INTRODUCTION

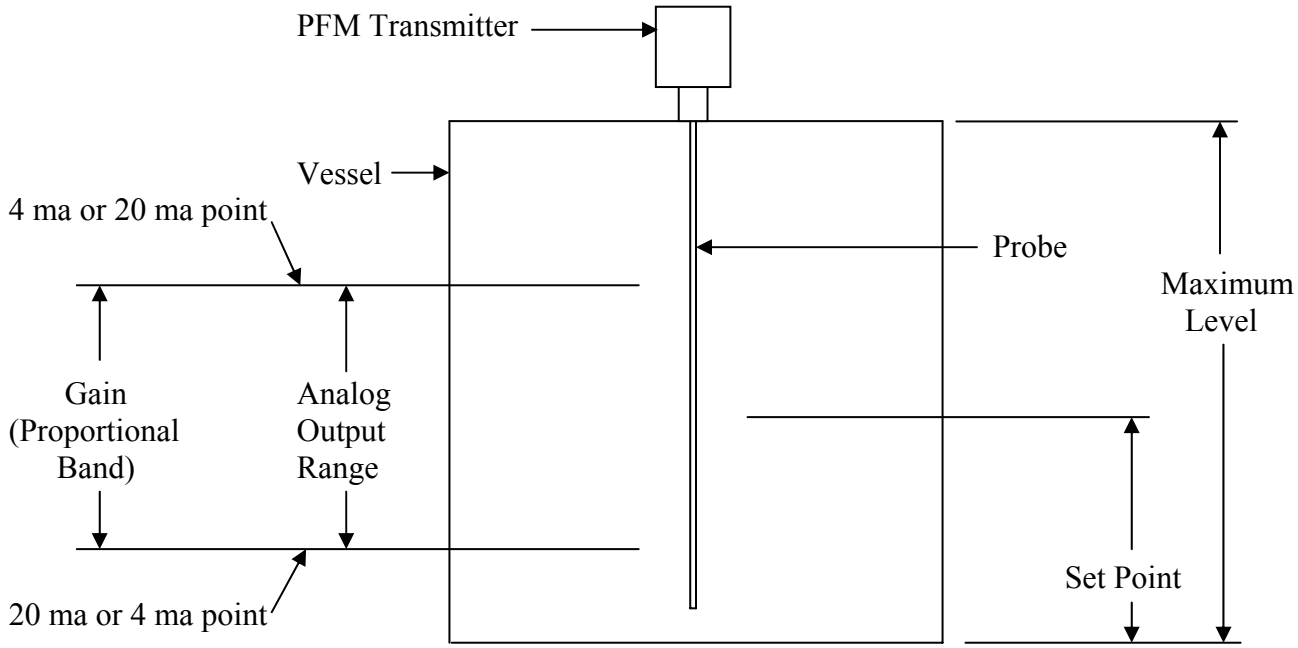
It is not the intent of this guide to teach the user about PID control or how to determine the constants. The intent of this guide is to assist the user in navigating through the setup and calibration procedure for PID control with the model 7000.

PRIOR TO USING THIS SETUP & CALIBRATION GUIDE THE INSTRUMENT MUST FIRST BE SETUP AND CALIBRATED ACCORDING TO THE TYPE OF MEASUREMENT TO BE EMPLOYED, LEVEL ONLY, LEVEL AND VOLUME OR LEVEL AND FLOW. THE INITIAL SETUP AND CALIBRATION SHOULD BE PERFORMED ON THE BASIS THAT THE PID CONTROL WILL NOT BE USED (PID off). LISTED BELOW ARE THE SETUP & CALIBRATION GUIDES THAT ARE AVAILABLE FOR THIS IF NEEDED.

