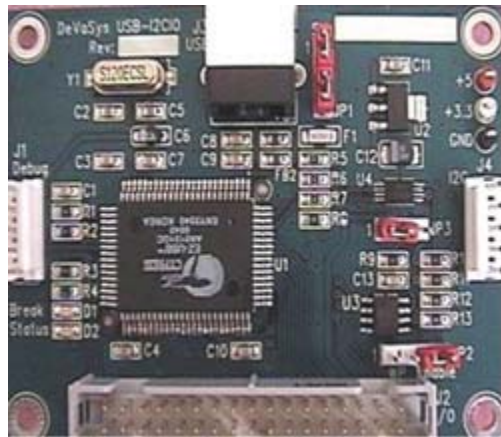


## **Programmable Timing Products Solve Design Problems**

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In today's world of constantly changing technology, new products can be delayed in their time to market by something as simple as a missing crystal oscillator of the correct frequency. To help alleviate this problem, Cardinal Components, Inc. introduced the world's first Field Instantly Programmable Oscillator FIPO™ in 2000 — which allowed customers the flexibility to program oscillators to custom frequencies anytime anywhere.



*USB interface board.*

This programming is performed using the powerful PG 3000 software and programmer. The innovative FIPO and the subsequent MIPO™ won worldwide industry recognition as Product of the Year in 2000 and again in 2002.

If imitation is the highest form of flattery, then Cardinal can feel well flattered; these highly successful products have been copied extensively. In addition, the programmable oscillator today constitutes a significant and growing share of the industry's sales. This level of success is based on at least six factors:

- There is a short lead time, or effectively no lead time, for a custom and unique frequency product.
- There is never a line-down situation. But, if you are ever in a line-down situation, programmable is a great line-down solution. This is because the programmable oscillators mean that there can be local inventory at customer sites, distributors, or factories as blanks; these can then be programmed to the specific needs of the customer. In addition, programmable devices offer significant cost savings, since fixed frequency device pricing is based on frequency and volume, while programmable pricing is based on volume, alone, thereby saving the customer many dollars as frequencies continue to go up.
- Programmable parts are available in the industry standard packages (Form, Fit, and Function).
- Programmables today meet Military Temperature ranges (-55 to +125° C), and low PPM options are available down to 20PPM.
- Custom frequencies can be obtained in minutes. Board frequency ranges from 1 to 800MHz, voltage ranges from 5.0 to 1.8V, along with CMOS, LVDS and LVPECL output levels.
- Cost-effective pricing.

The programmable timing solution has been successfully adopted for many varied

applications. Customers who make secure handheld radios are using our dual frequency programmable products. This allows for a seamless transition between two frequencies, which would be difficult and costly to achieve with two discrete clock sources. Applications that have trouble passing FCC interference testing find solutions in the spread spectrum programmable devices, with direct drop-in replacements. The small size and power-down option of these programmable devices, for instance, allow them to be used in the tracking of migratory birds. Here many different frequencies are required, making the use of traditional fixed quartz oscillators prohibitive.

Users in network systems are performing system stressing or margining of their design by simply programming the same oscillator product to their margin limits during qualification testing. Customers in the Industrial, Medical and Instrumentation sectors are using programmables because of the speed at which custom frequency parts can be delivered. Applications using programmable oscillators are legion, ranging from Aerospace to handheld printers.

The migration from fixed-frequency to programmable oscillators has provided flexibility in design for customers by offering them innovative derivative products like the CPPD with dual-frequency outputs in one device to the reconfigurable on-the-fly multi-frequency MIPO series allowing up to 6 frequencies to be controlled via an I<sup>2</sup>C interface. Products of this type were unheard of in the fixed-frequency domain before their introduction by Cardinal.

Because some major OEM accounts had valid concerns about jitter and phase noise, we went to work to patent a solution that would both reduce jitter and improve phase noise — allowing these customers to have the benefits of programmability. The latest Platinum Series provides low period jitter less than 8pS (LeCroy) and low phase noise -100dBc at 10kHz as measured with Agilent E5052B. These improvements have allowed customers in the most stringent applications, like video, the ability and flexibility to use programmable timing products.

