CleaverBrooks®

Packaged Water Systems

Pump Sequence & Pressure Control

Model PCS140e.1

Installation, Operation, and Parts

750-329
05/2010

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 train and advise not only his or her personnel, but any contractor's personnel who are servicing, repairing, or operating the equipment, in all safety aspects.

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 free him of certain repetitive chores and give him more time to devote to 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 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.

CLEAVER-BROOKS Pump Sequence and Pressure Control System
Model PCS140e.1

Installation, Operation, Service and Parts Manual

Manual Part No. 750-329

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CHAPTER 1 - GENERAL DESCRIPTION AND PRINCIPLE OF OPERATION

1.1-Introduction

Congratulations and thank you for choosing the Cleaver-Brooks PCS140e.1 pump control system. This system has been designed with the user in mind, and should provide many years of dependable, safe, and efficient operation. To ensure continued trouble-free operation, please be sure to follow all instructions in this manual regarding proper installation, set-up, operation, and maintenance.

1.2-How to Use this Instruction Manual

This manual is arranged to provide a straight forward, step-by-step process from installation through operation and maintenance of your system.

Chapter 1 describes the system, components, and principles of operation, and explains how to identify what type of system and components you should have.

Chapter 2 details the installation procedures, including mounting, wiring, and utility requirements, and the proper sequence to perform these procedures.

Chapter 3 explains how to setup the system and place it into operation.

Chapter 4 provides information on routine maintenance, troubleshooting, replacement parts, and warranty policy.

The appendix includes other pertinent information such as I/O addressing and information for remote data monitors.

1.3-System Description - General

The C-B PCS140e.1 System is a PLC based control system designed to maintain water pressure in a common header using a 4-20 mA pressure signal to control up to four (4) pump starters.

The PCS140e.1 uses a 3.5" 160x128 monochrome LCD touchscreen display. The complete system comprises a pressure sensor and a control panel which houses the PLC. This system is connected to a motor control center and the LWCO switch on the source water tank.

The system provides visual indication of header pressure, pump sequence, run status and alarms.

1.4-Principle of Operation

The system monitors the pressure in the common feedwater header and acts to maintain the desired pressure by adding or shedding pumps as required. When the header pressure drops below the low pressure setpoint for a period of time, an additional pump is started. When the header pressure exceeds the high pressure setpoint for a period of time, a pump is shut off. The pumps are controlled with a sequenced Lead-Lag basis in either a First On-First Off or a Last On-First Off mode (user selectable). In Last On-First Off mode, the pumps may be automatically rotated on a timed basis. The operator may also select the Lead-Lag sequence for the pumps.

Manual controls are provided to bypass the PLC for maintenance or troubleshooting purposes. The system monitors the LWCO contact in the source water tank. All pumps are stopped on a low water condition.

1.5-System Components

- Pressure Sensor - a pressure sensor is installed in the water header to provide a 4-20 mA signal to the control system.
- PLC/HMI - The system is controlled by an integrated HMI / Programmable Logic Controller (PLC). I/O modules allow the PLC to interface with all the field equipment (motor starters, LWCO and pressure sensor). The PLC may communicate via Modbus RTU protocol to building management or SCADA systems provided by others.

1.6-Standard Warranty

The standard warranty on all Cleaver-Brooks Products is as set forth in form C9-188L4, Terms and Conditions of Sale

CHAPTER 2 - INSTALLATION

2.1-System Requirements

Electrical

120 VAC, 60 Hz, or 110 VAC 50 Hz 10 Amp

3-wire grounded system.

Environmental

Temperature:

Control Panel 32-122 °F

2.2-Determining Locations

General instructions for determining equipment mounting locations:

The interconnecting signal cables between the PCS Panel and field devices should be located as far as possible from high voltage wiring and large electrical equipment. Devices such as the pump motor can introduce voltage spikes which could upset the operation of the PLC. The signal cables should be run at right angles to any power wiring and must not be routed with any boiler wiring.

The Control Panel may be mounted on a pedestal, a wall, or a convenient post. It should be located away from large or high voltage equipment such as power distribution panels, motors, ignition transformers, etc. If pedestal mounted, the base must be securely anchored.

2.3-Wiring

The control panel requires 120 VAC at 10 Amp. All wiring must conform to the National Electrical Code (NEC), and all applicable local codes.

