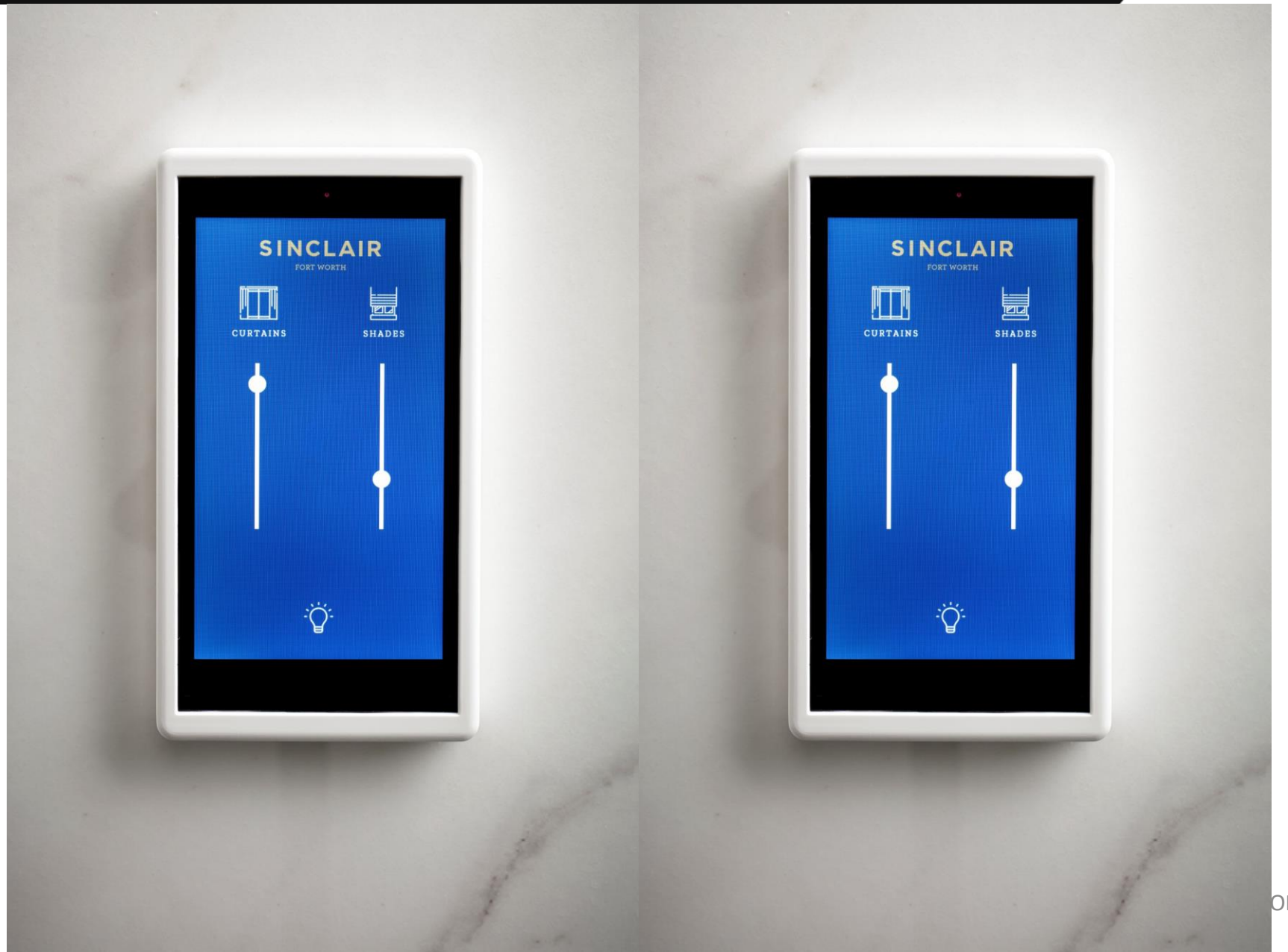
© 2021 | WWW.4DSYSTEMS.COM.AU

Sinclair Hotel – Fort Worth Texas

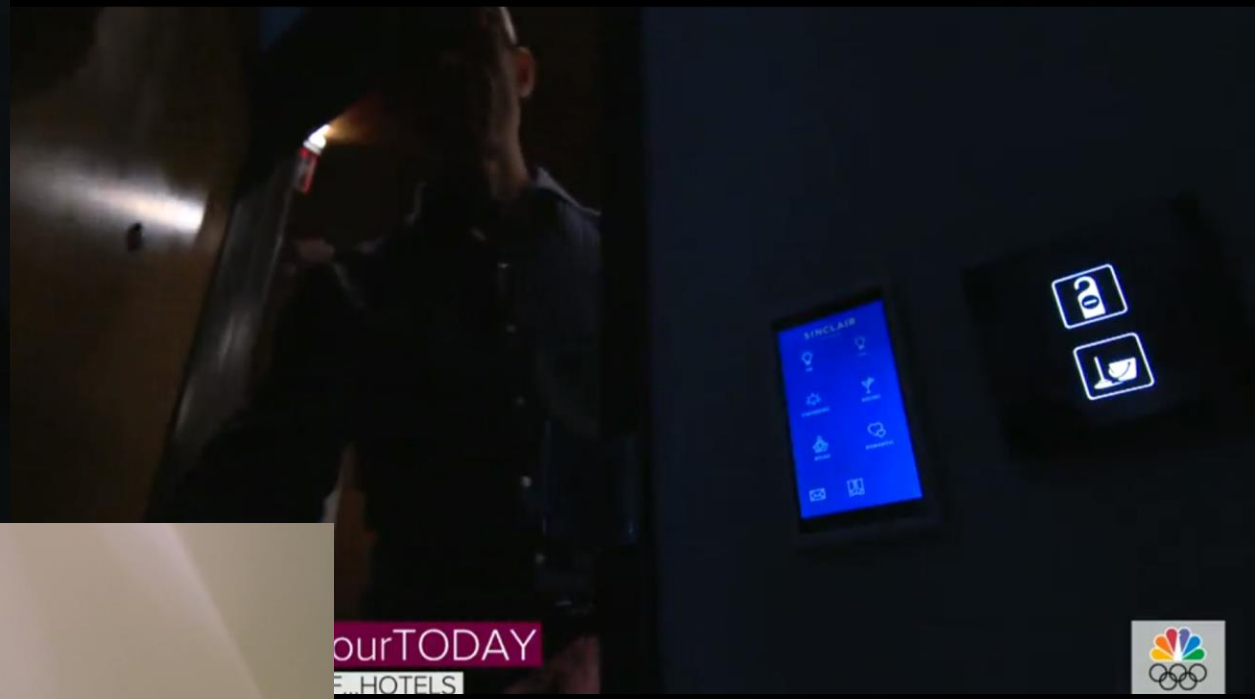
4D SYSTEMS
MAKING HUMAN INTELLIGENCE SMARTER



Sinclair Hotel – Fort Worth Texas



INTEL CORPORATION
3RD HOUR TODAY
@3rdHourTODAY
FUTURE OF...HOTELS


SINCLAIR

SINCLAIR
ON
OFF
G'MORNING
RELAX
3RD HOUR TODAY
@3rdHourTODAY
FUTURE OF...HOTELS

3RD HOUR TODAY
@3rdHourTODAY
FUTURE OF...HOTELS

SINCLAIR
OFF
SOCIAL
ROMANTIC
RELAX
3RD HOUR TODAY
@3rdHourTODAY
FUTURE OF...HOTELS

Software Tools – 4D Workshop4 IDE

- Combines
  - Editor
  - Compiler
  - Linker
  - Downloader
  - to develop complete 4DGL application code.
- All user application code is developed within the Workshop4 IDE.
- Available as a free download.
- Includes multiple development environments, to cater for different user requirements and skill level.

Four Design Environments

Designer

This environment enables the user to write 4DGL code in its natural form to program the display module.

