



Packaged Water Systems  
***Level Control***

***Model LCS150e.1***

**Single Tank System**

**Installation, Operation, and Parts**



750-327  
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 Single Tank Level Control System

## Model **LCS150e.1**

Installation, Operation, and Parts

Manual Part No. 750-327



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## **CHAPTER 1 — GENERAL DESCRIPTION AND PRINCIPLE OF OPERATION**

### **1.1-Introduction**

Congratulations and thank you for choosing the Cleaver-Brooks LCS150e.1 tank level 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, piping, wiring, and utility requirements, and the proper sequence to perform these procedures.

Chapter 3 explains how to setup the system and then place the system in 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 LCS150e.1 System is a PLC based control system intended to control level in a single tank using a 4-20 mA level signal and one or two 4-20 mA modulating water valves.

The LCS150e.1 uses a 3.5" 160x128 monochrome LCD touchscreen display.

The complete system comprises a level sensor, a control panel which houses the PLC, and modulating valves to control water flow into the tank.

The system provides visual indication of tank water level and feedwater valve position.

### **1.4-Principle of Operation**

The system monitors the water level in the tank and acts to maintain a desired level setpoint. When water level is low, the primary valve is modulated toward the open position. As water level returns to normal setpoint level, the valve is modulated toward the closed position. On systems equipped with two water valves, a secondary valve will also act to control water level to a setpoint. This valve acts as a backup to the primary valve. The setpoint of the secondary valve is typically set lower than that of the primary valve. There are five (5) level switch contacts available for either alarm or control use. For each relay contact, the switch point, differential for reset, and time delay can be user-programmed.

### **1.5-System Components**

#### **Level Sensor**

A level sensor is installed in the tank to provide a 4-20mA signal to the control system. A LWCO switch is also installed in the tank as a backup to the transmitter.

#### **PLC/HMI**

The system is controlled by an integrated HMI/-Programmable Logic Controller (PLC). Integrated I/O allows the PLC to interface with all the field equipment (valves, LWCO and level sensor). The PLC may

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communicate via Modbus RTU protocol to building management or SCADA systems provided by others.

**Level Control Valve**

Water is added to the tank through a modulating valve controlling water flow. The valve is modulated by the PLC with a 4-20 mA control signal. An optional secondary valve can be used as a backup to the primary valve. When using a two valve system, the primary valve would typically control water from a surge tank or condensate return line, and the secondary valve would typically control water from a fresh water source.

## **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**

The interconnecting signal cables between the LCS 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, 10 Amp. All wiring must conform to the National Electrical Code (NEC), and all applicable local codes.



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## CHAPTER 3 — SYSTEM OVERVIEW

### 3.1-PLC Overview

The system monitors the water level in the tank and acts to maintain a desired level setpoint. When water level is low, the primary valve is modulated toward the open position. As water level returns to normal setpoint level, the valve is modulated toward the closed position. On systems equipped with two water valves, a secondary valve will also act to control water level to a setpoint. This valve acts as a backup to the primary valve. The setpoint of the secondary valve is set lower than that of the primary valve.

The PLC has five (5) available 'soft switches' - programmable level positions that when reached will trip a relay. Each soft switch is available for either alarm or control use, with programmable switch point, differential for reset, and time delay.

### 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 level setpoint, actual water level, valve position, 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 via push button 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 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:* 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 PLC 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 LCS150e.1 system. There are several screens that are used to view and/or change the system parameters.

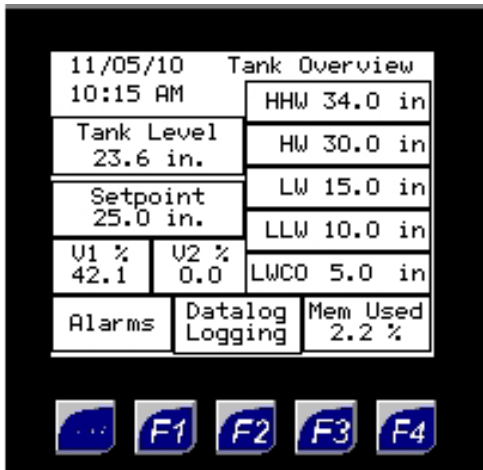
### Main Menu Screen

This screen is the primary navigation screen to gain access to all the other screens.