CHAPTER 3 - SYSTEM SET-UP AND CONFIGURATION

3.1-PLC Overview

The system monitors the pressure in the common feedwater header and acts to maintain the desired pressure by adding or shedding pumps as required. When the header pressure drops below the low pressure setpoint for a period of time, an additional pump is started. When the header pressure exceeds the high pressure setpoint for a period of time, a pump is shut off. The pumps are controlled with a sequenced Lead-Lag basis in either a First On-First Off or a Last On-First Off mode (user selectable). In Last On-First Off mode, the pumps may be automatically rotated on a timed basis. In the event of a low water condition in the source tank, the LWCO input is lost and all pumps are stopped. A set of dry contacts is available for remote alarm indication

3.2-Data Logging

The PLC can log data to an optional micro SD memory card. When Data Logging is enabled, data for the water level setpoint, actual water pressure, pump on/off status, pump lead-lag sequence, and I/O status are written to a CSV file on the memory card. A new data log file is created every hour with a time and date coded file name: MMDDHH.CSV. Data logging can be enabled/disabled and the logging interval set at the HMI. The used capacity of the memory card is also displayed at the HMI.

To install a micro SD card: Align its 8-pin gold edge connector down, facing the ront of the HMI. Carefully push it all the way into the memory slot. Ensure that it clicks into place.

To remove the micro SD card: Disable data logging before removing. Push down on the top of the card gently to release the spring. The card will pop up for removal.

3.3-Remote Monitoring

The PIC provides data via Modbus RTU serial protocol. See Appendix C for address information and communications parameters.

3.4-HMI Screens

The HMI displays all the information related to the PCS140e.1 system. There are several screens that are used to view and/or change the system parameters.

Main Menu Screen

This screen is the primary navigation screen to gain access to all the other screens. The 'F1' button is used to access the Pump Elapsed Hours screen. The 'F2' button is used to access the System Setup Menu screen. The 'F3' button is used to access the Alarm History screen. The 'F4' button is used to access the Alarm Summary screen.

Overview Screen

This screen displays all the pertinent data for the system, including header pressure, pump sequence and run status. The current elapsed run time is also displayed. When using Last On-First Off mode, the time setpoint for automatic rotation may be adjusted.

Overview Trend Screen

This screen displays the tank level information in a trend format. The level are also displayed in numerical format.
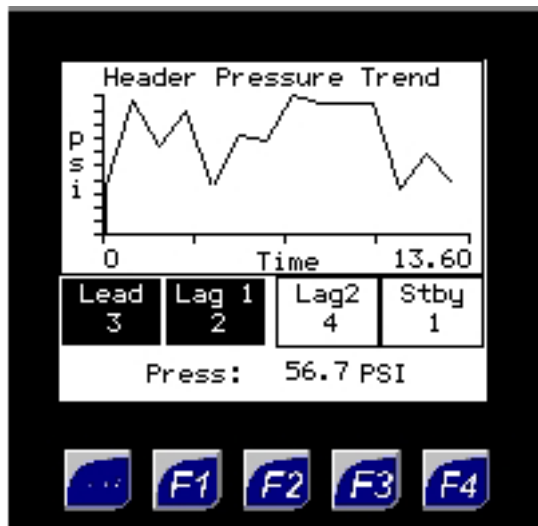
System Setup Menu Screen

This screen allows the operator to access the setpoint and configuration screens. This screen is password protected.

Analog Input Scaling Screen

The screen allows the operator to adjust the raw input and scaled values for each analog input point. Normal signal values are 4 and 20 mA. The scaled values should correspond to the engineering unit range of the level transmitter that is wired to the analog input.
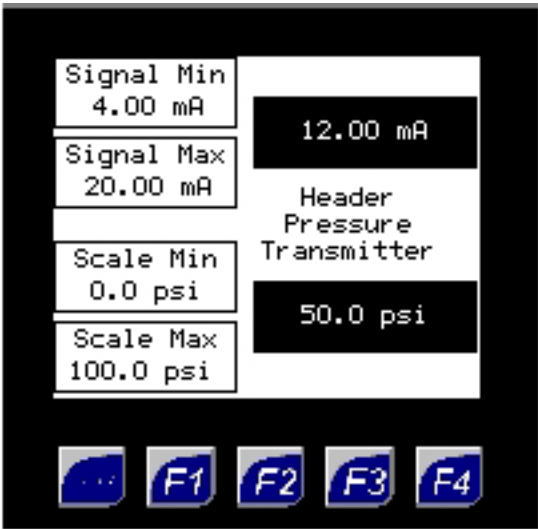
Digital I/O Screens

