

# *UDC 3300 Cascade Control*

## Advantages of Cascade Control

- Prevents inner loop disturbances from affecting the outer loop
- Keep non-linearities (such as adverse valve characteristics or a sticky valve) within the inner loop.
- Permits “metering” of mass flow or energy.

## When to use Cascade Control

- Primary variable has slow response to disturbances.
- Process changes cause serious upsets in controlled variable.
- Another variable is affected by disturbance and closely related to the controlled variable.
- Secondary variable can be controlled and responds quickly to primary controller.

## Cautions

- There must be two different input variables that affect the process.
- The Inner loop (Loop 1) should be significantly faster ( say, 3 to 10 times faster) than the Outer loop (Loop 2).
- If the Inner loop and the Outer loop dynamics are about the same, then the Loop 2 (primary controller) should be tuned for a slower response.
- Cascade control may be more difficult for operators to understand.

## Start-Up Information

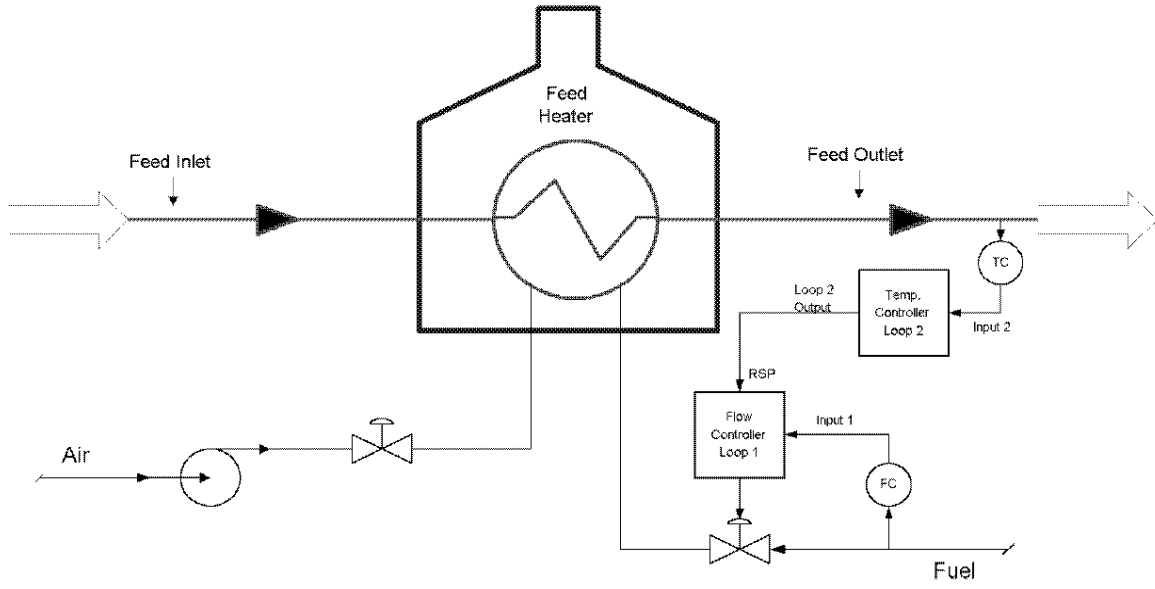
1. Make sure that the unit is not in the Cascade mode (no “I” on display).
2. Select Loop 1, Tune loop 1 using the “Accutune”.
3. Place the unit in the Cascade mode (“I” on the display).
4. Select Loop 2, Tune loop 2 using the “Accutune”.

