CleaverBrooks®

PIM
Pump Interface Module
Operation Manual

PIM Program #
985-00490-000

Oview | Setup | Seq.

750-378
09/2015

TO: **Owners, Operators and/or Maintenance Personnel**

This operating manual presents information that will help to properly operate and care for the equipment. Study its contents carefully. The unit will provide good service and continued operation if proper operating and maintenance instructions are followed. No attempt should be made to operate the unit until the principles of operation and all of the components are thoroughly understood.

It is the responsibility of the owner to provide training and advice in all aspects of safety not only to his or her personnel, but to any contractors' personnel who will be servicing, repairing, or operating the equipment.

Cleaver-Brooks equipment is designed and engineered to give long life and excellent service on the job. The electrical and mechanical devices supplied as part of the unit were chosen because of their known ability to perform; however, proper operating techniques and maintenance procedures must be followed at all times.

Any "automatic" features included in the design do not relieve the attendant of any responsibility. Such features merely eliminate certain repetitive chores, allowing more time for the proper upkeep of equipment.

It is solely the operator's responsibility to properly operate and maintain the equipment. No amount of written instructions can replace intelligent thinking and reasoning and this manual is not intended to relieve the operating personnel of the responsibility for proper operation. On the other hand, a thorough understanding of this manual is required before attempting to operate, maintain, service, or repair this equipment.

Operating controls will normally function for long periods of time and we have found that some operators become lax in their daily or monthly testing, assuming that normal operation will continue indefinitely. Malfunctions of controls lead to uneconomical operation and damage and, in most cases, these conditions can be traced directly to carelessness and deficiencies in testing and maintenance.

The operation of this equipment by the owner and any operating personnel must comply with all requirements or regulations of the insurance company and/or other authority having jurisdiction. In the event of any conflict or inconsistency between such requirements and the warnings or instructions contained herein, please contact Cleaver-Brooks before proceeding.

PIM Pump Interface Module

CONTENTS

1 - Introduction

The Cleaver-Brooks Pump Interface Module (PIM) is a control system specifically designed to operate up to four pumps to meet a desired set point for a building heating system or similar process heating application.

The PIM monitors temperature, pressure, Delta T, or flow and uses this value to maintain the operator-entered setpoint.

Pumps can be commanded to run simultaneously or (available in a future release) in a lead lag sequence.

The PIM includes a 3.5" monochrome touch-screen display and two RTD temperature inputs used for pump modulation.The inputs accept a 4-20mA current signal. Digital inputs include pump status signals for pumps 1-4. The PIM can also receive a remote set point or remote modulation signal from an energy management system via Modbus RTU.