Serial

For transforming the module into a slave device and control it from any host microcontroller with a serial port.

ViSi

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.

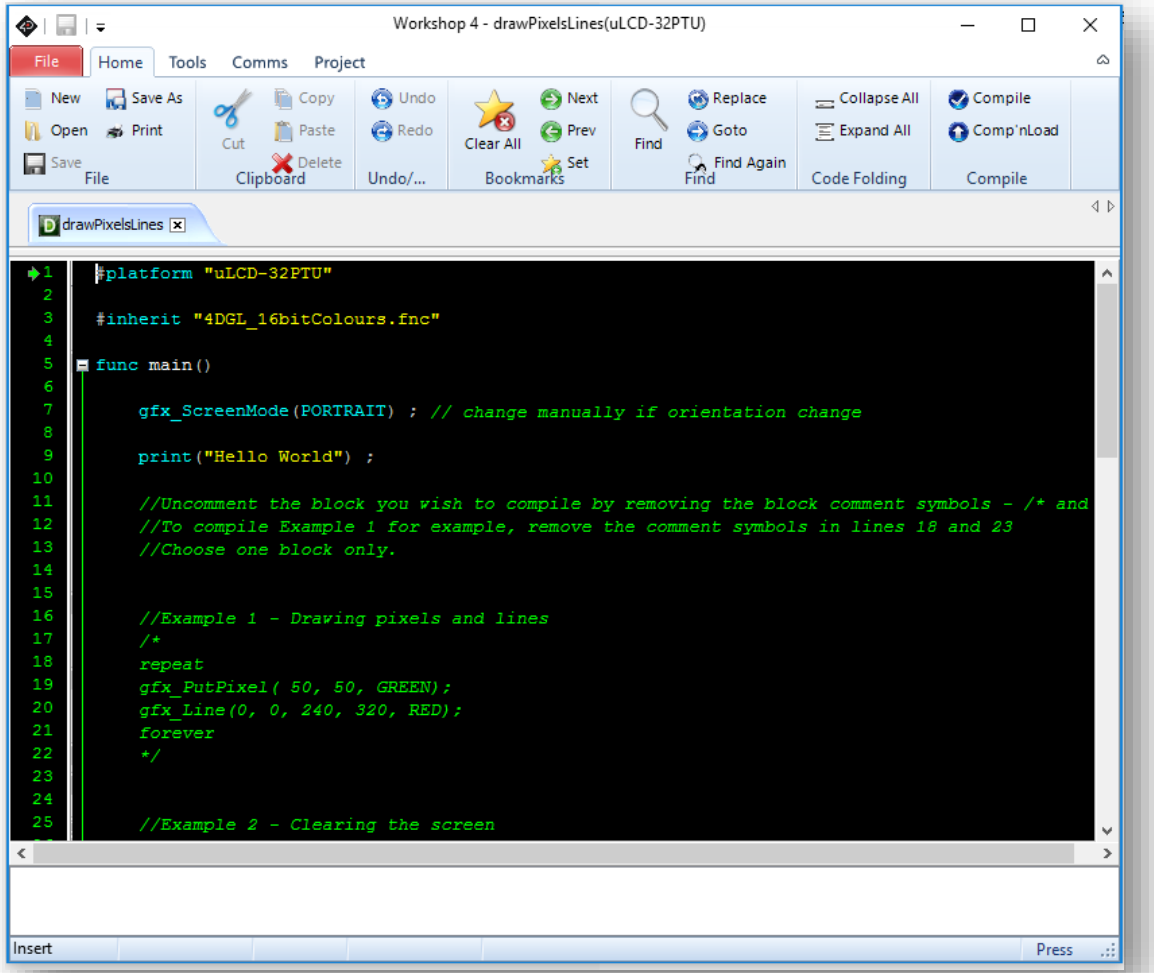
Visi-Genie

An advanced environment that doesn't require any 4DGL coding. Everything is automated. Simply lay the display out with the objects you want, set the events to drive them and the code is written automatically.