AVAILABLE SETUP & CALIBRATION GUIDES

LEVEL ONLY
LEVEL & VOLUME IN A VERTICAL CYLINDER
LEVEL & VOLUME IN A VERTICAL CYLINDER WITH CONE BOTTOM
LEVEL & VOLUME IN A HORIZONTAL CYLINDER
LEVEL & VOLUME IN A HORIZONTAL TANK WITH ELLIPTICAL ENDS
LEVEL & VOLUME IN A HORIZONTAL TANK WITH SPHERICAL ENDS
LEVEL & VOLUME IN A SPHERICAL VESSEL
LEVEL & VOLUME IN A USER DEFINED VESSEL
LEVEL & FLOW IN A V-NOTCH WEIR
LEVEL & FLOW IN A PARSHALL FLUME
LEVEL & FLOW IN A RECTANGULAR WEIR (WITHOUT END CONTRACTIONS)
LEVEL & FLOW IN A CONTRACTED WEIR
LEVEL & FLOW IN A CIPOLLETTI WEIR
LEVEL & FLOW IN A USER DEFINED FLUME OR WEIR

SETUP AND CALIBRATION



Determine the Maximum Level. This is the highest point that can possibly be measured and should have been established during the previous setup and calibration. Fill in the value below.

If using Level and Volume measurement, determine the Volume at the Maximum Level. Fill in the value below.

If using Level and Flow measurement, determine the Flow at the Maximum Level. Fill in the value below.

If the ma output is to decrease upon rising level the 4 ma Point will be 0% and the 20 ma Point will be 100%. If the ma output is to increase upon rising level the 4 ma Point will be 100% and the 20 ma Point will be 0%. Fill in the % values (0 and 100) for the 4 ma and 20 ma Points below.

Determine the Set Point, in terms of the variable to be controlled (level, volume or flow). Enter the value below.

Determine the Gain. If this cannot be determined, use 2. Enter the value below.

Determine the Reset. If this cannot be determined, use 1. Enter the value below.

Determine the Rate. If this cannot be determined, use 0. Enter the value below.

The following values should be filled in before proceeding. They will be required during calibration.

Maximum Level: _____

Maximum Volume: _____ (if applicable)

Maximum Flow: _____ (if applicable)

Set Point: _____

4 ma Point: _____

20 ma Point: _____

Gain: _____

Reset: _____

Rate: _____

PID CONTROLLER

KEYPAD ENTRY	REMARKS
SETUP	**Access Level** appears in VFD line 2.
▽ △	Scroll until **PID Mode** appears in VFD line 2.
ENTER	**Off** appears in VFD line 2.
▽ △	Scroll until **On** appears in VFD 2.
ENTER	**Setup Menu** appears in VFD line 1. **PID Mode** appears in VFD line 2.
See note →	If VFD does not look like the above press **CLEAR**.
NEXT △	Scroll until **PV Display Variable** appears in VFD line 2.
ENTER	**Level** appears in VFD line 2.
▽ △	Scroll until the desired controlled variable appears.
ENTER	**PV Display Variable** appears in VFD line 2.
NEXT △	Scroll until **SP Display Variable** appears in VFD line 2.
ENTER	**Setpoint** appears in VFD line 2.
ENTER	**SP Display Variable** appears in VFD line 2.
NEXT △	Scroll until **VFD Line 1 Variable** appears in VFD line 2.
ENTER	**Output (%)** appears in VFD line 2.
ENTER	**VFD Line 1 Variable** appears in VFD line 2.
NEXT △	Scroll until **VFD Line 2 Variable** appears in VFD line 2.
ENTER	**Output (%)** appears in VFD line 2.
NEXT △	Scroll until **Level w/EU** appears in VFD line 2..
ENTER	**VFD Line 2 Variable** appears in VFD line 2.
CLEAR	**XX.XX percent** appears in VFD line 1. **XX.XX xxxxxs** appears in VFD line 2.