2 - Applications

The PIM will work in standalone mode either as an independent pump modulating control, or in conjunction with a building Energy Management System. In addition, the PIM functions as an integral component of the C-B Hydronic System Control.
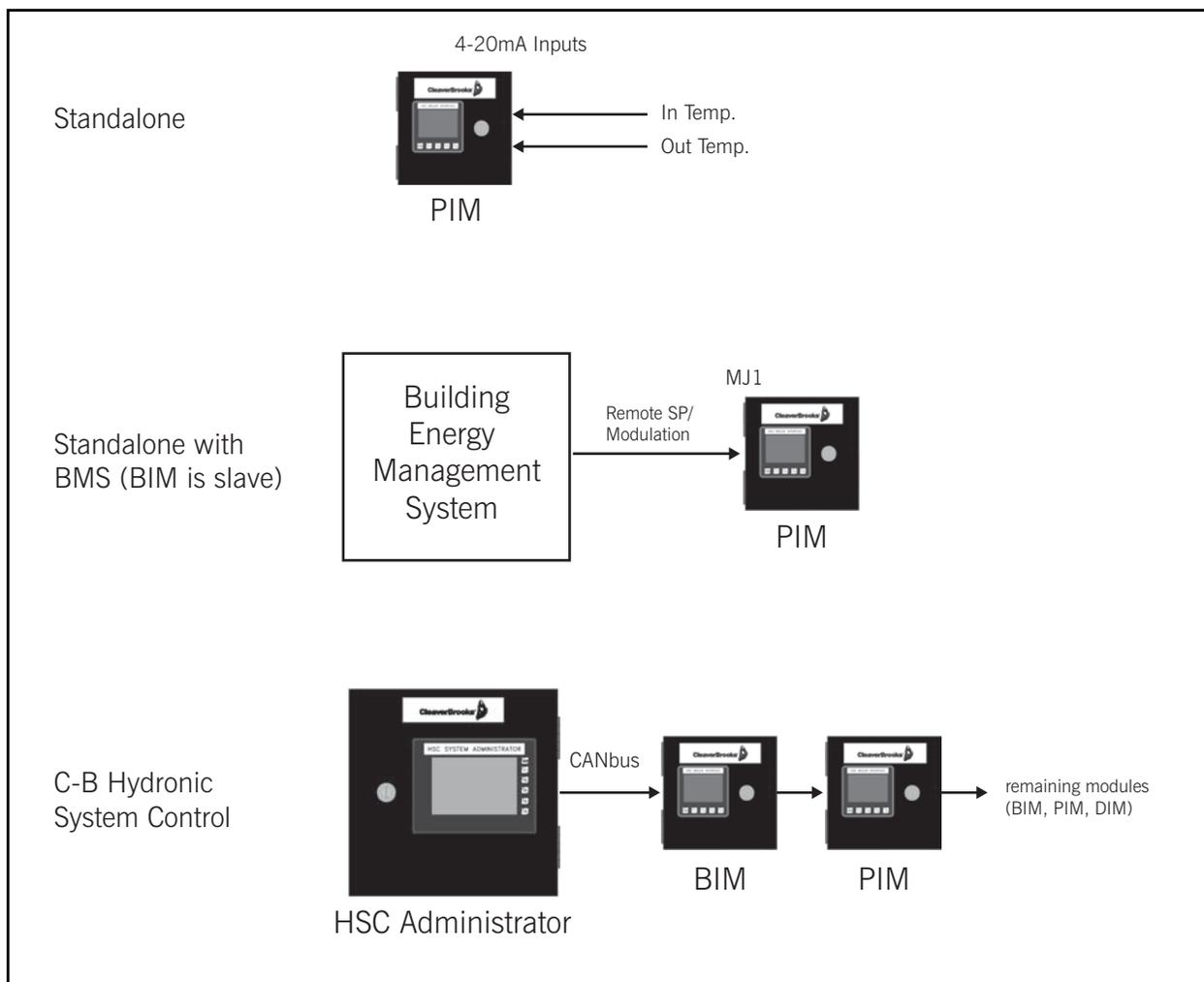
3 - Main Menu

