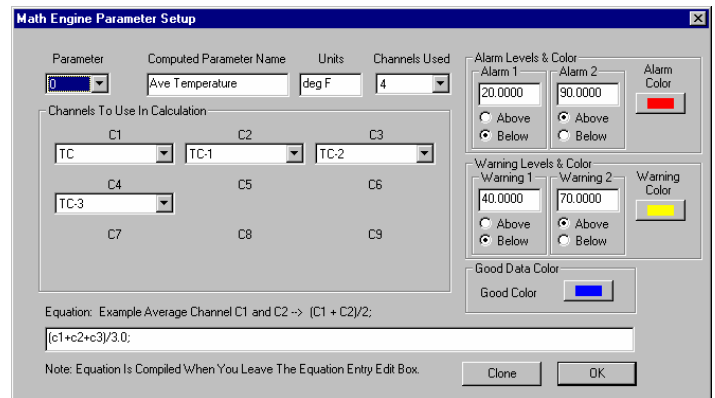


PI660 Math Engine Introduction

The PI660 Math Engine is an add-on capability. It allows the user to define up to 300 equation channels. The equation (computed) channels are updated in real time and are available for display on the PI660 data displays.

The math engine provides a programming language syntax that allows the user to define complex equations. The syntax of the language provides for single point based calculations. There is no looping structure to the language. Users can generate loop structure calculations using the Component Module DLL (CMD) Software Developer's Kit.



Each computed channel can be derived from up to nine other channels. The nine other channels can be either real inputs to the 6000 system hardware or other computed channels. A computed channel consists of an equation, a name, a units tag, two alarm levels, two warning levels, and colors for alarm, warning, and good data levels.

Math Engine Structure

Each computed channel allows the definition of an equation that is dependent on up to nine other channels. The channels selected for each computed channel are denoted c1-c9 in the equation for the computed channel. For instance, the user enters c1 in the equation when he wants the math engine to insert the value corresponding to the channel selected in the c1 combo box on the math engine dialog box. Each computed channel can be derived from different sets of channels.

The user enters the equation using infix notation. The PI660 math engine compiles the equation when the user finishes editing the equation. The equation is compiled into a postfix execution stack. When the PI660 software is acquiring data it calculates new computed values each time it refreshes the Current Value Table (CVT). The computed values are calculated after the CVT is refreshed, and the real channel EU values are used in the processing of the postfix equation stacks for the computed channels. Further, the computed channels are calculated first to last. This means that computed channel 2 can use the result from computed channel 1 in its equation without time skew.

Equation Elements

The following is a list of the mathematical operations presented by the PI660 math engine.

Operator	Example
cN	c1 means the EU value of the channel selected in the c1 channel selection combo box for the computed channel.
2.0	Numerical constant.
+	c1+c2 Add two values
-	c1-c2 Subtract one value from another
*	c1*c2 Multiply one value by another
/	c1/c2 Double precision divide c1 by c2
()	(c1+c2)/2; Evaluate c1+c2 before division
;	c1+c2; Equation end
~	~c1 Negate c1 value
div	c1 div c2 Integer division of c1 by c2
mod	c1 mod 4 Remainder of c1 div 4
sin	Sin(c1) Calculate sin of c1

Operator Example

Operator	Example	Description
cos	Cos(c1)	Calculate cos of c1
tan	Tan(c1)	Calculate tan of c1
sqrt	Sqrt(c1)	Square Root of c1
pow	c1 pow 2.0	Raise c1 to power of 2
atan	Atan(c1)	Calculate arctan of c1
asin	Asin(c1)	Calculate arcsin of c1
acos	Acos(c1)	Calculate arccos of c1
log10	log10(c1)	Calculate log base 10 of c1
log2	log2(c1)	Calculate log base 2 of c1
exp	exp(c1)	Calculate exponent of c1
ln	ln(c1)	Calculate natural log of c1
inv	inv(c1)	Invert c1 (ie. 1.0/c1)
abs	abs(c1)	Absolute value of c1
sinh	sinh(c1)	Hyperbolic sin of c1
cosh	cosh(c1)	Hyperbolic cos of c1

Equation Files

Equations are saved to disk files that have the .equ file extension. The files are binary in nature and contain information about all 300 computed channels. The user may save the equations to many files. PI660 provides open, save, and save as dialog boxes for equation file manipulation.