

DAPL 3000 Operating System Changes

This document lists system changes that:

1. affect back-compatibility with older applications;
2. provide extended capabilities for new applications.

Changes providing new features

Item	Change	Effects
ABS BAVERAGE BMERGEF COPYVEC CORRELATE CROSSPOWER COSINEWAVE SINEWAVE TRIANGLE SAWTOOTH SQUAREWAVE DECIBEL DELTA DLIMIT FINDMAX FREQUENCY HIGH, LOW INTERP LCOPY LIMIT LOGIC MERGEF NMERGE PCASSERT RANDOM RANGE RAVERAGE REPLICATE RMS SEPARATE SEPARATEF TFUNCTION1 TFUNCTION2 VARIANCE WAIT	Additional data types supported	Adds previously unsupported data types to data types the processing command will accept and process.
BIRAMP	New command	New signal generator command produces highly-configurable excitation signal sequences for testing that requires precise control of a linear ramp through a specified range.

CORRELATE , CROSSPOWER	Parameters simplified	Relaxed or removed size restrictions on data blocks to integer powers of 2. Removed most input and output data type restrictions.
WAIT	Generalized sample selection parameters	Now you can select entire blocks of samples that are displaced either forward or backward in time relative to a software triggering event.
DEXPAND	Added support for more products	Now includes direct support for <i>SI Series</i> high-performance I/O boards, as well as all of the previous <i>a-series</i> expansion boards.
BAVERAGE BMERGE BMERGEF	Longer block lengths supported	New variants of these commands will allow extreme block sizes, as needed — up to the limits of memory to contain them.
MIXRFFT	New processing command	Adds a high-performance mixed-radix FFT to the DAPL system processing commands. Eases many restrictions with regard to block length, data types, and processing options.
MTSFILT	Integrated processing command	The MTSFILT command, previously available only by request as a separate download, is now included. Allows efficient time-alignment of samples to facilitate phase-sensitive signal analysis.
MRBLOCK	Integrated processing command	The MRBLOCK command helps "data on demand" applications to receive the most recent block of data instantly, discarding any unrequested and stale data automatically. Replaces an older variant that was provided with certain language API packages.
PRIORITY	Specify time-critical processing tasks	Placing time-critical processing in a processing procedure at higher execution priority allows more deterministic real-time response that won't be disrupted by background crunching of ordinary data processing.
ALARM	Alternative addressing scheme	Adds the ability to use a flexible PORT::BIT addressing scheme, in addition to the scheme used previously.
FINDMAX	Extended output option	A trigger output, index output, or <i>both</i> can be specified.
PID	Efficient implementation with new features	The new PID command uses the ISO-style gains (loop gain, integral time constant, derivative time constant) which are a little easier to tune. You don't need to re-tune loops after adjusting the sampling rate, just specify the new update interval.

A separate command path (zero-shaping) gain helps reduce any tendency to overshoot in response to setpoint changes.
High-precision state-space implementation internally.

PIDLATCH
PIDRAMP
PIDSCRAM

PID supervisory
features in new
commands

The obsolete `PID1` command had a mix of real-time loop control processing (*response to the latest input signals*) and supervisory processing (*initiating, suspending, or ending activity*). Covering the supervisory control concerns with separate new processing commands allows:

- loops that don't need extra features can run more efficiently;
- separate tasks manage the separate issues of controlling the process and controlling the controller task;
- allows different control strategies besides PID within the same supervisory logic.

COSINEWAVE
SINEWAVE
SQUAREWAVE
TRIANGLE
SAWTOOTH

Non-harmonic
frequencies

You can tune the waveform period to something with no direct harmonic relationship to the sampling interval using floating point data formats. A new specification scheme allows configuration of waveforms by specifying min to max range and frequency, as an alternative to the traditional amplitude and sample count scheme.

THERMO

Devices by name

You can specify thermocouple types by name: for example, a type J thermocouple is specified as "J".

PWM

Redesigned
command

Uses an integral conversion algorithm. Does not require extreme sample rates, attempts to spread pulses evenly, and does not average an analog input signal to determine the duty level.

BOUND

New command

Enforces configurable minimum and maximum limits on the values in a data stream.

RSUM

New "running sum"
command

Combines the features of `RAVERAGE` and the historical (obsolete) commands `INTEGRATE` and `BINTEGRATE`, plus more. You can configure when the running sum is reset, the scaling to apply, and how often the current sum values are selected for output.

