

Change Summary

6000 Series Software Reference

Revision J

February 1997

The following is a summary of the primary technical changes to this document since the last revision was released. This document, p/n 88-012966-01 J, supersedes 88-012966-01 I.

Topic	Description																					
<i>General Information</i>	<p>This manual revision covers the features for these 6000 Series products with revision 4.5 firmware:</p> <table><thead><tr><th><u>Bus-Based</u></th><th><u>Stand-Alone</u></th><th><u>OEM Level</u></th></tr></thead><tbody><tr><td>AT6200</td><td>610n Series</td><td>OEM-AT6200</td></tr><tr><td>AT6400</td><td>615n Series</td><td>OEM-AT6400</td></tr><tr><td>AT6250</td><td>6200</td><td>OEM6200</td></tr><tr><td>AT6450</td><td>6201</td><td>OEM6250</td></tr><tr><td></td><td>6250</td><td></td></tr><tr><td></td><td>6270</td><td></td></tr></tbody></table> <p>Content/Organization Changes:</p> <ul style="list-style-type: none">• The “Programming Guide” portion of previous revisions has been removed. This information is found in the <i>6000 Series Programmer's Guide</i> (p/n 88-014540-01). Overview information about command syntax, command value substitutions, programmable I/O bit patterns, and error messages is still provided in this document (see pages 1-9).• Appendix C (Command Value Substitutions) from previous revisions has been removed; follow the guidelines outlined in the <i>Command Value Substitutions</i> section on page 4. Appendix D (ASCII Table) from previous revisions has been renamed as Appendix C.• The presentation of programming examples was modified so that you can copy them from the Help system (in Motion Architect) or from the PDF file (on our www.compumotor.com web site) and paste them directly into your program (e.g., using Motion Architect's Editor).	<u>Bus-Based</u>	<u>Stand-Alone</u>	<u>OEM Level</u>	AT6200	610n Series	OEM-AT6200	AT6400	615n Series	OEM-AT6400	AT6250	6200	OEM6200	AT6450	6201	OEM6250		6250			6270	
<u>Bus-Based</u>	<u>Stand-Alone</u>	<u>OEM Level</u>																				
AT6200	610n Series	OEM-AT6200																				
AT6400	615n Series	OEM-AT6400																				
AT6250	6200	OEM6200																				
AT6450	6201	OEM6250																				
	6250																					
	6270																					
Commanded Direction Reversal (CMDDIR)	<p>Enhancement: The commanded direction polarity reversal command (CMDDIR) is available for the 615n series, the 6270, and all stepper products (610n, AT6n00, 620n). The CMDDIR command allows you to reverse the direction that the controller considers to be the “positive” direction; this also reverses the polarity of the counts from the feedback devices. Thus, using the CMDDIR command, you can reverse the referenced direction of motion without the need to (a) change the connections to the drive or motor and the feedback device, or (b) change the sign of motion-related commands in your program.</p>																					

