

## *The Control Processor may be user programmed to produce control or data outputs, mathematically derive parameters or generate waveforms*

### **Built-in algorithms**

PI660 DSP programming is built on the concept of Solutions each of which contains up to twelve DSP algorithms that are executed sequentially. To create a Solution, the user adds algorithms to a project and maps the algorithm's inputs and outputs to measurement channels, memory locations, data bus outputs and the Control Processor's analog and digital outputs. The user then downloads the solution to the Control Processor's static RAM and initiates its execution.

Each algorithm in the solution works with other algorithms in the project. When an algorithm finishes execution, the results are placed into memory where they can be used to drive DAC outputs or as inputs to other algorithms. When the next algorithm executes, it retrieves information from defined memory locations, or user selected channel inputs, processes the data, and continues the sequence. When all algorithms have been processed, the solution cycle can be started again.

The example shown is a simple solution with two algorithms that converts binary measured channel data to engineering units applying user entered slopes and offsets and outputs the engineering units data as an analog signals on the DACs.

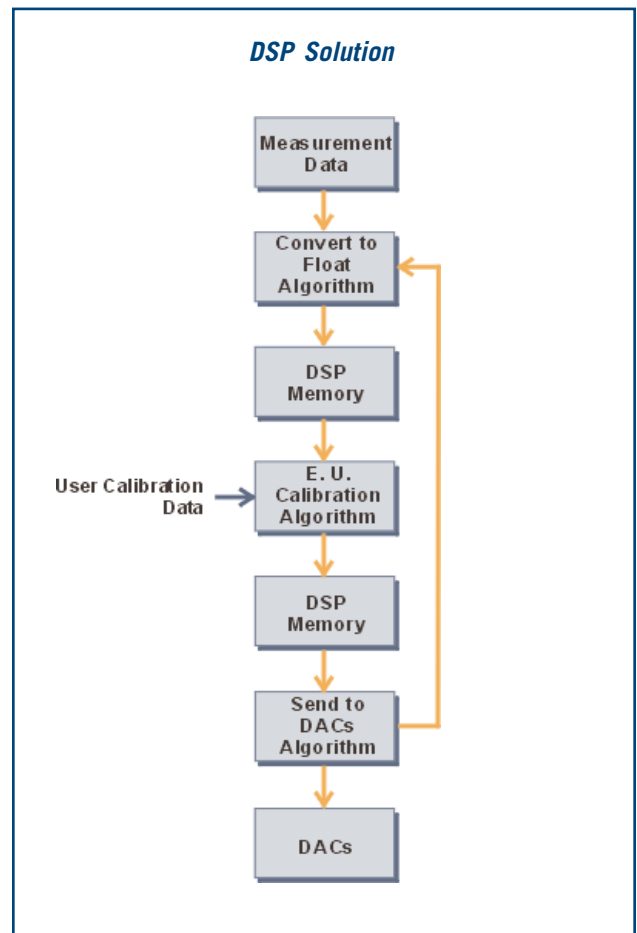
### **User developed algorithms**

Algorithms for the Control Processor can be developed using the Texas Instrument Code Composer Studio Software Development Kit (SDK). Once developed, the algorithm is compiled into executable code, debugged using one of many available emulators, and downloaded to the DSP's memory for execution. A significant feature of the Model 6042 is that it allows debugging of user developed algorithms directly on the DSP hardware. Just attach a debugging pod to the JTAG port and step through the program execution while observing the results using PI660.

User developed algorithms can be saved in the Control Processor's non-volatile flash RAM, which avoids downloading from the host computer each time they are used.

### **Derived parameters**

The DSP on the Control Processor provides a fast and efficient means of deriving parameters from measurement data without consuming processor resources in the system CPU. Use built-in or user developed algorithms to process data from one or more measurement channels then output the new parameter on one of the Control Processor's sixty-four data bus outputs. Like measurement channels these data bus outputs can be selected for recording and display.



### **Derived Parameters Using the Math Engine**

The math engine in PI660XP and XPS is another way to derive parameters from measurement data for display and recording. Each computed parameter can use up to nine measurements along with constants, +, -, \*, /, (). ;, div, mod, sin, cos, tan, sqrt, pow, atan, asin, acos, log10, log2, exp, ln, inv, abs, sinh, and cosh. Mathematical equations are written in a straightforward manner and are performed each time the current value display table is updated. Two sets of high and low alarm limits, with operator selected display colors, are provided for each derived parameter and checked for each calculation.