Mosaic Industries Inc
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Embedded Controllers

for

Instruments and Automation

Home
Embedded GUI
SBC
Design Kits
Modular I/O

Getting Started
QScreen Starter Kit
QCard Starter Kit
PDQ Starter Kit

STATUS | KEYPAD | GRAPH
SHUT DOWN HEAT EXCHANGER 1
INPUT PRESSURE: 314 PSI
OUTPUT PRESSURE: 65 PSI
PUMP T
PUMP P

Shut Down Heater 1 Control
Config | Stats | Exit
Flow: 568.3 Liters/min   Set Limits
Temp: 314.2 C   Set Limits
Power: 67%
413 Watts   Dec | Inc
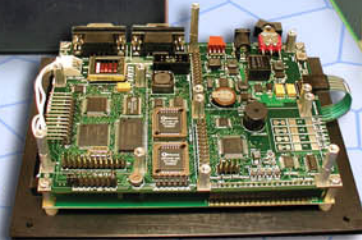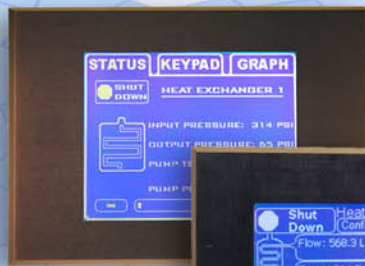
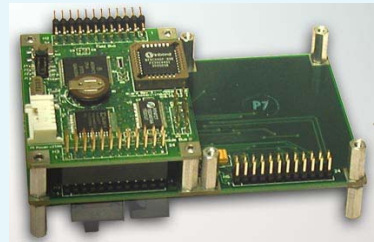# www.mosaic-industries.com

call: 510-790-8222   fax: 510-790-0925

PRODUCT GUIDE

SINGLE BOARD COMPUTERS

Our versatile board-level computers are an ideal solution for data acquisition, measurement, control, signal processing, and communications. They integrate ample memory and input/output capability with ready-to-use software on compact low cost boards.

INSTRUMENT CONTROLLERS & OPERATOR INTERFACES

Mosaic's touchscreen-operated Graphical User Interfaces combined with powerful I/O-rich embedded controllers provide and easy-to-use operator interface for your instrument.

PORTABLE INSTRUMENTS

Design your own custom portable instrument using the Mosaic Handheld, which packs a programmable computer, plenty of memory, communications, analog and digital I/O, battery power, 128x128 graphic display and 32 button keypad into a rugged enclosure.

WILDCARD MODULAR I/O

Create your own "custom off-the-shelf" system by mixing-and-matching these tiny 2 x 2.5" Wildcard I/O modules for high performance measurement and real-time control.

SOFTWARE

Mosaic's Integrated Development Environment (IDE) supports your application with easy-to-use software and extensive on-board firmware. Programming you controller is a snap using either Mosaic's ANSI-compatible Control-C or QED-Forth languages.

Mosaic Industries Inc.   Phone: 510-790-1255 Fax: 510-790-0925   **www.mosaic-industries.com**
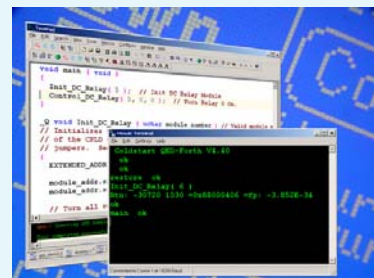
Quick Easy Design and Fast Time To Market

Since 1985, Mosaic Industries has provided embedded computer solutions for scientific instruments, manufacturing automation and industrial control. Our off-the-shelf customized hardware/software packages speed the development of new products and help you get to market faster.

As instrument control specialists, we are familiar with the challenges of new product design. This catalog describes powerful hardware and software tools that can speed your instrument design, product upgrade and automation projects.

A major trend in industrial applications is the integration of operator interfaces, real-time control, modular I/O, data acquisition, and communications – all in compact, easily programmed packages.

State-of-the-art control systems and instruments now span functions from data acquisition through signal processing and instrument control. So single board embedded computers must do it all – deal directly with sensors and actuators, implement control algorithms, interact with a user through a front panel, and serve out data via communications links. In particular, today's sophisticated instruments need intuitive interfaces for appliance-style ease of use.

Mosaic supplies OEMs and industrial systems integrators with low cost, single board computers incorporating a high level of software integration and pre-programmed user interfaces. Our products combine rugged, low cost hardware, graphic displays and touchscreens, powerful yet easy-to-use software, plenty of memory, advanced communications capability, a wide selection of off-the-shelf I/O expansion modules, and real-time, multitasking operating systems.

We can help you solve challenging sensing and data analysis problems and reduce the solution to a compact, rugged, real-time instrument.

Typical applications for Mosaic's controllers require powerful I/O-rich embedded computers and smart user interfaces, including:

- Scientific and Analytic Instruments
- Manufacturing Automation
- Data Acquisition & Logging
- Laboratory Automation & Robotics
- Motion Control
- Sensors and Actuators
- Operator Interface Panels
- Test and Measurement Systems

Using This Catalog

1. Choose among our core computer products for the one best suited to your application. You may need a single-board embedded computer, a full-featured operator interface with touchscreen and graphic display, or a customizable handheld computing platform. Whatever your choice, for each of our computer products there's a Starter Kit that includes everything you need to rapidly prototype your new product.

2. Need additional I/O? Choose among the Wildcard I/O modules for those best suited to your needs. Need custom I/O for your OEM product? Give us a call and we'll be glad to design a custom solution.

3. Choose the programming language you prefer. The Mosaic IDE provides a full-featured FORTH language development environment at no cost, and a one-time purchase of the C-language compiler gives you unlimited, royalty-free use of C for all your development needs.

4. Give us a call – our friendly, knowledgeable applications engineers will be glad to help you specify the core components best suited to your new product.

The PDQ™ Board

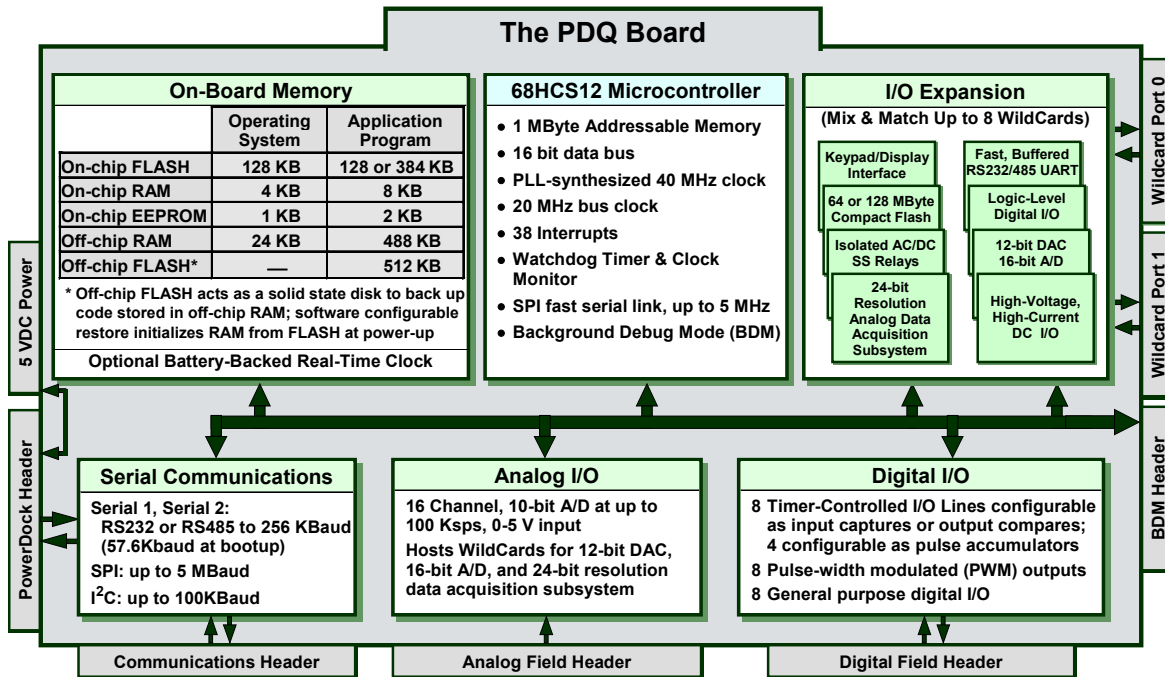## *Speedy Controller Delivers High Performance I/O*

A Fast and Versatile Embedded Computer

- Low cost
- Easy to program in C or Forth
- 8 PWM, 8 counter/timer, and 8 digital I/O lines
- Sixteen 10-bit A/D inputs
- Two RS232/485 ports, plus SPI and I^2C ports
- 256K or 512K on-chip Flash
- 512K RAM with Flash backup
- Plug-in I/O expansion, including:
  - 4x20 character display & keypad
  - High resolution A/D, D/A
  - 24-bit data acquisition subsystem
  - Isolated high current drivers
  - Compact Flash Card interface
  - Buffered RS232/422/485 UART and much more…

The PDQ™ Board is a fast I/O-rich computer that dramatically cuts the cost of data acquisition and control. It packs up to 1 megabyte of memory, communications, dozens of analog and digital I/O lines, and dual expansion I/O buses onto a compact low-cost board. This 2.5" x 4" single board computer is ideal for instrumentation, industrial control, automation, and data acquisition.

The PDQ Board hosts a fast Motorola 68HCS12 microprocessor. This controller has a 16-bit data bus and uses a Phase Locked Loop to synthesize a 40MHz internal clock and 20MHz bus clock, resulting in execution speeds 8 times faster than the 8-bit 68HC11 processor. The processor's 1 MByte address space is populated by 256K or 512K internal flash, 12K internal RAM, and 2K available internal EEPROM, plus 512K of fast off-chip RAM. The 512K RAM is "shadowed" by external flash that acts like an onboard disk drive, restoring your program code from flash memory each time the board is powered up. This flexible memory architecture allows for both RAM- and flash-intensive applications, and makes program development a snap.

The PDQ Board packs dozens of analog and digital I/O lines plus versatile serial communications links onto a compact board. It delivers 8 digital I/O lines with counter/timer capabilities, 8 pulse-width modulated (PWM) digital output signals, and 8 general purpose digital I/O lines. Additional I/O includes sixteen analog inputs with 10-bit resolution, dual RS232/485 ports with speeds to 256KBaud, and synchronous SPI and I^2C serial interfaces. Any of the digital I/O ports can be configured for general purpose I/O, and the analog input lines can be configured as digital inputs. An optional battery-backed real-time clock reports the time and date.

The PDQ Board is easily programmable in C, Forth or Assembly using any PC. Built-in programming tools include a multitasking executive and comprehensive device-driver libraries. All functions can be called interactively from the terminal to speed the debugging process. In addition, the processor implements a "Background Debug Mode" (BDM) in hardware that facilitates real-time debugging. A low-cost attachment to your desktop PC connects to the BDM port on the board, enabling you to set breakpoints, single step, and trace to diagnose your program at runtime.

Convenient connectors allow for simple mechanical integration. The PDQ Board can directly host up to 8 I/O expansion modules called Wildcards™ that you can mix and match depending on your application. The easy to use Wildcards stack onto the dual 24 pin Wildcard connectors on the PDQ Board. A convenient PowerDock™ module includes an efficient switching power regulator, dual DB-9 serial connectors, a power jack and an on/off switch.

Wildcards implement a wide variety of user interface, communications, data acquisition and control capabilities. Available Wildcards include a Keypad/Display module, octal 12-bit D/A and 16-bit A/D converters, a 24-bit resolution analog data acquisition subsystem, Compact Flash card mass memory interface, fast buffered RS232/485 dual UART, high voltage/high current isolated I/O, and AC or DC solid state relays. You can select the Wildcards that meet your needs to configure a cost-effective customized controller for your application.