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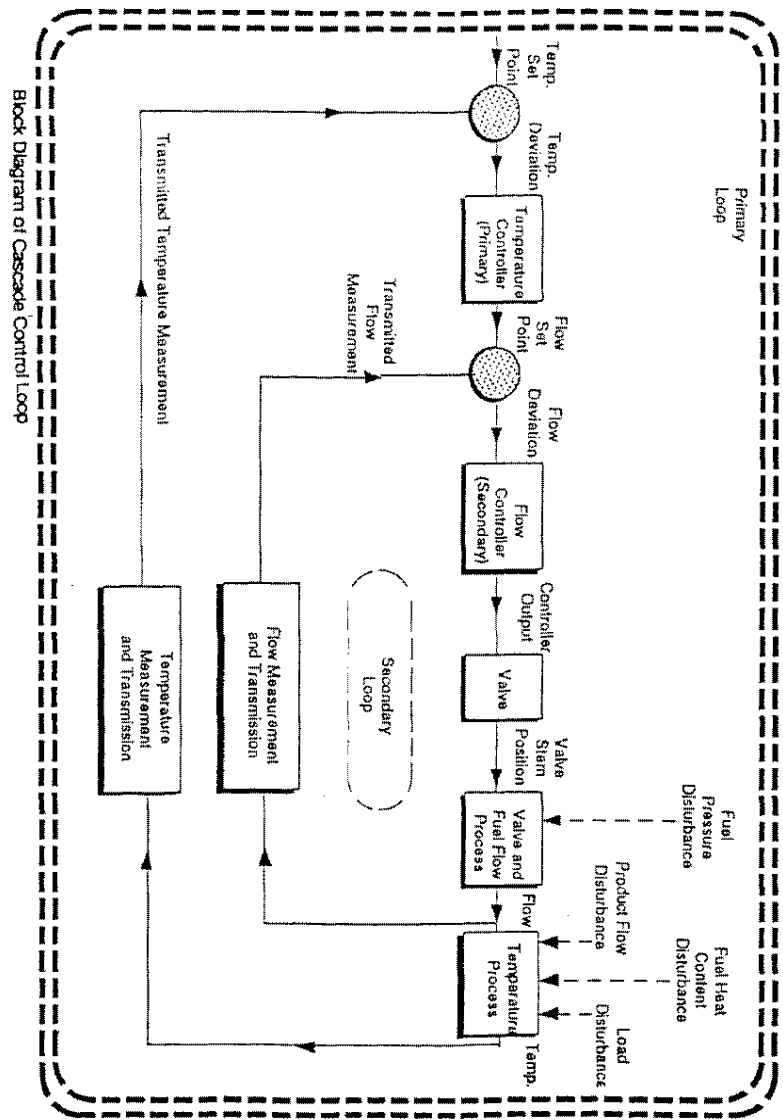
Attached documents for reference:

- Page 2                      Sample Loop
- Page 3                      Block diagram of a Cascade loop and it’s operation
- Pages 4 to 6              UDC 3300 Configuration record sheet

# UDC 3300 CASCADE CONTROL (Expanded Model)



# Cascade Control



Block Diagram of Cascade Control Loop

## 3.24 Configuration Record Sheet

### Expanded Model: DC330E-XX-XXX

**Keep a record**

Enter the value or selection for each prompt on this sheet so you will have a record of how your controller was configured.

Group Prompt	Function Prompt	Value or Selection	Factory Setting	Group Prompt	Function Prompt	Value or Selection	Factory Setting	
<b>TUNING</b>	PROP BD	_____	--	<b>TUNING2</b>	PROPBD3	_____	--	
	or				or			
	GAIN	__1.00__	1.000		GAIN 3	__10__	1.000	
	or				or			
	GAINVALn	Read Only	--		GAINVALn	Read Only	--	--
	RATE MIN	__0.0__	0.00		RATE3MIN	__25__	0.00	0.00
	RSET MIN	__5.00__	1.00		RSET3MIN	__2.0__	1.00	1.00
	or				or			
	RSET RPM	_____	--		RSET3RPM	_____	--	--
	MAN RSET	_____	0		MANRSET3	_____	0	0
	PROPBD2	_____	--		PROPBD4	_____	--	--
	or				or			
	GAIN 2	_____	1.000		GAIN 4	_____	1.000	1.000
	RATE2MIN	_____	0.00		RATE4MIN	_____	0.00	0.00
	RSET2MIN	_____	1.00		RSET4MIN	_____	1.0	1.0
	or				or			
	RSET2RPM	_____	--		RSET4RPM	_____	--	--
	CYC SEC	_____	20		CYC3 SEC	_____	20	20
	or				or			
	CYC SX3	_____	20		CYC3 SX3	_____	20	20
	CYC2 SEC	_____	20		CYC4 SEC	_____	20	20
	or				or			
	CYC2 SX3	_____	20		CYC4 SX3	_____	20	20
	SECURITY	__0__	0		PVEUVAL1	_____	0	0
	LOCKOUT	__CALIB__	CALIB		PVEUVAL2	_____	0	0
	AUTO MAN	__ENABLE__	ENABLE		PVEUVAL3	_____	0	0
	SP SEL	__ENABLE__	ENABLE		PVEUVAL4	_____	0	0
	RUN HOLD	__DISABL__	ENABLE		PVEUVAL5	_____	0	0
	PVEUVAL1	_____	0		PVEUVAL6	_____	0	0
	PVEUVAL2	_____	0		PVEUVAL7	_____	0	0
	PVEUVAL3	_____	0		PVEUVAL8	_____	0	0
	PVEUVAL4	_____	0		GAINVAL1	_____	1.000	1.000
PVEUVAL5	_____	0	GAINVAL2	_____	1.000	1.000		
PVEUVAL6	_____	0	GAINVAL3	_____	1.000	1.000		
PVEUVAL7	_____	0	GAINVAL4	_____	1.000	1.000		
PVEUVAL8	_____	0	GAINVAL5	_____	1.000	1.000		
GAINVAL1	_____	1.000	GAINVAL6	_____	1.000	1.000		
GAINVAL2	_____	1.000	GAINVAL7	_____	1.000	1.000		
GAINVAL3	_____	1.000	GAINVAL8	_____	1.000	1.000		
GAINVAL4	_____	1.000						
GAINVAL5	_____	1.000						
GAINVAL6	_____	1.000						
GAINVAL7	_____	1.000						
GAINVAL8	_____	1.000						
				<b>SP RAMP</b>	SP RAMP	__DISABL__	DISABL	
					TIME MIN	_____	3	
					FINAL SP	_____	1000	
					SP RATE	__DISABL__	DISABL	
					EU/HR UP	_____	0	
					EU/HR DN	_____	0	
					EU/HRUP2	_____	0	
					EU/HRDN2	_____	0	
					SP PROG	_____	DISABL	