KEYPAD ENTRY	REMARKS
CALIBRATE	**Level** appears in VFD line 2.
ENTER	**Units** appears in VFD line 2.
▽ △	Scroll until **Lower Range Value** appears in VFD line 2.
ENTER	**Lower Range Value** appears in VFD. **XX.XX->**
NUMERIC	Enter 0 using appropriate keys.
ENTER	**Lower Range Value** appears in VFD line 2.
NEXT △	Scroll until **Upper Range Value** appears in VFD line 2.
ENTER	**Upper Range Value** appears in VFD. **XX.XX->**
NUMERIC	Enter same value as Maximum Level using appropriate keys.
ENTER	**Upper Range Value** appears in VFD line 2.
CLEAR	**Level** appears in VFD line 2.
See note →	For Level and Volume or Level and Flow continue on. For Level Only go to and press **CLEAR**
▽ △	Scroll until **Volume** or **Flow** appears in VFD line 2.
ENTER	**Units** appears in VFD line 2.
▽ △	Scroll until **Upper Range Value** appears in VFD line 2.
ENTER	**Upper Range Value** appears in VFD. **XXX.XX->**
NUMERIC	Enter same value as Maximum Volume or Flow using appropriate keys.
ENTER	**Upper Range Value** appears in VFD line 2.
△ ▽	Scroll until **Lower Range Value** appears in VFD line 2.
ENTER	**Lower Range Value** appears in VFD. **XXX.XX->**
NUMERIC	Enter 0 using appropriate keys.
ENTER	**Lower Range Value** appears in VFD line 2.
CLEAR	**Volume** or **Flow** appears in VFD line 2.
CLEAR	**XX.XX percent** appears in VFD line 1. **XX.XX xxxxxs** appears in VFD line 2.

KEYPAD ENTRY	REMARKS
SETUP	**Access Level** appears in VFD line 2.
NEXT △	Scroll until **PID Controller** appears in VFD line 2.
ENTER	**Controlled Variable** appears in VFD line 2.
ENTER	**Level** appears in VFD line 2.
▽ △	Scroll until desired Controlled Variable appears in VFD 2.
ENTER	**Controlled Variable** appears in VFD line 1.
NEXT △	Scroll until **PID Output** appears in VFD line 2.
ENTER	**4 mA Point (%)** appears in VFD line 2.
ENTER	**4 mA Point (%)** appears in VFD. **X.XX->**
NUMERIC	Enter the 4 mA Point % using the appropriate keys.
ENTER	**4 mA Point (%)** appears in VFD line 2. "Output Span Too Low" may appear for a short time.
NEXT △	**20 mA Point (%)** appears in VFD line 2.
ENTER	**20 mA Point (%)** appears in VFD. **XXX.XX->**
NUMERIC	Enter the 20 mA Point % using the appropriate keys.
ENTER	**20 mA Point (%)** appears in VFD line 2.
CLEAR	**PID Output** appears in VFD line 2.
NEXT △	Scroll until **Gain** appears in VFD line 2.
ENTER	**PID Gain Constant** appears in VFD. **X.XXXX->**
NUMERIC	Enter Gain using appropriate keys.
ENTER	**Gain** appears in VFD line 2.
NEXT △	Scroll until **Reset** appears in VFD line 2.
ENTER	**PID Reset Constant** appears in VFD. **XXXX.XX->**
NUMERIC	Enter Reset using appropriate keys.
ENTER	**Reset** appears in VFD line 2.

KEYPAD ENTRY	REMARKS
NEXT△	Scroll until **Rate** appears in VFD line 2.
ENTER	**PID Rate Constant** appears in VFD. **X.XX->**
NUMERIC	Enter **Rate** using appropriate keys.
ENTER	**Rate** appears in VFD line 2.
CLEAR	**PID Controller** appears in VFD line 2.
CLEAR	**XX.XX percent** appears in VFD line 1. **XX.XX xxxxxs** appears in VFD line 2.
	MANUAL LED must be lit, if not, press MANUAL.
	Manually bring the process to a point that is close to the desired setpoint. Process (Level, Volume or Flow) must be close to stable.
AUTO	MANUAL LED must not be lit. The Setpoint in the SP Display should have changed to conform to the process at the time the AUTO/MANUAL key was pressed.
NUMERIC	Press any number. **PID Setpoint** appears in VFD. **XX.XX->**
NUMERIC	Enter the desired Setpoint (Level, Volume or Flow).
ENTER	**XX.XX percent** appears in VFD line 1. **XX.XX xxxxxs** appears in VFD line 2.