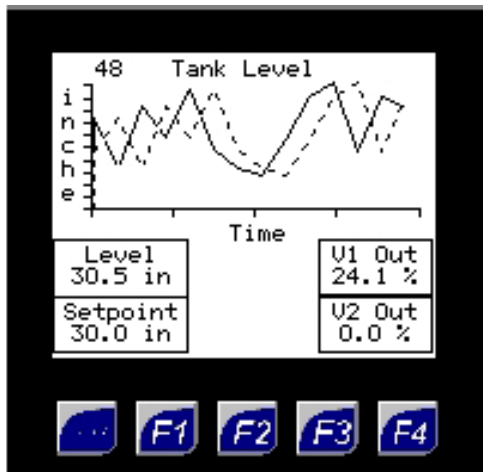
### Overview Screen

This screen displays all the pertinent data for the tank. The valve positions and level are displayed. Tank level setpoint and level switch setpoints and status are also displayed.



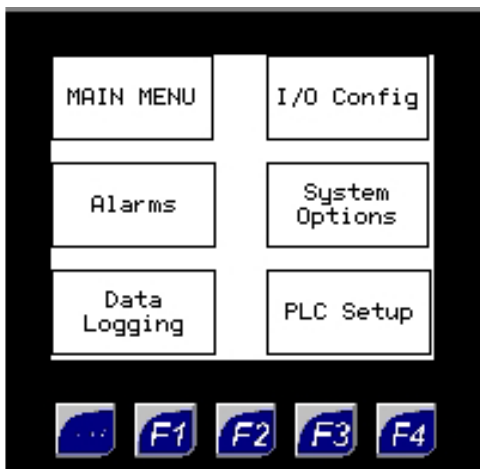
### Overview Trend Screen

This screen displays the tank level information in a trend format. The valve positions and level are also displayed in numerical format.



### System Setup Menu Screen

This screen allows the operator to access the I/O Configuration screens, System Options, PLC Setup, Data Logging and the Alarm screen. This screen is password protected.



### Analog Input Scaling Screen

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



### Analog Output Scaling Screen

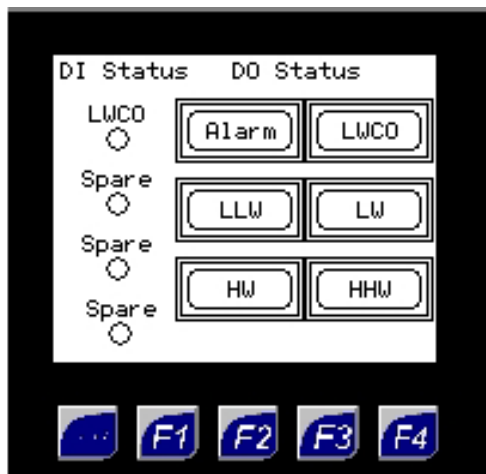
The screen allows the operator to adjust the scaled and actual values for each analog output point. **Note: When this screen is displayed, the normal control values for the analog points are overridden by the values displayed on this screen. Analog output adjustments should not be done while the system is in operation.** Normal raw values are 0-100% open valve position. The scaled values should correspond to the 4-20 mA signal controlling the valve.



## Digital I/O Screen

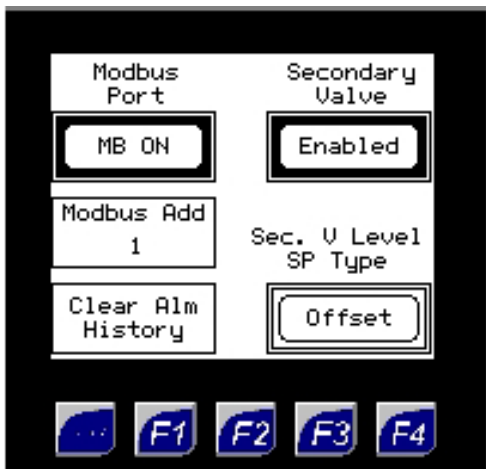
The screen allows the operator to view the status for each digital input point. When an input signal is on, the corresponding indicator for that point is highlighted. When the input signal is off, the indicator is clear. The operator can also view the current status of the output points. The operator is able to 'force' each output to an on state by pressing the button corresponding to the digital output point.

