UDC 3500 Application Note

Loop 1 Tuning Set Up Group

Introduction

Tuning consists of establishing the appropriate values for the tuning constants you are using so that your controller responds correctly to changes in process variable and setpoint. You can start with predetermined values but you will have to watch the system to see how to modify them. The Accutune feature automatically selects Gain, Rate, and Reset on demand.

There can be as many as for PID sets available for Loop 1.

ATTENTION

Because this group contains functions that have to do with security and lockout, we recommend that you configure this group last, after all other configuration data has been loaded.

Function Prompts

Table -1 TUNING Group Function Prompts

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
PROP BD or **GAIN**	0.1 to 9999 % or 0.001 to 1000	**PROPORTIONAL BAND** (simplex) is the percent of the range of the measured variable for which a proportional controller will produce a 100 % change in its output. **GAIN** is the ratio of output change (%) over the measured variable change (%) that caused it. $G = \frac{100\%}{PB\%}$ where PB is the proportional band (in %) If the PB is 20 %, then the Gain is 5. And, at those settings, a 3 % change in the error signal (SP-PV) will result in a 15 % change in the controller's output due to proportional action. If the Gain is 2, then the PB is 50 %. Also defined as "HEAT" Gain on Duplex models for variations of Heat/Cool applications. *The selection of Proportional Band or Gain is made in the CONTROL parameter group under prompt PBorGAIN.*
RATE MIN	0.00 to 10.00 minutes	**RATE** action, in minutes, affects the controller's output whenever the deviation is changing; and affects it more when the deviation is changing faster. Also defined as "HEAT" Rate on Duplex models for variations of Heat/Cool applications.

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
RSET MIN or **RSET RPM**	0.02 to 50.00	**RSET MIN** = Reset in Minutes per Repeat **RSET RPM** = Reset in Repeats per Minute **RESET** (or **Integral Time**) adjusts the controller's output in accordance with both the size of the deviation (SP–PV) and the time that it lasts. The amount of the corrective action depends on the value of Gain. The Reset adjustment is measured as how many times proportional action is repeated per minute or how many minutes before one repeat of the proportional action occurs. Used with control algorithm PID-A or PID-B. Also defined as "HEAT" Reset on Duplex models for variations of Heat/Cool applications. **ATTENTION** The selection of whether Minutes per Repeat or Repeats per Minute is used is made in the CONTROL parameters group under the prompt **MINorRPM**.
MAN RSET	–100 to +100 (in % output)	**MANUAL RESET** is only applicable if you use control algorithm PD WITH MANUAL RESET in the Algorithm Set Up group. Because a proportional controller will not necessarily line out at setpoint, there will be a deviation (offset) from setpoint. This eliminates the offset and lets the PV line out at setpoint. **ATTENTION** Bias is shown on the lower display.
PROPBD2 or **GAIN 2**	0.1 to 9999 % or 0.001 to 1000	**PROPORTIONAL BAND 2** or **GAIN 2**, **RATE 2**, and **RESET 2** parameters are the same as previously described for "Heat" except that they refer to the **cool** zone tuning constants on duplex models or the second set of PID constants, whichever is pertinent.
RATE2MIN	0.00 to 10.00 minutes	This is the same as above except that it applies to Duplex models for the "COOL" zone of Heat/Cool applications or for the second set of PID constants.
RSET2MIN **RSET2RPM**	0.02 to 50.00	These are the same as above except that they apply to Duplex models for the "COOL" zone of Heat/Cool applications or for the second set of PID constants.
PROPBD3 or **GAIN 3**	0.1 to 9999 % or 0.001 to 1000	**PROPORTIONAL BAND 3** or **GAIN 3** parameters are the same as previously described. This prompt appears only when four PID sets are enabled.
RATE3MIN	0.00 to 10.00 minutes	**RATE 3 MINUTES** parameter are the same as previously described. This prompt appears only when four PID sets are enabled.

