



INSTRUCTION & OPERATION MANUAL SERIES 1400 / UPC-1000 UNIVERSAL PROCESS CONTROLLER

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FIRMWARE VERSION >= 1.59

The SERIES 1400 / UPC1000 is a controller that has three control modes: Flow proportional, Residual/ORP/pH control, and compound loop control.

To select the instrument as a Series 1400 controller (UPC1000), gas detector (GA-1000), meter, or residual analyzer (RA-1000), do as follows: From the current main operating screen, press SET and enter the password "1?1" and press the ENT pushbutton. Alternatively, if one is in the setup menu, press the right most pushbutton until the password screen is displayed, enter the password "1?1" and press the ENT pushbutton.

Parameter: MODE

Selects the instrument as a controller (UPC1000), gas detector (GA-1000) or residual analyzer (RA-1000). Press the ADJ pushbutton to set the choice to CONTROLLER (UPC1000).

Parameter: UNIT

Sets the engineering units (i.e., ppm, mg/l, etc.).

Parameter: BUZZER

Enables (ON) or disables (OFF) the audible alarm.

Parameter: PSC MODULE

Set to YES if the PSC1000 (with BNC connector) is installed.

Parameter: INPUT ENABLE

ON: INPUT (RA-1000-DSP-TB10) is used to enable the controller.

OFF: The controller auto/manual control is by the pushbutton assignment in the main operating screen.

NOTES WHEN INPUT ENABLE IS ON: If the contact is energized (MAKE), the controller will run. If the contact is de-energized (BRAKE), the controller will stop and the analog output, PO1 will fall to 4mA (Note: The PO1 continues to display the last calculated output). When the controller is restarted, the previous PO1 output is restored and control resumes. The A/M function is not available when the remote input is enabled. If one changes the manual PO1 setting, the output will rise to the user setting until the controller is restarted.

Parameters: K1, K2, & K3

Sets the operating mode of the selected relay.

K1, K2, K3	ENERGIZED	DE-ENERGIZED
OFF	NEVER	ALWAYS
LOW	INPUT <= SP	INPUT > SP
LOW /w ACK	INPUT <= SP	INPUT > SP OR Acknowledged by USER
HIGH	INPUT >= SP	INPUT < SP
HIGH /w ACK	INPUT >= SP	INPUT < SP OR Acknowledged by USER

When one is finished, press the ESC pushbutton to return to the main operating screen.

FLOW MODE SETUP

From the main operating screen, press the SET pushbutton and enter the password (default 000). Press ENT to, if a valid password was entered, enter the main setup menu; two choices are shown: CAL and PARM. Press PARM to enter the parameter setup or press ESC to return to the main operating screen after a DOSE and set PO1 (if in manual mode) prompt.

PARAMETER LIST IN FLOW MODE

Parameter: **CTRL**

Sets the control type: Flow proportional (FLOW), Residual control (RESIDUAL), and compound loop (COMPOUND). Press ADJ to set using the UP and DOWN pushbuttons. Press SET when the FLOW selection is made.

Parameter: **PV FAIL>PO1**

If the flow signal is no longer detected (PV1 input <3.3mA), the 4-20mA, analog output PO1 will react per the setting of this parameter.

HOLD	The PO1 signal will hold its position (five seconds before the loss of signal detection)
DROP	The PO1 signal will drop to 4mA.

FLOW RUN SCREEN

The flow run screen displays the flow (FL) input (PV1) in percentage and the process output (PO) in percentage.

Pushbutton A/M: Automatic (run) or manual (stop).

Pushbutton SET: Enter setup

FL	10.0	[FLW]
PO	10.0%	A/M SET

MANUALLY SETTING PO1

To manually set PO1 when the process is NOT in automatic mode (process is stopped), press the SET pushbutton and then press the same pushbutton again to exit the password screen; the PO1 adjustment screen should now be displayed. Use the UP and DOWN pushbuttons to set the desired value of PO1, and, finally, press the SET pushbutton to return to the main operating screen.

DOSAGE

After one exits the SETUP screen by pressing the ESC pushbutton, the DOSE adjustment screen is displayed. Use the UP and DOWN pushbuttons to set the desired value. After the SET pushbutton is pressed, either the PO1 adjustment screen (manual mode) or the main flow screen (automatic mode) will be displayed

Basic formula: $OUT = FLOW \times DOSE$

RESIDUAL/ORP/pH CONTROL SETUP

From the main operating screen, press the SET pushbutton and enter the password (default 000). Press ENT to, if a valid password was entered, enter the main setup menu; three choices are shown: CAL, ALM and PARM. Press PARM to enter the parameter setup or press ESC to return to the main operating screen after several prompts.