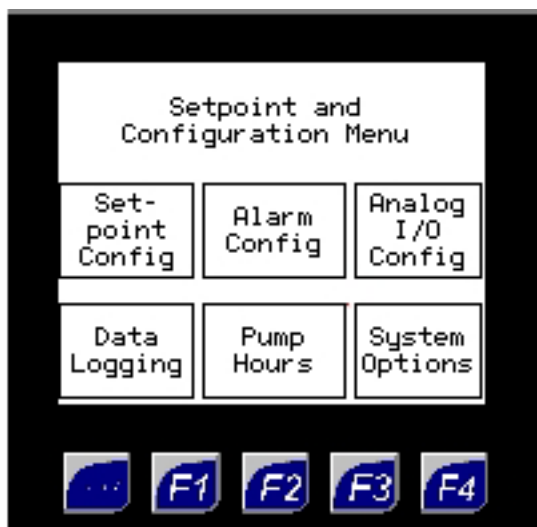The DI Status screen allows the operator to view the status for each digital input point. When an input signal is on, the corresponding indicator for that point is highlighted. When the input signal is off, the indicator is clear.

On the DO Status screen operator can view the current status of the output points, and is able to 'force' each output to an ON state by pressing the button corresponding to the digital output point.

Note: When the DO Status screen is displayed, the normal control values for the digital output points may be overridden by operator input. Changes should not be made while the system is in operation.
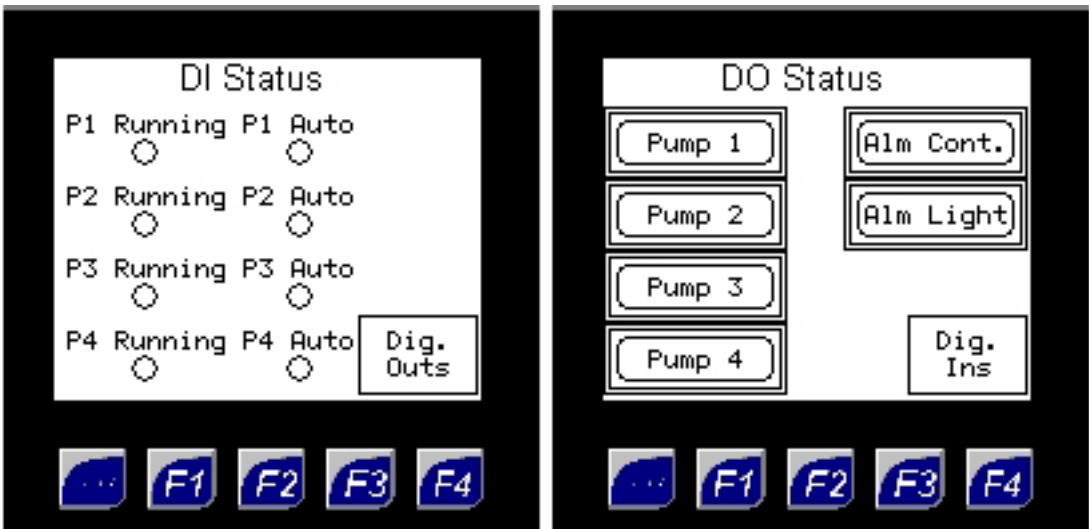
System Options Screen

This screen is used to set the site-specific configuration of the system. The number of pumps to be used is entered. The unit of measure for the pressure transmitter is selected. The operator can also configure the ModbusThis data communications parameters and clear the Alarm history. This screen is also used to access the 'System' area of the PLC controller to set the time/date.

```
        Modbus          Number of
        Port             Pumps
                           4
       ┌─────────┐
       │ MB ON   │
       └─────────┘      ┌─────────┐
                        │ Pressure│
       ┌─────────┐      │  Units  │
       │Modbus Add│     │   psi   │
       │    1     │     └─────────┘
       └─────────┘
       ┌─────────┐      ┌─────────┐
       │ MB Baud │      │Clear Alm│
       │  38.4k  │      │ History │
       └─────────┘      └─────────┘

       [...] [F1] [F2] [F3] [F4]
```