The PDQ Board

On-Board Memory

	Operating System	Application Program
On-chip FLASH	128 KB	128 or 384 KB
On-chip RAM	4 KB	8 KB
On-chip EEPROM	1 KB	2 KB
Off-chip RAM	24 KB	488 KB
Off-chip FLASH*	—	512 KB

* Off-chip FLASH acts as a solid state disk to back up code stored in off-chip RAM; software configurable restore initializes RAM from FLASH at power-up

Optional Battery-Backed Real-Time Clock

68HCS12 Microcontroller

- 1 MByte Addressable Memory
- 16 bit data bus
- PLL-synthesized 40 MHz clock
- 20 MHz bus clock
- 38 Interrupts
- Watchdog Timer & Clock Monitor
- SPI fast serial link, up to 5 MHz
- Background Debug Mode (BDM)

I/O Expansion
(Mix & Match Up to 8 WildCards)

- Keypad/Display Interface
- 64 or 128 MByte Compact Flash
- Isolated AC/DC SS Relays
- 24-bit Resolution Analog Data Acquisition Subsystem
- Fast, Buffered RS232/485 UART
- Logic-Level Digital I/O
- 12-bit DAC 16-bit A/D
- High-Voltage, High-Current DC I/O

5 VDC Power

PowerDock Header

Wildcard Port 0

Wildcard Port 1

BDM Header

Serial Communications

Serial 1, Serial 2:
RS232 or RS485 to 256 KBaud
(57.6Kbaud at bootup)
SPI: up to 5 MBaud
I²C: up to 100KBaud

Analog I/O

16 Channel, 10-bit A/D at up to 100 Ksps, 0-5 V input

Hosts WildCards for 12-bit DAC, 16-bit A/D, and 24-bit resolution data acquisition subsystem

Digital I/O

- 8 Timer-Controlled I/O Lines configurable as input captures or output compares; 4 configurable as pulse accumulators
- 8 Pulse-width modulated (PWM) outputs
- 8 General purpose digital I/O

Communications Header   **Analog Field Header**   **Digital Field Header**

CPU
- 16 Bit 68HCS12
- 1 MB address space
- 20 MHz bus speed

Onboard Memory
- 256K or 512K on-chip Flash
- 12K on-chip RAM
- 2K on-chip EEPROM
- 512K RAM, shadowed by Flash which acts as a backup disk to load program code at power-up

Real-Time Clock
- Optional battery-backed real-time clock

Interrupts
- 38 interrupts support the processor's I/O

Communications
- Dual RS232 or RS485 hardware UARTs at up to 256 Kbaud (default bootup at 57.6 KBaud)
- Fast synchronous serial peripheral interface (SPI) at up to 5 Mbaud
- I²C at up to 100 Kbaud

Power
- 5 VDC at 250 mA

Timer-Controlled Input and Output
- 8 bitwise programmable I/O configurable as input captures or output compares. Up to 4 lines can be used as pulse accumulators

10-bit Analog to Digital Conversion
- 16 input channels, up to 100 kHz sampling rate
- May be used as digital inputs

Connectors
- Two 24-pin Wildcard bus connectors
- 24-pin digital field bus connector
- 24-pin analog field bus connector
- 10-pin dual RS232/485 serial connector
- 10-pin PowerDock interface connector
- 10-pin optional interprocessor connector
- 6-pin BDM (background debug) connector
- 7-pin 2mm pitch single row power connector

Runtime Security
- Watchdog timer and clock monitor

I/O Expansion
- PDQ Board directly hosts 8 Wildcards
- Wildcards provide additional I/O for:
  - 4 x 20 character display and 5 x 4 keypad
  - 16- or 24-bit resolution A/D
  - 12-bit D/A
  - Isolated AC or DC solid state relays
  - 64 or 128 Mbyte Compact Flash
  - Logic level, high voltage, and high current digital I/O
 - Fully buffered dual RS232, RS422 or RS485 up to 56Kbaud

How to Order

Part Number	Product
PDQB	PDQ Board, which includes 256K on-chip Flash, and 512K RAM with Flash memory shadow/backup.
	Options:
	-RB Battery-backed real time clock
	-MM 512K on-chip Flash replaces 256K
PDQBSK	PDQ Board Starter Kit
	Includes a PDQ Board (p/n **PDQB-RB**) with 256K on-chip Flash, 512K RAM and a real time clock; a 4" x 2.5" version of the PowerDock (p/n **PDW**) to provide a power supply and convenient connectors for your PDQ Board and for up to eight Wildcards; a 9-pin serial cable, an 8VDC wall-mount power supply and documentation.

The QCard^{TM} Controller

The QCard Delivers an Integrated Hardware and Software Solution at a Low Price
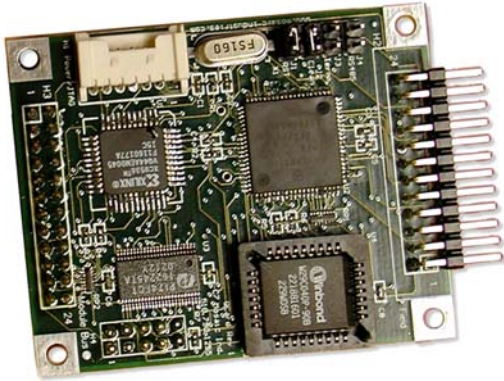
A Tiny Yet Versatile Embedded Computer

- Smaller than a credit card
- Low cost
- Easy to program in C or Forth
- Two RS232/485 ports, 16 analog & digital I/O
- 512K Flash, 128K RAM
- Plug-in I/O expansion, including:
  - 4x20 character display & keypad
  - High resolution A/D, D/A
  - 24-bit data acquisition subsystem
  - Isolated high current drivers
  - Compact Flash Card interface
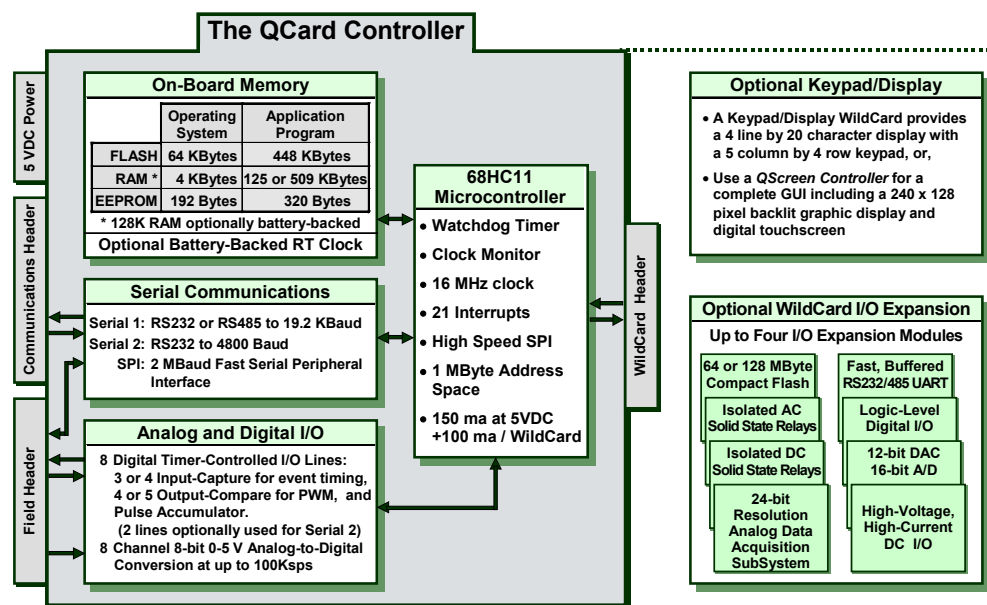 - Buffered RS232/422/485 UART and much more…

The QCard^{TM} packs a C-programmable computer, up to 1 MB of memory, communications, analog and digital I/O, and an expansion I/O bus onto a tiny low-cost board. This 2" x 2.5" single board computer is perfect for space-constrained applications and dramatically cuts the cost of data acquisition and control. It is ideal for machine automation, industrial control, robotics, handheld data acquisition, and scientific instrumentation.

The I/O-rich QCard hosts a 16 MHz Motorola 68HC11F1 microprocessor, 512K Flash and 128K RAM (expandable to 512K), and 320 bytes of EEPROM. On-board I/O includes 8 digital I/O lines with counter/timer capabilities, 8 analog inputs, a fast synchronous SPI serial interface, and dual RS232/485 ports. An optional real-time clock

tracks the calendar and time of day and battery backs the 128K RAM.

The QCard is easily programmable in C, Forth or Assembly using any PC. Built-in programming tools include an interactive debugger, a multitasking executive, and comprehensive device-driver libraries.

Convenient connectors allow for simple mechanical integration. The QCard can directly host up to 4 I/O expansion modules called Wildcards^{TM} that you can mix and match depending on your application. The easy to use Wildcards stack onto the 24 pin Wildcard connector on the QCard. A convenient PowerDock^{TM} module includes an efficient switching power regulator and expands the Wildcard bus to host up to 8 Wildcards.

The QCard Controller

5 VDC Power

Communications Header

Field Header

On-Board Memory

	Operating System	Application Program
FLASH	64 KBytes	448 KBytes
RAM *	4 KBytes	125 or 509 KBytes
EEPROM	192 Bytes	320 Bytes

* 128K RAM optionally battery-backed

Optional Battery-Backed RT Clock

Serial Communications

Serial 1: RS232 or RS485 to 19.2 KBaud
Serial 2: RS232 to 4800 Baud
SPI: 2 MBaud Fast Serial Peripheral Interface

Analog and Digital I/O

8 Digital Timer-Controlled I/O Lines:
 3 or 4 Input-Capture for event timing,
 4 or 5 Output-Compare for PWM, and
 Pulse Accumulator.
 (2 lines optionally used for Serial 2)
8 Channel 8-bit 0-5 V Analog-to-Digital Conversion at up to 100Ksps

68HC11 Microcontroller

- Watchdog Timer
- Clock Monitor
- 16 MHz clock
- 21 Interrupts
- High Speed SPI
- 1 MByte Address Space
- 150 ma at 5VDC +100 ma / WildCard

WildCard Header

Optional Keypad/Display

- A Keypad/Display WildCard provides a 4 line by 20 character display with a 5 column by 4 row keypad, or,
- Use a *QScreen Controller* for a complete GUI including a 240 x 128 pixel backlit graphic display and digital touchscreen

Optional WildCard I/O Expansion

Up to Four I/O Expansion Modules

64 or 128 MByte Compact Flash	Fast, Buffered RS232/485 UART
Isolated AC Solid State Relays	Logic-Level Digital I/O
Isolated DC Solid State Relays	12-bit DAC 16-bit A/D
24-bit Resolution Analog Data Acquisition SubSystem	High-Voltage, High-Current DC I/O

Get a Fast Start with the QCard Starter Kit

The QCard Starter Kit includes everything you need to develop your product. It includes a QCard Controller with 128K RAM, 512K Flash, and a real time clock; a 4" x 2.5" version of the PowerDock to provide a mechanical and electronic platform for your QCard and for up to eight Wildcards; a 9 pin serial cable, an 8VDC wall-mount power supply and documentation.

**Our free technical support and comprehensive documentation will
help you get the most from this powerful embedded computer.**

Technical Specifications

CPU
- 16 MHz 68HC11F1, 1 MB address space

Onboard Memory
- 512K Flash
- 128K RAM (or optional 512K RAM)
- 320 bytes of EEPROM
- Optional battery backup of 128K RAM

Real-Time Clock
- Optional battery-backed real-time clock

Interrupts
- 21 interrupts support the 68HC11's on-chip I/O

Communications
- RS232 or RS485 hardware UART at up to 19.2 Kbaud
- RS232 software UART at up to 4800 baud
- Fast synchronous serial peripheral interface (SPI) at up to 2 megabaud

Power
- 5 VDC at 150 mA

Timer-Controlled Input and Output
- 8 bitwise programmable I/O (2 used for the secondary serial port), including 3 or 4 input captures, 4 or 5 output compares, and a pulse accumulator

8-bit Analog to Digital Conversion
- 8 input channels, up to 100 kHz sampling rate
- May be used as digital inputs

Connectors
- 24-pin 0.1" pitch dual row Wildcard bus connector
- 24-pin 0.1" pitch dual row field bus connector
- 10-pin 0.1" pitch dual row serial connector
- 7-pin 2mm pitch single row power connector

Runtime Security
- Watchdog timer and clock monitor

I/O Expansion
- QCard directly hosts 4 Wildcards; with PowerDock, hosts up to 8 Wildcards
- Wildcards provide additional I/O for:
  - 4 x 20 character display and 5 x 4 keypad
  - 16- or 24-bit resolution A/D
  - 12-bit D/A
  - Isolated AC or DC solid state relays
  - 64 or 128 Mbyte Compact Flash
  - Logic level, high voltage, and high current digital I/O
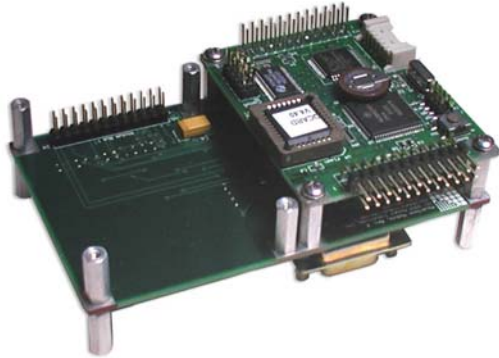 - Fully buffered dual RS232, RS422 or RS485 up to 56Kbaud

How to Order

Part Number	Product
QCC	QCard Controller, which includes 128K RAM and 512K Flash
	Options: **-RB** Real Time clock and battery- backup for 128K RAM **-MM** 512K RAM replaces 128K RAM (Cannot be battery backed)
QCSK	QCard Starter Kit
	Includes a QCard (p/n **QCC-RB**) with 128K RAM, 512K Flash, and a real time clock; a 4" x 2.5" version of the PowerDock (p/n **PDW**) to provide mechanical and electronic platform for your QCard and for up to eight Wildcards; a 9 pin serial cable, an 8VDC wall-mount power supply and documentation

The PowerDock^{TM}

Low-Cost Board Hosts Custom Assortment of Stackable I/O

Convenient Platform for the PDQ Board, QCard Controller and Wildcard I/O Modules

- Mates to the PDQ Board or to the QCard Controller
- Provides dual serial connectors, power jack and power switch
- Efficient 1A switching power supply
- Easily mounted on instrument panels
- Slim version hosts 4 Wildcards for space-constrained QCard applications
- Delivers a compact I/O-rich controller solution

Mosaic's **PowerDock™** provides a mechanical and electronic platform for the PDQ Board, QCard Controller and Wildcards. The combination of the PowerDock, PDQ or QCard processor board, and I/O Wildcards provides a "custom off-the-shelf" solution for instrumentation and control applications that require an embedded computer and a customized complement of analog, digital and communications I/O. Measuring only 2" x 2.5" for the slim version, or 4" x 2.5" for the wide version, this solution packs a lot of control and I/O capability into a compact form factor. The PowerDock hosts a 1 amp 5 volt switching power supply, dual DB-9 serial connectors, a power jack, a master power switch, plus Wildcard

interface connectors onto a compact card. The serial connectors, jack and switch are positioned for easy mounting to an instrument panel.

The PowerDock mates with the high performance PDQ Board or the very low cost QCard Controller, provides clean regulated 5V power, and brings out the processor board's dual serial ports to convenient connectors. The slim version of the PowerDock hosts a QCard plus up to 4 Wildcards. The wide PowerDock hosts a QCard plus up to 8 Wildcards in two stacks of up to 4 Wildcards each. The PDQ Board can host up to 8 Wildcards when mated to either version of the PowerDock.