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next page

### 3.24 Configuration Record Sheet, *Continued* Expanded Model: DC330E-XX-XXX

Group Prompt	Function Prompt	Value or Selection	Factory Setting	Group Prompt	Function Prompt	Value or Selection	Factory Setting
ACCUTUNE	FUZZY	DISABL	DISABL	ALGORITHM (continued)	8SEG CH2		DISABL
	ACCUTUNE	TUNE	DISABL		X0 VALU2		0
	ACCUTUN2	TUNE	DISABL		X1 VALU2		0
	SP CHANG		10		X2 VALU2		0
	KPG		1.00		X3 VALU2		0
	SP CHAN2		10		X4 VALU2		0
	KPG 2		1.00		X5 VALU2		0
	CRITERIA		FAST		X6 VALU2		0
	CRITERA2		FAST		X7 VALU2		0
	AT ERROR		NONE		X8 VALU2		0
ALGORITHM	CONT ALG	PID A	PID A	Y0 VALU2		0	
	PIDLOOPS	CASCADE	1 or 2	Y1 VALU2		0	
	CONT2ALG	PIDA	PID A	Y2 VALU2		0	
	OUT OVRD	DISABL	DISABL	Y3 VALU2		0	
	TIMER	DISABL	DISABL	Y4 VALU2		0	
	PERIOD		0.01	Y5 VALU2		0	
	START		KEY	Y6 VALU2		0	
	L DISP		TI REM	Y7 VALU2		0	
	INP ALG1		NONE	Y8 VALU2		0	
	MATH K		--	TOTALIZE		DISABL	
	CALC HI		--	□XXXXXXX		--	
	CALC LO		--	TOT SCAL		E0	
	ALG1 INA		--	TOT SEC		UNLOCK	
	ALG1 INB		--	□ RSET ?		NO	
	ALG1 INC		--	TOT RATE		SECOND	
	PCO SEL		DISABL	OUT ALG	OUT ALG	CURRNT	CURRNT
	PCT CO		0.200		4-20 RNG		100PCT
	ATM PRES		760.0		OUT2 ALG	NONE	CURRNT
	INP ALG2		NONE	RLYSTATE		1OF2ON	
	MATH K2		--	RLY TYPE		MECHAN	
	CALC HI		--	INPUT 1	IN1 TYPE	4-20 MA	0-10mV
	CALC LO		--		XMITTER1	LINEAR	LINEAR
	ALG2 INA		--		IN1 HI	100	1000
	ALG2 INB		--		IN1 LO	0	0
	ALG2 INC		--		RATIO 1	1.00	1.00
	8SEG CH1		DISABL		BIAS IN1	0	0
	X0 VALUE		0		FILTER 1	2	0
	X1 VALUE		0		BURNOUT1	NONE	NONE
	X2 VALUE		0		EMMISIV1		0.00
	X3 VALUE		0		INPUT 2	IN2 TYPE	J T/C L
	X4 VALUE		0	XMITTER2			LINEAR
	X5 VALUE		0	IN2 HI		770.0	1000
	X6 VALUE		0	IN2 LO		20.0	0
	X7 VALUE		0	RATIO 2		1.00	1.00
	X8 VALUE		0	BIAS IN2		0	0
	Y0 VALUE		0	FILTER 2		2	0
	Y1 VALUE		0	BURNOUT2		UP	NONE
	Y2 VALUE		0	EMMISIV2			0.00
	Y3 VALUE		0	INPUT 3		IN3 TYPE	
	Y4 VALUE		0		XMITTER3		LINEAR
Y5 VALUE		0	IN3 HI			1000	
Y6 VALUE		0	IN3 LO			0	
Y7 VALUE		0	RATIO 3			1.00	
Y8 VALUE		0	BIAS 3			0	
PCT H2		--	FILTER 3		0		
				Continued next page			