Topic	Description
Compiled Motion	<p>New Feature: (see <i>6000 Series Programmer's Guide</i> for detailed description)</p> <p>Related commands (new):</p> <p>FOLRNF.... Numerator of Final Slave-to-Master Ratio, Preset Moves</p> <p>GOBUF Store a Motion Segment in Compiled Memory</p> <p>PLN..... Loop End, compiled motion</p> <p>PLOOP Loop Start, compiled motion</p> <p>POUTA Output on Axis 1, compiled motion</p> <p>POUTB Output on Axis 2, compiled motion</p> <p>POUTC Output on Axis 3, compiled motion</p> <p>POUTD Output on Axis 4, compiled motion</p> <p>[SEG] Number of Segments Available In Compiled Memory</p> <p>TSEG Transfer Number of Segments Available, Compiled Memory</p> <p>VF Final Velocity</p> <p>Existing commands, modified to support compiled motion:</p> <p>GOWHEN..... Conditional GOs allowed in compiled motion</p> <p>PCOMP Pre-Compile a Program</p> <p>PRUN Run a Pre-Compiled Program</p> <p>PUCOMP..... Un-Compile a Program</p> <p>[SS] Bit #29 set if compiled memory 75% full, bit #30 set if 100% full Bit #31 is set if a compile (PCOMP) failed; cleared on power-up, reset, or after a successful compile. (See <i>Status Reporting</i>, <i>Additions</i> below for a list of typical causes.)</p> <p>TRGFN Execute GOWHENS or start new master cycle in compiled motion</p> <p>TSS.....(see [SS] description above)</p>
Contouring (Circular Interpolation)	<p>Enhancement: As of Rev 4.1, the Contouring feature is now available for <u>all</u> multi-axis products, steppers and servos. (see <i>Path Contouring</i> command group on inside back cover)</p>
Continuous Command Execution Mode (COMEXC1)	<p>Enhancement: On-The-Fly changes (pre-emptive motion). In addition to velocity (V), acceleration (A & AA), and deceleration (AD & ADA), you may now change the positioning mode (MC & MA), the distance (D), and the Following ratios (FOLRN & FOLRD). These changes will affect the subsequent GO command executed while moving; thus, this new enhancement is referred to as “pre-emptive GOs.”</p> <p>When pre-processing subsequent moves, the subsequent move may now be executed as soon as the next GO command is executed. Previous to revision 4.0, the subsequent move could not be executed until all moves on all axes were completed.</p>
Drive Configuration & Reset	<p>Enhancements:</p> <p>New commands added to set up the drive component of the 610n:</p> <p>DACTDP.... Enable/disable active damping for speeds greater than 3 rps. (configuration procedure: see the <i>ZETA6104 Installation Guide</i>)</p> <p>DAREN Enable/disable anti-resonance. Anti-resonance is inhibited at or below 3 rps, and if active damping is enabled.</p> <p>DELVIS.... Enable/disable electronic viscosity for speeds at or below 3 rps. (configuration procedure: see the <i>ZETA6104 Installation Guide</i>)</p> <p>DAUTOS.... Enable/disable automatic current standby mode in which current to the motor (& torque) is reduced by 50% if no pulses are sent for 1 second. Full current is restored upon the next pulse.</p> <p>DMTIND.... Motor inductance (used only for active damping—DACTDP).</p> <p>DMTSTT.... Motor static torque (used only for active damping—DACTDP).</p> <p>DWAVEF.... Motor waveform (required for matching the motor to the drive).</p> <p>615n only: As of Rev 4.1, you may use the new DRESET command to reset the internal drive independent of the internal controller. The purpose of the DRESET command is to clear fault conditions with the internal drive.</p>
Encoder Polarity Reversal (ENCPOL)	<p>Enhancement: The encoder polarity reversal command (ENCPOL) is now available to all 6000 stepper products (AT6n00, 620n, & 610n). Previous to 4.0 the ENCPOL command was only applicable to the 6270. The ENCPOL command is used to reverse the polarity (counting direction) of the encoder feedback counts. This is an alternative to reversing the A+ and A- connections to the encoder.</p>