Technical Specifications

Power
- 8 to 26 VDC unregulated DC input
- Supplies 5V @ 1.1A
- Onboard switching power regulation, EMI filter and surge protection.

Connectors
- 2 DB-9 serial connectors, each brings out RS232/485 serial port from the PDQ or QCard.
- 2.1mm female power jack.
- 1 (slim version) or 2 (wide version) 24-pin dual row 0.1"pitch Wildcard bus connector to host up to 4 or 8 Wildcards
- 10-pin dual row 0.1" pitch serial communications connector.
- 4-pin 0.1" pitch keyed Molex power connector brings out raw Vin, regulated +5V, GND, and VBAT (optional off-board battery supply for QCard real-time clock and RAM backup).
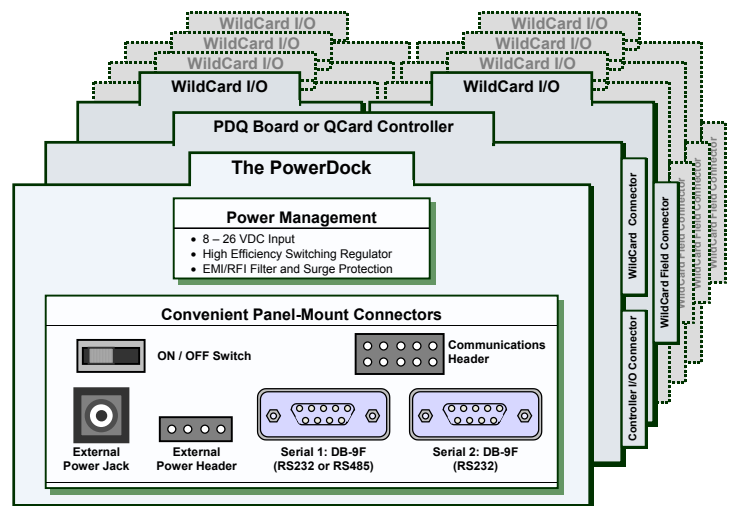

How to Order

Part Number	Product
PDS	PowerDock, Slim Version
PDW	PowerDock, Wide Version
	Options:
-NC	No DB9 connectors, power jack, or power switch (available for quantity orders of 10 or more)

The QScreen^{TM} Controller

Low Cost, Versatile Instrument Controller Hosts Mix-and-Match I/O

Instrument Control: More for Less!

- Powerful Real-Time Controller
- Touchscreen-operated Graphical User Interface (GUI)
- Programmable in C and Forth
- 4.8" diagonal, 128x240, CCFL-backlit LCD
- Hundreds of Screens, Buttons, and Menus
- Two RS232/485 Serial Ports
- Precoded Software: Menu Manager, Graphic Routines, Multitasking RTOS, I/O Drivers
- Up to 1MB Flash & 512KB RAM
- Eight Timer-Controlled Digital I/O Lines
- Eight 8-Bit A/D Inputs
- I/O Expansion (add up to 7 Wildcards)

The QScreen™ Controller combines a C-programmable computer with a touchscreen-operated graphical user interface. Designed as a fully-functional industrial controller, the QScreen is ideal for OEM applications where installation space is critical, such as embedded systems, scientific instruments, robotics, and portable data acquisition. The QScreen can be commanded remotely from a PC or used stand-alone to provide real-time control of dozens of analog and digital I/O lines.

State-of-the-Art Graphical User Interface

The QScreen Controller sports a touchscreen-operated graphical user interface on a high-contrast 128x240 pixel display with a 5x4 touchscreen overlay. It comes complete with object-oriented menuing software that makes it easy to control your application using buttons, menus, graphs, and bitmapped pictures.

Display your own custom graphics on a bright white-on-blue cold-cathode fluorescent (CCFL) backlit screen. You can create hundreds of sophisticated screens including your company logo, system diagrams, and icon-based control panels using most Windows paint programs, such as PC Paintbrush. Startup screens and your application program execute automatically on power-up.

Plenty of Memory

Choose from several memory options: from 512K Flash and 128K RAM for a standard configuration, up to 1M Flash and 512K RAM with the expanded memory option. For those really extensive applications that require lots of memory or removable data storage, the Compact Flash Wildcard adds 64MB or 128MB mass memory.

A Powerful Controller and Operating System

The QScreen Controller includes a powerful microcontroller you can program either in Control C™ or QED-Forth™. It comes loaded with a real-time multitasking operating system (RTOS) and hundreds of precoded device drivers. Programming is a snap using the interactive debugger and multitasking executive. Program in ANSI C by compiling your application on your PC and downloading the code to the Controller where it is automatically executed. The RTOS in onboard FLASH memory manages all required initializations and autostarts your application code.
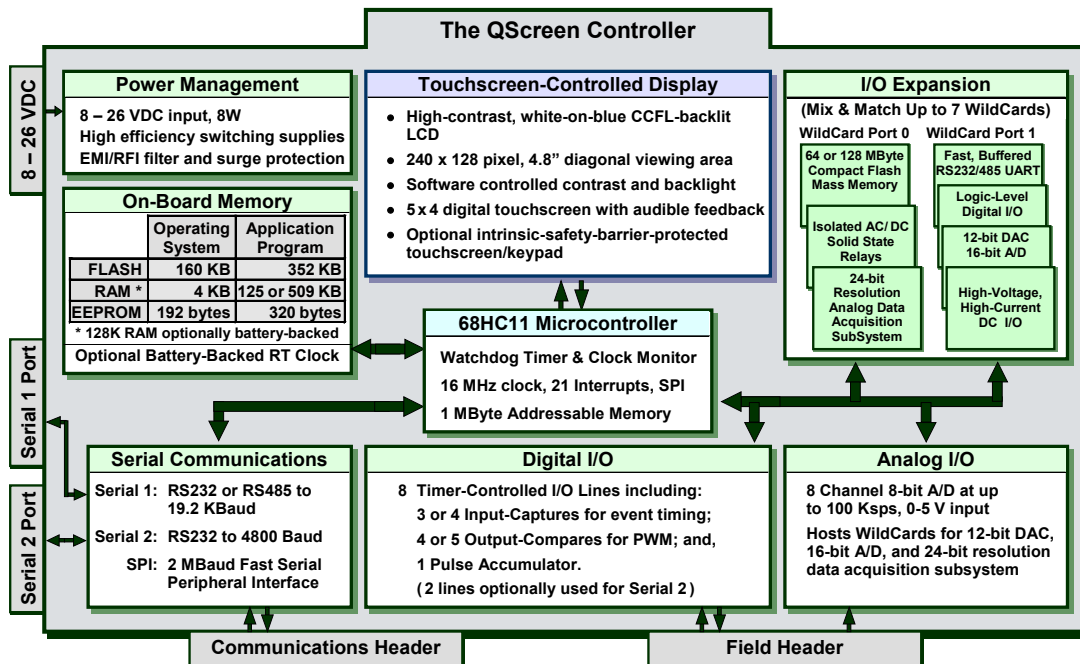
Expand and Customize I/O

Control dozens of analog and digital I/O lines in real time. The QScreen Controller commands eight 8-bit A/D lines, 8 digital I/O lines including timer-controlled and PWM channels, and two RS232/485 ports. Precoded I/O drivers are provided for all I/O, and make it easy to do data acquisition, pulse width modulation, motor control, frequency measurement, data analysis, analog control, PID control, and communications.

Need even more I/O? The QScreen Controller hosts Mosaic's Wildcards™, small stackable I/O modules for sophisticated and dedicated I/O. Stack up to seven Wildcards for: 16- or 24-bit resolution programmable gain A/D; 12-bit D/A; compact flash mass memory; opto-isolated AC or DC solid state relays; configurable digital I/O; additional RS232, RS422 or RS485; or high-voltage, high-current DC inputs and outputs (see Wildcards section of this Catalog).

The QScreen Starter Kit – Everything You Need for Rapid Prototyping

The QScreen Starter Kit includes everything you need to develop your GUI-based instrument: a QScreen Controller with LCD display & touchscreen, real time clock, 512K RAM and 1MB flash, convenient connectors, serial cable, power supply, and documentation. For a sleek look you can add a black anodized aluminum bezel. The QScreen can either be flush mounted using the bezel or directly mounted to a panel with a cutout.

The QScreen Controller

8 – 26 VDC

Power Management
- 8 – 26 VDC input, 8W
- High efficiency switching supplies
- EMI/RFI filter and surge protection

On-Board Memory

	Operating System	Application Program
FLASH	160 KB	352 KB
RAM *	4 KB	125 or 509 KB
EEPROM	192 bytes	320 bytes

* 128K RAM optionally battery-backed

Optional Battery-Backed RT Clock

Touchscreen-Controlled Display
- High-contrast, white-on-blue CCFL-backlit LCD
- 240 x 128 pixel, 4.8" diagonal viewing area
- Software controlled contrast and backlight
- 5 x 4 digital touchscreen with audible feedback
- Optional intrinsic-safety-barrier-protected touchscreen/keypad

I/O Expansion
(Mix & Match Up to 7 WildCards)

WildCard Port 0
- 64 or 128 MByte Compact Flash Mass Memory
- Isolated AC/DC Solid State Relays
- 24-bit Resolution Analog Data Acquisition SubSystem

WildCard Port 1
- Fast, Buffered RS232/485 UART
- Logic-Level Digital I/O
- 12-bit DAC 16-bit A/D
- High-Voltage, High-Current DC I/O

68HC11 Microcontroller
- Watchdog Timer & Clock Monitor
- 16 MHz clock, 21 Interrupts, SPI
- 1 MByte Addressable Memory

Serial 1 Port

Serial 2 Port

Serial Communications
- **Serial 1:** RS232 or RS485 to 19.2 KBaud
- **Serial 2:** RS232 to 4800 Baud
- **SPI:** 2 MBaud Fast Serial Peripheral Interface

Digital I/O
- 8 Timer-Controlled I/O Lines including:
  - 3 or 4 Input-Captures for event timing;
  - 4 or 5 Output-Compares for PWM; and,
  - 1 Pulse Accumulator.
  - (2 lines optionally used for Serial 2)

Analog I/O
- 8 Channel 8-bit A/D at up to 100 Ksps, 0-5 V input
- Hosts WildCards for 12-bit DAC, 16-bit A/D, and 24-bit resolution data acquisition subsystem

Communications Header

Field Header

CPU
- 16 MHz 68HC11F11, 2 MB address space

Onboard Memory
- 512K Flash and 128 RAM
- 128K RAM optionally battery backed
- 320 bytes EEPROM

Memory Expansion
- 1024K Flash and 512K RAM (RAM cannot be battery backed)
- 64 or 128 Mbyte Wildcard compact flash mass memory

Interrupts
- 21 interrupts support I/O subsystems

Real-Time Clock
- Optional real-time clock

Touchscreen/Display User Interface
- High contrast CCFL white-on-blue monochrome LCD display with software controlled backlight and contrast
- 4.8" diagonal (4.25"x2.25") 240 x 128 pixel display.
- 5 column by 4 row touchscreen with software controlled beeper. Custom antiglare, clear, and EMI touchscreens also available
- Optional intrinsic safety barrier on touchscreen

Digital Input and Output
- 8 timer-controlled I/O lines including 3 or 4 input capture functions, 4 or 5 output compare functions and pulse accumulator

Power
- 8 to 26 VDC at 3.5W
- 0.5 W per Wildcard I/O module
- Onboard regulation, EMI filter and surge protection

Communications
- RS232 or RS485 hardware UART at up to 19.2 Kbaud
- RS232 software UART at up to 4800 baud
- RS485 R, RC, and bias termination
- Fast synchronous serial peripheral interface (SPI) at up to 2 megabaud

Analog to Digital Conversion
- 8 channels, 0 - 5 V, 8-bit ADC
- May be used as digital inputs.

Connectors
- 2 DB9 serial connectors
- 2.1 mm female power jack
- 24 pin I/O header
- 2, 24 pin Wildcard ports

Runtime Security
- Watchdog timer and clock monitor

I/O Expansion
- up to 7 Wildcards

Size & Weight
- 4.125" x 6" x 1.55"
- 335 gm (12 oz)

Optional Bezel
- 5" x 7" black anodized aluminum
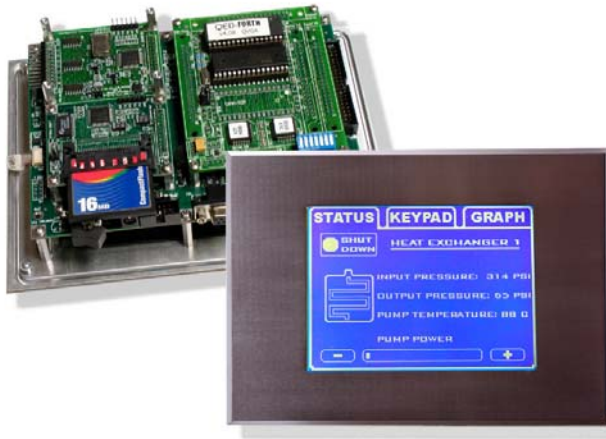- 270 gm (7.75 oz)

Operating Conditions
- 0 to 70°C (-30° to 80°C storage)
- 0 to 95% RH, noncondensing

How to Order

Part No.	Product
QSC	QScreen Controller which includes a powerful real time controller, 240 x 128 pixel CCFL-backlit monochrome LCD, 5 x 4 touchscreen, 128K RAM and 512K Flash
	<u>Options:</u> (add price to the standard option)
	-BZ — Mounted on a 5"x7" black anodized aluminum bezel
	-MM — 512K RAM (can not be battery backed) replaces 128K RAM, and 1MB Flash replaces 512K Flash
	-RB — Real time clock and battery-backup for 128K RAM (does not back up 512K RAM)
	-CC* — CCFL current controller provides sure start and even luminosity over all temperatures
	-NC* — Does not include DB9 serial connectors, power jack, or power switch
	-IS* — An intrinsic safety barrier protects all touchscreen leads
	<u>Note:</u> -CC, -NC, -IS options are only available for quantity orders of 10 or more
QSSK	Includes everything you need for a fast start: the QScreen Controller (p/n **QS-RB-MM**) with a monochrome LCD, real time clock, 512K RAM and 1MB flash, convenient connectors, 9 pin serial cable, power supply, and documentation

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The QVGA Controller[TM]

I/O Rich Instrument Controller Sports Super-Visible 1/4 VGA Display

Everything You Need For Instrument Control

- Powerful C-Programmable Controller
- Built-In Real Time Operating System (RTOS)
- 6", 1/4 VGA (320x240 pixel) Monochrome Display
- Hundreds of Screens, Buttons, and Menus
- Two RS232/485 Serial Ports
- Precoded Software: Object-Oriented Menu Manager, Graphic Routines, Multitasking RTOS, I/O Drivers
- Up to 768K Flash & 640K RAM
- 48 Analog and Digital I/O Lines
- Eight 12 Bit and Eight 8-bit A/D Inputs
- I/O Expansion (add up to 8 Wildcards)

The **QVGA Controller™** is a state-of-the-art embedded microcontroller with an advanced operator interface. It's an ideal "brain" for instruments that need a highly visible graphical user interface (GUI), touchscreen control, computational power, I/O, and serial communications – all in one compact package. Use it for scientific instruments, machine or process control, or as an advanced operator interface for existing products. The built-in multitasking operating system facilitates concurrent functioning of its user interface, I/O, and application software. This compact, integrated device provides the core hardware, software and user interface for your new products, delivering an I/O-rich computer *and* an advanced user interface.