**Note: When this 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**



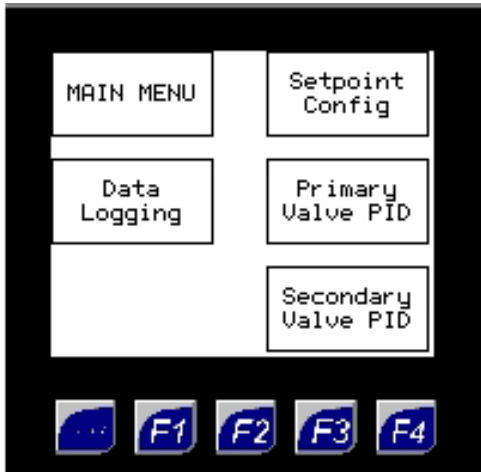
## System Options Screen

This screen is used to set the site-specific configuration of the system. The secondary valve can be enabled or disabled. If the secondary valve is enabled, the operator can choose to have the setpoint for the valve be either independent or calculated by an offset from the primary valve level setpoint. The operator can also configure the Modbus data communications and clear the Alarm history.



## Setpoint and Tuning Menu

This screen allows access to the setpoint entry and PID tuning screens. The screen is password protected.



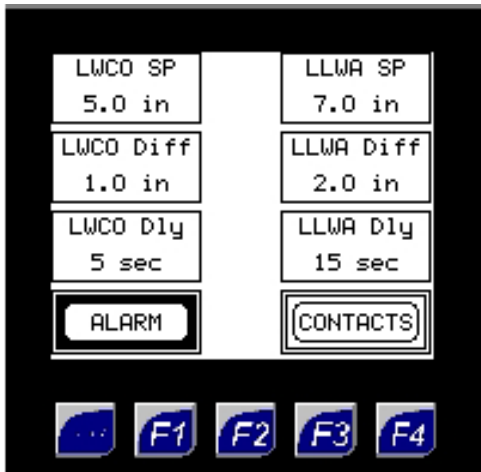
## Setpoint Entry Screens

The screen allows the operator to adjust the current level setpoint for each soft switch.

The operator can also set the differential for each switch. This value is the number of inches above (for low level switches) or below (for high level switches) setpoint that the water level must reach to reset the switch.

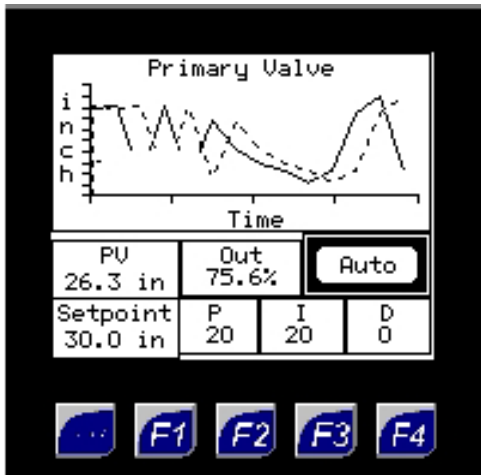
The operator can also set a time delay to avoid triggering nuisance alarms on a momentary excursion past the level setpoint.

Each level switch can be designated as 'alarm' or 'contact'. Switches defined as 'alarm' require operator acknowledgement before being reset to the normal state. Switches defined as 'contacts' will reset automatically based on water level. The F4 key is used to display the next set of level switch setpoints.



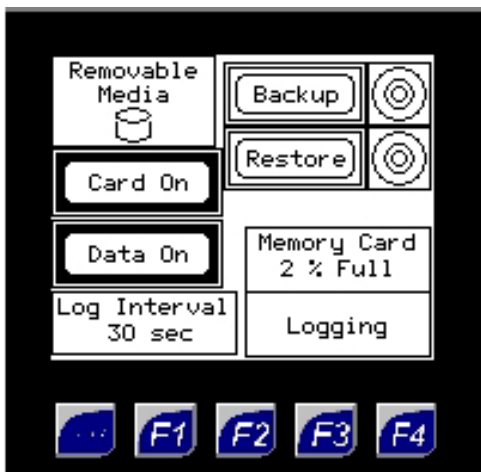
## PID Tuning Screen

This screen displays the PID control loop parameters for the feedwater valve. The operator can manually control the valve from this screen, as well as set the PID parameters and level control setpoint. On systems using two valves, each would be controlled by an independent PID loop.



## Data Logging Screen

This 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.