Topic	Description
Error Checking Conditions	<p>Enhancements:</p> <ul style="list-style-type: none"> • 610n: The <i>drive fault</i> error (reported with error status bit #4 and axis status bit #14) can be caused by any one or combination of the factors list below. To ascertain the exact cause, use the extended axis status (see TASX, TASXF, or ASX): <ul style="list-style-type: none"> - Motor fault (disconnected/faulty motor cable or short in motor) — bit #1 - Low-voltage (power) — bit #2 - Maximum drive temperature (131°F, 55°C) exceeded — bit #3 • Error status enhancements (see [ER], TER, TERF, ERROR, and ERRORP): <ul style="list-style-type: none"> - Error bit #8 is set if a stop input (assigned with INFNCi-D) is activated. - Error bit #10 is set if the target position specified for a pre-emptive GO or a registration move is not achievable at the time the pre-emptive GO command is executed or the registration input is activated. This condition also sets bit #30 in the axis status register (reported with TAS & AS). To clear error bit #10 and axis bit #30, execute another GO command. • Related commands: <ul style="list-style-type: none"> [ER] Error Status (assignment or comparison) ERROR Error-Checking Enable ERRORP Error Program Assignment TER Transfer Error Status (see also TERF)
Fast Status (bus-based products)	<p>Correction: The bit assignments for the Limits status in block 5 are <u>not</u> the same as those for the TLIM report. A new table of Limit Bit Assignments has been added to the FASTAT command description.</p> <p>Clarification: The input buffer is 256 bytes.</p>
Following	<p>Enhancements:</p> <ul style="list-style-type: none"> • The new Following Kill (FOLK) command allows you to limit what will kill the Following profile. That is, it allows the slave to remain in synchronization with the master even after the occurrence of a drive fault, user fault input, excess position error, or enable or pulse-cut input. • The new Numerator of Final Slave-to-Master Ratio, Preset Moves (FOLRNF) command designates that the motor will move the load the distance assigned in the preset GOBUF segment, completing the move at a final ratio of zero. FOLRNF applies only to the first subsequent GOBUF, which marks an inter-mediate “end of move” within a Following profile. The FOLRNF command is only useful for <u>compiled</u> Following moves. • The new Following Step and Direction (FOLSND) command allows you to Follow the step & direction input connected to the encoder connector (this is an alternative to the standard quadrature encoder input).
Homing	<p>Clarification: Avoid using pause and resume functions during the homing operation (HOM). A pause command (PS or !PS) or pause input (input configured with the INFNCi-E command) will pause the homing motion. However, when the subsequent resume command (C or !C) or resume input (INFNCi-E input) occurs, motion will resume at the <u>beginning</u> of the homing motion sequence.</p>
Memory Management	<p>Enhancements:</p> <ul style="list-style-type: none"> • Compiled Memory status commands: <ul style="list-style-type: none"> - System status (TSS, TSSF, & SS) bit #29 is set if compiled memory is 75% full, bit #30 is set if compiled memory is 100% full - TSEG & SEG report the number of available segments in compiled memory • All stand-alone products are shipped with 150,000 bytes of memory. The -M option has thus been eliminated for these products. • The second field in the MEMORY command is re-defined to be for “compiled memory” (i.e., anything compiled with the PCOMP command). • These commands are automatically saved in non-volatile memory: <ul style="list-style-type: none"> CMDDIR Commanded Direction Polarity (610n, 615n, 620n, 6270 only) DMTIND Motor Inductance (610n only) DMTSTT Motor Static Torque (610n only) DRPCHK RP240 check (610n, 615n, 620n, & 625n only) ENCPOL Encoder Polarity (610n, 620n, & 6270 only)

Topic	Description
On-The-Fly Motion (AKA: <i>Pre-Emptive GOs</i>)	<p>Enhancements: (see GO command description)</p> <ul style="list-style-type: none"> The two basic ways of creating a complex profile are with compiled buffered motion, or with pre-emptive GOs. With compiled buffered motion, portions of a profile are built piece by piece, and stored for later execution. Compiled buffered motion is appropriate for motion profiles with motion segments of pre-determined velocity, acceleration and distance. With pre-emptive GOs, the motion profile underway is pre-empted with a new profile when a new GO is issued. The new GO both constructs and launches the pre-empting profile. Pre-emptive GOs are appropriate when the desired motion parameters are not known until motion is already underway. Affected Commands: COMEXC.... COMEXC1 mode allows pre-emptive motion with buffered commands GO Allows pre-emptive D, MC, MA, FOLRN, & FOLRD changes TAS & AS... Bit #30 is set if the load has already passed the target position (D) specified in a pre-emptive GO. (also sets error status bit #10) TER & ER... Error status bit #10 is set if axis status bit #30 is set.
Registration	<p>Enhancements:</p> <ul style="list-style-type: none"> New Commands: REGLOD.... Registration Lock-Out Distance. Establishes a <i>lock-out</i> distance (measured from the start of motion to the current actual position) to be traveled before a registration move is allowed. REGSS Registration Single-Shot. Allows only one registration move on the specified axis. Prevents other triggers from interrupting the registration move in progress. Axis status bit #28, reported by the TAS, TASF and AS commands, is set to 1 when a registration move has been initiated by any registration input (trigger). Bit #28 is cleared (set to 0) upon the next GO command for that axis. If, when the registration input is activated, the registration move profile cannot be performed with the specified parameters, the 6000 controller will kill the move in progress and set axis status bit #30 (see TAS & AS). If error-checking bit #10 is enabled with the ERROR command, the controller will also set error status bit #10 (see TER, TERF & ER) and branch to the assigned ERRORP error-handling program. Axis status bit #30 and error status bit #10 are cleared (set to 0) upon the next GO command for that axis. As of revision 4.1, Registration is now available <u>all</u> 6000 products (previous to 4.1, Registration was available only for stepper products).
Serial Communication	<p>Enhancements:</p> <ul style="list-style-type: none"> BOT command was created to control the beginning-of-transmission characters for all responses from the 6000 product. XONOFF command (new) enables/disables XON/XOFF ASCII handshaking. Additional features to control multiple serial ports on stand-alone products: [.....Send response from the subsequent command to both ports.]Send response from the subsequent command to the alternate port from the one selected with the most recent PORT command. DRPCHK..... Configures the serial port (specified with the last PORT command) to be used with an RP240, or 6000 commands, or both. PORT Determines which serial port is affected by the subsequent DRPCHK, E, ECHO, BOT, EOT, EOL, ERRORK, ERBAD, ERRDEF, ERLVL, and XONOFF commands. <p style="text-align: right;"><i>Continued on next page</i></p>