There are particular benefits realized immediately by both OEMs and EMS providers:

- Authorized distributors and customers can program custom parts.
- The CPP series are two-time programmable (no obsolete inventory, making it your EPP choice).
- Innovative products like the dual and multi-frequency products cut customer costs by reducing the number of components on a board and cut component costs by saving valuable board space and providing simplicity of system design.
- The patented FIPO technology reduces jitter and phase noise inside the oscillator.
- Programmable products are an instant solution to line-down situations, with next day delivery.
- The low-cost field programmers allow customers to program on the PG-3000 from 1 to 133MHz and on the new PG-3100 from 1 to 700MHz at their own facilities.
- Power-down mode is available for battery- and power-sensitive applications.
- The higher the frequency, the better the cost benefit.
- Stability to 20PPM and operating temperature range of -55 to +125°C available from inventory direct from the factory or any of its distributors worldwide, for the most demanding applications.
- Quick ramp in production-friendly (24 to 48 hours) turns — quick time to

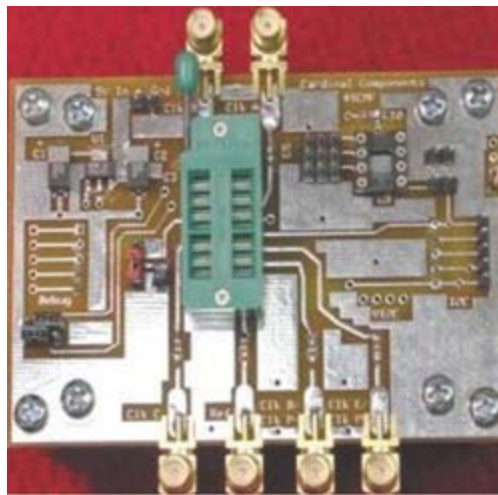
volume.

- Additional tools are provided to simplify the customer design efforts with prototyping development boards.

Recently introduced is the MIPO-R, a reconfigurable, digitally controlled VCXO with an I2C interface vs. traditional analog circuitry. This takes advantage of microprocessor and

microcontroller hardware on board, reducing added analog circuitry. Another new offering is the Spread Spectrum Series of programmables (the CSS Series). This new series targets products that require reduced EMI emissions to meet the demands of regulatory bodies such as the FCC. By spreading the spectrum of the clock oscillator source, the EMI peaks generated by the product are reduced, thereby eliminating the need for a costly redesign or the use of special enclosures to conform to the regulations. The CSS Series is available in both center and down spreading to meet customer application needs.

The Platinum Series reduces jitter and phase noise to a range comparable to traditional fixed-frequency oscillators and saves the customer significant dollars on the higher frequency products (100 to 700MHz). All industry standard 4 pad and 6 solder pad configurations — 5 x 7mm, 5 x 3.2mm, and 3.2 x 2.5mm surface-mount devices, are available. The Platinum Series also offers output formats in CMOS, HCMOS, TTL, LVDS, and LVPECL outputs and also Voltage controlled variants "VCXO." The voltage range of the



*Prototype development board.*

Platinum Series is 1.8, 2.5, and 3.3V with stabilities of 25, 50, and 100PPM.

The company is developing a complete line of programmable TCXO and VCXO products to provide customers the advantages of programmability in what are the traditionally higher performance markets.

We see further advantages in the programmable market as technology advancement takes place over the next few years. These include higher frequencies reaching above 1GHz, as well as migration to all silicon-based timing products and other MEMS-based products. Cardinal currently has programming centers in the U.S., China, and Brazil, as well as with its worldwide network of authorized distributors that include: Digi-Key, Jaco, Dove, Mast, SMD, Carlton Bates, Simcona, WDI, Adelco, Young Electronics, Addcom, Phoenix Electronics, Cemesa, M3, First Phase, Eurocontact, Domar, Khalus Electric, Boraro, Clark & Severn, New Advantage, BMG Plus, Farnell One, Target Electronics, T & G Electronics, Electronic Components, Dependable Electronics, Dimac Red SRL and Crystal Components. All have programmable blanks on hand, as well as programming capability in-house.

All of these programmable components are RoHS-compliant. The company has embraced the spirit of helping the Federal government to "buy green," and is fully engaged in the "Environmentally Preferable Purchasing" (EPP) program. Cardinal is an ISO 9001-2000 registered industry supplier.