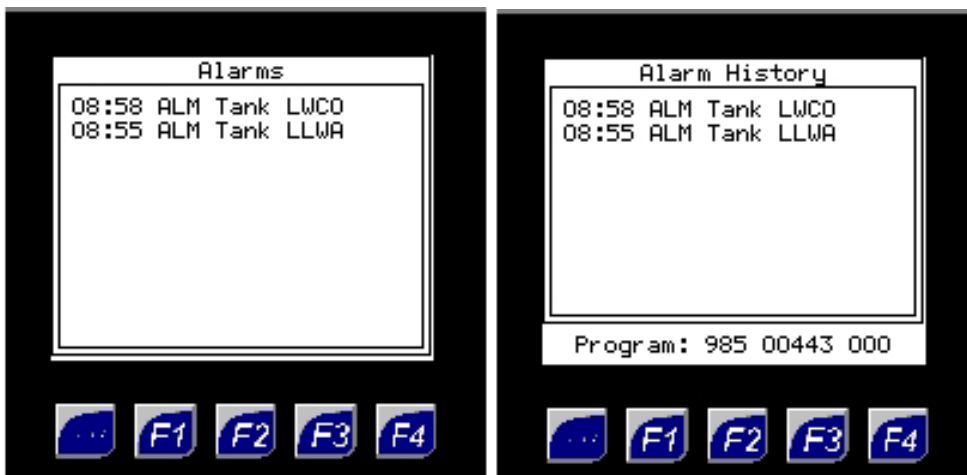
## Password Entry Screen

This screen is for entering passwords to access secured screens.



## Alarm Summary and History Screens

The Alarm Summary 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

**HMI Display** – The PLC has a built-in screen display. 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.

**Power Supplies** – The 24 VDC power supply mounted on the back panel provides power to the PLC/HMI.

**Relays** – The relays provide dry contacts for use by the customer.

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

**Transformer** – This device is used on installations that require 24 VAC power to operate the valves. The transformer steps down the 120 VAC power to 24 VAC for use by the valve actuator.

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## CHAPTER 4 — PLACING SYSTEM INTO OPERATION

It is suggested the following sequence be used when the LCS150e.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 on the main power breaker. Turn on the main power switch. The PLC will power up and the HMI will display the Main Menu screen.

### 4.2-System Setup and Configuration

The system needs to be configured to reflect the various options that have been selected for the installation.

#### A. Set System Options

1. Go to the Setup Screen Menu at the HMI by pressing the "Setup" button.
2. At the setup menu, press the "System Setup" button.
3. After entering the correct password, select "System Options"
4. If a secondary valve is used, enable it by pressing the 'Enable/Disable' button.
5. If a secondary valve is used, choose the type of setpoint it will use—'Independent' or 'Offset'. The 'Independent' selection will use a level setpoint that is independent of the primary valve level setpoint. The 'Offset' selection will calculate the secondary level control setpoint by subtracting an offset from the primary level control setpoint.
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.

#### B. 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 the appropriate parameters for the level transmitter. Typically the 'Raw' signal values will be 4 and 20 mA. The Scale values should correspond to the range of the transmitter in inches of water. 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 'Analog Out Config' button.
6. The Scale Min and Max values should correspond to 0-100% open valve position. The 'Out Min' and 'Out Max' values correspond to the 4-20 mA modulation signal to the valve. Enter 0 for the 'Force Value' and verify that the valve travels to the 0% open position. Repeat with 50% and 100% open positions.
7. Press the 'F4' button to access the configuration screen for the second analog output. This output controls the secondary valve (if used) or a retransmission of the tank level signal.
8. Repeat step 6 to configure the second analog output.
9. Press 'F1' to return to the I/O Config menu.
10. Select the 'Digital I/O' button.

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11. Verify that the LWCO input is highlighted when the LWCO switch is made.
  12. Verify that the LWCO input is not highlighted when the LWCO switch is open.
  13. 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.
  14. Press 'F1' until the Main Menu is displayed.

#### C. Setpoint Entry

1. Select the 'SP & Tuning' button.
2. After entering the correct password, select the 'Setpoint Config' button.
3. Enter the water level setpoint for the LWCO soft switch.
4. Enter the level differential that the system will use to reset the switch state.
5. Enter the desired time delay before the system sets the switch when the water level passes setpoint.
6. Select 'Alarm' or 'Contact' for the level switch. Switches defined as alarms will remain set until the condition clears and the operator acknowledges the alarm. Switches defined as contacts will clear automatically when the water level passes the setpoint differential point.
7. Repeat for each level switch. Press the 'F4' button to access the next set of level switches.
8. After all level switch setpoints have been set, press the 'F1' button to return to the Setpoint and Tuning menu screen.