Topic	Description																																																																																																																																			
Serial Communication <i>(continued from previous page)</i>	<ul style="list-style-type: none"> As of 4.0, the ECHO command was enhanced with options 2 and 3. The purpose is to accommodate an RS-485 multi-drop configuration in which a host computer communicates to the “master” 6000 controller over RS-232 (COM1 port) and the master 6000 controller communicates over RS-485 (COM2 port) to the rest of the units on the multi-drop. For this configuration, the echo setup should be configured by sending to the master the following commands executed in the order shown. In this example, it is assumed that the master’s device address is set to 1. Hence, each command is prefixed with “1_” to address only the master unit. <ul style="list-style-type: none"> 1_PORT2...Subsequent command affects COM2, the RS-485 port 1_ECHO2...Echo characters back through the other port, COM1 1_PORT1...Subsequent command affects COM1, the RS-232 port 1_ECHO3...Echo characters back through both ports, COM1 and COM2 																																																																																																																																			
Servo Output, ANA (AT6n50 only)	<p>Enhancement:</p> <p>Use the OUTANA command to control the analog output voltage on the AT6n50's ANA output terminal.</p>																																																																																																																																			
Servo Updates Changed (Servo Products Only)	<p><i>(see SSFR command description for full explanation of table contents)</i></p> <table border="1"> <thead> <tr> <th rowspan="2"># of Axes (INDAX)</th> <th rowspan="2">SSFR Setting</th> <th colspan="2">Servo Sampling Update</th> <th colspan="2">Motion Trajectory Update</th> <th colspan="2">System Update</th> </tr> <tr> <th>Frequency (samples/sec.)</th> <th>Period (µsec)</th> <th>Frequency (samples/sec.)</th> <th>Period (µsec)</th> <th>Frequency (samples/sec.)</th> <th>Period (µsec)</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>1</td> <td>3030</td> <td>330</td> <td>3030</td> <td>330</td> <td>757</td> <td>1320</td> </tr> <tr> <td>1</td> <td>2</td> <td>5405</td> <td>185</td> <td>2703</td> <td>370</td> <td>675</td> <td>1480</td> </tr> <tr> <td>Default, Single-Axis</td> <td>1</td> <td>4</td> <td>6250</td> <td>160</td> <td>1563</td> <td>640</td> <td>520</td> <td>1920</td> </tr> <tr> <td></td> <td>1</td> <td>8</td> <td>6667</td> <td>150</td> <td>833</td> <td>1200</td> <td>417</td> <td>2400</td> </tr> <tr> <td>2</td> <td>1</td> <td>2353</td> <td>425</td> <td>2352</td> <td>425</td> <td>588</td> <td>1700</td> </tr> <tr> <td>2</td> <td>2</td> <td>3571</td> <td>280</td> <td>1786</td> <td>560</td> <td>446</td> <td>2400</td> </tr> <tr> <td>Default, Two-Axis</td> <td>2</td> <td>4</td> <td>3571</td> <td>280</td> <td>893</td> <td>1120</td> <td>446</td> <td>2400</td> </tr> <tr> <td></td> <td>2</td> <td>8</td> <td>3571</td> <td>280</td> <td>446</td> <td>2240</td> <td>446</td> <td>2400</td> </tr> <tr> <td>3</td> <td>1</td> <td>1667</td> <td>600</td> <td>1667</td> <td>600</td> <td>555</td> <td>1800</td> </tr> <tr> <td>3</td> <td>2</td> <td>2222</td> <td>450</td> <td>1111</td> <td>900</td> <td>555</td> <td>1800</td> </tr> <tr> <td>3</td> <td>4</td> <td>2353</td> <td>425</td> <td>588</td> <td>1700</td> <td>588</td> <td>1700</td> </tr> <tr> <td>4</td> <td>1</td> <td>1250</td> <td>800</td> <td>1250</td> <td>800</td> <td>417</td> <td>2400</td> </tr> <tr> <td>4</td> <td>2</td> <td>1667</td> <td>600</td> <td>833</td> <td>1200</td> <td>417</td> <td>2400</td> </tr> <tr> <td>Default, Four-Axis</td> <td>4</td> <td>4</td> <td>2000</td> <td>500</td> <td>500</td> <td>2000</td> <td>500</td> <td>2000</td> </tr> </tbody> </table>	# of Axes (INDAX)	SSFR Setting	Servo Sampling Update		Motion Trajectory Update		System Update		Frequency (samples/sec.)	Period (µsec)	Frequency (samples/sec.)	Period (µsec)	Frequency (samples/sec.)	Period (µsec)	1	1	3030	330	3030	330	757	1320	1	2	5405	185	2703	370	675	1480	Default, Single-Axis	1	4	6250	160	1563	640	520	1920		1	8	6667	150	833	1200	417	2400	2	1	2353	425	2352	425	588	1700	2	2	3571	280	1786	560	446	2400	Default, Two-Axis	2	4	3571	280	893	1120	446	2400		2	8	3571	280	446	2240	446	2400	3	1	1667	600	1667	600	555	1800	3	2	2222	450	1111	900	555	1800	3	4	2353	425	588	1700	588	1700	4	1	1250	800	1250	800	417	2400	4	2	1667	600	833	1200	417	2400	Default, Four-Axis	4	4	2000	500	500	2000	500	2000