Advanced Graphical User Interface

The QVGA Controller features a touchscreen-controlled graphical user interface. Combining a high-contrast 6" diagonal ¼VGA display and high resolution analog touchscreen, it comes complete with object-oriented menuing software that makes it easy to control your application using buttons, menus, graphs, and bitmapped pictures.

Display your own custom graphics on a bright white-on-blue cold-cathode fluorescent (CCFL) backlit LCD. Display screens and graphics objects are quickly developed with most Windows paint programs, such as PC Paintbrush. Real-time data plotting routines are precoded for you, so the user can *see* what your instrument is doing. Your application's startup screen executes automatically on power-up.

You can use hundreds of screens, each with software configurable buttons and menus. A precoded menu manager simplifies menu-driven control, making it easy to define buttons, menus, icons, and their associated actions. With the touch or release of a button, the menu manager responds, sending an appropriate command to your application program. Onboard software draws the screen graphics and responds to button presses for you, so you can focus on your application.

Programmable and Customizable

You can program the QVGA Controller using either the ANSI-standard C language or Mosaic's QED-Forth language for real-time control. Its embedded firmware reduces your time time-to-market – it comes loaded with a real-time multitasking operating system (RTOS), object oriented GUI Toolkit, and hundreds of precoded device drivers. Programming is a snap using the interactive debugger and multitasking executive. Firmware libraries including drawing and plotting functions for the display are already preprogrammed for you. The RTOS in onboard FLASH memory manages all required initializations, and automatically initializes and starts your application code.

Mix and Match I/O

Control dozens of analog and digital I/O lines in real time. The QVGA Controller commands eight 12-bit analog input channels, eight 8-bit analog inputs, eight 8-bit D/A lines, 24 digital I/O lines including timer-controlled channels, 4 high current drivers, and two RS232/485 ports. Precoded I/O drivers make it easy to do data acquisition, pulse width modulation, motor control, frequency measurement, data analysis, analog control, PID control, and communications.

Need even more I/O? The QVGA Controller hosts Mosaic's Wildcards[TM], small I/O modules for sophisticated and dedicated I/O. Stack up to eight Wildcards for: high resolution A/D; 12-bit D/A; compact flash mass memory; AC or DC solid state relays; configurable digital I/O; additional RS232, RS422 or RS485; or high-voltage, high-current DC inputs and outputs.
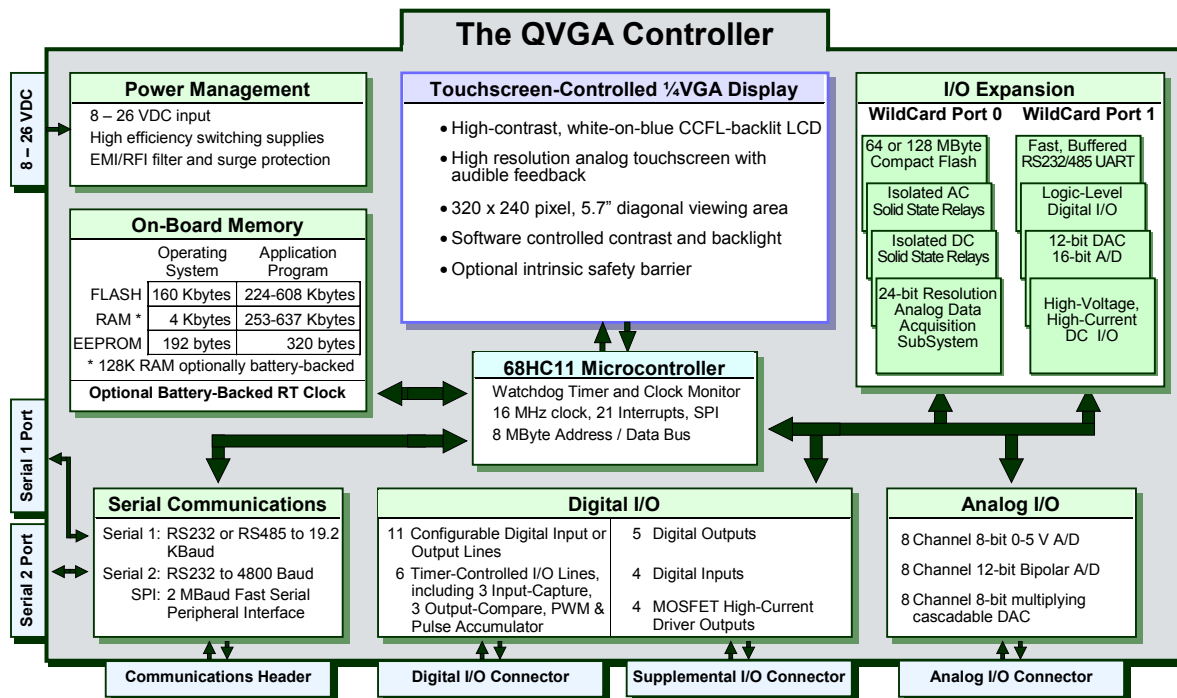
Plenty of Memory

384K Flash & 256K RAM provides ample room for application code and graphic screens. Custom controllers with 768K Flash and 640K RAM are also available. For those really extensive applications that require lots of memory or removable data storage, you can use compact flash cards of 64 MB or more.

QVGA Starter Kit

The QVGA Starter Kit includes everything you need to develop a prototype instrument with and advanced GUI: a QVGA Controller with display and touchscreen, battery backup for 128K RAM memory, a full documentation package, power supply and all cables. For a sleek look you can add a black anodized aluminum bezel. The QVGA Controller can either be flush mounted using the bezel or directly mounted to a panel with a cutout.

The QVGA Controller

Power Management
8 – 26 VDC input
High efficiency switching supplies
EMI/RFI filter and surge protection

Touchscreen-Controlled ¼VGA Display
- High-contrast, white-on-blue CCFL-backlit LCD
- High resolution analog touchscreen with audible feedback
- 320 x 240 pixel, 5.7" diagonal viewing area
- Software controlled contrast and backlight
- Optional intrinsic safety barrier

I/O Expansion
WildCard Port 0   **WildCard Port 1**

WildCard Port 0	WildCard Port 1
64 or 128 MByte Compact Flash	Fast, Buffered RS232/485 UART
Isolated AC Solid State Relays	Logic-Level Digital I/O
Isolated DC Solid State Relays	12-bit DAC 16-bit A/D
24-bit Resolution Analog Data Acquisition SubSystem	High-Voltage, High-Current DC I/O

On-Board Memory

	Operating System	Application Program
FLASH	160 Kbytes	224-608 Kbytes
RAM *	4 Kbytes	253-637 Kbytes
EEPROM	192 bytes	320 bytes

* 128K RAM optionally battery-backed

Optional Battery-Backed RT Clock

68HC11 Microcontroller
Watchdog Timer and Clock Monitor
16 MHz clock, 21 Interrupts, SPI
8 MByte Address / Data Bus

Serial Communications
Serial 1: RS232 or RS485 to 19.2 KBaud
Serial 2: RS232 to 4800 Baud
SPI: 2 MBaud Fast Serial Peripheral Interface

Digital I/O
11 Configurable Digital Input or Output Lines
6 Timer-Controlled I/O Lines, including 3 Input-Capture, 3 Output-Compare, PWM & Pulse Accumulator

5 Digital Outputs
4 Digital Inputs
4 MOSFET High-Current Driver Outputs

Analog I/O
8 Channel 8-bit 0-5 V A/D
8 Channel 12-bit Bipolar A/D
8 Channel 8-bit multiplying cascadable DAC

Communications Header   **Digital I/O Connector**   **Supplemental I/O Connector**   **Analog I/O Connector**

8 – 26 VDC • Serial 1 Port • Serial 2 Port

CPU
- 16 MHz 68HC11F11, 8 MB address space

Onboard Memory
- 384K Flash and 256K RAM with 128K RAM optionally battery backed
- 320 bytes EEPROM

Memory Expansion
- Onboard memory expandable to 768K Flash and 640K RAM with 128K RAM optionally battery backed
- 64 or 128 Mbyte Wildcard compact flash mass memory

Interrupts
- 21 interrupts support I/O subsystems

Real-Time Clock
- Optional real-time clock

Touchscreen/Display User Interface
- High contrast CCFL white-on-blue monochrome LCD display with software controlled backlight and contrast
- 5.7" diagonal (3.5" x 4.6"), 320 x 240 pixel display
- High resolution transparent analog touchscreen with software controlled beeper for audible feedback

Digital Input and Output
- 28 user-configurable I/O lines including 3 or 4 input capture functions, 4 or 5 output compare functions and pulse accumulator
- Four open-drain high-current outputs with onboard snubbers drive 150 mA continuously or 1 amp intermittently

Power
- 8 to 24 VDC
- 4 W
- 0.5 W per Wildcard I/O module
- Onboard regulation, EMI filter and surge protection

Digital to Analog Conversion
- 8 channels of 8 bit multiplying D/A conversion, cascadable

Analog to Digital Conversion
- 8 channels of 8-bit A/D at up to 100 kHz sampling rate
- 8 channels single-ended or 4 channels differential 12-bit A/D at up to 30kHz sampling rate with unipolar (0 to +5V) or bipolar (-5 to +5V) input

Connectors
- 40 pin digital I/O
- 40 pin analog I/O
- 38-pin supplemental digital I/O
- 2, DB-9 serial
- 10 pin serial communications
- 10 pin power connector and modular power jack
- 2, 24 pin Wildcard headers

Runtime Security
- Watchdog timer and clock monitor

I/O Expansion
- Modular Wildcards provide additional I/O for:
- 16- or 24-bit resolution A/D
- 12-bit D/A
- Isolated AC or DC solid state relays
- 64 Mbyte Compact Flash
- Logic level, high voltage, and high current digital I/O
- RS232, RS422 or RS485

Operating Conditions
- Temp 0-60°C (-20°-70°Cstorage)
- Humidity: 0-35% non condensing

Weight & Size:
- 500 gm; 6.75" x 5" x 2"
- Optional Bezel 220 gm; 6" x 8"

How to Order

Part No.	Product
QVGA	QVGA Controller which includes 384K Flash, 256K RAM, 5.7" 320 x 240 pixel Monochrome LCD display, touchscreen, and precoded GUI Toolkit Options: (add price to the standard option)
-BB	128K sealed battery-backed RAM in place of 128K RAM
-BZ	Mounted on a 6"x8" black anodized aluminum bezel
-CC*	CCFL current controller provides sure start and even luminosity over all temperatures
-IS*	An intrinsic safety barrier protects all touchscreen leads
-MM	Additional 384K RAM and 384K Flash for total of 640K RAM and 768K Flash
-NC*	Does NOT include DB9 connectors, power jack, or power switch
-RT	Includes a battery-backed real time clock
Note:	-CC, -IS, and -NC options are only available for quantity orders of 10 or more
QVGASK	Includes all you need for a fast start: the QVGA Controller (p/n **QVGA-BB**) with a monochrome LCD, battery-back up of the 128K RAM, 9 pin serial cable, power supply, and documentation

The Mosaic Handheld™

A Customizable Computing, Data Acquisition and Communications Instrument

Everything You Need To Create a Portable Instrument

- 128x128 Graphics Display and 32 Button Keypad
- Precoded GUI Toolkit for easy user interface design
- Built-in Real–Time Operating System (RTOS)
- Programmable in C & Forth
- 8 Timer-Controlled I/O Lines, 8-Channel 8-bit A/D, SPI interface, Dual RS232/485 serial ports
- Up to 1MB Flash & 512K RAM plus 320 Bytes of EEPROM
- Built-in charger for 6 AA Nickel Metal Hydride batteries
- Customizable Personality Board with prototyping area
- Hosts up to 4 Wildcards

The **Mosaic Handheld** makes it easy for you to design a custom portable instrument. It integrates a graphics display, keypad with customizable overlay, processor, memory, analog and digital I/O, serial communications, an expansion I/O bus, rechargeable batteries, power conditioning and battery charger circuitry in a rugged handheld enclosure. A DB-25 connector at the bottom of the instrument allows you to connect external signals to the instrument. The built-in Personality Board makes it easy to route internal and external I/O and data signals inside the instrument, and includes a prototyping area to simplify the addition of custom circuitry. You can plug in up to 4 Wildcard I/O cards inside the instrument to customize the Handheld for your application. The rugged plastic enclosure is small enough to fit comfortably in your hand but large enough to hold your custom circuitry, sensors and actuators.