© 2021 | WWW.4DSYSTEMS.COM.AU

Designer Environment

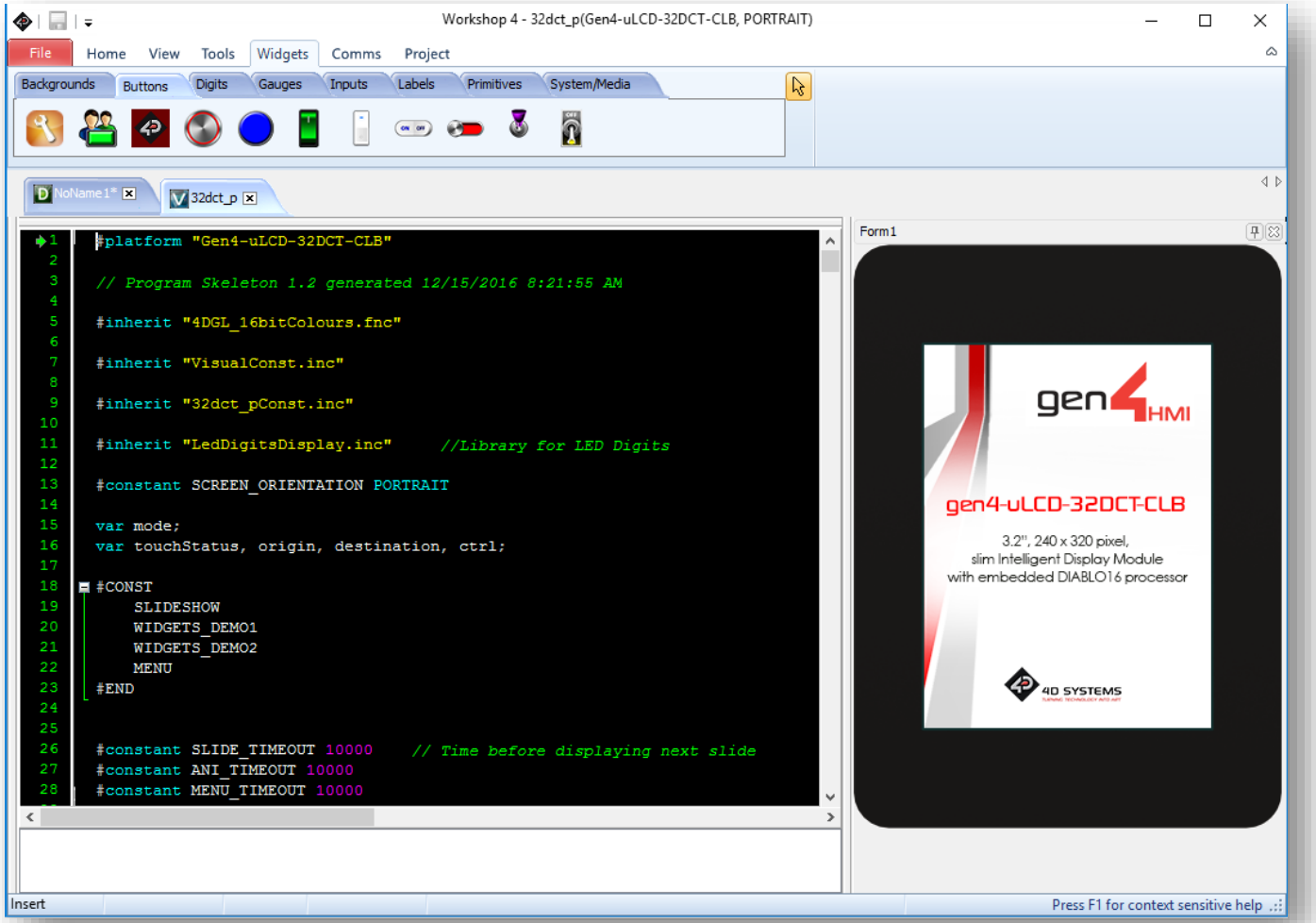
- Enables user to write 4DGL code in its natural form to program the display module.
- 4DGL is optimized for GOLDELOX, PICASO and DIABLO Controllers.
- 4DGL Syntax is very similar to C. No real need to learn a new language.