### 3.24 Configuration Record Sheet, *Continued* Expanded Model: DC330E-XX-XXX

Group Prompt	Function Prompt	Value or Selection	Factory Setting	Group Prompt	Function Prompt	Value or Selection	Factory Setting		
<b>CONTROL</b>	PV SOURC	<u>INP 1</u>	INP 1	<b>COM</b>	ComSTATE	_____	DISABL		
	PID SETS	<u>1 ONLY</u>	1 ONLY		Com ADDR	_____	0		
	SW VALUE	_____	0.00		ComADDR2	_____	0		
	LSP'S	<u>1 ONLY</u>	1 ONLY		SHEDTIME	_____	0		
	RSP SRC	_____	NONE		PARITY	_____	ODD		
	AUTOBIAS	_____	DISABL		BAUD	_____	300		
	SP TRACK	_____	NONE		DUPLEX	_____	HALF		
	PWR MODE	<u>A RSP</u>	MANUAL		TX DELAY	_____	1		
	PWR OUT	_____	LAST		SHEDMODE	_____	LAST		
	SP HiLIM	<u>100</u>	1000		SHEDSP	_____	TO LSP		
	SP LoLIM	<u>0</u>	0		UNITS	_____	PERCNT		
	ACTION	<u>REVERSE</u>	REVRSE		CSP RATO	_____	1.0		
	OUT RATE	<u>DISABL</u>	DISABL		CSP BIAS	_____	0		
	PCT/M UP	_____	0		CSP2RATO	_____	1.0		
	PCT/M DN	_____	0		CSP2BIAS	_____	0		
	OUTHILIM	<u>100</u>	100		LOOPBACK	_____	DISABL		
	OUTLoLIM	<u>0</u>	0.0		<b>ALARMS</b>	A1S1 VAL	_____	90	
	I Hi LIM	<u>100</u>	100.0			A1S2 VAL	_____	10	
	I Lo LIM	<u>0</u>	0.0			A2S1 VAL	_____	95	
	DROPOFF	<u>0</u>	0			A2S2 VAL	_____	5	
	DEADBAND	_____	1.0			A1S1TYPE	_____	NONE	
	OUT HYST	_____	0.5			A1S2TYPE	_____	NONE	
	FAILMODE	<u>NO LAT</u>	NO LAT			A2S1TYPE	_____	NONE	
	FAILSAFE	<u>0</u>	0.0			A2S2TYPE	_____	NONE	
	MAN OUT	<u>0</u>	--			A1S1 H L	_____	HIGH	
	AUTO OUT	<u>0</u>	--			A1S1 EV	_____	--	
	PBorGAIN	<u>GAIN</u>	GAIN			A1S2 H L	_____	LOW	
	MINorRPM	<u>MIN</u>	MIN			A1S2 EV	_____	--	
	<b>CONTROL2</b>	PV2 SRC	<u>INP 2</u>			INP 2	A2S1 H L	_____	HIGH
		FORCE MA	<u>DISABL</u>			DISABL	A2S1 EV	_____	--
		PID SETS	<u>1 ONLY</u>			1 ONLY	A2S2 H L	_____	LOW
		SW VALUE	_____			0.00	A2S2 EV	_____	--
LSP'S		<u>1 ONLY</u>	1 ONLY	AL HYST	_____	0.1			
RSP SRC		_____	NONE	ALM OUT1	_____	NO LAT			
AUTOBIAS		<u>DISABL</u>	DISABL	BLOCK	_____	DISABL			
SP TRACK		_____	NONE	<b>DISPLAY</b>	DECIMAL	<u>XXX.X</u>	XXXX		
SP HiLIM		<u>770</u>	1000		DECIMAL2	<u>XXXX</u>	XXXX		
SP LoLIM		<u>20</u>	0		TEMPUNIT	<u>DEG F</u>	NONE		
ACTION		<u>REVERSE</u>	REVRSE		PWR FREQ	<u>60 HZ</u>	60 HZ		
OUT RATE		<u>DISABL</u>	DISABL		RATIO 2	<u>DISABL</u>	DISABL		
PCT/M UP		_____	0		LANGUAGE	<u>ENGLIS</u>	ENGLIS		
PCT/M DN		_____	0						
OUTHILIM		<u>100</u>	100						
OUTLoLIM		<u>0</u>	0						
I Hi LIM	<u>100</u>	100.0							
I Lo LIM	<u>0</u>	0.0							
DROPOFF	<u>0</u>	0							
DEADBAND	_____	1.0							
FAILMODE	<u>NO LAT</u>	NO LAT							
FAILSAFE	<u>0</u>	0							
<b>OPTIONS</b>	AUX OUT	_____	DISABL						
	or								
	CUR OUT2	_____	DISABL						
	4mA VAL	_____	0.0						
	20mA VAL	_____	0						
	DIG IN 1	_____	NONE						
	DIG1 COM	_____	DISABL						
DIG IN 2	_____	NONE							
DIG2 COM	_____	DISABL							