When designing a new portable device, the job of integrating the battery charger, switching power supplies, user interface, embedded computer and board-to-board interconnects in a compact enclosure consumes a huge amount of engineering effort. The Mosaic Handheld solves all these problems for you, providing an elegant platform that lets you concentrate on the unique aspects of your application. By starting with this highly integrated system, you'll get to market faster.

The Mosaic Handheld is ideal for prototyping and manufacturing portable instruments for data logging, inventory management, data acquisition, sensor calibration, industrial control, and scientific instrumentation.

A Powerful Controller and Lots of I/O

The *Processor Board* inside the Handheld hosts a 16 MHz Motorola 68HC11F1 microprocessor, 512K Flash and 128K RAM (expandable to 1 MB Flash and 512K RAM), and 320 bytes of EEPROM. On-board I/O includes 8 digital I/O lines with counter/timer capabilities, 8 analog inputs, a fast synchronous SPI serial interface, and dual RS232/485 ports. An optional real-time clock tracks the calendar and time of day and battery backs the 128K RAM.

The processor is easily programmable in C, Forth or Assembly using any PC. Built-in programming tools include an interactive debugger, a multitasking executive, comprehensive device-driver libraries, and a GUI (Graphical User Interface) toolkit.

Friendly Graphical User Interface

The Handheld features a keypad and 128 x 128 pixel liquid crystal display for showing text and graphical images. The high-contrast 3.4" diagonal display and 4 column by 8 row keypad are controlled by means of a precoded GUI Toolkit that makes it easy to program an intuitive user interface using menus and bitmapped graphics. The software draws the screen graphics, responds to keypad presses, provides audible keypress feedback, and even implements front panel control of the backlight and display contrast.

Easy To Customize

The *Personality Board* allows you to filter and protect the I/O lines and to route them to a customizable DB25 connector on the bottom of the enclosure. The Personality Board also hosts up to 4 I/O Wildcards™ that stack onto 24-pin Wildcard connectors in the Handheld. Wildcards implement a wide variety of communications, data acquisition and control capabilities. In the Wildcards section of this catalog you can select the Wildcards that meet your needs to configure a cost-effective customized instrument for your application.

A convenient prototyping area allows you to integrate application-specific circuitry including sensors and actuators.

Battery Power for Portability

The Handheld can operate for up to 10 hours on its six rechargeable 2 amp-hour nickel-metal hydride (NiMH) batteries. The *Power Board* contains circuitry that recharges the batteries in only two hours. The battery pack may be charged overnight or while the instrument is in use. For non-battery applications, you can power the instrument with 15 to 26 VDC via the power jack or through the DB25 connector on the bottom of the unit.

The Power Board also implements power control circuitry that responds to a dedicated on/off key on the front panel keypad.

The Mosaic Handheld

1234567890123456789 01
Backlit
LCD
Display

Graphics or Text
16 lines by
21 characters/line
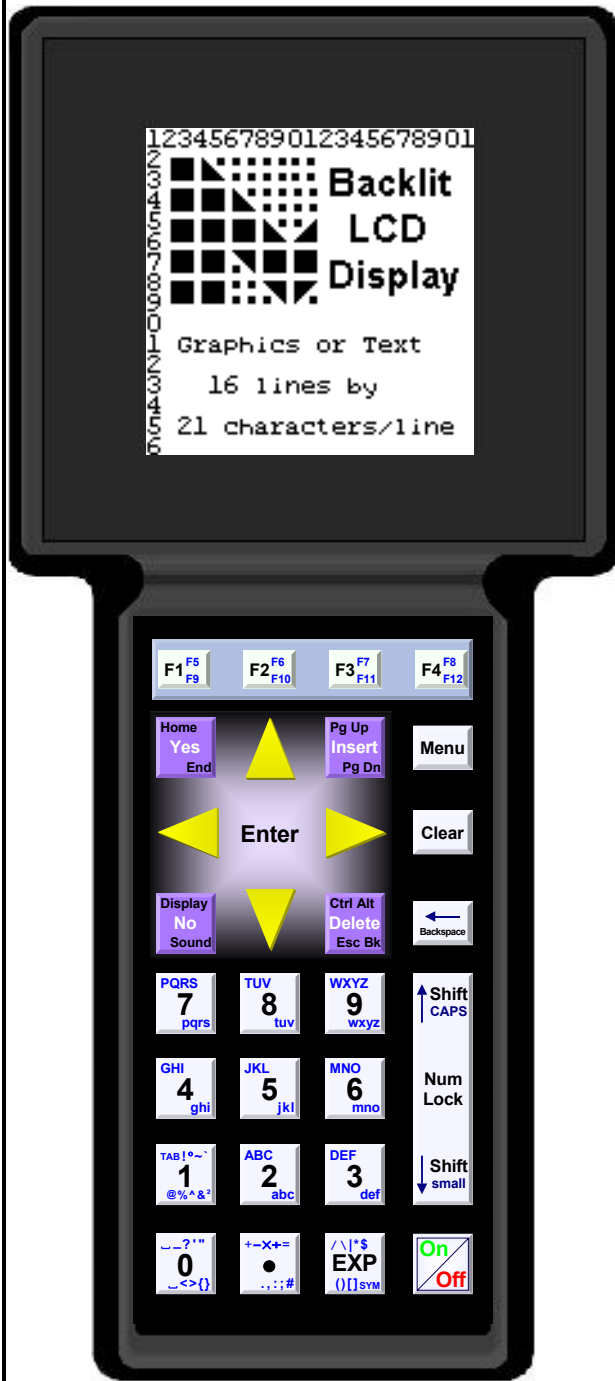
High-Performance, Real-Time Controller

Processor and Graphic User Interface

68HC11 microcontroller with watchdog timer & clock monitor, 16 MHz clock, 21 interrupts, SPI, 1 MByte addressable memory

128 x 128 pixel, 3.4" diagonal LCD display with LED backlight

Software controlled contrast and backlight intensity

32 key keypad (8x4) with audible and tactile feedback

On-Board Memory

	Operating System	Application Program
FLASH	160 KB	352 or 864 KB
RAM *	4 KB	125 or 509 KB
EEPROM	192 bytes	320 bytes

* 128K RAM optionally battery-backed

Optional Battery-Backed RT Clock

Serial Communications

Serial 1: RS232 or RS485 to 19.2 KBaud

Serial 2: RS232 to 4800 Baud

SPI: 2 MBaud Fast Serial Peripheral Interface

Digital I/O

8 Timer-Controlled I/O Lines including:

3 or 4 Input-Captures for event timing;

4 or 5 Output-Compares for PWM; and,

1 Pulse Accumulator.

(2 lines optionally used for Serial 2)

Analog I/O

8 Channel 8-bit A/D at up to 100 Ksps, 0-5 V input.

Hosts WildCards for 12-bit DAC, 16-bit A/D, and 24-bit resolution data acquisition subsystem.

Extensive, Customizable I/O

Configuration Area

Prototyping area for custom analog or digital circuitry, sensors, or actuators.

Signal selection and routing of 24 I/O signals to a DB-25 mounted on the bottom of the handheld.

Room for mounting custom hardware.

User-configurable I/O protection or filtering.

Connection for an external probe

I/O Expansion

(Mix & Match Up to 4 WildCards)

WildCard Port 0   **WildCard Port 1**

64 or 128 MByte Compact Flash Mass Memory

Fast, Buffered RS232/485 UART

Logic-Level Digital I/O

Isolated AC / DC Solid State Relays

12-bit DAC 16-bit A/D

24-bit Resolution Analog Data Acquisition SubSystem

High-Voltage, High-Current DC I/O

Flexible Power Options

External Power

15-26 volt power adapter.

High efficiency switching supplies.

EMI/RFI filter and surge protection.

Auto-ON/OFF and keypad power control.

Battery Power Management

6 AA cell NiMH battery pack uses off-the-shelf batteries.

Built-in battery charger with voltage and temperature protection.

10 hour operating time on battery power.

Keypad keys:

F1 F5 F9 | F2 F6 F10 | F3 F7 F11 | F4 F8 F12

Home Yes End | Pg Up Insert Pg Dn | Menu

Enter | Clear

Display No Sound | Ctrl Alt Delete Esc Bk | Backspace

PQRS 7 pqrs | TUV 8 tuv | WXYZ 9 wxyz | Shift CAPS

GHI 4 ghi | JKL 5 jkl | MNO 6 mno | Num Lock

TAB !°~' 1 @%^&² | ABC 2 abc | DEF 3 def | Shift small

_ _ ? ' " 0 _ <>{} | +−×+= • .,;:# | /\|*$ EXP ()[]sym | On Off

The Handheld comprises a graphics/text display, keypad, processor board (or motherboard) with native I/O and communications, personality board for customization and I/O expansion, and power board with built-in battery charger.

Technical Specifications

Power
- 15 to 26 VDC, 17 W to charge batteries while operating
- 0.5 W per additional Wildcard I/O module

Batteries
- 6 2000mAh Rechargeable NiMH, 2 hour charge time
    Will run the instrument for approximately:
    - 10 hours without any Wildcards and the backlight off
    - 6 hours without any Wildcards and the backlight on
    - 5 hours with 4 Wildcards and the backlight off
    - 4 hours with 4 Wildcards and the backlight on

CPU
- 16 MHz Motorola 68HC11F1, 2 MByte address space

Onboard Memory
- 512K Flash and 128K RAM (optionally up to 1MB Flash and 512K RAM)
- 320 bytes of EEPROM
- Optional battery-backed RAM and real-time clock

Memory Expansion
- 64 or 128 MByte Wildcard compact flash mass memory

Real-Time Clock
- Optional real-time clock

Interrupts
- 21 interrupts support the 68HC11's on-chip subsystems

Keypad/Display User Interface
- FSTN gray monochrome LCD display with software controlled backlight and brightness
- 3.46" diagonal (2.44" x 2.44"), 128 x 128 pixel display
- 4 column by 8 row keypad with dedicated on/off key
- Software controlled beeper for audible feedback.
- Custom keypads are available

Communications
- A hardware UART supports either RS232 or RS485 at up to 19.2 Kbaud
- A second software UART implements RS232 at up to 4800 baud
- A fast synchronous serial peripheral interface (SPI) provides communications at speeds up to 2 Mbaud

Timer-Controlled Input and Output
- 8 bitwise programmable I/O (2 used for the secondary serial port)
- 3 or 4 input capture functions
- 4 or 5 output compare functions
- Pulse accumulator

8-bit Analog to Digital Conversion
- 8 input channels
- Up to 100k samples per second
- May be used as digital inputs

Connectors
- DB-25 connector – customizable for your I/O needs by installing jumper wires on the Personality Board
- 2.1mm female power jack

Runtime Security
- A watchdog timer and clock monitor ensures orderly reset after an error

Modular I/O Wildcard Expansion
- 16- or 24-bit resolution A/D
- 12-bit D/A
- Isolated AC or DC solid state relays
- 64 or 128 Mbyte Compact Flash
- Logic level, high voltage, and high current digital I/O
- Fully buffered dual RS232, RS422 or RS485 up to 56Kbaud

Weight
- 2 lbs (0.9kg) with batteries installed, 1.5 lbs (0.7kg) without batteries

Size
- 4.6"/3.3" wide x 10.3" tall x 2.5" thick

Operating Conditions
- Temp 0 to 70°C (-40 to 80°C storage)
- Humidity 0-90% non-condensing

How to Order

Part No.	Product	
HH11	The Handheld which includes 512K Flash, 128K RAM, 128x128 LCD display, 4x8 keypad, black plastic enclosure, and precoded GUI Toolkit	
	Options: (add price to the standard option)	
	-CE	Enclosure slotted to provide access for a Compact Flash Card
	-MM	1MB Flash replaces 512K Flash, and 512K RAM (backed up by the NiMH batteries, if incl.) replaces 128K RAM
	-RB	Real-time clock and battery backup for 128K RAM (does not back up the 512K RAM)
	-PB	Prototyping/WildCard expansion board
	-BT	Includes 6 high-capacity NiMH batteries, AA size
HH11SK	The Handheld Starter Kit includes everything you need to develop a battery operated handheld instrument: the Mosaic Handheld (p/n **HH11**) with options: -**MM**, -**RB**,- **BT**, -**PB** **PS-HH-24V**, board interconnect cable to facilitate hardware development, serial cable, and a full documentation package.	
Handheld Accessories	**PS-HH-24V**	Wall transformer for the Mosaic Handheld delivers 24VDC at 800mA
	QED-COM-CABLE-9	QED 9 pin communication cable
	CF-64	64MB Compact Flash
	CF-128	128MB Compact Flash
	AA-NiMH-BAT	2 sets of 6 high-capacity NiMH batteries, AA size

Get a Fast Start with the Handheld Starter Kit

The Handheld Starter Kit includes everything you need to develop a battery operated instrument: The Mosaic Handheld with memory expanded to 1 MB Flash and 512 KB RAM, a real time clock, high-capacity NiMH batteries, external power adapter and battery charger, board interconnect cable for easy hardware development, a serial cable, a prototyping/ WildCard expansion board, and a full documentation package.

Call or email anytime for free technical support.