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
RSET3MIN **RSET3RPM**	0.02 to 50.00	**RESET 3 MINUTES or RSET 3 REPEATS PER MINUTE** parameters are the same as previously described. This prompt appears only when four PID sets are enabled.
PROPBD4 or **GAIN 4**	0.1 to 9999 % or 0.001 to 1000	**PROPORTIONAL BAND 4** or **GAIN 4**, **RATE 4**, and **RESET 4** parameters are the same as previously described. This prompt appears only when four PID sets are enabled
RATE4MIN	0.00 to 10.00 minutes	**RATE 4 MINUTES** parameter are the same as previously described. This prompt appears only when four PID sets are enabled.
RSET4MIN **RSET4RPM**	0.02 to 50.00	**RESET 4 MINUTES or RSET 3 REPEATS PER MINUTE** parameters are the same as previously described. This prompt appears only when four PID sets are enabled.
CYC SEC or **CYC SX3**	1 to 120	**CYCLE TIME (HEAT)** determines the length of one time proportional output relay cycle. Defined as "HEAT" cycle time for Heat/Cool applications. **CYC SEC**—Electromechanical relays **CYC SX3**—Solid state relays **ATTENTION** *Cycle times are in either second or 1/3-second increments depending upon the configuration of RLY TYPE in the Output Algorithm Set Up group.*
CYC2 SEC or **CYC2 SX3**	1 to 120	**CYCLE TIME 2 (COOL)** is the same as above except it applies to Duplex models as the cycle time in the "COOL" zone of Heat/Cool applications or for the second set of PID constants. **CYC2 SEC**—Electromechanical relays **CYC2 SX3**—Solid state relays **ATTENTION** *Cycle times are in either second or 1/3-second increments depending upon the configuration of RLY TYPE in the Output Algorithm Set Up group.*
SECURITY	0 to 9999	**SECURITY CODE**—The level of keyboard lockout may be changed in the Set Up mode. Knowledge of a security code may be required to change from one level to another. This configuration should be copied and kept in a secure location. NOTE: The Security Code is for keyboard entry only and is not available via communications. **ATTENTION** *Can only be changed if LOCKOUT selection is NONE.*

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
LOCKOUT		**LOCKOUT** applies to one of the functional groups: Configuration, Calibration, Tuning, Accutune. **DO NOT CONFIGURE UNTIL ALL CONFIGURATION IS COMPLETE.**
	NONE	**NONE**—No lockout; all groups are read/write.
	CALIB	**CALIB**—All groups are available for read/write except for the Calibration and Keyboard Lockout groups.
	+ CONF	**+ CONF**—Tuning, SP Ramp, and Accutune groups are read/write. All other groups are read only. Calibration and Keyboard Lockout groups are not available.
	+ VIEW	**+ VIEW**—Tuning and Setpoint Ramp parameters are read/write. No other parameters are viewable.
	MAX	**MAX**—Tuning and Setpoint Ramp parameters are available for read only. No other parameters are viewable.
AUTO MAN		**MANUAL/AUTO KEY LOCKOUT**—Allows you to disable the Manual/Auto key
	DISABLE ENABLE	**DISABLE** **ENABLE**
		ATTENTION *Can only be viewed if LOCKOUT is configured for NONE.*
RUN HOLD		**RUN/HOLD KEY LOCKOUT**—Allows you to disable the  key, for either SP Ramp or SP Program. *The Run/Hold key is never disabled when used to acknowledge a latched alarm 1*
	DISABLE ENABLE	**DISABLE** **ENABLE**
		ATTENTION *Can only be viewed if LOCKOUT is configured for NONE.*
SP SEL		**SETPOINT SELECT KEY LOCKOUT**—Allows you to disable the Setpoint Select key
	DISABLE ENABLE	**DISABLE** **ENABLE**
		ATTENTION *Can only be viewed if LOCKOUT is configured for NONE.*

Loop 2 Tuning Set Up Group

Introduction

Tuning consists of establishing the appropriate values for the tuning constants you are using so that your controller responds correctly to changes in process variable and setpoint. You can start with predetermined values but you will have to watch the system to see how to modify them. The Accutune feature automatically selects Gain, Rate, and Reset on demand.

There can be as many as for PID sets available for Loop 2.

Function Prompts

Table -2 TUNING 2 Group Function Prompts

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
PROP BD5 or **GAIN 5**	0.1 to 9999 % or 0.001 to 1000	**PROPORTIONAL BAND** (simplex) is the percent of the range of the measured variable for which a proportional controller will produce a 100 % change in its output. **GAIN** is the ratio of output change (%) over the measured variable change (%) that caused it. $G = \frac{100\%}{PB\%}$ where PB is the proportional band (in %) If the PB is 20 %, then the Gain is 5. And, at those settings, a 3 % change in the error signal (SP-PV) will result in a 15 % change in the controller's output due to proportional action. If the Gain is 2, then the PB is 50 %. Also defined as "HEAT" Gain on Duplex models for variations of Heat/Cool applications. *The selection of Proportional Band or Gain is made in the CONTROL parameter group under prompt PBorGAIN.*
RATE5MIN	0.00 to 10.00 minutes	**RATE** action, in minutes, affects the controller's output whenever the deviation is changing; and affects it more when the deviation is changing faster. Also defined as "HEAT" Rate on Duplex models for variations of Heat/Cool applications.