PARAMETER LIST IN RESIDUAL/ORP/pH CONTROL MODE

Parameter: CTRL

Sets the control type: Flow proportional (FLOW), RESIDUAL/ORP/pH, and compound loop (COMPOUND). Press ADJ to set using the UP and DOWN pushbuttons. Press SET when the RESIDUAL/ORP/pH selection is made. NOTE: Either RESIDUAL, ORP or pH will be displayed depending on the "PV2 IN TYPE" screen selection.

Parameter: CTRL OUT

CTRL OUT setting	OUTPUT INCREASES	OUTPUT DECREASES
<i>CHLOR</i>	RES < SET POINT	RES > SET POINT
<i>DECHLOR</i>	RES > SET POINT	RES < SET POINT

Parameter: P (GAIN)

Sets the responsiveness to an error calculated by comparing PV2 to the set point (label: RES SP, ORP SP, or pH SP). Higher values are more responsive/less stable.

Parameter: D-BAND

Set in ppm, this sets a band around the SV where the controller will not make any more adjustments if the PV2 input is within the +/- (window) range. For example, if SV is 10 and D-BAND is set to 1, the controller will not make any adjustments if the PV2 input is >=9 and <=11.

Parameter: PV FAIL>PO1

If the residual/ORP/pH signal is no longer detected (PV2 input <3.3mA), the 4-20mA, analog output PO1 will react per the setting of this parameter.

HOLD	The PO1 signal will hold its position.
DROP	The PO1 signal will drop to 4mA.

Parameter: LAG FIX

Sets the time between PV2 samples that are used to, ultimately, adjust the output, PO1 to correct for any PV2 to SP errors.

Parameter: PV2 IN TYPE

Selects the PV2 input as RESIDUAL, ORP, FLR (fluoride) or pH. Other labels the are specific to the PV2 input will change accordingly (i.e., CTRL).

Parameter: RES FS, ORP FS, FLR FS, or pH FS

Sets the value the display will read when the PV2 input is at 20.00mA.

Parameter: RES ZERO, ORP ZERO, FLR FS, or pH ZERO

Sets the value the display will read when the PV2 input is at 4.00mA.

DECIMAL POINT

S2, located on the RA-1000-CPU board, sets the decimal point as follows:

SWITCH, S2	CL2 RESIDUAL	pH	ORP	FLR (Fluoride)
A	0.0	0.0	0	0.0
B	0.00	0.0	0	0.0

RESIDUAL/ORP/pH RUN SCREEN

For the rest of this section, it is assumed that the RESIDUAL input type is selected.

Pushbutton A/M: Automatic (run) or manual (stop).

Pushbutton SET: Enter setup

RE	10.0	[RES]
SP	10.0	A/M SET

MANUALLY SETTING PO1

To manually set PO1 when the process is NOT in automatic mode (process is stopped), press the SET pushbutton and then press the same pushbutton again to exit the password screen; the PO1 adjustment screen should now be displayed. Use the UP and DOWN pushbuttons to set the desired value of PO1, and, finally, press the SET pushbutton to return to the main operating screen.

VIEWING PO1 WHILE THE PROCESS IS RUNNING

To view the process output while the process is running, press the left most pushbutton and the dynamic PO1 value is displayed. Press one of the ESC pushbuttons to return to the main operating screen.

SETPOINT

After one exits the SETUP screen by pressing the ESC pushbutton, the set point (i.e., RES SP) adjustment screen is displayed. Use the UP and DOWN pushbuttons to set the desired value. After the SET pushbutton is pressed, either the PO1 adjustment screen (manual mode) or the main compound loop screen (automatic mode) will be displayed

Basic formula: $OUT = OUT' + k(SP - RES)$

COMPOUND LOOP (FLOW+RESIDUAL/ORP/pH) CONTROL MODE SETUP

From the main RUN screen, press the SET pushbutton and enter the password (default 000). Press ENT to, if a valid password was entered, enter the main setup menu; three choices are shown: CAL, ALM and PARM. Press PARM to enter the parameter setup or press ESC to return to the main operating screen after several prompts.

PARAMETER LIST IN COMPOUND LOOP (FLOW+RESIDUAL/ORP/pH) CONTROL MODE

Parameter: **CTRL**

Sets the control type: Flow proportional (FLOW), RESIDUAL/ORP/pH, and compound loop (COMPOUND). Press ADJ to set using the UP and DOWN pushbuttons. Press SET when the COMPOUND selection is made.