Setpoint Entry Sceens

These screens allows the operator to adjust the pressure setpoints for adding or shedding a pump. The operator can also set a time delay between pump starts/stops to avoid cycling pumps on a momentary excursion outside of the normal operating range and to give the system time to react to the effects caused by newly started or shed pumps.

```
   Pump Start/Stop SPs              Header Pressure Alarm SPs
  Low Press.   High Press.          Low Press.   High Press.

  25.0 psi     35.0 psi             25.0 psi     85.0 psi

 PSL Time Dly PSH Time Dly         PSL Time Dly PSH Time Dly

   15 sec       30 sec              30.0 sec     60.0 sec

 ( F On-F Off)  Alarm SPs

 [...] [F1] [F2] [F3] [F4]         [...] [F1] [F2] [F3] [F4]
```

Pump Sequence Screen

This screen displays the current sequence and total run hours for each pump. The user can use this screen to change the rotation order of the pumps.

```
Pump 1:     285.6 hrs.
Pump 2:     300.0 hrs.
Pump 3:     148.2 hrs.
Pump 4:     342.6 hrs.
 Lead  | Lag1 | Lag2 | Stby
   2   |  1   |  3   |  4
       Sequence Valid
    Cancel    |    Save
```
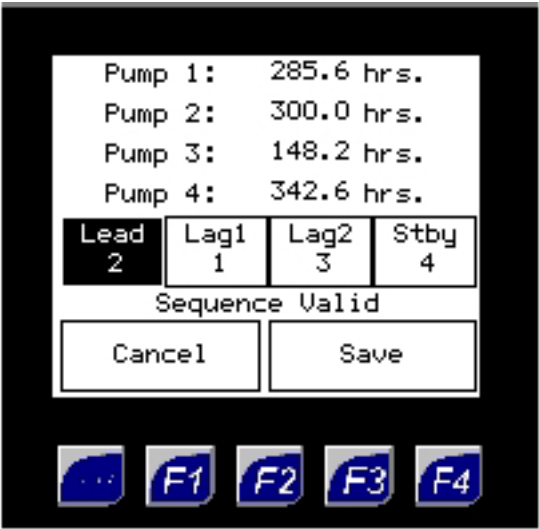
Pump Elapsed Hours Screen

This screen shows the total elapsed run hours for each pump. The user can use this screen to reset the run hours for each of the pumps.

```
Pump 1:  1253.2   hrs.
Pump 2:  1028.9   hrs.
Pump 3:   857.2   hrs.
Pump 4:  2033.5   hrs.

P1 ET Reset     P2 ET Reset

P3 ET Reset     P4 ET Reset
```
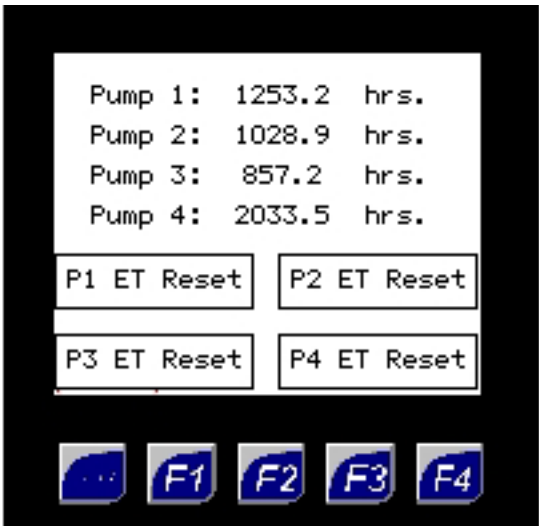
Data Logging Screen

The screen is for controlling the removable media (Micro SD card). The operator can enable or disable data logging and the memory card. The data logging needs to be disabled before removing the memory card. The data logging time interval can be adjusted on this screen as well. The time range is from 1 second to 3600 seconds (once per hour). The data logging status and disk usage are displayed. The operator can also backup and restore the PLC data registers.
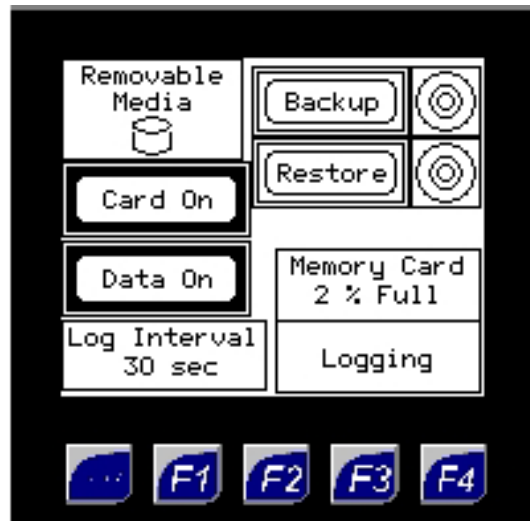
Password Entry Screen

The screen is for entering passwords to access secured screens.