The chart below shows the PIM menu structure. The [F1] key goes to the previous screen or back to the Main screen. After reaching the Main screen, [F1] toggles between the Main and Overview screens. [F4] accesses the Alarm screen.
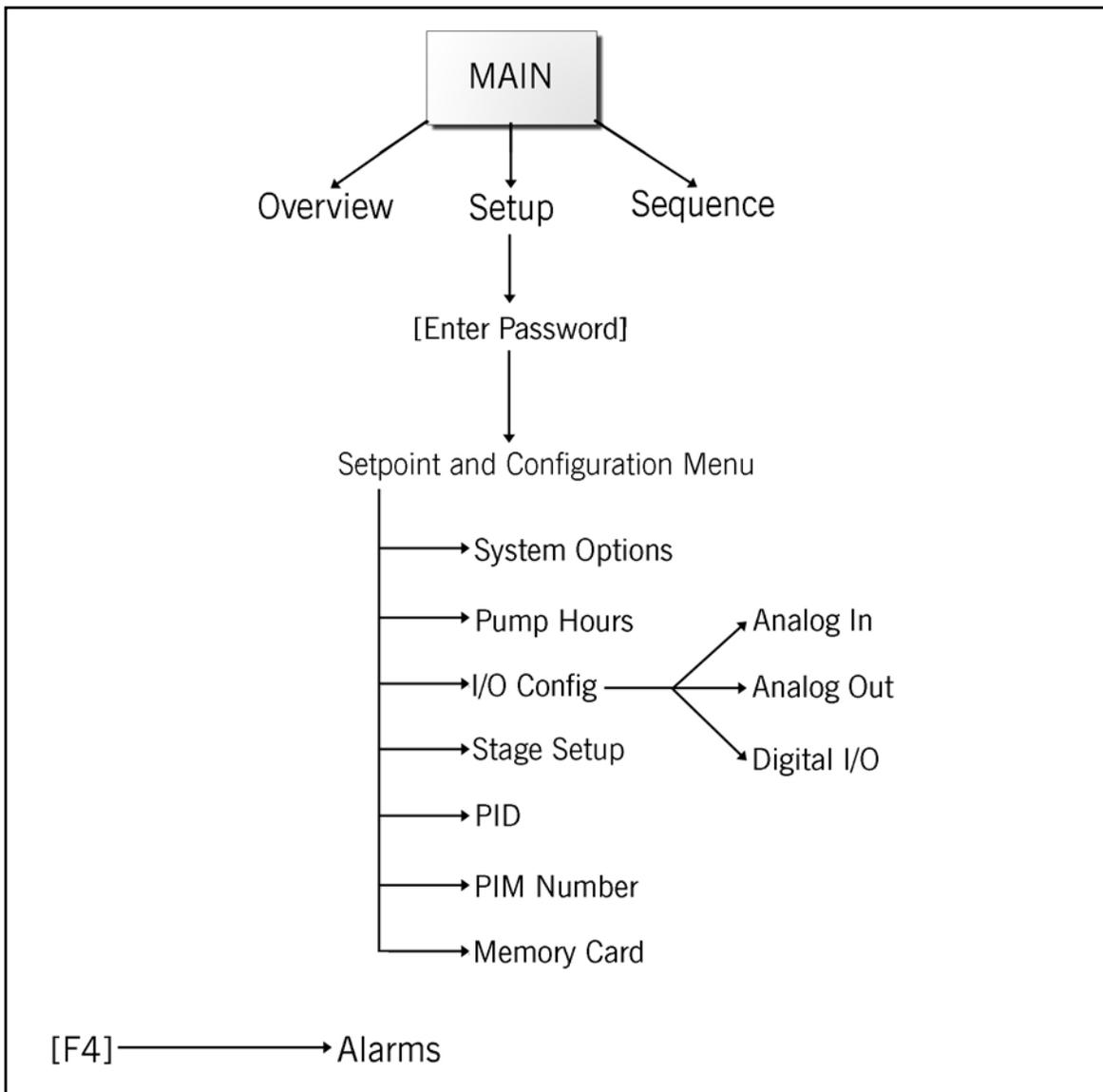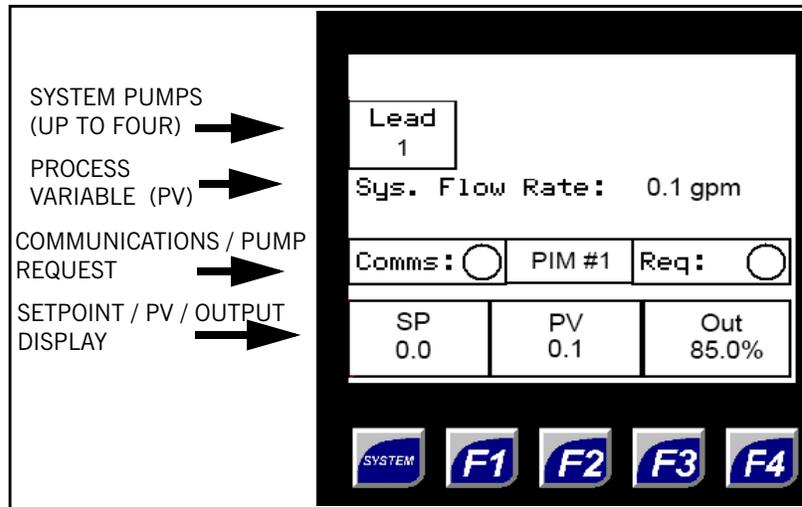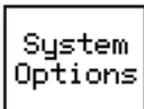
4 - Overview

The overview screen shows the number of system pumps (up to four) with lead/lag status and number in sequence for each.*

The process variable displayed is based on the method of pump control chosen under **Control Select** (see Setup below).

