## **Application Notes**

## How to configure PIDD (PID with Derivative Decay) Instruction

1. In WindLDR software (make sure FC6A PLC is selected), click **Module Configuration** tab, add the FC6A-L03CN1 analog I/O module and configure it as follow:

A	nalog Module Configuration (Slot 1)												
	Type: FC6A-L03CN1												
	DR Allocation:	D0500	D0500-D	0505	5 🔲 Use data register for setting parameters D0506 - D0519								
	Channel	Filter (ms)	Sampling Time	Signal Type	Data Type	Min.	Max.	Data	Status				
	AIO	C	100ms	4 to 20mA DC	Binary data	0	65535	D0500	D0501				
i.	Al1			Unused				D0502	D0503				
	AQ0			4 to 20mA DC	Binary data	0	4095	D0504	D0505				

2. In the **Configuration** tab, click **Memory Backup**, enter M2000 through M2200 in the **Internal Relay, Keep Specified Range** 

	Function Area S	Settings		-					×	
	Run/Stop Con	trol		Figure Kase /Cla						
	Memory Back	Memory Backup								
	Input Configu	ration	Internal F	ernal Relay						
	Communication Ports		M0000 to 1	47997		Ì	M10000 to M1	17497		
	External Memo	ory Devices	O Clear A	.11			Clear All			
	Device Setting	s	Keep A				Keep All			
	Program Prote	ection	Keep S	pecified Range	M2000 through	M2200	Keep Spec	cified Range		
3.	Insert a N	IO open M0	as PIDD	trigger b	bit					
	Rung 1	1 PIDI	D Bit		_					
4.	Under <b>Ho</b>	<b>me</b> tab, clic	ck <b>A (Ad</b> v	vanced) a	and select <b>PID</b>	Instruction		D (PID with Derivative Decay)		
	PID Instruction				(PID Control (FC	5A Compatible	e))			
	Dua	l/leaching lin	ner 🕨	PID PID	A (PID Control)					
	Trig	onometric Fur	nction 🕨	PID PID	D (PID with Deriv	vative Decay)				
5.	Configure	e the PIDD p	aramete	ers as fol	ow:					
	a. D	evice tab: 5	S1 = D20	00, S2 =	M776, S3 = M	2000				
	F	PIDD (PID with Deriva	ative Decay)	-				₽ <mark>×</mark>		
		Device Controller	Tuning							
			51 (C	ontrol Pegister)	S2 (Initialization Input)	53 (Control Relay)				
		Tag Name:	D200		M0776	M2000				
		Davice Address	D200	0		M2000	_			
		Device Addicas								
		Comment:	PIDI Reg -D1	D Control isterUses D 1000 100	PIDD Intialization Input (Internal Relay)	PIDD Control Relay Uses M2000-M2032				



- b. Controller tab:
  - i. In this example, assume that we are working with a pressure transducer which produces a 4-20ma signal to the analog module and the range we're working with is 0-145 PSI.
  - ii. As a result, fill in the Controller tab parameters as follow:
    - PV (process variable) Upper Range Value = 145.0 EU
    - PV (Process variable) Lower Range Value = 0.0 EU
       Note: The FC6A PLC automatically scale the analog signal in the analog module to this range Upper and Lower
       Range Value you specify here.
       EU stands for engineering unit.
    - SP (set point) High Limit = 145.0 EU
    - SP (set point) Low Limit = 0.0 EU

Note: An operator can't enter a set point value below or beyond the values you specify here.

- Set Point (SP) = 50.0 EU Note: This is the initial set point which can also be controlled with data register D2002
- MV (manipulated variable) High Limit = 100.0 %
- MV (manipulated variable) Low Limit = 0.0%
   Note: If, MV+PID Control > MV High Limit, then MV = MV High Limit
   If, MV+PID Control < MV Low Limit, then MV = MV Low Limit</li>

Control Mode and Set Point:	Auto Mode - LSP (S	1+2, 51+3)  Master PIDD No.:	-
Control Action:	Reverse Control Ad	ion 🔽	
Kp Dependent:	Dependent		
Process Variable (PV):	Analog Input: Oata Register:	Expansion Module 1 AI000	•
PV Upper Range Value (URV):	145.0	EU	
PV Lower Range Value (LRV):	0.0	EU	
SP High Limit:	145.0	(0.0 to 145.0) EU	
SP Low Limit:	0.0 ≑	(0.0 to 145.0) EU	
Set Point (SP):	50.0 🚔	(0.0 to 145.0) EU	
MV HighLimit:	100.0 🚔	(0.0 to 100.0) %	
MV Low Limit:	0.0	(0.0 to 100.0) %	



- c. Tuning tab:
  - We'll start off with the following K parameters Kp (Gain) = 1
     Ki (Integral) = 0.5
     Kd (Derivative) = 0.00001

	001			
PIDD (PID with Derivative Decay)				? x
Device Controller Tuning				
Kp (Gain): Ki (Integral):	1.00000 - 0.50000 -	(0.00001 to 100.0) (0.00001 to 100.0) repeats/min		
Kd (Derivative):	0.00001	(0.00001 to 100.0) sec		
<ul> <li>Disable Kd (Derivative)</li> <li>Disable Kd (Derivative) D</li> <li>Enable PV Tracking</li> </ul>	lecay			
PIDD No.: 1			ОК	Cancel

6. Click **OK**. Your ladder program should look like this.

Rung 1	1	PIDD Bit		PIDD Control RegisterUs es D1000-	PIDD Intialization Input (Internal R	PIDD Control Relay Uses M200	PIDD Set Point	PIDD Control RegisterUs es D1000-	PIDD Ouput (MV 0-100.0)
		M0000	PIDD 1	S1 D2000	S2 M0776	S3 M2000	SP D2002	PV D2000	MV D2016

7. To convert the PIDD Output (as percentage) to 4-20mA output, insert the following ladder code: -D2016: PIDD MV (PIDD Ouput) of 0-100.0% is multiplied by 40.95 in order to scale the PIDD output from 0-100.0% to 0-4095 (Resolution of Analog Output Point) Floating Data is stored into D1500 and then converted to a Word producing 0-4095 into D504 (AO 4-20mA to drive the VFD of Water Pump)

Rung 2 2	In- operation Output	In- operation Output				Multiply X 40.95 to convert to AO full scal	
	M8125		MUL(F)	S1 - D2016	S2 - 40.95	D1 - D1500	REP
3					Multiply X 40.95 to convert to AO full scal	0-4095 AO TO VFD Drive to output 4-2	
				CVDT(F) FTOW	S1 - D1500	D1 - D0504	REP

8. Your completed ladder program should look like this:



- 9. Click **Online** tab  $\rightarrow$  **Download** to download the project into your FC6A PLC.
- 10. To execute the PID instruction, go to WindLDR Monitor mode and turn On these two internal bits:
  - a. M0776 PIDD initialization bit
  - b. **MO** PIDD trigger bit