# of Axes (INDAX)	SSFR Setting			Servo Sampling Update		Motion Trajectory Update		System Update																																																																																																																												
		Frequency (samples/sec.)	Period (µsec)	Frequency (samples/sec.)	Period (µsec)	Frequency (samples/sec.)	Period (µsec)																																																																																																																													
1	1	3030	330	3030	330	757	1320																																																																																																																													
1	2	5405	185	2703	370	675	1480																																																																																																																													
Default, Single-Axis	1	4	6250	160	1563	640	520	1920																																																																																																																												
	1	8	6667	150	833	1200	417	2400																																																																																																																												
2	1	2353	425	2352	425	588	1700																																																																																																																													
2	2	3571	280	1786	560	446	2400																																																																																																																													
Default, Two-Axis	2	4	3571	280	893	1120	446	2400																																																																																																																												
	2	8	3571	280	446	2240	446	2400																																																																																																																												
3	1	1667	600	1667	600	555	1800																																																																																																																													
3	2	2222	450	1111	900	555	1800																																																																																																																													
3	4	2353	425	588	1700	588	1700																																																																																																																													
4	1	1250	800	1250	800	417	2400																																																																																																																													
4	2	1667	600	833	1200	417	2400																																																																																																																													
Default, Four-Axis	4	4	2000	500	500	2000	500	2000																																																																																																																												
Status Reporting	<p>Enhancements:</p> <ul style="list-style-type: none"> New transfer (display status) commands: <ul style="list-style-type: none"> TASX Transfer extended axis status (see also TASXF). Bit assignments: <ul style="list-style-type: none"> Bit #1: Motor fault (610n only) Bit #2: Drive low voltage fault (610n only) Bit #3: Drive over-temperature fault (610n only) Bit #4: Drive fault input is active TSEG Transfer number of segments available in compiled memory New assignment/comparison operators: <ul style="list-style-type: none"> SEG Number of segments available in compiled memory ASX Extended axis status information Pre-emptive Motion and Registration status: <ul style="list-style-type: none"> TAS & AS ... Axis status bit #28 is set if a registration move occurs. <ul style="list-style-type: none"> Bit #30 is set if the profile specified for a pre-emptive GO or registration move is not possible at the time of the GO or the registration input (also sets error status bit #10). TER & ER Error status bit #8 is set if a stop input (INFNCi -D) is activated. <ul style="list-style-type: none"> Bit #10 is set if axis status bit #30 is set. Bit #16 is set if a bad command is detected; cleared with TCMDER. <p style="text-align: right;"><i>Continued on next page</i></p>																																																																																																																																			