#### D. PID Loop Setup

1. Select the 'Primary Valve PID' button.
2. A trend of water level and setpoint is displayed. The PID loop is toggled between 'Manual' and 'Auto' modes by pressing the 'Auto/Manual' button. When in manual mode, the valve may be forced to a specified position. The position is entered by touching the 'Out' value and entering the desired valve position with the numeric keypad. Verify that the valve responds to the manual commands.
3. Enter the setpoint to be maintained by the PID control loop.
4. Place the system in Auto mode for normal operation.
5. Enter values for the P and I parameters. In general, larger values cause the loop to respond faster to water level deviations from setpoint, and smaller values will cause the loop to respond more slowly.
6. Adjust P and I parameters for proper valve operation and control of level.
7. Press the 'F1' button to return to the Main menu.

On systems equipped with two water valves, a secondary valve will also act to control water level to a setpoint. This valve acts as a backup to the primary valve. The setpoint of the secondary valve is typically set lower than that of the primary valve.

#### E. Acknowledge alarms

1. From the Main Menu screen, select "Alarm".
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.

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## CHAPTER 5 — MAINTENANCE AND TROUBLESHOOTING

Under normal operating circumstances the LCS150e.1 requires little maintenance. See table below for basic troubleshooting.

### Basic Troubleshooting

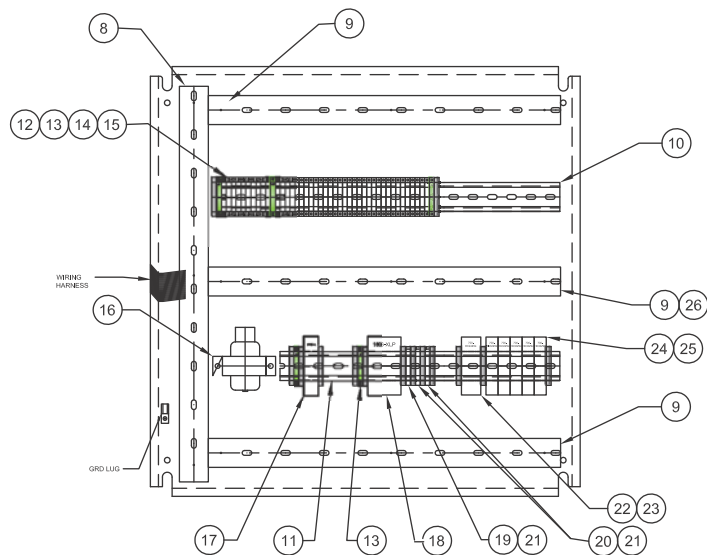
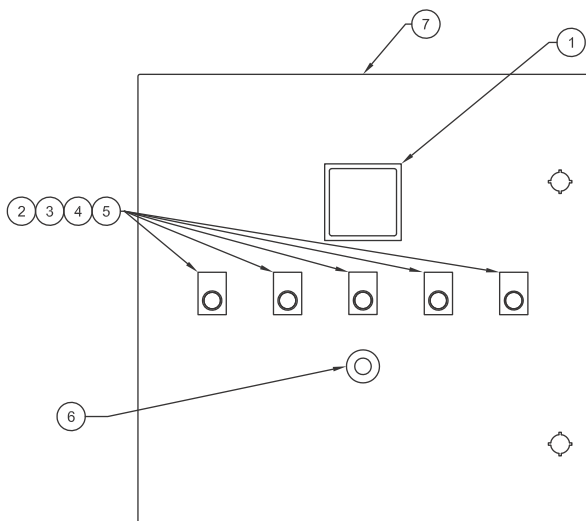
Problem	Possible Cause	Action
No display at HMI	Power Failure	Check supply voltage to the panel is 120 VAC +/- 10% Check supply voltage to the HMI is 24 VDC
	Tripped circuit breaker or blown fuse	Check circuit breaker and fuses inside the control panel. 24 VDC power supply should have a green LED to 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 level in the tank. Ensure float is installed in correct orientation. Ensure transmitter sensor is 180 degrees opposite the indicator flag assembly. Replace transmitter if necessary.
Valve not controlling level	Valve not moving	Check that 24 VAC power is at the valve. Verify that the correct control signal is at the valve. Correct wiring problems or replace transformer if necessary.
	PID signal to valve not changing	Verify that the PID loop is in Auto mode. Verify that values are entered for the PID parameters.

