Application Note - AN-113

Open Loop Valve Control

NOTICE

This application note is provided for use as a general example and a guide. Divelbiss assumes no responsibility, liability or warranty regarding this application, its use, functionality or reliability to meet application needs. User assumes all responsibility to ensure all safety precautions are taken when using this application note. This application must not be used alone in applications which would be hazardous to personnel in the event of a failure. Precautions must be taken by the user to provide mechanical and/or electrical safeguards external to this application and controllers shown.

Application Description

This application illustrates how to control valve operation using Pulse Width Modulation (PWM) in an open-loop configuration. Open-loop identifies that there is **no active feedback** to identify and adjust the control parameters to verify the valve has reached it's intended target.

This open-loop control accepts an analog input signal (0-20mADC) and controls a valve using PWM by changing the PWM duty cycle. This, in effect changes the valve's position. The lower the duty cycle, the less energized the valve. The PWM duty cycle is always 0-100% and the analog input is scaled to provide that range of operation.

While this example does not represent it, some applications will require a dead band due to actual valve limitations.

Equipment Used

Harsh Environment 1000 Series		
Controller Part #:		HEC-1000
Programming Software:		EZ LADDER Toolkit
Digital I/O:		On -Board
Application Filename:		AN113-HEC1X.dld
Programming Cable:		HEC-910 & Null Modem

This Application Note applies to any Divelbiss Controller that programs with EZ LADDER Toolkit, has analog inputs and Pulse Width Modulation (PWM) Outputs. Some of which are: HEC-1XXX, HEC-4XXX, and PCS. To use these other targets, generally, only a few program changes are required (typically I/O assignments).

Input / Output Description

Analog Input 0: Analog Input 0 is a 0-20mA Analog Input that is read using the variable AN0.

PWM1: Pulse Width Modulation Channel 1. This channel is configured for 16 bit and the output signal is on the GPO1 pin.

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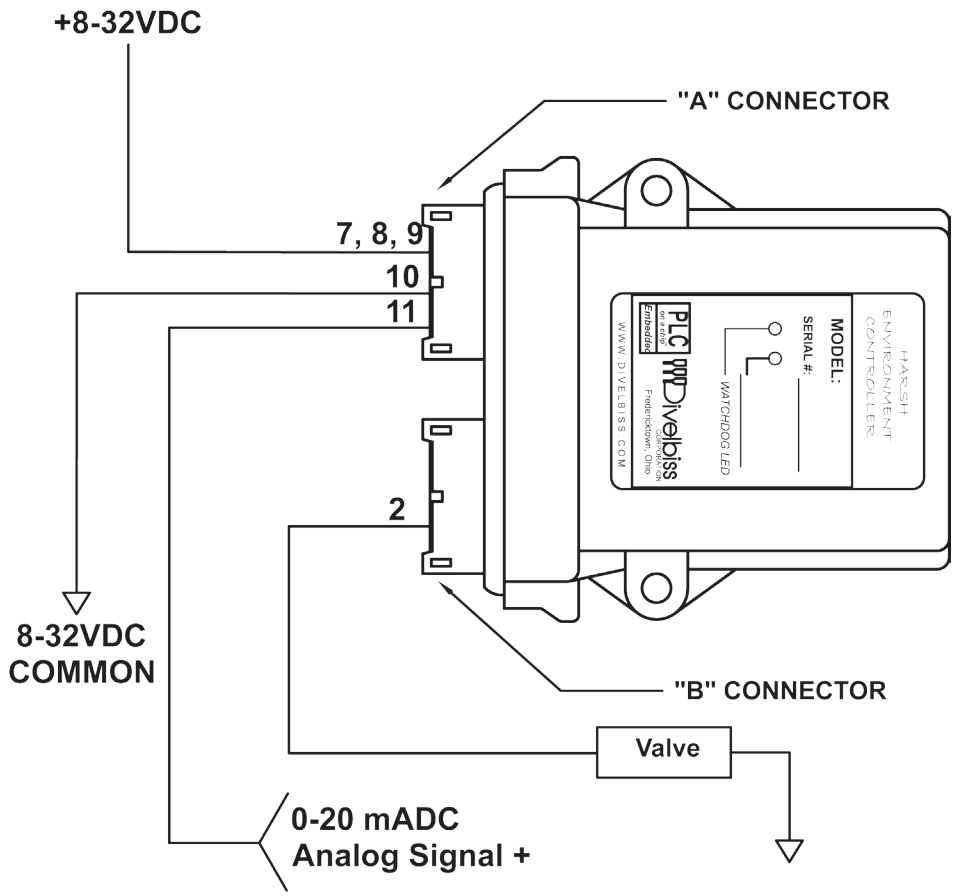
Program Variables

AN0	Variable that holds the actual analog input's reading (as an integer with a range of 0-1023).
AN0avg	The analog input as a 20 sample moving average.
R_AN0avg	The averaged analog input reading after being converted to a Real Variable type.
R_1023	Real Variable with a default value of 1023.0. This is used for calculations.
R_Mult	Real Variable that represents a multiplier that is used to scale the analog input.
R_1000	Real Variable with a default value of 100.0. This is used for calculations.
R_Setpt	Real Variable that represents the target setpoint from the calculations (0-100%).
DtyCycle	Integer Variable that represents the sepoint target for the duty cycle. This is the R_Setpt converted to an integer.

Program Description

Rungs 7-8:	The analog input (AN0) is averaged 20 times and then converted to a real variable type for calculations later.
Rungs 11-13	The real variable analog input (averaged) is then divided by the maximum scale of the analog input (1023). This provides a scaling multiplier. The multiplier is then multiplied by the required end result scale for 0-100% (100). This set point is then converted to an integer type for control of the PWM block.
Rungs 16-17	The PWM is enabled with the PWM function block. The Duty Cycle (calculated setpoint) is input into it.

Connection Diagrams



Ladder Diagram