Alarm Summary and History Screens

The screen displays the current alarms for the system. Each alarm is time stamped. The operator may also acknowledge alarms at this screen. The 'F4' button is used to access the alarm history screen. This screen displays a historical record of all alarms and the time they were acknowledged.

3.5-Control Panel

(1) HMI Display – The PLC has a built-in display screen. It shows all the information pertaining to the LCS system and is the means for operator interface to the PLC. All operating parameters are entered and/or adjusted via this interface.

(2) Power Supply – The 24 VDC power supply mounted on the back panel provides power to the PLC/HMI.

(3) Relays – The relays provide dry contacts for use by the customer as well as an interface with the pump motor starters.

(4) Circuit Breaker/Fuse Blocks – These provide protection from electrical shorts caused by improper wiring or damaged electrical equipment.

CHAPTER 4 - PLACING SYSTEM INTO OPERATION

It is suggested the following sequence be used when the PCS140e.1 is started for the first time. If, at any time, the expected result is not obtained, see the troubleshooting chapter. Before applying power to the unit inspect all wiring

4.1-Supplying Power to the System

Check that the supplied voltage is 120 VAC (+/- 10%). Turn all of the pump Hand-Off-Auto switches to the 'Off' position. Turn on the main power breaker. The PLC will power up and the HMI will display the Main Menu screen. Verify that there is adequate water level in the source tank (above LWCO level).

4.2-System Setup and Configuration

The system needs to be configured to reflect the various options that are required the specific installation.

Setting System Options

1. From the main menu screen, access the Setup Screen Menu by pressing the 'F2' button.
2. After entering the correct password, select "System Options"
3. Enter the correct password for access to the System Option screen.
4. Enter the correct number of pumps (2, 3 or 4) for the system.
5. Enter the correct units for the header pressure (psi, kPa, or bar).
6. If Modbus data monitoring is desired, turn the Modbus port on by pressing the button. The Modbus address has a default value of 1. A different value may be entered at this screen.
7. Press 'F1' to return to the System Setup menu.

I/O Configuration/verification

1. Select "I/O Config" from the System Setup menu.
2. At the I/O Config menu, select the "Analog In Config" button.
3. Enter appropriate parameters for the header pressure transmitter. Typically, the 'Raw' signal values will be 4 and 20 mA. The Scale values should correspond to the range of the transmitter in the selected units of measurement (psi, kPa or bar). The actual values for the input signal and the scaled signal are displayed.
4. Press 'F1' to return to the I/O Config menu.
5. Select the 'Digital I/O' button.
6. Turn each H-O-A switch to the 'Auto' position and verify that the correct inputs are highlighted.
7. Return each switch to the 'Off' position and verify that the inputs return to a non-highlighted state.
8. Turn each H-O-A switch to the 'Hand' position and then back to the 'Off' position. Verify that each pump starter pulls in and the correct pump runs. Verify that the correct 'Pump Running' input is highlighted while the pump is on and returns to the non-highlighted state when the pump is off.
9. Press the 'Dig Outs' button to access the Digital Output screen.
10. With the H-O-A switches off, press each of the DO buttons and verify that the correct relay changes state while the button is pressed. Relays that are off will turn on and relays that are on will turn off when the button is pushed.
11. For each pump, turn the H-O-A switch to the 'Auto' position and press the corresponding DO button. Verify that the correct pump runs. Repeat for all pumps.
12. Press 'F1' until the System Setup Menu is displayed.

Setpoint Entry

1. Select the 'Setpoint Config' button.
2. Enter the Low Pressure setpoint. When the header pressure falls below this level, another pump will be started.

3. Enter the Low Pressure time delay. This is the amount of time (in seconds) that the system will wait before starting additional pumps on a low pressure condition.
4. Repeat for the High Pressure setpoint. When the header pressure rises above this level for the amount of time defined with the delay setpoint, a pump will be turned off. A minimum of one pump will be run at all times.
5. Choose 'First On-First Off' or 'Last On-First Off' for the rotation mode. In 'First On-First Off' mode, the lead pump is rotated to the last position in the sequence whenever a pump is turned off on a high pressure condition. The remaining pumps move up in the sequence. In 'Last On-First Off' mode, the last pump started will be the pump that is turned off on a high pressure condition.
6. After all pressure setpoints have been set, press the 'Alarm Setpoints' button to enter the alarm setpoints.