STDDEV

New statistical
command

A new shortcut, this command is like a combination of the `VARIANCE` command and the `SQRT` command.

CMAG CANGLE	Complex magnitude, complex phase angle	When you don't need both magnitude and angle computations of the <code>POLAR</code> command, these variations produce just the part that you need.
CHIRP	New signal generation command	This command can generate waves with up, down, or bidirectional sweeps in frequency.
DFT	New digital signal processing command	For special cases of analyzing just a few frequencies, a narrow band of frequencies, or blocks of data with lengths that don't mesh well with the ordinary power-of-2 size limitations, the <code>DFT</code> command might be faster than the <code>FFT</code> command.
QDECODE	New encoder input command	For simple monitoring of rotating devices that never move fast, avoid special decoder hardware and use the <code>QDECODE</code> command to read the encoder signals directly from digital port bits.
DIGITALOUT, DACOUT	Self-generated timing option	New timing features support predictable and regular output sequences, where previously only unpredictable data bursts were possible.
DIGITALIN	New processing command	Adds support for xDAP "digital control port" input, so that tasks can poll for changes in bit status asynchronously on the digital input pins.
BUFFERS, PIPES	Low-overhead data buffering	For special applications requiring fast response, but not processing much data, pipes can be configured to use small but efficient pre-allocated memory pools.
Pipe configurations	Eased reader-writer restrictions	Tasks in the same <i>start group</i> as defined by a <code>START</code> command can read from the same data stream, even if the tasks are located in different processing procedures.
STATISTICS	Improved process monitoring	Improved task monitoring results in easier analysis of processor loading and worst-case latency. Analyzes where short-term and long-term backlogs occur in the pipe system.
DIGITALIN	New processing command for control signaling	Enables watching digital control signals independent of high-speed sampling, for hardware architectures supporting it.
SCAN	New input configuration	Allows applications to specify the time interval for capturing all channels in sampling channel list, regardless of signal routing

	command for channel list timing	through parallel channel selectors.
TIME	Modified role of input sampling specification	This now works in conjunction with <code>SCAN</code> command, allowing supplemental control of channel-to-channel sample timing.
fault detection	Continuous monitoring of digital ports	Monitors xDAP digital input/output port signals for intermittent and long-term faults to a low-impedance power source. This is an extra "line of defense" to protect digital I/O devices from damage, and it is entirely automatic.
START	Pipe readers allowed in multiple procedure groups	The restriction that all readers of a data pipe must be defined in the same procedure is removed. However, all reader tasks must be in the same "START group," started by a single <code>START</code> command. With care, this enables data access by task at different priority levels.
error logging	Error messages automatically logged by host	Missed an error message? Having problems polling the DAPL system to find out what happened? Now you can find the error message history in your host system error log, accessed through the Control Panel.
rescue task	Allows diagnosis of resource and priority deadlocks	A subtle but wrong configuration of high-priority processing can cause the processor activity to be dedicated to watching for an event while the intended input/output activity is locked out. The "rescue task" uses a very small amount of time to allow you to at least see diagnostics — with such small overhead that there is rarely a good reason to disable it.
OPTIONS	New configuration control options	Simplified the scheduling and buffering control options. Added new controls for rescue task.
DISPLAY	New configuration display options	Now provides more options to examine hardware properties, task priority, and configuration parameters.
START, DISPLAY	New notations	These commands now support "qualified" input procedure references, allowing control and monitoring for multiple concurrent sampling configurations.
DISCARD	New processing command	A straightforward alternative to the historical <code>PCOUNT</code> trick for discarding unneeded data from user-defined pipes.

FIRFILTER, FIRLOWPASS	Extended multi-channel support	These DSP processing commands can now apply the same filtering to multiple channels in parallel.
DAPL expressions	Extended data type support	New support for 64-bit and unsigned data types. Additional new control over data types in from constant terms and intermediate calculations. A "conditional evaluation" expression is added.