*Lead lag functionality for future release.

SYSTEM PUMPS (UP TO FOUR) ➡

PROCESS VARIABLE (PV) ➡

COMMUNICATIONS / PUMP REQUEST ➡

SETPOINT / PV / OUTPUT DISPLAY ➡

Lead
1

Sys. Flow Rate: 0.1 gpm

Comms: ◯	PIM #1	Req: ◯
SP 0.0	PV 0.1	Out 85.0%

SYSTEM   F1   F2   F3   F4

5 - Setup

System Options

To configure the PIM, first press <Setup> and enter password. Go to <System Options> for the following parameters.

Number of System Pumps (4 maximum)

Number of Pumps to Run - number of pumps that will run simultaneously

Control Select - Delta T, Pressure, Temperature, or Flow control. For pump pressure control, a 4-20mA input (differential or gauge pressure) is needed.

Temp/Press Source - select Admin (HSC use) or Local (4-20mA input to this PIM).

Prove Required - if yes, lag pump will be called if lead pump does not prove.

Press [F4] to advance the menu page.

On Page 2:

Modulation Delay - when called, the pump will run at the **Hold Speed** for this amount of time.

Pump Type - Constant or VSD.

Flt Delay - Time delay between fault detection and annunciation.

Sig Loss PID - Sets the PID output upon loss of signal. Choices are 0% CV, LAST CV, 100% CV.

PID Action - Direct for pump Delta T control or Reverse for Delta P.

On Page 3:

NC Start Speed - when in Condensing mode and a non-condensing boiler is called pumps will be forced to this speed for the duration of the **NC Start Override Time**

On/Off Delay - time delay applied to a call for pump start/stop.

Screen Update - this adjusts the refresh time of the PIM screen (from 20=slowest to 50=fastest). Faster update times may slow down overall processor performance.

Pump Rotation Setup - (lead lag functionality for future release) sets the amount of run time after which PIM will rotate the pump sequence.

On Page 4:

The Outdoor Air Temperature feature is used when the PIM is part of an HSC system and is receiving a signal from the System Administrator. For further information see the Hydronic System Control manual 750-350.

OAT SP - Outdoor air setpoint in Degrees F.

Hyst. - Degrees F hysteresis applied to **OAT SP.**

OAT Function - either **ON>SP** ('condensing mode') or **ON<SP** ('non-condensing mode').

Time Delay - delay after **OAT Function** condition is met until OAT switchover occurs.

```
Pump
Hours
```
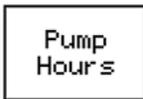
The next item in the Setpoint and Configuration Menu, <Pump Hours>, shows the total elapsed run time for each pump, and allows for resetting the totalizers.

```
I/O
Config
```
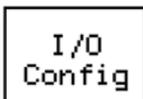
<I/O Config> gives three options, <Analog In Config>, Analog Out Config>, and <Digital I/O>.

<Analog In Config> has the following parameters:

Scale Min - input (deg F or psi, depending on type of pump control) corresponding to **Signal Min** (minimum input within the 4-20 mA range).

Scale Max - input (deg F or psi, depending on type of pump control) corresponding to **Signal Max** (maximum input within the 4-20 mA range).