© 2021 | WWW.4DSYSTEMS.COM.AU

ViSi Environment

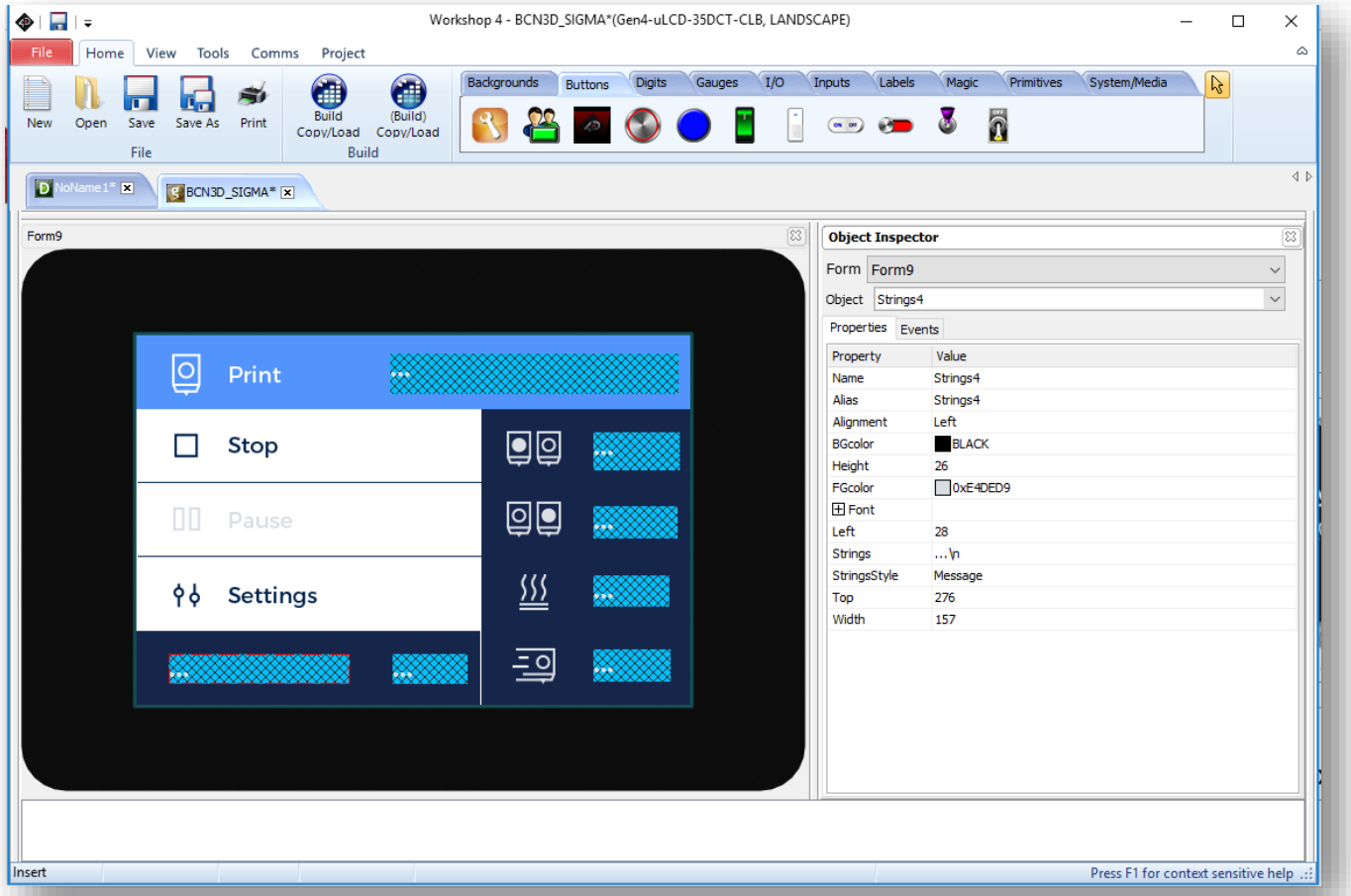
- A Visual programming experience
- Enables drag and drop of objects in a WYSIWYG editor
- Software generates 4DGL code for the graphics