Changes affecting back-compatibility

Item	Change	Effects/Mitigation
ALARM	Default tracking behavior	Omitting the <i>reset</i> parameter does not cause a one-shot behavior; rather, it has a restarting behavior the same as a <i>reset</i> parameter of 0. To get a permanently latching behavior, specify a negative <i>reset</i> time interval.
INTEGRATE, BINTEGRATE	Deprecated	Equivalent capability and more is provided by the <code>RSUM</code> (running sum) command.
BPRINT	Obsolete command, no longer supported	Substitute a <code>MERGE</code> or <code>COPY</code> command.
PRINT	Obsolete command dropped	Possibly the <code>FORMAT</code> command. Text format is in general not recommended for data transfers.
CABS	Obsolete command dropped	Misnamed command, "absolute value of complex", but didn't do that! To get intended result, use new <code>CMAG</code> command. To get original result, "absolute value of complex squared" use a DAPL expression.
CHANGE	Obsolete command dropped	Applications should instead use <code>DLIMIT</code> on range <code>OUTSIDE, 0, 0</code> .
CORRELATE	Parameters simplified	Dropped unused "reserved" parameters. Data block sizing is now independent of FFT analysis restrictions and windowing. Input and output data types can now be specified independently.
CROSSPOWER	Parameters simplified	Data input and output types can now be specified independently. Data analysis is no longer restricted to block sizes that are integer powers of 2 in length. Unused <i>reserved</i> parameters eliminated.

COSINEWAVE , SINEWAVE , TRIANGLE , SAWTOOTH , SQUAREWAVE	Changes to waveform configuration parameters	Instead of using a numeric enumeration code followed by one or two pipes, specify each modulation option as a separate, optional string keyword with one associated modulation signal pipe. The SAWTOOTH waveform now begins at a zero crossing point, rather than jumping immediately to the negative extreme peak for the first output value. It also evaluates as zero exactly at a discontinuity. The new BIRAMP command can be a better choice for applications requiring a ramp signal generator.
WAVEFORM	Collective waveform alias dropped	Specify the name of the waveform command you want.
EXTRACT	Deprecated	Use a DAPL expression with bitwise operations.
PEAK	Dropped	Maybe FINDMAX will work instead. The PEAK command had some behaviors that could result in deadlocks, with no workararound possible, and could not support all data types.
OFFSET, SCALE	Deprecated	Use DAPL expression.
LCOPY	Deprecated	Processing is re-routed to the COPY command — you do not get the intended data grouping. New pipe configuration features will achieve the intended purpose in a better a better way.
PID, PID1	Legacy support dropped	PID replaces the archaic PID command from DAPL 3 and the limited PID1 from DAPL 4 and DAPL 2000. A back-compatibility PID1 command accepts the basic PID1 parameter forms but maps them into the new PID command internally. Use PIDRAMP, PIDSCRAM, or PIDLATCH for the supervisory features previously bundled into PID1.
POLAR	Optional feature dropped	The optional <i>clamp</i> parameter was ineffective at producing better data; it only introduced a second kind of erratic nonlinear behavior. No known suitable alternative.
PWM	Parameter revision	Completely new design, requiring different configuration parameters. See new feature list for more information.
SCAN	Obsolete processing command dropped	Has no meaning in DAPL 3000. See the new SCAN command for input sampling.
Type-variant	Legacy notations	Older versions of DAPL allowed declaration of constants,

<code>initializers</code>	dropped	variables, and vectors with unspecified data type. The data type was then determined from the values of the initializer expression. This is no longer supported. Declare the data types you want, and make sure the initializers are compatible.
Type-deferred initializers	Legacy notations dropped	Older versions of DAPL allowed declarations of <code>VECTORS</code> in which vector initializer terms were specified first, and then a type override could specify a different data type later. These notations are no longer supported. You must declare data types before initializer lists.
Critical task timing	Scheduling algorithm modified	Configurations specifically structured and tuned to optimize flow of execution for DAPL 2000 will act differently. The scheduling algorithms in DAPL 3000 will schedule tasks according to priority and resource constraints in addition to the tie-breaker round-robin ordering. This will cause some differences in timing.
<code>TRIGGER</code>	Legacy syntax support removed	Obsolete notations from prior system versions are dropped. Use only the documented command forms. The relaxed restrictions on reading and writing data within start groups makes the old notations unnecessary.
<code>FILL</code>	Text insertion not supported	You cannot use the <code>FILL</code> command to inject text data into the reserved <code>\$SysIn</code> and <code>\$SysOut</code> text pipes.
diagnostics	Earlier error detection	DAPL 3000 can perform more "compile-time" validation, so errors are sometimes detected earlier, with diagnostic messages that are different or appear at different times than before.
DAPL expressions	C++ compatible sign extension	Treatment of signed and unsigned values is vastly more consistent, but this might cause obscure differences in the way values are sign extended — particularly bit-masks using old hex constant notations.