Alarm Setpoint Entry

1. Enter the header pressure values at which the system triggers an alarm condition. A time delay for each may also be set to avoid nuisance alarms caused by momentary spikes or excursions past the alarm setpoints.
2. Press the 'F1' button to return to the Main menu.

Acknowledge alarms

1. From the Main Menu screen, press the 'F4' button.
2. If any alarms are indicated on the Alarm Summary screen, they may be acknowledged by touching the alarm summary and pressing the 'Ack' or 'Ack All' button.
3. Press the 'F1' button to return to the Main menu.

Pump Sequence Entry

1. From the Main menu, press the 'Seq' button to access the pump sequence screen. The current Lead-Lag sequence of the pumps is shown as well as the total elapsed run hours for each pump.
2. The sequence may be changed by touching the pump position and using the up/down arrows to select the desired pump for that position. Each pump may only be assigned to one position, and all pumps must be assigned to a position. If an invalid sequence is entered, the changes will not be saved and the operator will be alerted that the entered sequence is invalid.
3. When a valid sequence is entered, press the 'Save' button. The sequence will immediately go into effect. Pressing the 'Cancel' button leaves the screen with no changes to the sequence.

Rotation Time Set

If Last On-First Off mode is set, the operator may set an automatic rotation time by touching the 'Rotation Hours' button and entering a value. When the elapsed run time of the lead pump is greater than the time setpoint, it is shifted to the last lag position and the other pumps move up in position. If this time is set to zero, automatic timed rotation is disabled. The pumps will then only rotate in the event of a pump failure, or by manually changing the sequence order.

Pumps to Auto

When the above steps are finished, initial setup is complete. Turn the HOA switches for the pumps to the Auto position for normal operation.

CHAPTER 5 - MAINTENANCE AND TROUBLESHOOTING

Very little maintenance should be required for the PCS140e.1. A basic troubleshooting table is shown below.

Basic Troubleshooting - PCS140e.1

Problem	Possible Cause	Action
No display at HMI	Power Failure	Check supply voltage to the panel is 120 VAC +/- 10% Check supply voltage to the HMI is 24 VDC
	Tripped circuit breaker or blown fuse	Check circuit breaker and fuses inside the control panel. 24 VDC power supply should have a green LED to indicate power
I/O Failure Alarms	Blown Fuse/Power Failure	Check that the 24 VDC power supply is on. A green LED should be lit to indicate power. Replace fuse or power supply if necessary.
	Signal Polarity Reversed	Check signal from the transmitter. Verify that the transmitter is wired correctly. Reverse the signal wires if necessary.
	Transmitter Problem	Check signal from the transmitter. Verify that the signal corresponds to the water pressure in the header. Replace transmitter.
Pump not running	Pump not in a running sequence position	Check the sequence position of the pump. The lead pump should always be running. Other pumps are started and stopped according to header pressure demand.
	Wrong Switch Position	Check H-O-A switch position. The switches should be in the 'Auto' position.
	No Motor Power	Check for voltage at the pump motor. Verify that all disconnects are on.
	No Control Power	Check that the relay in the control panel and the starter at the MCC are both pulled in. Verify 120 VAC power across the control circuit. Replace fuses or control transformer.
	Starter Failure	Check that the pump starter has power at the coil. Replace starter.
	Relay Failure	Check that the pump relay has 24 VDC power at the coil. Replace relay.
	Low Tank Level	Check that there is adequate water level in the tank. Verify that CR-6 is energized.