Topic	Description
Status Reporting <i>(continued from previous page)</i>	<ul style="list-style-type: none"> • Compiled profile status: TSS & SS System status bit #29 is set if compiled memory is 75% full. Bit #30 is set if compiled memory is 100% full. Bit #31 is set if a compile (PCOMP) failed, cleared on power-up, reset, or after a successful compile. Possible causes include: <ul style="list-style-type: none"> - Errors in profile design (e.g., change direction while at non-zero velocity, distance & velocity equate to < 1 count/system update, preset move profile ends in non-zero velocity) - Profile will cause a Following error (see TFS & FS status) - Out of memory (see system status bit #30) - Axis already in motion at the time of the PCOMP command - Loop programming errors (e.g., no matching PLOOP or PLN, more than 4 embedded PLOOP/END loops) <p>TSEG & SEG Report number of available segments in compiled memory.</p> <ul style="list-style-type: none"> • Drive Fault Input Status: As of revision 4.1, extended axis status (TASX & ASX) bit #4 is now available to check the drive fault input status whether or not the drive is enabled (DRIVE1) or disabled (DRIVEØ). Previous to revision 4.1, the status of the drive fault input could only be checked while the drive was enabled (DRIVE1) and was reported only with axis status (TAS & AS) bit #14 and error status (TER & ER) bit #4. The branch to the error program has not been changed—the error program is called only if the drive fault occurs while the drive is enabled. • The INDUST command (which allows you to create your own custom status word based on other status registers) now allows you to use the status bits from the extended axis status (see TASX description above). In the syntax INDUSTi - ic, the options for “c” (the status register source) now include L, M, N and O, representing the extended axis status registers for axes 1, 2, 3 and 4, respectively. For additional details on creating a custom user status word, refer to the INDUST command description. • As of Rev 4.1, the TVELA command is now applicable to all stepper controllers using encoder feedback (previously only for servos). For steppers, the TVELA command reports the current velocity (in revs/sec) as derived from the encoder. The reported value is <u>not</u> affected by scaling. The VELA assignment/comparison operator for TVELA is now available as of rev 4.0. <p>Clarification: Some status commands also have a full-text version that takes the guesswork out of identifying the function of each status bit in a binary report.</p> <p>TASF Axis Status TASXF Axis Status, Extended TERF Error Status TFSF Following Status TINOF Other Inputs Status (joystick inputs, and the P-CUT or ENBL input) TSSF System Status</p>
Target Zone	<p>Enhancement:</p> <ul style="list-style-type: none"> • The Target Zone mode allows you to define what the controller considers a “completed move,” based on specified end-of-move distance, velocity, and settling time parameters. As of revision 4.0, the Target Zone mode is now applicable to <u>all</u> 6000 products (previous to 4.0, the Target Zone mode was available only for servo products). NOTE: Steppers require encoder feedback (and ENC1 mode) for this feature. • Target Zone Commands: STRGTE.... Target Zone Mode Enable/Disable STRGTD.... Target Distance Zone STRGTT.... Target Settling Timeout Period STRGTV.... Target Velocity Zone
Variables, Clearing	<p>Enhancement: You can clear all numeric (VAR), binary (VARB) and string (VAR_S) variables at one time by using the VARCLR command (sets all variables to factory default values).</p>
Velocity (actual) Assignment	<p>Enhancement: Using the new [VELA] operator, you can assign/compare (e.g., for a conditional expression) the current velocity as measured from the feedback device. Use [VEL] for commanded velocity, and [V] for programmed velocity.</p>