



UDC 3500 Application Note

Accutune Set Up Group

Introduction

Accutune III automatically calculates GAIN, RATE, and RESET TIME (PID) tuning constants for your control loop. When initiated on demand, the Accutune algorithm measures a process step response and automatically generates the PID tuning constants needed for no overshoot on your process.

Fuzzy, Fuzzy Overshoot Suppression: When enabled, this configuration will suppress or eliminate any overshoot that may occur as a result of the existing tuning parameters, as the PV approaches the setpoint.

Tune, Demand Tuning: The tuning process is initiated through the operator interface keys or via a digital input (if configured). The algorithm then calculates new tuning parameters and enters them in the tuning group. *Tune* will operate with PIDA, PIDB, PD+MR and Three Position Step Control algorithms.

SP, SP Tuning: SP tuning continuously adjusts the PID parameters in response to setpoint changes. You can select tuning on minimum setpoint changes of 5 % up to 15 % span. Perform SP tuning after you have configured the controller. SP Tuning does not operate with the Three Position Step Control algorithm.

Simplex Tuning is used when a Simplex Control Algorithm is configured and uses the current SP value and alters the output over the Output Limit Range.

Duplex Tuning is used when a Duplex Control Algorithm is configured. To perform a Duplex Tune, Two Local Setpoints must be configured per the Control Group.

Function Prompts

Table 1 ACCUTUNE Group Function Prompts

Function Prompt Lower Display	Selections or Range of Setting Upper Display	Parameter Definition
FUZZY	DISABLE	FUZZY OVERTSHOOT SUPPRESSION —Can be enabled or disabled independently of whether Demand Tuning or SP Tuning is enabled or disabled. DISABLE —Disables Fuzzy Overshoot Suppression.
	ENABLE	ENABLE —The instrument uses Fuzzy Logic to suppress or minimize any overshoot that may occur when PV approaches SP. It will not recalculate any new tuning parameters.
	ENABLE2	ENABLE ON LOOP2 ONLY —Fuzzy Tune used only on Loop 2.
	ENABL12	ENABLE ON BOTH LOOPS —Fuzzy Tune used on both loops.



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<p>ACCUTUNE</p>	<p>DISABLE</p>	<p>ACCUTUNE III</p>
	<p>TUNE</p>	<p>DISABLE—Disables the Accutune function.</p>
	<p>SP</p>	<p>DEMAND TUNING—If TUNE is selected, and tuning is initiated through the operator interface or digital input (if configured), the algorithm calculates new tuning parameters and enters them into the tuning group. This tuning requires no process knowledge and does not require line out for initialization.</p> <p>TUNE is the recommended start-up mode—to be used when no knowledge of the process tuning values is available. In the Start-up mode, after enabling ACCUTUNE, the operator simply configures the desired SP value and enables the ACCUTUNE process via the keyboard.</p> <p>SETPOINT TUNING—This selection tunes on setpoint changes only. It employs time domain analysis to accelerate line out at any desired setpoint without prior initialization or process knowledge. This method should only be used after the process has lined out (stabilized).</p> <p>ATTENTION SP Tune must be disabled in order to change tuning constant values via the keyboard.</p>
	<p>TUNE+PV</p>	<p>DEMAND TUNING PLUS PV ADAPTIVE TUNING—This selection provides “TUNE” on demand tuning plus PV Adaptive tuning whenever a PV process disturbance equal to or greater than 0.3% of span occurs. After a disturbance of 1.5 process cycles around the Setpoint occurs, this selection will initiate a recalculation of the Tuning parameters.</p>
<p>SP+PV</p>	<p>SETPOINT TUNING PLUS PV ADAPTIVE TUNING—This selection tunes whenever the SP is changed plus performs a PV Adaptive Tune whenever a PV process disturbance equal to or greater than 0.3% of span occurs. After a disturbance of 1.5 process cycles around the Setpoint occurs, this selection will initiate a recalculation of the Tuning parameters.</p> <p>ATTENTION SP+PV Tune must be disabled in order to change tuning constant values via the keyboard.</p>	