Parameter: **CTRL OUT**

CTRL OUT setting	OUTPUT INCREASES	OUTPUT DECREASES
<i>CHLOR</i>	RES < SET POINT	RES > SET POINT
<i>DECHLOR</i>	RES > SET POINT	RES < SET POINT

Parameter: **P (GAIN)**

Sets the responsiveness to an error calculated by comparing PV2 to the set point (label: RES SP, ORP SP, or pH SP). Higher values are more responsive/less stable.

Parameter: **P (GAIN2)**

Sets the responsiveness to an error calculated by comparing the PV2 residual to the set point (RES SP, etc.). Higher values are more responsive/less stable. This is the gain set CLC mode when CLC EQU is set to DOSE; one must still set P (GAIN) since it's the gain value used by the residual (or other) only control mode.

Parameter: **CLC EQU** (CLC equation)

ADD: The residual loop adds a corrective offset to the output to attain set point.

DOSE: Adjustments are made to the DOSE value to attain set point.

Parameter: D-BAND

Set in ppm, this sets a band around the SV where the controller will not make any more adjustments if the PV2 input is within the +/- (window) range. For example, if SV is 10 and D-BAND is set to 1, the controller will not make any adjustments if the PV2 input is ≥ 9 and ≤ 11 . This parameter does not apply to the flow input.

Parameter: PV FAIL>PO1

If the residual & flow signals are no longer detected (PV1 & PV2 inputs are $< 3.3\text{mA}$), the 4-20mA, analog output PO1 will react per the setting of this parameter.

HOLD	The PO1 signal will hold its position (five seconds before the loss of signal detection)
DROP	The PO1 signal will drop to 4mA.

Parameter: LAG

Choose fixed lag where the time between PV2 samples is fixed or variable lag where the time between samples is dependent on the flow.

Parameter: LAG FIX

Sets the time between PV2 samples that are used to, ultimately, adjust the output, PO1 to correct for any PV2 to SP errors.

Parameter: LAG VAR (shown only if the LAG selection is set to VARIABLE)

Sets the lag time for the flow "FLOW @ VAR" setting where the time between samples is dependent on the flow input, PV1. For example, if the "LAG VAR" parameter is set to 100s and the FLOW@VAR parameter is set to 50%, a 25% flow would yield a lag time of 200s. Also, a flow of 100% would yield a lag time of 50s. Note: Not all installations can employ this parameter unless the flow verses lag time is inversely linear proportional.

Parameter: FLOW@VAR (shown only if the LAG selection is set to VARIABLE)

Sets the flow rate in percentage for the LAG VAR parameter see LAG VAR for more information.

Parameter: PV2 IN TYPE

Selects the PV2 input as RESIDUAL, ORP or pH, FLR (fluoride). Other labels that are specific to the PV2 input will change accordingly (i.e., CTRL).

Parameter: RES FS, ORP FS, FLR FS, or pH FS

Sets the value the display will read when the PV2 input is at 20.00mA.

Parameter: RES ZERO, ORP ZERO, FLR ZERO, or pH ZERO

Sets the value the display will read when the PV2 input is at 4.00mA.

Parameter: FLOW@VAR (shown only if the LAG selection is set to VARIABLE)

Sets the flow rate in percentage for the LAG VAR parameter see LAG VAR for more information.

Parameter: 0 FLW (Zero flow)

ALLOW RES: Residual only control will control the output when the flow is less than or equal to the RES@FL point; flow no longer is a part of the output control.

ZERO OUT: When flow reaches 0%, the output will be forced to zero to stop the feed of Cl_2 .

Parameter: RES@FL (Residual mode at flow %)

Used in conjunction with the 0 FLW parameter to allow residual only control when the flow reaches the set point.

Parameter: CTL OVRIDE (Control override)

NONE, FLOW, or RES - Sets the controller to an alternate control mode while being able to view the other input. This is used temporarily while installing/servicing the controller.

Parameter: DOSE RST (Control override)

This sets the initial value of the DOSE after a reset. An entry of zero disables this parameter.

DECIMAL POINT

S2, located on the RA-1000-CPU board, sets the decimal point as follows:

SWITCH, S2	CL2 RESIDUAL	pH	ORP	FLR (Fluoride)
A	0.0	0.0	0	0.0
B	0.00	0.0	0	0.0

COMPOUND LOOP RUN SCREEN

For the rest of this section, it is assumed that the RESIDUAL input type is selected.

Pushbutton A/M: Automatic (run) or manual (stop).

Pushbutton SET: Enter setup

RE	10.0	[CMP]
SP	10.0	A/M SET

MANUALLY SETTING PO1

To manually set PO1 when the process is NOT in automatic mode (process is stopped), press the SET pushbutton and then press the same pushbutton again to exit the password screen; the PO1 adjustment screen should now be displayed. Use the UP and DOWN pushbuttons to set the desired value of PO1, and, finally, press the SET pushbutton to return to the main operating screen.