The Mosaic Wildcards™

Custom, Off-the-Shelf I/O for Instruments and Automation
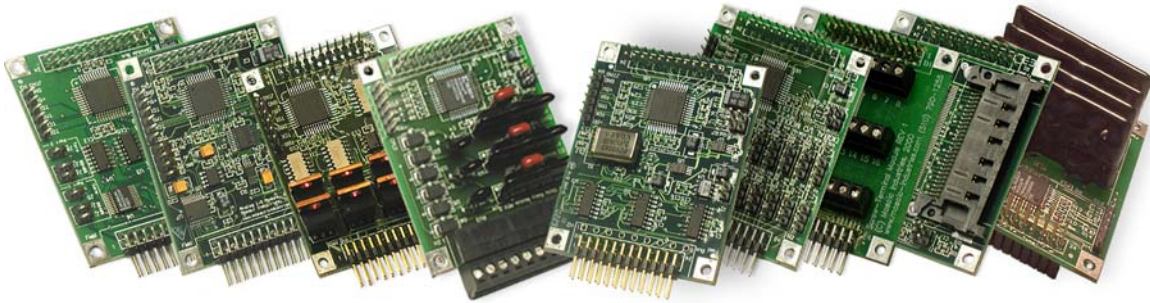
Mosaic's embedded controllers contain plenty of I/O for most applications, including serial ports, SPI, interfaces to graphics displays and keypads, analog I/O, and timer-controlled digital I/O lines.

But what if your application needs a unique combination of specialized I/O? For those special needs we have Wildcards – small (2.5"x2.0"), stackable I/O expansion boards, including digital I/O, A/D, D/A, and AC and DC relays – that you can mix and match to create your own custom system.

Wildcards provide unprecedented I/O density. Their modular design is well suited to instrumentation and automation projects where cost and physical size are critical.

Data Acquisition and Analog I/O

For data acquisition, the **24/7 Data Acquisition Wildcard** provides precision measurement (24-bit resolution) with programmable gain and filtering, and the **Analog I/O Wildcard** features fast 16-bit resolution measurement. The **Analog I/O Wildcard** also supplies eight channels of 12-bit resolution analog voltage outputs for controlling analog devices and actuators.

Additional Serial Ports

Additional serial ports are provided by the **UART Wildcard**, which buffers two full-duplex ports using RS232, RS422, or RS485 protocols.

Low-Cost Character Display and Keypad Interface

A **Keypad/Display Wildcard** provides a convenient interface to a 4 x 20 character display and 4 x 5 keypad.

Digital I/O and Relays

Need lots of digital I/O points? The **Digital I/O Wildcard** provides twenty channels of user-configurable I/O. For turning on and off high current loads the optically isolated **Power I/O Wildcard** or the **DC Relay Wildcard** do the job nicely, and AC line operated devices are easily controlled using the **AC Relay Wildcard**.

Program Memory and Mass Storage

A **Compact Flash Wildcard** provides removable mass storage of 64+ megabytes and a DOS/Windows compatible file system. It allows you to plug in widely available compact flash memory cards that measure only 1.5"x1.7".

All wildcards include precoded device drivers giving you full high level access to their functions whether you use the C or Forth programming languages. You can connect to the Wildcards using either ribbon cables or the convenient **Screw Terminal Wildcard**.

How to Order

Part No.	Product	Part No.	Product
W-DA24/7	24/7 Data Acquisition Wildcard	**W-DCM**	DC Solid State Relay Wildcard
W-AIM	Analog I/O Wildcard	**W-CFM**	Compact Flash Wildcard
W-DIM	Digital I/O Wildcard	**W-UAM**	UART (Universal Asynchronous Receiver/Transmitter) Wildcard
W-PWR	Power I/O Wildcard	**W-SCM**	Screw Terminal Wildcard
W-ACM	AC Solid State Relay Wildcard	**W-KPD**	Keypad/Display Wildcard

(see detailed descriptions on the following pages)

The 24/7 Data Acquisition Wildcard

A Programmable Gain, High Resolution Data Acquisition System Available at Low Cost

The **24/7 Data Acquisition Wildcard** is your instrument's complete analog front end, offering exceptional resolution, excellent stability, and remarkable noise rejection. Ideal for high resolution, low frequency measurements, this I/O module accepts low level signals directly from transducers – it amplifies and conditions them – and it converts them with 24 bits of resolution with no missing codes performance.

This analog-to-digital subsystem performs all the signal conditioning and conversion you need for up to seven input channels. Amplifier gain, low-pass filter corner frequency, and sampling rate are all software programmable using simple commands. This data acquisition system can extract highly accurate data, even from noisy sources with imperfect signal conditioning in electrically harsh environments. It has 256 times the resolution of standard 16-bit converters, but at comparable cost.

Mosaic's 24/7 Data Acquisition Wildcard is the price-performance standard for high-resolution data acquisition systems.

Extensive Input Capability

Four true-differential, or seven pseudo-differential, overvoltage-protected, high-impedance analog input channels are available on a 24-pin header or screw terminals.

Programmable Gain

The gain range on all channels is 1 to 128 allowing the input full scale range to be user-selectable from 0-20 mV to 0-2.5V for unipolar signals, or a genuine bipolar range of +/- 20 mV, or a quasi-bipolar range of +/- 2.5 V (where both inputs are in the range 0-5VDC).

In unbuffered mode the common mode range of the inputs is nominally 0-5V (precisely -30 mV to 5.03 V). In buffered mode the input impedance is very great at the expense of slightly reducing the common mode input range to 50 mV to 3.5 V.

On-Board Reference

An on-board 2.5 V reference is accurate to +/- 5 mV. This reference is available for use by sensors requiring a reference or producing a proportionate output. An external reference may also be used.

Conversion Rate and Operating Modes

Conversion rate is programmable from 4.8 Hz to over 1010 Hz. Other features under software control include self-calibration, system calibration, input gain, filter cutoff, channel selection, signal polarity, and bipolar or unipolar input ranges.

A/D Type:	24-bit sigma-delta A/D converter
Programmable Gain:	Precisely 1, 2, 4, 8, 16, 32, 64 or 128, software selectable
Input Range:	Differential: +/-2.5V with each input within -0.03 V to +5.03 V Common Mode: -30 mV to 5.0 V unbuffered, 50 mV to 3.5V buffered
Analog Inputs:	4 fully differential or 7 pseudo-differential, protected to +/- 70 volts continuous
Conversion Rate:	Programmable to 1010 Hz, determines the effective resolution and filter cut-off frequency. For example:
Monotonicity:	24 bits at up to 60 Hz data rate
Linearity:	0.0015% FS at up to 60 Hz data rate
Noise Rejection:	DC Common Mode: > 90 dB Normal Mode at 50/60 Hz: >100 dB Common Mode at 50/60 Hz: >150 dB
Filter Settling:	< 4x the data conversion period
Size:	2.0 x 2.5 in.
Power :	5.5 to 14 v at 70 ma.

Data Rate	Filter Cutoff	Effective Resolution
10 Hz	2.6 Hz	21.5 bits
30 Hz	7.9 Hz	20
100 Hz	26 Hz	18.5
500 Hz	131 Hz	13

Input Impedance

In unbuffered mode the analog inputs are repeatedly switched through a 9 kΩ resistor into a 7 pf input sampling capacitor with a DC leakage current less than 1 nA. The maximum source impedance allowed for there to be no gain errors at the 16- or 20-bit level, in unbuffered mode, varies from 10 kΩ to 150 kΩ depending on the selected gain and the external capacitance.

In buffered mode the input impedance is very great with a <1 nA offset leakage current. This input current does not cause a gain error, but it does produce a small dc offset voltage in the source impedance. For example, a 10kΩ source will cause an offset error of less than 10 uV.

Accuracy and Noise Rejection

The 24/7 Data Acquisition Wildcard features excellent static performance with 24-bit no missing codes, less than 2 μvolt rms effective output noise, and ±0.0015% linearity. Endpoint errors and the effects of temperature drift are eliminated by on-chip self-calibration, which removes zero- and full-scale errors.

The wildcard provides excellent rejection of power line interference. Normal mode rejection of 50 and 60 Hz exceeds 100 dB; common mode rejection is >150 dB.

Filtering

On-board digital filtering provides a low-pass filter with $(sinx/x)^3$ response. For a first notch at 10 Hz, attenuation at 50 Hz and 60 Hz is better than 100 dB.

The Analog I/O Wildcard

Interface to Any Analog Sensor or Actuator with
Eight 16-bit Analog Inputs and Eight 12-bit Analog Outputs

Analog Inputs	
Channels	8 unipolar single-ended, or 4 unipolar differential inputs
Resolution	16-bits (0 – 65,535 counts)
Input Filtering	Land patterns are provided for optional input RC filters
Input Voltage Range	+IN: -0.2 V to 5.2 V -IN: -0.2 V to 1.25 V
FS Differential Range	Jumper selectable full scale (FS) reference: 1.024 V, 2.048 V, 4.096 V, 5.0 V, or external.
Excitation	Jumper selectable excitation output voltage of: 1.024 V, 2.048 V, 4.096 V, or 5.0 V.
NonLinearity	Integral: ± 8 LSB max, ± 3 LSB typ; Differential: ± 1 LSB typ
Noise and Accuracy	20 µV rms effective input noise; 14.4 bits effective resolution
Sample Rate	Up to 17k samples per second

This general purpose **Analog I/O Wildcard** is ideal for controlling analog devices and actuators. It features eight channels unipolar, single-ended or four channels unipolar, differential 16-bit resolution analog voltage inputs and eight channels of 12-bit resolution analog voltage outputs. Inputs and outputs use onboard or external references, and the onboard references are optionally provided as excitations for external circuitry.

This tiny 2" by 2.5" module is a member of the Wildcard™ series that directly connects to any of Mosaic's controllers.

The Analog I/O Wildcard comprises a Wildcard bus header, field header, digital logic circuitry, an octal 12-bit digital to analog converter (DAC), an octal 16-bit analog to digital converter (A/D), and a 4.096 volt reference.   The 4.096 reference voltage varies less than 100 microvolts per degree Celsius change in temperature.   Jumpers enable module address selection and reference voltage selection among 5V, 4.096V, the DAC reference voltages (1.024 or 2.048 V), or an external reference voltage.   The Wildcard bus header interfaces to the host processor (any of Mosaic's controllers), and the field header brings out the analog I/O signals for the reference, DAC, and A/D.

Precoded Software
A package of precoded device driver functions makes it easy to use the Analog I/O Wildcard. High level functions initialize the A/D and DAC, acquire 16-bit samples from the A/D, and write 12-bit values to the DAC.

The Analog I/O Wildcard device driver software is provided as a precoded modular runtime library, known as a "kernel extension" because it enhances the on-board kernel's capabilities. The library functions are accessible from C and Forth.

Mosaic Industries provides you with a web site link that will enable you to create a packaged kernel extension that has drivers for all of the hardware that you have on your system.

Analog Outputs	
Channels	8 unipolar outputs
Resolution	12-bits (0 – 4095 counts)
Output Filtering	Land patterns are provided for optional output RC filters
Output Voltage Range	Jumper selectable: 2.048 V, 4.096 V, or 2x external reference; 4.6 V max.
Settling Time	1 µsec typically, slew rate is typically 10V/µsec
Load Impedance	Capable of driving 2 kΩ minimum resistance, 100 pF maximum capacitance, see data sheet for load regulation.
NonLinearity	Integral: ± 2 LSB typ Differential: ± 0.5 LSB typ
Update Rate	Up to 15k samples per second

In this way the software drivers are customized to your needs, and you can generate whatever combination of drivers you need. Make sure to specify the Analog I/O Wildcard Drivers in the list of kernel extensions you want to generate, and download the resulting "packages.zip" file to your hard drive

The Power I/O Wildcard

*Read Switches and Directly Control High Current DC Devices
with this Versatile Wildcard*

Voltage / Switch Inputs (each channel)	
Input Channels	4 isolated bipolar voltage or switch closure inputs, with a common field ground and optional pull-ups to a common field supply
Input High Voltage	± 4 to ±50 VDC
Input Low Voltage	< ± 0.8 V
Switch Inputs	Optionally pulled-up through 10kΩ to field supply
Isolation	Optically isolated to ± 2500 V, $10^{11}\,\Omega$ isolation resistance

The heavy-duty **Power I/O Wildcard** provides eight high-current outputs and four high-voltage digital inputs. Inputs and outputs are optically isolated to ±2500 volts. This versatile Wildcard makes it a snap to interface high voltage peripherals to your instrumentation or automation project.

This tiny 2" by 2.5" board is a member of the Wildcard series that connects to any of Mosaic's controllers.

High Current Outputs

The current sinking outputs are intended to actuate high-current devices such as motors, relays, heaters and solenoids. They can each sink 2 A continuously and up to 10 A intermittently while withstanding field voltages of 50 volts, and they are snub-diode protected against kickback from inductive loads. Owing to the low ON resistance of the MOSFETs, the power dissipated in them is low: when OFF they are subjected to the field voltage but there is no current so no power is dissipated; when ON their internal resistance is low (typically 0.15 Ω) so the I^2R power is also low. The MOSFET outputs control DC loads only; to control AC loads, use the AC Relay Wildcard, also available from Mosaic Industries.

High-Voltage Inputs

The opto-isolated inputs sense switch closures and/or bipolar voltages to ±50 volts. When the input voltage is ±5 to ±50V, a logical one input is read. When the input voltage is less than ±0.8V, a logical zero input is read. The high voltage inputs are also optically isolated to ±2500 volts. Onboard pull-up resistors enable monitoring of contact closure devices such as switches.