© 2021 | WWW.4DSYSTEMS.COM.AU

ViSi Genie Environment

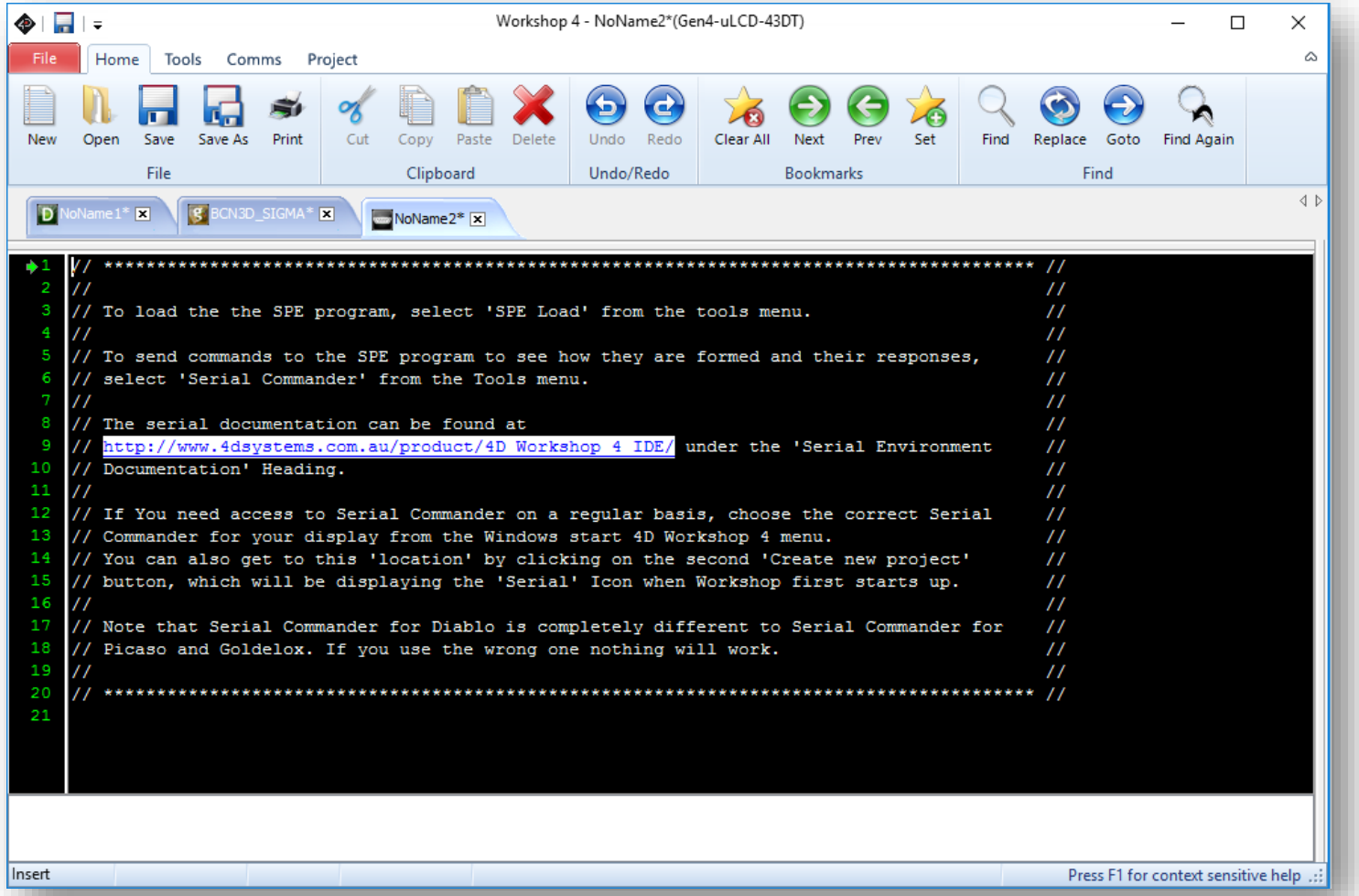
- No Coding Required
- Everything is automated
- Drag and drop objects on the display and define the events
- Code written automatically