Monitor and evaluate the performance of the instrument in controlling the process. If necessary, the Setpoint may be changed as often as required to accomplish this by repeating the last three steps above (NUMERIC, NUMERIC, ENTER).

To improve the performance the instrument must be tuned. This may be done manually or by employing the AUTOTUNE function. No recommendation is made as to which method should be employed.

MANUAL TUNING

KEYPAD ENTRY	REMARKS
SETUP	**Access Level** appears in VFD line 2.
NEXT △	Scroll until **PID Controller** appears in VFD line 2.
ENTER	**Controlled Variable** appears in VFD line 2.
▽ △	Scroll until desired constant (Gain, Reset or Rate) appears in VFD line 2.
ENTER	**XX.XX->** appears in VFD line 2.
NUMERIC	Enter new value using appropriate keys.
ENTER	Desired constant appears in VFD line 2.
▽ △	If changes to additional constants are required scroll to the constant and repeat the previous 3 steps (ENTER, NUMERIC, ENTER) as required.
CLEAR	**PID Controller** appears inn VFD line 2.
CLEAR	**XX.XX percent** appears in VFD line 1. **XX.XX xxxxxs** appears in VFD line 2.

Repeat changing Setpoint and constants until optimum results are obtained.

After the instrument has been tuned the PV Display, SP Display, VFD Line 1 and VFD line 2 Variables may be changed if desired.

AUTOTUNE

KEYPAD ENTRY	REMARKS
	MANUAL LED must not be lit, if it is, press MANUAL.
SETUP	**Access Level** appears in VFD line 2.
NEXT △	Scroll until **PID Controller** appears in VFD line 2.
ENTER	**Controlled Variable** appears in VFD line 2.
▽ △	Scroll until **Autotune Mode** appears in VFD 2.
ENTER	**OFF** appears in VFD line 2.
▽ △	Scroll until the desired Mode appears.
ENTER	**Autotune Mode** appears in VFD line 2.
CLEAR	**PID Controller** appears in VFD line 2.
CLEAR	**XX.XX percent** appears in VFD line 1. **XX.XX xxxxxs** appears in VFD line 2.

While the instrument is performing the Autotune function the Autotune LED will be lit and the process will fluctuate from the setpoint. When the Autotune function is complete the Autotune LED will no longer be lit. This may take awhile.

After the instrument has been tuned the PV Display, SP Display, VFD Line 1 and VFD line 2 Variables may be changed if desired.

SETTING THE ALARMS

There are 2 alarms that relate only to PID Control. Setpoint Alarm #1 and Setpoint Alarm #2. These alarms, when used, set minimum and/or maximum limits for the setpoint. If an operator changes to a setpoint outside of either of these limits an alarm condition will be indicated. Either, or both of these alarms, may be enabled.

There are 2 alarms that relate to the 4-20 ma output. Output Alarm #1 and Output Alarm #2. These alarms, when used, indicate when the output is below and/or above predetermined values. It is recommended that these 2 alarms be disabled when using PID Control so as to avoid nuisance alarm indications.

For disabled alarms use the instructions below. For enabled alarms skip this page and proceed to the next page.