High Current DC Outputs (each channel, without heat sink, T_A = 0 to 70°C)	
Output Channels	8 isolated current sinking outputs with common field supply and ground
Isolation	Optically isolated to ± 2500 V, $10^{11}\,\Omega$ isolation resistance
Output Protection	Snub diodes to field supply to protect against inductive spikes
Field Voltage	+1 to +50 VDC max
OFF Voltage	+1 to +50 V (field supply)
OFF Leakage	< 25 µA at 25° C
ON Voltage	0.6 V typical at 2 A continuously 0.3 V typical at 2 A intermittently
Max ON Resistance	<0.2 Ω at I < 1A, typically 0.15 Ω <0.3 Ω to <0.4 Ω (at I = 2A for T_A = 25 to 70°C)
Max ON Current	2 A continuously; or, 2 A pulses from 25 V at 50% duty cycle at frequencies to 5 kHz; or, 10 A pulse (<50 msec on time, <6% duty cycle at T_A = 25°C or <4% duty cycle at T_A = 70°C).
Switching Times	t_{on} = 9 µsec, t_{off} = 12 µsec for 10%-90% transitions

Precoded Software

Precoded device drivers provide high-level functions for turning on, turning off, and toggling the output lines, for reading back the state of the outputs, and for reading the inputs.

The Digital I/O Wildcard

This Versatile Wildcard Provides an Additional 20 Digital Inputs and Outputs to Your Embedded Controller.

Channels	
Configurable Channels:	16, configurable as input or output in groups of 4
Fixed Input Channels:	4
Inputs	
Input Voltage Range:	0 – 5 V (-0.5 to 5.5 absolute max)
Input Low Voltage:	< 0.80 V
Input High Voltage:	>2.0 V
Input Leakage Current:	± 10 µA
Outputs	
Output Voltage Range:	0 – 5 V (-0.5 to 5.5 absolute max)
Output Low Voltage:	< 0.5 V at 24 mA
Output High Voltage:	>3.5 V typ., 5.0 V pulled up, >2.4 V at -4.0 mA
Output Current:	24 mA sink, 4 mA source
Pull up/down	
Optional Pull-up/down:	10 KΩ, jumper selectable pull up/down

The **Digital I/O Wildcard** expands the digital I/O capabilities of Mosaic controllers. Up to 8 wildcards can be connected at once, increasing the number of I/O lines up to 160.

Need lots of I/O?
The Digital I/O Wildcard adds plenty of programmable digital I/O to your controller. In addition to 4 dedicated digital inputs, you can configure up to 16 more channels for either input or output. Each I/O line is also easily configured for pull-up, pull-down, or tri-state operation.

This allows you to set the appropriate level of each I/O line in the interval between power-up and software initialization. These pull up / pull down jumpers also facilitate monitoring switch closures.

Precoded software drivers allow you to configure the I/O lines as either inputs or outputs in groups of four, initialize, read from, and write to the lines.

Output sink capability is sufficient to directly drive LEDs and other low power devices.

The Screw Terminal Wildcard

Simplifies Connecting to Other Mosaic Wildcards

You can easily connect to the field side of any Wildcard using these handy screw terminals.

Each board provides 24 terminals rated at 2 A and 300 VDC (limited by the included ribbon cable).

Be careful not to confuse the current and voltage rating of the **Screw Terminal Wildcard** with the current and voltage limits of the wildcard you are connecting to.

These simple connections are ideal for prototyping and breadboarding your product.

The DC Solid State Relay Wildcard

Isolated Control of Any DC Operated Device

Channels	Three independent, optically isolated solid state DC relays
Voltage	Controls 3 - 60 VDC
Current	Switches up to 3 A continuously, 12 A surge for 10 msec.
Isolation	Optically isolated to 2500 V rms
Maximum ON Voltage Drop	0.4 VDC
Maximum OFF Leakage Current	100 µA
Turn On/Off Times	Max turn on/off times of 50/300 µsec
Connections	Easy-to-connect-to screw terminals

The **DC Solid State Relay Wildcard** gives you optically isolated control of up to three, 3-amp DC devices. Activation of solenoids, motors, pumps, heaters, relays, valves, thermoelectric coolers and fans is a snap with this Wildcard.

Each relay supports high or low side switching from a common supply. Fly-back, transient and surge protection provide safe and reliable control of inductive loads.

The AC Solid Relay Wildcard

This Wildcard Independently Controls up to Four AC Operated Devices

Channels	Four independent, optically isolated solid state AC relays
Voltage	Controls 12 to 280 VAC at 50 or 60 Hz
Current	Switches up to 5 amps
Isolation	Optically isolated to 4000 V rms
Switching Mode	Zero voltage switching
Turn On/Off Times	Max turn on/off time of ½ AC cycle
Connections	Easy-to-connect-to screw terminals

The **AC Solid State Relay Wildcard** gives you independent control of up to four, 5-amp AC devices.

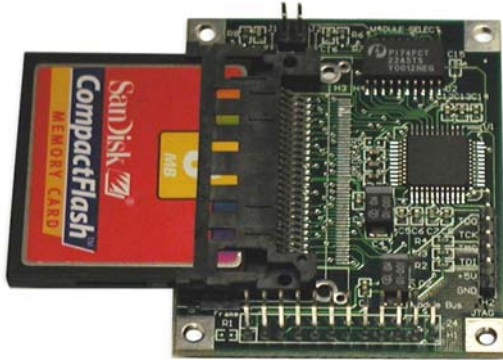Each AC relay is fully isolated from the others and switches at zero crossings of the AC line.

Use the AC Solid State Relay Wildcard to turn on and off larger relays, motors, pumps, heaters, refrigerators, valves, and fans.

The Compact Flash Wildcard

This Mass Memory Interface Provides Removable Storage, File Transfer with PCs, and Field Upgrades for Your Instrument

The **Compact Flash Wildcard** is ideal for applications that require large amounts of memory, the convenience of removable storage, and file-based data exchange with a PC. It allows you to plug in widely available Compact Flash memory cards that measure only 1.5" by 1.7" and hold many megabytes of nonvolatile data. Inexpensive form-factor adapters let you plug a CF Card into your laptop's PCMCIA socket for fast and easy file exchanges.

This tiny 2" by 2.5" board is a member of the Wildcard series that connects to all Mosaic controllers.

Built-in Software
Built-in software running on the companion Mosaic controller implements C file manipulation functions and supports a standard DOS- and Windows-style "FAT" (File Allocation Table) file system, allowing files to be created on a PC and read via the CF Wildcard, or visa versa. An automated file processing capability facilitates fool-proof software upgrades and data exchanges.

File Management Functions
A comprehensive set of file management functions modeled on the ANSI C file library lets you create, open, close, read, write, rename, copy and delete files. Other software features include directory listing commands that behave like the DOS DIR command, printing and file capture commands, and a powerful redirection capability that allows any function to take its input from a specified file and send its output to a specified file. This set of functions allows files to be managed from within the QED and/or the PC environment.

Memory Sizes Available	Compact FLASH cards of 64Mbyte +
File Format	DOS/Windows compatible FAT-12 and FAT-16
Compatability	File exchange with any Windows 95, 98, NT, 2000, or XP machine using standard PCMCIA socket.
Application Interface	ANSI C file manipulation functions including create, open, close, read, write, rename, copy and delete. Directory listing, file_type and file_capture commands
File Transfer	Files can be created, read, and modified on either the Mosaic or Windows platforms.
Automated File Processing	Files may be automatically executed on startup, input/output piped from/to any file, and controller programs automatically upgraded.

Automated File Loading and Execution
Fool-proof software upgrades are facilitated by the automated file processing feature. You can specify one or more files to be automatically loaded to or from the QED Board's memory at startup.

This powerful capability enables field software upgrades that are accomplished by simply inserting a preconfigured CF Card into the CF Wildcard socket.

Any Questions?

Our experienced applications engineers provide free telephone and email technical support. They are expert in the use of embedded systems in consumer and scientific instruments. Call or email anytime to support@mosaic-industries.com

The UART Wildcard

This Versatile Wildcard Makes It a Snap to Add Serial Peripherals to Your Instrumentation or Automation Project

UART Wildcard Specifications	
Ports:	Two full-duplex serial ports, each capable of simultaneous transmission and reception
Protocols:	RS232, RS422, and RS485
Baud Rates:	Standard baud rates up to 56000 baud
Buffers:	Dual 16-byte FIFO (first-in/first-out) buffers on each port
Handshaking:	Optional handshaking signals enable a modem connection for remote communications via any phone line
Drivers:	Precoded communications software

The **UART Wildcard** implements two full-duplex serial ports that can be configured for RS232, RS422, and RS485 protocols with data rates up to 56000 baud. Optional handshaking signals enable a modem connection for remote communications via any phone line. Dual 16-byte FIFO (first-in/first-out) buffers on each port reduce processor overhead when sending and receiving serial data streams.

This tiny 2" by 2.5" board is a member of the Wildcard series that connects to Mosaic controllers. Communicate with serial peripherals using this dual UART.

Precoded Software and Easy Configuration

Precoded software lets you specify the number of start bits, data bits, and stop bits, baud rate, parity, and communications protocol for each port. The software makes it easy to revector the standard serial I/O print and scan functions to use a specified serial port on the UART Wildcard.

A "UART" is a *Universal Asynchronous Receiver/ Transmitter* that converts parallel data from the host processor (any Mosaic controller) into a serial data stream. This Wildcard uses the industry standard 16C552 dual UART chip. Each of the two UARTs is capable of *full duplex* communications, meaning that both transmission and reception can occur simultaneously. Software-selectable baud rates up to 56,000 baud are supported. Standard attainable baud rates are 300, 1200, 2400, 4800, 9600, 19200, 38400 and 56000 baud. Parity options include even, odd, high, low, or no parity. Data format options include 5 to 8 bits per character and 1 to 2 stop bits. Each of the two serial ports can be configured for RS232, RS422, or RS485 communications. All of the serial interface signals are brought out to a 24 pin field header.

The serial data stream at the UART is conditioned by serial driver chips that transmit and receive the data. The resulting signal levels on the interface cable connect the local and remote in a manner specified by a standard protocol. The most widely used protocol is RS232, a full duplex protocol with a single-ended bipolar voltage swing on the serial cable. The UART Wildcard also implements the full duplex RS422 and the half duplex multi-drop RS485 protocols, each of which drives differential 0 to 5 volt signals on the serial cable. Optional jumper-selectable termination networks can be inserted at the RS422 and RS485 receivers to improve signal fidelity.

Optional Modem Connection

Serial port 1 can be configured to support an RS232 modem interface with the handshaking signals DTR, DSR, RTS, CTS, and DCD (data carrier detect). If the modem option is enabled, then serial port 2 must be configured for either RS422 or RS485 communications.

Need Something Different?

Do you need customized I/O? We can quickly engineer precisely the I/O capability you need, on a convenient plug-in Wildcard. Call or email anytime to support@mosaic-industries.com

The Keypad/Display Wildcard

Tiny Card Adds an Interactive User Interface to Your Instrument

The Keypad/Display Wildcard Specifications	
Property	**Value**
Power:	5 VDC derived from the WildCard bus at 0.5 W using the non-backlit display, or 2 W using an LED-backlit display.
Keypad:	5 column by 4 row keypad, tactile feedback, snap-on domes for user-configurable legends, mounting hole size 2.7" x 3.0", standard Grayhill part, interchangeable with other sizes.
Display:	4 line by 20 character LCD display with optional LED backlight
Backlight:	LED backlight with software ON/OFF.
Beeper:	Software controlled 2 KHz, 0.2 W buzzer at 80 dB
General Purpose I/O:	4 input lines and 4 lines programmable together as all inputs or all outputs
Output current capability:	4 mA source, 24 mA sink
Connectors:	34-pin dual row 0.1" pitch keypad/display connector 24-pin dual row 0.1" pitch field I/O connector

The **Keypad/Display Wildcard** provides a convenient interface to a 4 x 20 character display and 4 x 5 keypad.

Combined with Mosaic's **QCard Controller**, it is an ideal solution for hand-held or space-constrained applications that require a programmable embedded computer and a low cost yet *smart* user interface.

Measuring only 2" x 2.5", the Keypad/Display Wildcard mounts directly on the QCard. The Keypad/Display Wildcard is shipped with a 4 x 20 character display and 4 x 5 keypad, plus a simple ribbon cable interface that enables custom placement of the keypad and display in your instrument.

The KPD Wildcard has an additional field header that brings out 4 nibble-wise programmable input/output lines and 4 input lines.

The QCard Controller animates the keypad/display interface.

Smaller than a credit card, the QCard sports a 16 MHz Motorola 68HC11F1 microprocessor, 512K Flash and 128K RAM, 512 bytes of EEPROM, 8 lines of programmable digital I/O, 8 bit analog-to-digital conversion, and dual RS232/485 ports. The QCard is easily programmed in C, Forth, or assembly using any PC. Precoded device drivers make it easy to scan the keypad and write text to the display.