VIEWING PO1/PV1 WHILE THE PROCESS IS RUNNING

To view the flow input (PV1) and the process output while the process is running, press the left most pushbutton and the dynamic FLW (PV1) and PO1 values are displayed. Press the ESC pushbutton to return to the main operating screen.

DOSAGE & SETPOINT

If one is exiting the setup mode, before the main compound loop screen is displayed, the user is prompted to first enter the dosage, controller residual/ORP/pH set point and, if the controller is in manual mode, the 4-20mA output, PO1.

To change/view the dose and set point settings from the main operating screen, press the SET pushbutton, enter the password and press the ENT pushbutton; the setup menu is displayed. Press the ESC pushbutton to view/change dose value. Press SET again to view/change the set point (RES SP, ORP SP, or pH SP). Press the SET pushbutton to return to the main operating screen if the controller is in automatic mode. If the controller is in the manual mode, the PO1 value will be displayed and, if needed, changed. Press the SET pushbutton to return to the main operating screen.

Basic formulas: $OUT = FLOW \times DOSE + BIAS$ & $BIAS = BIAS' + k(SP - RES)$

REVERSIONARY MODE SUMMARY

A loss of a needed PV1/PV2 (RA & CR application) signal will cause the controller to revert to another control mode, see the reversionary modes table below.

LOSS OF INPUT	FLOW	RESIDUAL	COMPOUND LOOP
PV1	Manual	N/A	Residual
PV2	N/A	Manual	Flow
PV1 & PV2	N/A	N/A	Manual

Notes:

1. After a signal is restored in the residual/compound loop modes, there is a ten second delay before the reversionary mode is released.
2. After the reversionary mode is released, a five second delay occurs before the closed-loop calculation is performed.
3. A flashing controller mode display, [MAN] indicates a reversionary mode is in operation.

CALIBRATION (ALL MODES)

To calibrate from the main operating screen (flow, residual/ORP/pH, or compound loop), press the SET pushbutton, enter the password (default is 000), and press the CAL pushbutton.

The three selections (other than escape) are as follows:

- PV1: Flow input
- PV2: Residual/ORP/pH input (If PSC' is installed, see below).
- PO1: Process output.

For the analog inputs (PV1 & PV2), one must use a 4-20mA generator connected to the input that is to be calibrated.

- Set the mA generator to 4.00mA and press the pushbutton under the 4mA label to set the zero mA point. The display should read 4.00mA.
- Set the mA generator to 20.00mA and press the pushbutton under the 20mA label to set the span mA point. The display should read 20.00mA.
- Repeat to verify calibration. However, the zero and span points are not interactive so one can skip this step.
- Press the ESC pushbutton to exit to the calibration menu.

Repeat the above procedure for the second channel.

To calibrate the process output (PO1), one must connect either a DMM (mA input) or other device that can read the PO1 current output. The device should have, at least, 0.01mA precision.

1. Press the PO1 pushbutton to enter the SET ANALOG OUT screen.
2. Press the 4mA pushbutton and the mA meter should read around 4.00mA.
3. Use the UP & DOWN pushbuttons to set the output to exactly 4.00mA and press set when done. This is the zero point.
4. Press the 20mA pushbutton; the mA meter should read around 20.00mA.
5. Use the UP & DOWN pushbuttons to set the output to exactly 20.00mA and press set when done. This is the span point.
6. The two points are not interactive so one should not need to readjust each point again. Press the EXIT pushbutton to go back to the CALIBRATE menu.

CALIBRATION OF PSC1000

Selecting PV2 (controller) or IN (meter) in the calibration menu will display the screen to the right. Pushbuttons P1 and P2 set calibration points 1 and 2, respectively. Pressing RST restores the default calibration values to (P1) 0.2ppm @ 140mV & (P2) 2.0ppm @ 84mV. Pressing ESC backs to the calibration menu.

0.0ppm	0.00mV
P1 P2	RST ESC

Calibrate two points following a procedure documented in the probe manufacturer's manual. P1 (point 1) should be lower than P2 (point 2). Do not calibrate from 0.0ppm to 0.1ppm of fluoride, as the probe is quite non-linear below 0.2.

END OF CALIBRATION

PASSWORD

After one exits the CALIBRATION menu, one is first prompted to change the stored password. If one does not want to change the password, press the NO pushbutton. If the YES pushbutton is pressed, the SET new password screen is entered and now one can set the new password.

END OF DOCUMENT