© 2021 | WWW.4DSYSTEMS.COM.AU

Serial Environment

- Transforms the module into a serial slave
- Control the module from any host micro with a serial port
- All serial protocols and documentation are provided



© 2021 | WWW.4DSYSTEMS.COM.AU

Primary Displays for Raspberry Pi

- gen4-4DPI Series
- Supports: A+, B+, Pi2, and Pi Zero W.
- Sizes:
  - 4.3” – 480x272 pixels
  - 5.0” – 800x480 pixels
  - 7.0” – 800x480 pixels
- Touch options:
  - Resistive Touch
  - Capacitive Touch

© 2021 | WWW.4DSYSTEMS.COM.AU

Primary Displays for BeagleBone Black

- Sizes:
  - 4.3” – 480x272 pixels
  - 5.0” – 800x480 pixels
  - 7.0” – 800x480 pixels
- Touch options:
  - Resistive Touch
  - Capacitive Touch

© 2021 | WWW.4DSYSTEMS.COM.AU

4D LCD “Dumb” Displays

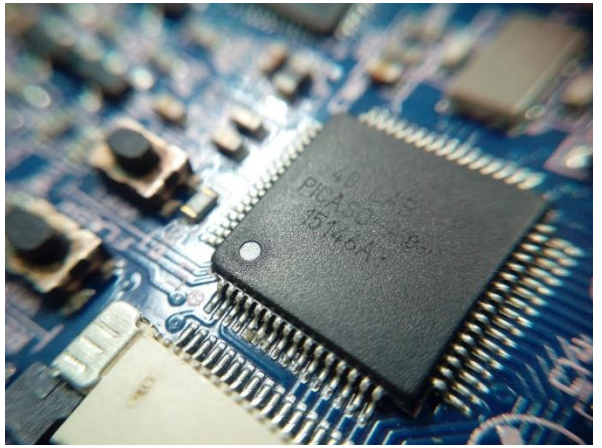
- Includes all displays used in the gen4 Series Smart Display Modules.
- Suitable for customers who know how to drive a display and/or are cost conscious.
- gen4 Series Smart Display Modules work as a great evaluation tool during the selection process.

Solutions options & Product Maturity

Module vs. Chipset Solution

- Module Viable and cost effective?
  - Continue using module
  - Viable for low to mid volume applications
  - Viability depends on value of end user application

- Module cost too high?
  - Integrate Processor in Application PCB
  - Source Display separately from 4D or alternative source
  - Module acts as development tool
  - GUI travels with processor. No need to re-develop.



© 2021 | WWW.4DSYSTEMS.COM.AU

One Stop Shop for Embedded Display Solutions

4D SYSTEMS
MAKING HUMAN INTELLIGENCE SMARTER

Integrate a Display with Touch to Virtually any Application

- Extremely fast time to market vs. traditional integration approach
- Scalable – seamless solutions from low volume to high volume applications without the need to invest in new software development.
- Cost effective even at lower volumes – low total cost of ownership
- Free professional quality software tools
- Secure supply of quality displays
- Codeless programming
- Equally beneficial for the pro-maker and to the most demanding professional
- Excellent documentation available
- Excellent customer support and technical support

4D SYSTEMS
MAKING HUMAN INTELLIGENCE SMARTER

Thank You

Q&A

© 2021 | WWW.4DSYSTEMS.COM.AU