Input signal in mA and engineering units (deg F or psi, depending on type of pump control) are also displayed.
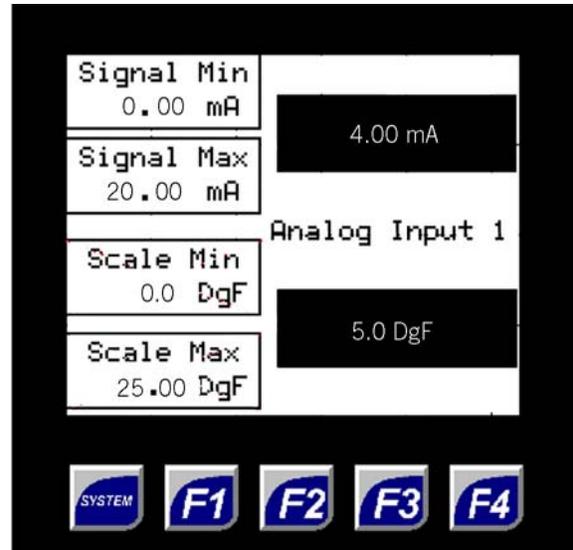
Analog In Config (PIM)

<Analog Out Config> has the following parameters:

Scale Min - percent control output corresponding to **Out Min** (minimum desired mA output within the 4-20 mA range).

Scale Max - percent control output corresponding to **Out Max** (maximum desired mA output within the 4-20 mA range).

Force Value - manual control of the analog output. Pressing <Force Value> will bring up a numeric keypad where the desired % output can be entered.

Pump VSD Analog Out - shows the mA output corresponding to the entered **Force Value.**

<Digital I/O> shows the status of the digital inputs and allows manual testing of the digital outputs.

Press <Dig. Outs> for the manual force buttons. Pumps 1-4, Alarm Contact, and Alarm Light outputs may be manually forced.

<Stage Setup> accesses parameters for on and off staging of pumps.

Note: *Pump lead lag functionality to be available in a future release.*

The **Signal Source** for adding/dropping pumps can be selected from the following:

*   AIN1 / AIN2 / AIN Delta (PIM local input)
*   Adm Sup / Adm Rtn / Admin Delta (System Administrator input; for HSC use)

6

The remaining parameters determine when a pump will be added to/dropped from the sequence. If the VSD is running at **VSD Spd** for the duration of **Add (Drop) Time Delay** while setpoint is below (above) the **Add (Drop) Setpoint,** a pump will be added (dropped). The add/drop setpoint is determined by the system setpoint + the **Setpnt Adder for Pump Add (Drop).** Note, adder can be a negative number.

Remaining items under the Setpoint and Configuration menu are <PID>, <PIM Number>, and <SD Card/Modbus>.

The **PID** screen accesses setpoint and PID settings for pump control. The process value (PV) depends on which type of pump control is selected under System Options (see above).

If this is the second PIM on the network (node address 32), set its **PIM Number** to 2.

SD Card/Modbus accesses two sub-menus: **Data Logging** functions are used to back up and restore the PIM's parameter settings, to clone settings from one PIM to another, and for data logging using a removable SD card. **Modbus** allows configuration of the PIM's Modbus port MJ1. Parameters are Modbus Address, Baud Rate, and Write Setup (for Remote Setpoint/Remote Modulate via Modbus).

6 - Pump Sequence Screen

Seq.
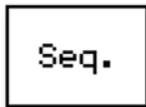
The last item under the PIM main menu is the pump sequence screen; press <Seq.> to access. This is where the order of rotation of the pumps is set. After entering the desired sequence, press <Save>. **Note:** *Pump lead lag functionality to be available in a future release.*