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
RSET5MIN or **RSET5RPM**	0.02 to 50.00	**RSET5MIN** = Reset in Minutes per Repeat **RSET5RPM** = Reset in Repeats per Minute **RESET** (or **Integral Time**) adjusts the controller's output in accordance with both the size of the deviation (SP–PV) and the time that it lasts. The amount of the corrective action depends on the value of Gain. The Reset adjustment is measured as how many times proportional action is repeated per minute or how many minutes before one repeat of the proportional action occurs. Used with control algorithm PID-A or PID-B. Also defined as "HEAT" Reset on Duplex models for variations of Heat/Cool applications. **ATTENTION** The selection of whether Minutes per Repeat or Repeats per Minute is used is made in the CONTROL2 parameters group under the prompt **MINorRPM**.
MAN5RSET	–100 to +100 (in % output)	**MANUAL5RESET** is only applicable if you use control algorithm PD WITH MANUAL RESET for Loop 2 in the Algorithm Set Up group. Because a proportional controller will not necessarily line out at setpoint, there will be a deviation (offset) from setpoint. This eliminates the offset and lets the PV line out at setpoint. **ATTENTION** Bias is shown on the lower display.
PROPBD6 or **GAIN 6**	0.1 to 9999 % or 0.001 to 1000	**PROPORTIONAL BAND 6** or **GAIN 6**, **RATE 6** and **RESET 6** parameters are the same as previously described for "Heat" except that they refer to the **cool** zone tuning constants on duplex models or the second set of PID constants, whichever is pertinent.
RATE6MIN	0.00 to 10.00 minutes	This is the same as above except that it applies to Duplex models for the "COOL" zone of Heat/Cool applications or for the second set of PID constants.
RSET6MIN **RSET6RPM**	0.02 to 50.00	These are the same as above except that they apply to Duplex models for the "COOL" zone of Heat/Cool applications or for the second set of PID constants.
PROPBD7 or **GAIN 7**	0.1 to 9999 % or 0.001 to 1000	**PROPORTIONAL BAND 7** or **GAIN 7** parameters are the same as previously described. This prompt appears only when four PID sets are enabled.
RATE7MIN	0.00 to 10.00 minutes	**RATE 7 MINUTES** parameter are the same as previously described. This prompt appears only when four PID sets are enabled.

Function Prompt Lower Display	**Selections or Range of Setting** Upper Display	**Parameter Definition**
RSET7MIN **RSET7RPM**	0.02 to 50.00	**RESET 7 MINUTES or RSET 7 REPEATS PER MINUTE** parameters are the same as previously described. This prompt appears only when four PID sets are enabled.
PROPBD8 or **GAIN 4**	0.1 to 9999 % or 0.001 to 1000	**PROPORTIONAL BAND 8** or **GAIN 8**, **RATE 8**, and **RESET 8** parameters are the same as previously described. This prompt appears only when four PID sets are enabled.
RATE8MIN	0.00 to 10.00 minutes	**RATE 8 MINUTES** parameter are the same as previously described. This prompt appears only when four PID sets are enabled.
RSET8MIN **RSET8RPM**	0.02 to 50.00	**RESET 8 MINUTES or RSET 8 REPEATS PER MINUTE** parameters are the same as previously described. This prompt appears only when four PID sets are enabled.
CYC5 SEC or **CYC5 SX3**	1 to 120	**CYCLE TIME (HEAT)** determines the length of one time proportional output relay cycle. Defined as "HEAT" cycle time for Heat/Cool applications. **CYC5 SEC**—Electromechanical relays **CYC5 SX3**—Solid state relays **ATTENTION** *Cycle times are in either second or 1/3-second increments depending upon the configuration of RLY TYPE in the Output Algorithm Set Up group.*
CYC6 SEC or **CYC6 SX3**	1 to 120	**CYCLE TIME 2 (COOL)** is the same as above except it applies to Duplex models as the cycle time in the "COOL" zone of Heat/Cool applications or for the second set of PID constants. **CYC6 SEC**—Electromechanical relays **CYC6 SX3**—Solid state relays **ATTENTION** *Cycle times are in either second or 1/3-second increments depending upon the configuration of RLY TYPE in the Output Algorithm Set Up group.*