# CHAPTER 6 — PARTS

## 6.1-Control Panel/PLC

### LCS150e.1 ASSEMBLY 283-03631-000

ITEM	QTY	PART NUMBER	DESCRIPTION
1	1	833-04072-000	PLC, HMI, B&W TOUCH, 2AI, 2AO, 12DI, 12 DO , HORNER HE264-XLT105
2	5	881-00412-000	LED LIGHT MODULE, 24 VAC/VDC, SCREW TERMINALS, RED, AB #800F-N3R
3	5	881-00350-000	PILOT LIGHT PLASTIC LENS, RED, AB #800FP-P4
4	5	879-00995-000	30 X 50 MM WHITE W/BLACK TEXT BLANK LEGEND PLATE HOLDER, AB #800F-12WE100
5	5	881-00348-000	LATCH, PLASTIC, AB #800F-ALP
6	1	817-03571-000	BUZZER, ALARM, PANEL MOUNT, 120 VAC, 98, AB #855P-B10ME22
7	1	119-00676-000	DOOR PANEL, CABINET, NEMA 4/12, 23-7/8"H X 23-7/8" W
8	1	848-00797-000	WIRING DUCT, 1-1/2"W X 2" H X 20-1/2 LG, PANF1.5X2WHG
9	3	848-00797-000	WIRING DUCT, 1-1/2"W X 2" H X 18-1/2 LG, PANF1.5X2WHG
10	1	832-02518-000	DIN RAIL, 35 MM, 18-1/2" LG
11	1	832-02518-000	DIN RAIL, 35 MM, 14-1/2" LG
12	4	832-02326-000	TERMINAL, FEED-THROUGH, TERMINAL BLOCK, AB #1492-J4
13	5	884-00185-000	TERMINAL, GROUNDING
14	1	832-02327-000	MARKERS FOR AB #1492-J4 TERMINAL
15	14	832-02248-000	RETAINING, END ANCHOR, COMPONENT, AB #1492-EAJ35
16	1	832-00235-000	TRANSFORMER, DAMPER, 40 VA, 115/25V, HONEYWELL #AT72D 1089
17	1	983-00179-000	CIRCUIT BREAKER, 10 AMP, 1 POLE, 120 V, AB #1489-A1C100
18	1	832-02378-000	PWR SUPPLY, 115VAC/24VDC, 30 WATT, AB #1606-XLP30E
19	1	832-02440-000	FUSE, 3 AMP, 5X20 MM, TIME DELAY, GLASS, BUSSMAN #GSC-3
20	2	832-02051-000	FUSE, 2 AMP, 5X20 MM, TIME DELAY, GLASS, BUSSMAN #GMD-2A
21	3	848-01321-000	FUSE BLOCK, SINGLE POLE, 300V 15A MAX, AB #1495-WFB4
22	1	833-03196-000	RELAY, SOCKET 14 BLADE MINIATURE SO, AB #700-HN104
23	1	833-09745-000	RELAY, SQUARE W/BLADE TERMINAL RELAY, AB #700-HC24Z24
24	5	833-03534-000	BASE, RELAY, 8 PIN, DIN RAIL MOUNTING, AB #700-HN222
25	5	833-04040-000	RELAY, DPDT, 24 VDC, AB #700-HK32Z24
26	1	826-00111-000	CABLE, PATCH, BOOTED, CAT5E, BLUE, 7FT



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## 6.2-GEMS Sensor/Transmitter