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DUPLEX	<p>MANUAL</p> <p>AUTO</p> <p>DISABLE</p>	<p>DUPLEX ACCUTUNING III—These prompts only appear when a duplex output type has been configured and TUNE or TUNE+PV has been selected.</p> <p>MANUAL—Tune manually using LSP 1 and LSP 2 values. LSP 1 is used to derive tuning parameters associated with HEAT (output > 50 %). LSP 2 is used to derive tuning parameters associated with COOL (output < 50 %).</p> <p>AUTOMATIC—Tuning is performed automatically on both HEAT and COOL sequentially. LSP 1 is used for HEAT tuning and LSP 2 is used for COOL tuning. To initiate tuning, either LSP 1 or LSP 2 must be in use.</p> <p>DISABLE—The current Setpoint is used to derive a single set of blended tuning parameters. This tuning is performed over the range of the output limits similar to Simplex Tuning. The Tuning Parameters derived are placed into both the HEAT and COOL tune sets (PID 1 and PID 2).</p>
SP CHANG	5 to 15%	<p>SETPOINT CHANGE—This prompt appears only when SP or SP+PV has been selected. This is the minimum Setpoint change on Loop 1 that will result in a re-tuning process.</p> <p>For example, if the SP range is 0 to 2400 and Setpoint change is set to 5%, then a re-tuning process will take place whenever the SP is changed by 120 or more.</p>
KPG	0.10 to 10.00	<p>PROCESS GAIN—This prompt appears only when SP or SP+PV has been selected. This is the Gain of the Loop 1 process being tuned. It is automatically recalculated during the tuning process. This is normally a READ ONLY value, but can be changed manually if the controller fails to identify the process. In that case, set the KPG value to the algebraic value of PV in percent divided by the output in percent while in manual mode.</p> <p>For example, if the PV range is 0 to 2400, the PV is currently at 1200 and the output is currently at 50.0%, then KPG should be set to $1200/2400 * 100/50$ or 1.0.</p>



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CRITERIA	NORMAL FAST	<p>TUNING CRITERIA (SETPOINT ADAPTIVE)—This prompt appears only when SP or SP+PV has been selected. Select a criteria best suited for your process.</p> <p>NORMAL—Original critical damping (no overshoot).</p> <p>FAST—A more aggressive tuning with overshoot equal to or less than 0.5%.</p>
ACCUTUNE2	Same selections as for Loop 1.	<p>ACCUTUNE III FOR LOOP 2—Available only when the instrument is configured for Cascade or Two Loop operation.</p> <p>Same selections as for Loop 1.</p>
DUPLEX 2	Same selections as for Loop 1.	<p>DUPLEX ACCUTUNING III FOR LOOP 2—These prompts only appear when a duplex output type has been configured for Loop 2 and TUNE or TUNE+PV has been selected.</p> <p>Same selections as for Loop 1.</p>
SP CHAN2	5 to 15%	<p>SETPOINT CHANGE—This prompt appears only when SP or SP+PV has been selected for Loop 2. This is the minimum Setpoint change on Loop 2 that will result in a re-tuning process.</p>
KPG 2	0.10 to 10.00	<p>PROCESS GAIN FOR LOOP 2—This prompt appears only when SP or SP+PV has been selected. This is the Gain of the Loop 2 process being tuned.</p>
CRITERA2	Same selections as for Loop 1.	<p>TUNING CRITERIA (SETPOINT ADAPTIVE) FOR LOOP 2—This prompt appears only when SP or SP+PV has been selected for Loop 2.</p> <p>Same selections as for Loop 1.</p>
AT ERROR (Read Only)	NONE RUNNING	<p>ACCUTUNE ERROR STATUS—When an error is detected in the Accutune process, an error prompt will appear.</p> <p>NONE—No errors occurred during last Accutune procedure.</p> <p>RUNNING—An Accutune process is still active checking process gain, even though “T” is not lit. It does not affect keyboard operation.</p>



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	ABORT SP2 OUTLIM IDFAIL LOW PV	<p>CURRENT ACCUTUNE PROCESS ABORTED— Caused by one of the following conditions:</p> <ul style="list-style-type: none"> changing to manual mode input detected heat region of output but a cool output was calculated, or vice versa SP was changed while PV (error) tune was in process <p>SP2—LSP2 not configured or a Setpoint other than LSP1 or LSP2 is in use.</p> <p>OUTPUT LIMIT REACHED (HIGH OR LOW)— Applies only to SP or SP+PV tuning. Output insufficient to get to SP value.</p> <p>ATTENTION This error will cause the controller to switch from Automatic to Manual Mode. The output is then set to the value present at the beginning of the ACCUTUNE process.</p> <p>PROCESS IDENTIFICATION PROCESS FAILED— Applies only to SP or SP+PV tuning. An illegal value for Gain, Rate or Reset was calculated.</p> <p>LOW PV—Applies only to SP or SP+PV tuning. PV did not change sufficiently or the PV has increased by more than 4% but Deadtime was not determined.</p>
AT ERR 2 (Read Only)	Same as Loop 1.	ACCUTUNE ERROR STATUS FOR LOOP 2