CHAPTER 6 - PARTS

PCS140e.1 ASSEMBLY 283-03630-000			
Item	Qty.	CB Part#	Description
1	1	833-04072-000	PLC/HMI, 2 AI, 2 AO, 12 DO, 12 DI
2	6/10	833-03534-000	Relay Base
3	6/10	833-04040-000	Relay, 24 VDC Coil, DPDT Contacts
4	1	848-01751-000	Panel, NEMA 4 20x16x8
5	1	848-01752-000	Sub Panel
6	1	832-02534-000	Power Supply 24 VDC, 30 W
7	3	832-02507-000	Fuse Block Plug
8	3	832-02508-000	Fuse Terminal Block
9	4	832-02510-000	Grounding Terminal
10	3	832-02512-000	Fuse 5x20mm, 2 A
11	1	832-02514-000	Circuit Breaker, DIN Mount, 6 A
12	1	832-02327-000	Terminal Markers
13	40	832-02326-000	Terminal Block
14	1	848-01612-000	Wire Duct, 1" x 4", with cover, 2 meter length
15	1	832-02518-000	DIN Rail, 35mm, 1 meter length
16	1	881-00412-000	LED Light Module, Red
17	1	881-00350-000	Pilot Light Lens, Plastic, Red
18	5	881-00995-000	Legend Plate
19	5	881-00348-000	Latch
20	4	836-01149-000	Selector Switch, Illum. 3 Position, Green
21	1	817-04006-000	Sounder, 120 VAC
22	4	881-00413-000	LED Light Module, Green
23	12	881-01136-000	Contact Block, NO, Screw Terminal
24	4	832-02248-000	Terminal Block End Anchor
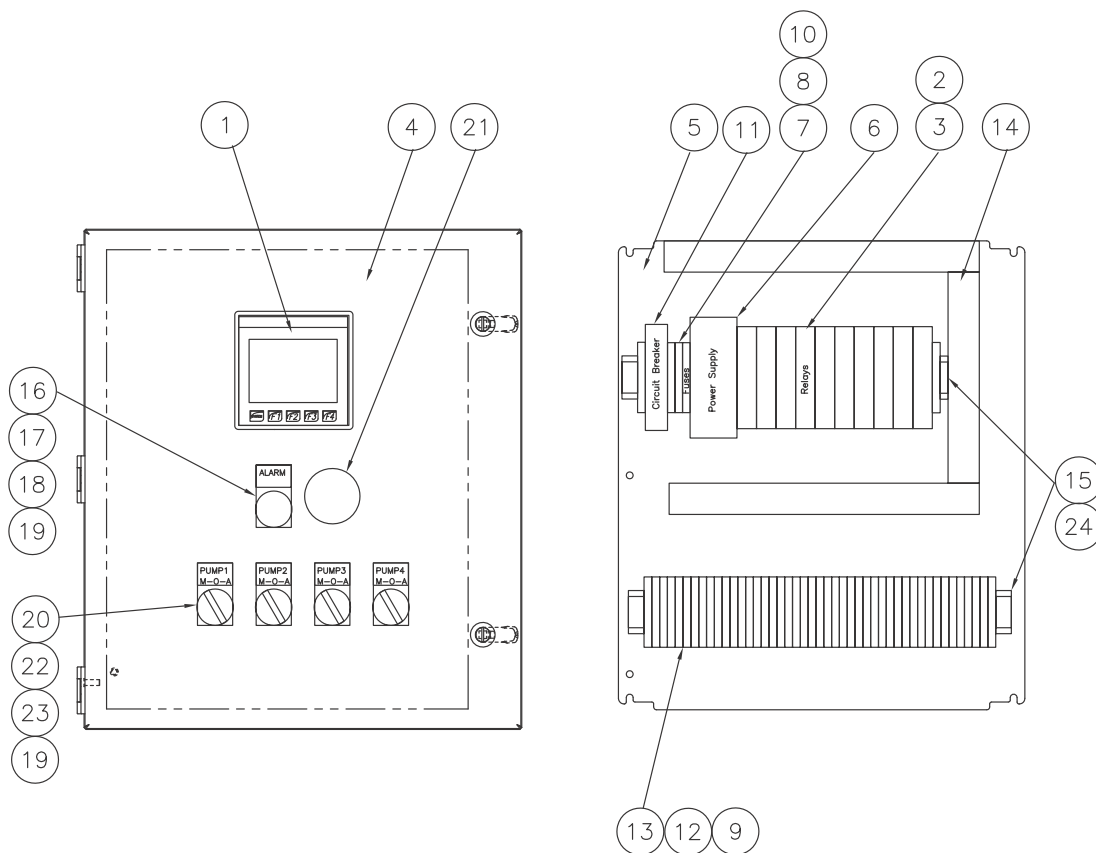
APPENDIX A - I/O List