<b>MODEL</b>	<b>Suggested GEMS Length</b>	<b>CB Part Number For Gauge</b>	<b>CB Part Number for Xmtr</b>
<b>SPRAYMASTER 36"</b>	29	881-365	817-4086
<b>SPRAYMASTER 48"</b>	29	881-365	817-4086
<b>SPRAYMASTER 54"</b>	29	881-365	817-4086
<b>SPRAYMASTER 60"</b>	29	881-365	817-4086
<b>SPRAYMASTER 66"</b>	29	881-365	817-4086
<b>SPRAYMASTER 72"</b>	29	881-365	817-4086
<b>SPRAYMASTER 84"</b>	48	881-366	817-4087
<b>SPRAYMASTER 96"</b>	59	881-376	817-4088
<b>SPRAYMASTER 108"</b>	59	881-376	817-4088
<b>SURGE 36"</b>	29	881-365	817-4086
<b>SURGE 48"</b>	29	881-365	817-4086
<b>SURGE 54"</b>	48	881-366	817-4087
<b>SURGE 60"</b>	48	881-366	817-4087
<b>SURGE 66"</b>	48	881-366	817-4087
<b>SURGE 72"</b>	48	881-366	817-4087
<b>SURGE 84"</b>	59	881-376	817-4088
<b>BOILERMATE 24"</b>	19		
<b>BOILERMATE 36"</b>	29	881-365	817-4086
<b>BOILERMATE 48"</b>	29	881-365	817-4086
<b>BOILERMATE 54"</b>	29	881-365	817-4086
<b>BOILERMATE 60"</b>	48	881-366	817-4087
<b>108"</b>	96	881-377	817-4089

### 6.3-Makeup Valves

<b>Siemens Make-up Valve Selection Normally Closed (Fail Closed)</b>		
Valve Size	CB P/N	Actuator CB P/N
1/2"FNPT	941-2567	945-222
1/2"FNPT	941-2568	945-222
1/2"FNPT	941-2569	945-222
1/2"FNPT	941-2570	945-222
3/4"FNPT	941-2571	945-222
1"FNPT	941-2572	945-222
1 1/4"FNPT	941-2573	945-222
1-1/2"FNPT	941-2574	945-223
2"FNPT	941-2575	945-223
Includes one 24 VAC transformer per valve		

#### **STANDARD WARRANTY**

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

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**APPENDIX A — I/O List**
**PLC/Touchscreen-CB# 833-04072-000****I/O Requirements**

DI	Local I/O
%I0001	Tank LWCO
%I0002	
%I0003	
%I0004	
%I0005	
%I0006	
%I0007	
%I0008	
%I0009	
%I0010	
%I0011	
%I0012	

DO	Local I/O
%Q0001	Common Alarm
%Q0002	Tank LWCO Alarm
%Q0003	Tank Low Low Water Alarm
%Q0004	Tank Low Water Alarm
%Q0005	Tank High Water Alarm
%Q0006	Tank High High Water Alarm
%Q0007	
%Q0008	
%Q0009	
%Q0010	
%Q0011	
%Q0012	

AI	Local I/O
%AI0001	Tank Level
%AI0002	

AO	Local I/O
%AO0001	Primary Valve
%AO0002	Secondary Valve/Level Retrains



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## 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 LCS150e.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	Tank Level	Integer 16	40050	Inches	0-10000
%AQ51	Reserved	Integer 16	40051	Inches	0-10000
%AQ52	Primary Valve Output	Integer 16	40052	Percent	0-10000
%AQ53	Secondary Valve Output	Integer 16	40053	Percent	0-10000
%AQ54	Digital Input Word	Integer 16	40054		
%AQ55	Digital Output Word	Integer 16	40055		
%AQ56	Alarm Word	Integer 16	40056		
%AQ57	Primary Valve Level Setpoint	Integer 16	40057	Inches	0-10000
%AQ58	Secondary Valve Level Setpoint	Integer 16	40058	Inches	0-10000
%AQ59		Integer 16	40059		
%AQ60		Integer 16	40060		
%AQ61		Integer 16	40061		
%AQ62		Integer 16	40062		
%AQ63		Integer 16	40063		
%AQ64		Integer 16	40064		
%AQ65		Integer 16	40065		
%AQ66		Integer 16	40066		
%AQ67		Integer 16	40067		
%AQ68		Integer 16	40068		
%AQ69		Integer 16	40069		
%AQ70		Integer 16	40070		

Alarm Word Bit Mapping (Register 40056)	
Bit 0	Tank Low Water Cutoff
Bit 1	Tank Low Low Water Level
Bit 2	Tank Low Water Level
Bit 3	Tank High Water Level
Bit 4	Tank High High Water Level
Bit 5	** Undefined Alarm6 **
Bit 6	** Undefined Alarm7 **
Bit 7	** Undefined Alarm8 **
Bit 8	** Undefined Alarm9 **
Bit 9	** Undefined Alarm10 **
Bit 10	Analog Input Failure
Bit 11	SD Data Card Full
Bit 12	** Undefined Alarm13 **
Bit 13	** Undefined Alarm14 **
Bit 14	** Undefined Alarm15 **
Bit 15	** Undefined Alarm16 **





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