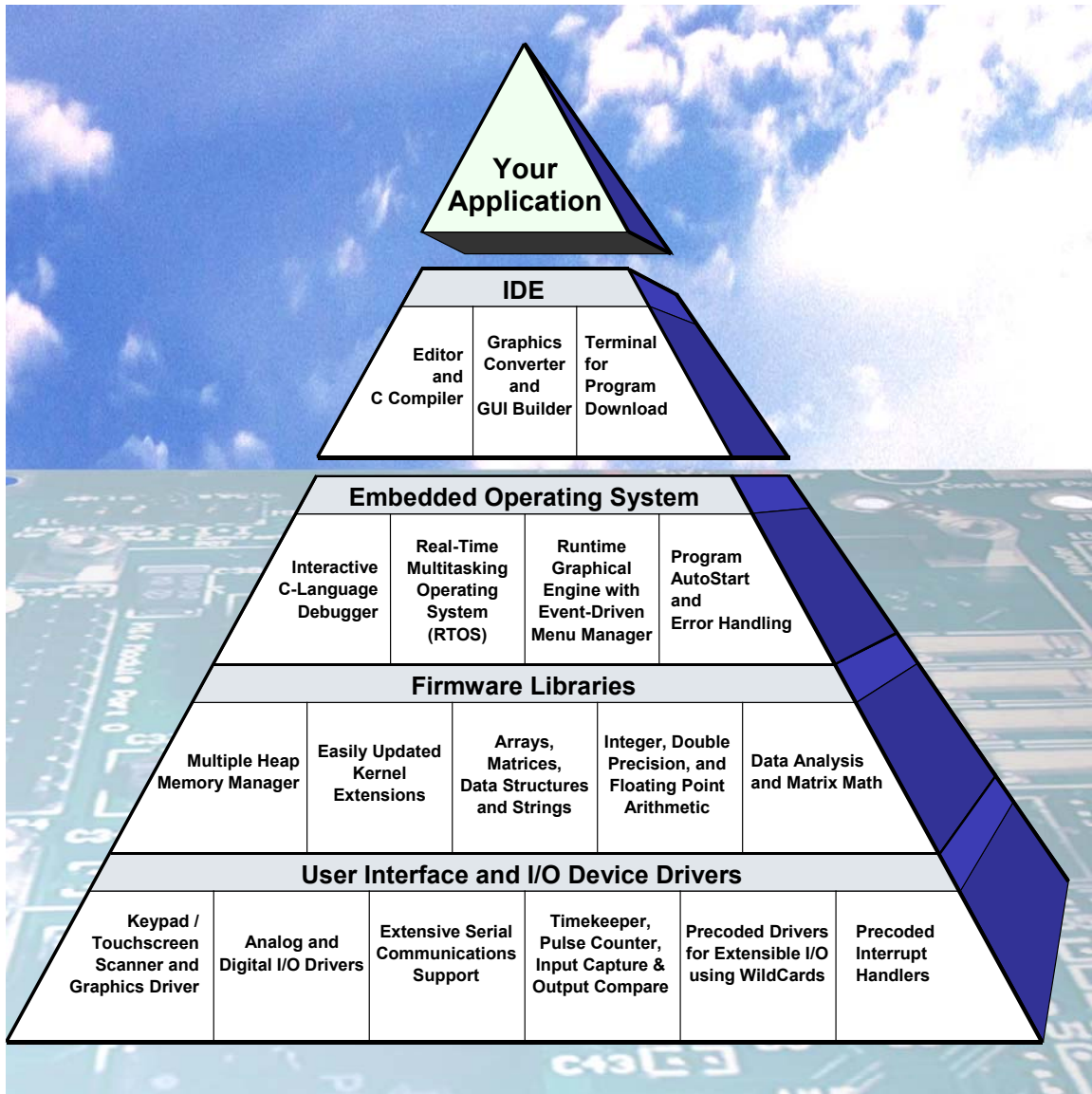You can add lots of "custom off-the-shelf" I/O to your system using Mosaic's diverse set of Wildcards.

For instruments that require a full-featured graphics display/touchscreen user interface, check out the cost-effective QScreen Controller (page 8 of this Catalog).

When combined with the QCard Controller, the Keypad/Display Wildcard makes it easy to design interactive instruments with intuitive user interfaces.

Integrated Development Environment (IDE)

*Mosaic Supports Your Application with Integrated Development Software
and Extensive On-Board Firmware*

Your Application

IDE

| Editor and C Compiler | Graphics Converter and GUI Builder | Terminal for Program Download |

Embedded Operating System

| Interactive C-Language Debugger | Real-Time Multitasking Operating System (RTOS) | Runtime Graphical Engine with Event-Driven Menu Manager | Program AutoStart and Error Handling |

Firmware Libraries

| Multiple Heap Memory Manager | Easily Updated Kernel Extensions | Arrays, Matrices, Data Structures and Strings | Integer, Double Precision, and Floating Point Arithmetic | Data Analysis and Matrix Math |

User Interface and I/O Device Drivers

| Keypad / Touchscreen Scanner and Graphics Driver | Analog and Digital I/O Drivers | Extensive Serial Communications Support | Timekeeper, Pulse Counter, Input Capture & Output Compare | Precoded Drivers for Extensible I/O using WildCards | Precoded Interrupt Handlers |

Mosaic Industries provides a suite of software development tools to simplify your programming. These comprehensive tools include an Integrated Development Environment (IDE) with editor and terminal, C and Forth compilers, assembler, interactive debugger, multitasking operating system, modular device drivers, precoded libraries, Graphical User Interface (GUI) toolkit, and a graphics image converter. Extensive documentation with precoded sample programs helps you finish your application quickly.

You'll be pleasantly surprised at how easy it is to develop your application using the IDE. Quick, easy development is facilitated by a wealth of precoded software. Mosaic's controllers include a well crafted operating system, hundreds of precoded library functions, and I/O device drivers. All this code is prepackaged in on-board firmware, so you can build your application on a firm foundation.

IDE Simplifies Development in C or Forth
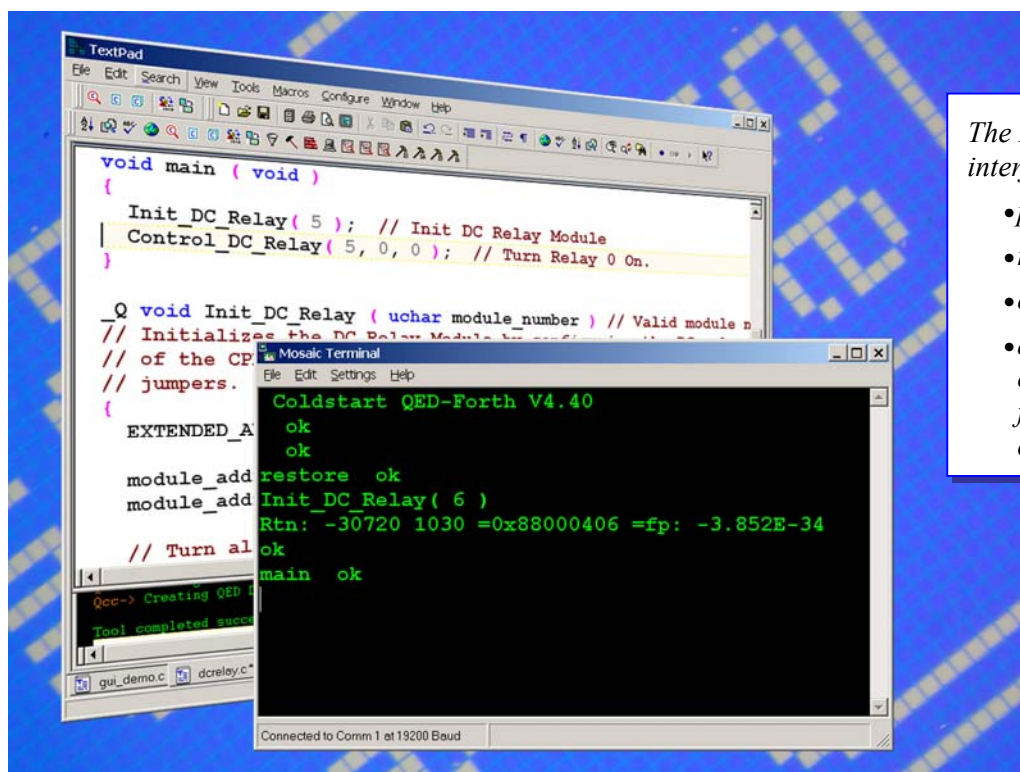
The IDE's standard Windows interface includes:

- *pull-down menus,*
- *multiple edit windows,*
- *compilation tools,*
- *and a convenient communications window for interacting with your controller.*

The **Mosaic Integrated Development Environment (IDE)** provides a full-featured text editor with source-code coloring of keywords and comments, plus icon-based invocation of the compiler, terminal, and graphics conversion tools. The IDE runs on your PC under the Windows operating system.

You have your choice of programming languages: Mosaic's ANSI-compatible Control-C™ or QED-Forth™. To program in C, use the IDE editor to create your source code program files, click the *Compile* icon to create a downloadable file, and click the *Terminal* icon to send the file to the target board via the RS-232 serial link. Individual C functions can be interactively exercised and debugged directly on your controller by typing the function name and input parameters into the terminal window. To run the entire application program, just type *main*.

Programming in Forth is also simple. Because the Forth compiler resides on the target board itself, you send the source code directly to the target. Simply compose your program source code files in the IDE editor, using the *#include* directive to organize multiple source files. Then send the source code to the target board by clicking on the *Terminal* icon. The interactive Forth monitor lets you interactively invoke any function, examine variables, and dump out sections memory to aid in debugging your code.

Using the IDE and the interactive debugger, you can quickly build your working application. Once debugging is complete, simply invoke the *Autostart* command to automatically run your application each time the system boots up.

Multitasking Real-Time Operating System

All Mosaic controllers run a built-in Real-Time Operating System (RTOS). This system implements cooperative and time-sliced multitasking, provides resource locking and mailbox services, implements an efficient paged memory manager, traps and reports errors, handles interrupts, and autostarts your application at system startup. By following some simple coding practices as shown in the documented coding examples, you can take advantage of these sophisticated features without having to worry about the implementation details.

Using Multitasking

An instrument control program can typically be broken down into a number of tasks, each of which performs a distinct function. For example, many programs perform data acquisition, computation, communications, control, and user interface functions. Grouping these functions as separate modularly coded tasks has two key advantages. First, each task may have its own timing behavior. For example, you may want to collect data ten times per second, print out average readings once per second, and scan the touchpad for events as often as possible to provide a responsive front-panel user interface. By coding separate tasks for data collection, printing, and user interface management, the RTOS ensures that each task uses a minimum of processor time without running inefficient timing loops. Second, task-oriented coding results in clean modular source code that is easy to debug and maintain.

Memory Management

All Mosaic controllers incorporate paged memory to greatly expand the available memory space beyond the 64K native address range of the processor. The IDE provides templates that set up ample memory maps for your code (in non-volatile flash memory) and data structures (in RAM). The real time operating system seamlessly handles page changes at runtime, so you can treat the memory as contiguous.

Precoded Device Drivers and Software Libraries

All hardware on Mosaic Controllers and Wildcards is supported by precoded device drivers. These drivers are provided as modular "kernel extensions" which are available on CD and on our web site to registered customers. The precoded driver software defines a set of functions that initialize, configure and operate the hardware, so you can concentrate on the high level design of your application.

In addition to device drivers, kernel extensions provide more extensive software toolkits including the Graphical User Interface (GUI) toolkit, and the GUI Builder. These software modules make it easy for you to interactively define and run a real-time menu-based user interface.

Graphics Converter Simplifies Custom Graphics Generation

The GUI Toolkit comes with an assortment of useful graphics that implement various sized buttons, arrows, and icons. For most applications, you'll also want to create your own custom graphics. A Graphics Converter program makes this easy to do on your Windows desktop PC. Simply create the desired graphical image using any graphical editor (such as PC Paint or Photoshop), and save it as a bitmap file. After you've created all your bitmap images, click on the Graphics Converter icon in the Mosaic IDE, and the images are transformed into a download file that puts the graphics in the flash memory of your controller. The graphics are now ready to use.

GUI Builder Enables Interactive Screen Design, and Generates Your Source Code

The GUI Builder lets you interactively place your buttons and images on the touchscreen. The program runs on your touchscreen-based controller, and you talk to it using the Mosaic Terminal program. You can select any of the buttons or graphics that have been loaded into flash memory, and use your finger or some arrow keys to move them on the screen to their desired locations. In this way you quickly build up the menu screens that the end user will see.

When you're pleased with the user interface design, the GUI Builder outputs source code in your selected programming language (C or Forth). All you have to do is attach an event handler routine to each button so it will perform its desired action at runtime.

GUI Toolkit Defines and Manages the User Interface

Using the Graphics Converter and the GUI Builder, you create and place buttons and graphics on the multiple screens that make up the user interface. Typically, an instrument will have a main screen, from which other screens are accessed. Each screen is in turn created from building blocks such as graphics images, button objects, and ASCII strings. These building blocks must be organized in an intuitive way so users can easily operate your instrument.

To simplify your programming and design of the user interface, the GUI Toolkit uses object oriented concepts to organize these building blocks. Object oriented programming allows you to organize data structures (*objects*) hierarchically and manipulate the data using pre-defined *methods*. With the GUI Toolkit, it is simple to create elementary objects such as graphics that contain bitmapped image data and textboxes that contain strings. You can load those objects into other objects such as screens so that they are shown on the display. You can create *controls* which acquire data from a user or actuate hardware when a user touches the touchscreen. A button is a simple control.

The GUI Toolkit allows you to create onscreen objects, control their properties, define and assign actions for them, and specify how they respond to events like a button press. You can easily create interactive buttons, graphics, and textboxes on multiple screens to implement a sophisticated yet intuitive graphical user interface.

The runtime engine of the GUI Toolkit scans the touchscreen for button presses, and activates the handler function associated with the touched button. In addition to specifying the called function, you can easily control other actions. For example, you can set a flag that sounds the audible beeper whenever the button is pressed. Or, you can provide visual feedback for the button press using a *pressed button* graphic. These functions are automatically handled by the GUI Toolkit so you can create a polished interface without delving into the low level details.

GUI Software Tools Implement Easy to Use Instrument Controls

Today's tech-savvy customers demand sophisticated yet easy-to-use front panel user interfaces. Mosaic provides software tools to help you quickly develop menu-based graphical interfaces that respond to the user's touch. The Graphics Converter application runs on your PC and converts your custom images into graphics that can be displayed by the controller. The GUI Builder program runs on the target controller board, allowing you to quickly design and place your buttons and graphics in a menu-based system, and it even generates the GUI source code for you! The GUI Toolkit is the runtime engine that processes user inputs (touchscreen or keypad presses) and manages the user interface. Taken together, these tools automate the process of designing a user interface so that you can get to market quickly.

How to Order

Part Number	Product
C-DEV	C Development Software provides a C cross-compiler, assembler and linker.
Forth-DEV	QED-Forth Development Software, included at no charge with every Mosaic controller, provides an interactive interpreter, compiler, assembler and debugger.