7 - PIM Parameter List

Pump Interface Module Parameter List

Setup/Configuration Screen or Parameter	Description	Units	Range	Default
\<System Setup\>				
\<PIM Number\>	Pump Interface Module No. -- equates to CANbus node address: #1 = 31 (CANbus); #2 = 32 (CANbus)		1 or 2	1
\<System Options\>, Page 1	PIM configuration			
\<Number of System Pumps\>	Number of pumps connected to PIM.		1 - 4	2
\<Number of Pumps to Run\>	Designate number of pumps to run at any time.		1 - 4	1
\<Prove Req.\> or \<No Prove\>	Specify if pump/flow prove is connected for each pump.			Prove Required
\<Control Select\>	Select process variable (PV) -- Pressure (DP or Head), Delta T, or single-point Temperature -- for pump speed modulation control			Pressure
\<Temp/Pressure Source\>	Local (PIM) analog input or Admin Delta T			Local
\<System Options\>, Page 2				
\<Modulation Delay\>	Time delay before releasing pump speed modula-tion	minutes		5
\<Hold Speed\>	For modulation control, initial pump speed to hold until Modulation Delay is completed	%		75
- PID Action: \<Direct\> or \<Reverse\>	PID modulating output control action			Direct
- Pump Type: \<VSD\> or \<Constant\>	VSD modulating or constant speed pump			VSD
\<NC Start Speed\>	Pump speed to hold upon initial Non-Condensing boiler request	%		85
\<NC Start Override Time\>	Hold time for pump speed hold upon initial Non-Condensing boiler request	seconds		900
\<On Delay\>	Pump on delay upon initial pump run request	seconds		0
\<Off Delay\>	Pump off delay upon removal of pump run request	minutes		30
\<Pump Hours\>	Elapsed Run Time for each pump			
\<P_ ET Reset\>	Reset elapsed run time for respective pump to zero.			
\<I/O Config\>	Switches to Analog and Digital I/O menu screen			
\<Analog In Config\>	Analog input scaling			
- \<Signal Min\>	Minimum analog input signal value	mA	0 - 10	4.00
- \<Signal Max\>	Maximum analog input signal value	mA	10 - 30	20.00
- \<Scale Min\>	Measured value corresponding to Signal Min	psi / degF		0.0
- \<Scale Max\>	Measured value corresponding to Signal Max	psi / degF		100.0
\<Analog Out Config\>	Analog Output scaling			
- \<Scale Min\>	Minimum control output percentage corresponding to Output Min setting	%	0 - 10	4.00
- \<Scale Max\>	Maximum control output percentage correspond-ing to Output Max setting	%	10 - 30	20.00
- \<Out Min\>	Minimum current output signal corresponding to Scale Min setting -- used for zero value of modula-tion output signal of VSD system pump. Can be utilized to limit minimum pump speed.	mA		0.0

Pump Interface Module Parameter List (Continued)

Setup/Configuration Screen or Parameter	Description	Units	Range	Default
- <Out Max>	Maximum current output signal corresponding to Scale Max setting -- used for 100% modulation output signal of VSD system pump. Can be utilized to limit maximum pump speed.	mA		20.0
<Digital I/O>				
- DI Status	Digital Input status			
- DO Status	Digital Output status -- momentary buttons to test outputs			
- Screen Update	Response time for screen changes relative to touchscreen interface actions. 50 is fastest response rate.	2 - 50		50
<Memory Card>	Switches to Memory Card screen for PIM SD card operations			
- Card On/Off	Enable PIM SD Card operations			Card Off
- Data On/Off	Enable Data Logging at PIM			Data Off
- Log Interval	Data log interval time	seconds		60
- <Backup>	Backup of parameters settings -- press once and wait 30 seconds for indicator to indicate successful Backup			
- <Restore>	Restore of previously backed up parameter settings -- press once and wait 30 seconds for indicator to indicate successful Restore			
- Memory Card capacity	Indicates memory used on card			
<PID>	Switches to system pump modulation PID tuning screen			
- <P Gain>	Proportional Gain			10
- <I Gain>	Integral Gain			10
- <D Gain>	Derivative Gain			0
- <Auto/Manual>	Switch between Auto and Manual modulation output			Auto
- <Out>	Current modulation (control output) percentage; when in manual, modulation can be forced	%		0.0
- <Setpoint>	In the case of loss of communication with Administrator, local PIM Setpoint can established for local pump modulation control.	psi / deg F		
<Seq>	Switches to system pump lead-lag sequence screen -- allows for assignment of sequence order; includes elapsed run time of each connected pump			