DISABLED ALARMS

KEYPAD ENTRY	REMARKS
CALIBRATE	**Level** appears in VFD line 2.
△ ▽	Scroll until **Alarms** appears in VFD line 2.
ENTER	**Process Alarm #1** appears in VFD line 2.
△ ▽	Scroll until desired Setpoint Alarm appears in VFD line 2.
ENTER	**Status** appears in VFD line 2.
ENTER	**Disable** appears in VFD line 2.
ENTER	**Status** appears in VFD line 2.
CLEAR	**Setpoint Alarm #X** appears in VFD line 2.
△ ▽	If additional alarms are to be disabled, scroll until the next desired Process Alarm appears in VFD line 2 and repeat the above. After all desired alarms have been disabled, proceed as follows.
CLEAR	**Alarms** appears in VFD line 2.
CLEAR	**XX.XX percent** appears in VFD line 1 (or other readout if previously changed). **XX.XX xxxxxs** appears in VFD line 2 (or other readout if previously changed).

ENABLED ALARMS

Before proceeding, determine maximum and/or minimum Setpoints that each enabled alarm is to be set at, whether it is to be LLFS (Low Level Failsafe) or HLFS (High level Fail Safe), and if it is to have a differential. Fill in the information below as this will be required when setting up the alarms.

SETPOINT ALARM SETTINGS

	ALARM #1	ALARM #2	REMARKS
STATUS Enable or Disable			
FAILSAFE MODE LLFS or HLFS			
ALARM TYPE FXD or ADJ Differential			
LOW SETPOINT			Only set this feature if the alarm is for LLFS and/or has an Adjustable Differential.
HIGH SETPOINT			Only set this feature if the alarm is for HLFS and/or has an Adjustable Differential.
OUTPUT RELAY None, #1, #2, #3 or #4			

KEYPAD ENTRY	REMARKS
CALIBRATE	**Level** appears in VFD line 2.
△ ▽	Scroll until **Alarms** appears in VFD line 2.
ENTER	**Process Alarm #1** appears in VFD line 2.
△ ▽	Scroll until desired Setpoint Alarm appears in VFD line 2.
ENTER	**Status** appears in VFD line 2.
ENTER	**Disable** appears in VFD line 2.
△ ▽	Scroll until **Enable** appears in VFD line 2.
ENTER	**Status** appears in VFD line 2.
NEXT △	Scroll until **Failsafe Mode** appears in VFD line 2.
ENTER	**LLFS** appears in VFD line 2.
△ ▽	Scroll until desired Failsafe Mode appears in VFD line 2.
ENTER	**Failsafe Mode** appears in VFD line 2.

KEYPAD ENTRY	REMARKS
NEXT △	Scroll until **Alarm Type** appears in VFD line 2.
ENTER	**Fixed Differential** appears in VFD line 2.
△ ▽	Scroll until **Adj Differential** appears in VFD line 2.
ENTER	**Alarm Type** appears in VFD line 2.
NEXT △	Scroll until **Low Setpoint** appears in VFD line 2. Only set this feature if the alarm is for LLFS and/or has an Adjustable Differential.
ENTER	**X.XX->** appears in VFD line 2.
NUMERIC	Enter Low Setpoint using appropriate keys.
ENTER	**Low Setpoint** appears in VFD line 2.
NEXT △	Scroll until **High Setpoint** appears in VFD line 2. Only set this feature if the alarm is for HLFS and/or has an Adjustable Differential.
ENTER	**XX.X->** appears in VFD line 2.
NUMERIC	Enter High Setpoint using appropriate keys.
ENTER	**High Setpoint** appears in VFD line 2.
NEXT △	Scroll until **Output Relay** appears in VFD line 2.
ENTER	**NONE** appears in VFD line 2.
△ ▽	Scroll until desired **Relay** or **None** appears in VFD line 2.
ENTER	**Output Relay** appears in VFD line 2.
CLEAR	**Setpoint Alarm #X** appears in VFD line 2.
△ ▽	If the other Setpoint alarm is to be enabled, scroll until the next it appears in VFD line 2 and repeat the above. After all desired alarms have been enabled, proceed as follows.
CLEAR	**Alarms** appears in VFD line 2.
CLEAR	**XX.XX percent** appears in VFD line 1 (or other readout if previously changed). **XX.XX xxxxxs** appears in VFD line 2 (or other readout if previously changed).

Calibration and Setup is complete.