PLC/Touchscreen-CB# 833-04072-000
I/O Requirements

DI	Local I/O		DO	Local I/O
%I0001	Pump 1 Aux		%Q0001	Pump 1 Output
%I0002	Pump 2 Aux		%Q0002	Pump 2 Output
%I0003	Pump 3 Aux		%Q0003	Pump 3 Output
%I0004	Pump 4 Aux		%Q0004	Pump 4 Output
%I0005	Pump 1 Auto		%Q0005	Alarm Contacts
%I0006	Pump 2 Auto		%Q0006	Alarm Light
%I0007	Pump 3 Auto		%Q0007	
%I0008	Pump 4 Auto		%Q0008	
%I0009	LWCO		%Q0009	
%I0010			%Q0010	
%I0011			%Q0011	
%I0012			%Q0012	

AI	Local I/O		AO	Local I/O
%AI0001	Header Pressure		%AO0001	Pressure Retrans 4-20 mA
%AI0002			%AO0002	Pressure Retrans 0-10 VDC

APPENDIX B — Removable Media

Using Removable Media to Load and Save Applications

A special file type, with a .PGM extension, is used to store application programs on Micro SD. To load an application from Micro SD to the controller, open the Removable Media Manager in the System Menu. Find and highlight the desired .PGM file and press the Enter key.

To prevent data loss or corruption, be sure to turn off the memory card via the HMI setup screen before installing or removing a Micro SD card.

To install a Micro SD card: Align its 8-pin gold edge connector down, facing the front of the HMI. Carefully push it all the way into the memory slot. Ensure that it clicks into place.

To remove the Micro SD card: Push down on the top of the card gently to release the spring. The card will pop up for removal.

The PCS140e.1 systems have been tested with SanDisk brand memory cards. Other brands should work, but their performance has not been verified or tested by Cleaver Brooks. The capacity of the memory card must be 2 GB or less.

APPENDIX C — Modbus Slave Addressing

Communications Parameters:

RS485, Half Duplex,9600/19.2k/38.4k Baud, No Parity, 8 Data Bits, 1 Stop Bit

Analog data is scaled 0-10,000. Apply the appropriate scaling factors to convert to site specific engineering units.

PLC Address	Description	Data Type	Modbus Register	Units	Scaling
%AQ50	Header Pressure	Integer 16	40050	PSI	0-10000
%AQ51	Reserved	Integer 16	40051		
%AQ52	Reserved	Integer 16	40052		
%AQ53	Reserved	Integer 16	40053		
%AQ54	Digital Input Word	Integer 16	40054	Bits	
%AQ55	Digital Output Word	Integer 16	40055	Bits	
%AQ56	Alarm Word	Integer 16	40056	Bits	
%AQ57	Lead Pump	Integer 16	40057	Number	
%AQ58	Lag 1 Pump	Integer 16	40058	Number	
%AQ59	Lag 2 Pump	Integer 16	40059	Number	
%AQ60	Lag 3 Pump	Integer 16	40060	Number	
%AQ61	Pump 1 Hours (10,000s)	Integer 16	40061	Hours/10000	
%AQ62	Pump 1 Hours (1s)	Integer 16	40062	Hours	
%AQ63	Pump 2 Hours (10,000s)	Integer 16	40063	Hours/10000	
%AQ64	Pump 2 Hours (1s)	Integer 16	40064	Hours	
%AQ65	Pump 3 Hours (10,000s)	Integer 16	40065	Hours/10000	
%AQ66	Pump 3 Hours (1s)	Integer 16	40066	Hours	
%AQ67	Pump 4 Hours (10,000s)	Integer 16	40067	Hours/10000	
%AQ68	Pump 4 Hours (1s)	Integer 16	40068	Hours	
%AQ69		Integer 16	40069		
%AQ70		Integer 16	40070		
	Alarm Word Bit Mapping (Register 40056)				
Bit 0	Pump 1 Fault				
Bit 1	Pump 2 Fault				
Bit 2	Pump 3 Fault				
Bit 3	Pump 4 Fault				
Bit 4	Header Pressure LL				
Bit 5	Header Pressure HH				
Bit 6	Analog Signal Failure				
Bit 7	Datalog SD Card Full				
Bit 8	Pump 1 in Manual Mode				
Bit 9	Pump 2 in Manual Mode				
Bit 10	Pump 3 in Manual Mode				
Bit 11	Pump 4 in Manual Mode				
Bit 12	Source Tank LWCO				
Bit 13	** Undefined Alarm14 **				
Bit 14	** Undefined Alarm15 **				
Bit 15	** Undefined Alarm16 **				

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